ELECTRONICS Australia

with CB and HIFI NEWS

JULY, 1978 AUST. $1.25* NZ $1.25

IMPLANTING IONS IN SIGNETICS IC WAFERS

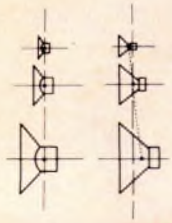
NEGATIVE IONS — GOOD FOR YOU?

4-CHANNEL SOUND & THE FUTURE

SIMPLE TRANSISTOR CHECKER ▶

WAY OUT FRONT
BECAUSE THEY'RE WAY OUT FRONT

SONY'S NEW G SERIES SPEAKERS.
WE LINED UP THE SOUND SOURCES—NOT THE SPEAKER EDGES—TO GET THE EDGE ON THE FRONT-NAME SPEAKERS.



We admit it, for years our front name reputation in audio and video hasn't quite been matched by our speakers.
So in 1972 we began a total new research programme specifically designed to put our speakers where all of our other stereo components have long been – out front.
After years of research and development our engineers have found the answers:
First spring water. Like good whisky, good cone papers depend on the purity of the water used in making them. So we built an entirely new factory at Kofu at the base of Mt. Fuji where we can get all the spring water we need.
Next there was the use of carbon fibre in our speaker cone paper. It's very strong and light. So our speakers are more efficient. And the carbon fibre prevents the cone from bending out of shape in the high frequency range. Moreover it doesn't resonate much. Which cuts out unwanted vibration.
Then so does our use of a cast basket rather than a cheap stamped one. Finally our big breakthrough came by breaking through the standard idea of simply attaching the front of each speaker to the baffle board.
By moving our woofer and mid-range forward to a position where the sound waves originate in the same line, we aligned them acoustically. The result is transparently smooth and deep sound over the entire audio frequency range.
It's a sound that specifications alone cannot describe.
But some of the toughest critics in the whole audio world can. They heard our new G Series speakers first at the last Japan Stereo Components Contest. Result? They awarded Sony the "Grand Prix".
Now hear this: The new Sony G Series speakers have arrived at your dealers. Listen to them and you'll hear just how beautiful five years' research can sound.

SONY

Research makes the difference.

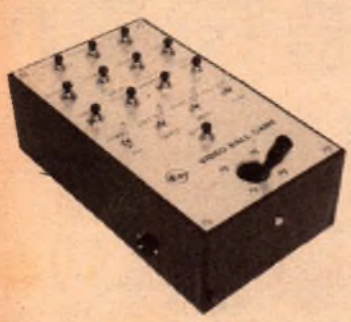
GAC.S.9777

ELECTRONICS Australia

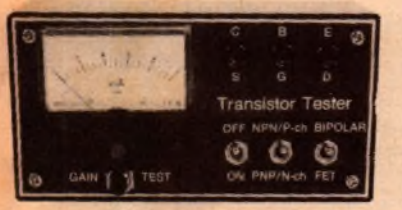
Australia's largest selling electronics & hi-fi magazine

On sale the first Monday of each month

VOL. 40 No. 4 JULY, 1978



Our new video ball game will provide hours of fun for the whole family. It is easy to build, has 10 distinct games, and features on-screen scoring and sound effects.



This simple transistor/FET checker should prove a most useful addition to your workshop. Besides checking transistors and FETs, it can also be used to check most other discrete semiconductor devices.

On the cover

Developed only a few years ago, the ion implantation technique is now an established part of semiconductor fabrication technology. This month's cover shows an operator at the controls of an ion implanter at the Signetics Corporation plant in Sunnyvale California. (Courtesy Signetics Corporation.)

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.

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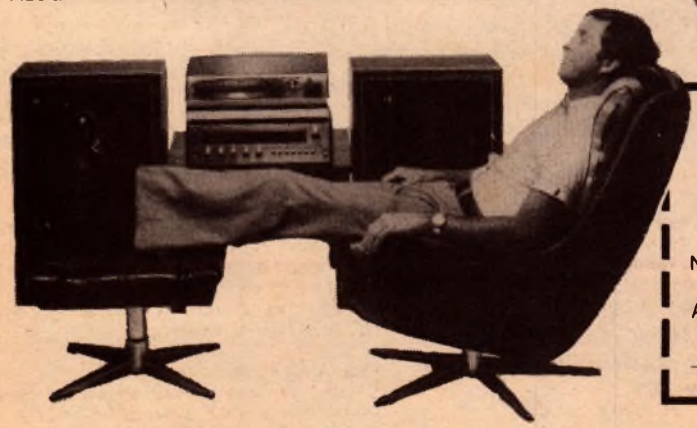

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Please send me full details and brochures on your loud speaker kits and a list of retailers who stock them.

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Editorial Viewpoint

Video games or number crunchers?

It would be foolish indeed to claim that my recent visit to the west coast of the USA had allowed me to gain profound insights into the long-term trends in electronics. Even the executives and engineers I met and talked with at the semiconductor firms in California's "silicon valley" would not claim this sort of insight, and they are generally regarded as being in the forefront of the electronics revolution. Still, in the short time available I think I may have learned a few interesting things, and I will try to pass these on over the next few months.

I found it particularly interesting to note the rather different ways in which the microprocessor-based "home computer" is viewed by the hobby computer assemblers on the one hand, and the makers of the actual integrated circuit chips on the other. The equipment assemblers, encouraged by the response of hobby enthusiasts and "computer freaks" seem to be confident that before long almost every home, office, shop and small business will have at least one and possibly a number of small computers of the conventional variety. Consequently they are roaring ahead, tooling up to produce increasingly more powerful machines with ever larger memories and growing families of peripherals.

In contrast, the IC makers themselves seem to be not nearly so sure that the home computer revolution is about to begin. Nor do they seem as sure that home computers will necessarily take the form of conventional "number crunchers". Rather, they seem to think that a much more promising everyday application of microcomputers is likely to be inside "intelligent" video games: gadgets which hook up to a standard colour TV set, and allow the user to play a wide variety of challenging and/or relaxing games.

I saw a number of samples of the new generation of these video games, and they were very impressive — a far cry from the simple tennis and ping-pong which have appeared to date. At Fairchild Semiconductor I saw a demonstration of their "Channel F" game, a fascinating unit which has a system of plug-in cartridges. There are currently around 20 different games you can play on it, including ball games, maze solving, backgammon, blackjack, target shooting, space war, aerial dogfight, drag racing and word and number guessing. You can also plug in cartridges to help the kids with their maths homework, or to simply fill the TV screen with relaxing coloured doodles!

In the development lab at Signetics Corporation I saw another type of advanced video game, which offers such intriguing attractions as a novel "boxing" match. Here the screen of your TV becomes a miniature boxing ring, with two small humanoid figures controlled by handpieces.

Judging by those I saw, the next generation of video games seems likely to be rather more satisfying than the first. And perhaps that the IC makers are right in believing that they are likely to have a wider impact than the conventional home computer — at least in the short term.

— Jamieson Rowe

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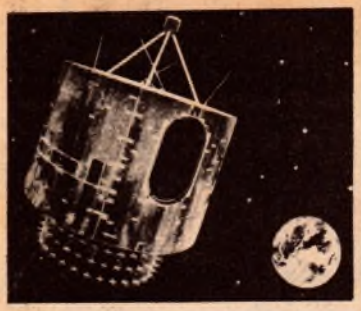


News Highlights

WARC: global spectrum rewrite?

The biggest communications battle this century is looming for the forthcoming World Administrative Radio Conference (WARC) to be held in Geneva, Switzerland late in 1979. Already billed by one British company as "The Global Spectrum Rewrite", WARC '79 will present an unprecedented opportunity for third world nations to grab spectrum space for their growing communications needs, at the expense of industrialised countries.

WARC '79 will be the first spectrum conference at which third world nations will be in the majority (the conference is held approximately once every 20 years), and their role will be critical. If sufficient "flexibility" is not incorporated into the international regulations prescribed by the 1979 WARC, US telecommunications (and presumably those of other western countries) may be restricted severely through the year 2000", says Joseph R. Fogarty, FCC Commissioner.

"You (the developed nations) have 90 per cent of the spectrum and 10 per cent of the population. We have 90 per cent of the population and 10 per cent of the spectrum. We want our share."

Ali Shumo,
Minister, Sudan

Understandably, there is a fair amount of nail-biting going on at governmental and corporate level in the advanced countries. The "propaganda war" has already begun, not just over which country gets what, but also between the various industry and spectrum user groups.

Here are just some of the ways in which decisions taken at WARC '79 could affect global and domestic communications to the year 2000:

- pressures from mobile radio, FM broadcasters, government, and direct broadcast satellite users, coupled with the prospect of highly selective TV receivers, could impact current UHF broadcasting allocations;
- a reduction in spacing for AM broadcast stations to 8kHz could increase the number of radio stations, require antenna and transmitter modifications in current facilities, and limit the growth of AM stereo;
- changes in HF broadcasting regulations could radically affect this service in terms of coverage, volume, receiver technology and transmission quality;
- a decision to amend the international radio regulations to require automatic transmitter identification could result in expensive modifications to existing equipment for mobile services;
- band saving techniques such as amplitude compression and SSB could relieve the pressure for additional spectrum space;
- a settlement of the issue of "orbital slot sovereignty" could restrict access of industrialised nations to satellite communications options;
- a phasing out of HF fixed allocations could damage established markets for HF transceivers and stimulate the growth of markets for satellite technology;
- a decisive turnaround of the first-come-first-served principle could severely restrict the international and domestic services of users in industrialised nations, or cause them to invest in expensive band-saving technologies;
- the outcome of conflicts over HF and UHF allocations among aeronautical, maritime and land mobile, and broadcast service interests will determine which of these has room for maximum growth;
- a reduction in frequency allocations could further restrict amateur radio activities (many third world countries have little or no interest in amateur radio).

"WARC will help determine domestic and international communications flows and communications technology from CB and TV to picturephone and satellite signals ... It also will affect, at least indirectly, the cost of most forms of electronic transmission as well as the cost of doing business abroad ...

"National security could be directly affected. The United States could lose frequencies now available for radar, missile components and for satellites ...

"The equatorial states have a new idea. Colombia is the leader in claiming that the heavens — up to outer space — are part of their sovereign territory ... This eventually could mean control of the information being bounced back and forth and a rental on the satellite's air space."

From a US Senate Foreign Relations Committee Staff Report by George Kroloff and Scott Cohen.

"The battle lines are drawn", says one industry observer. "The land mobile services have some very powerful allies. The allocations, once locked in, are what the broadcast industry will have to live with for the next quarter of a century."

Dick Smith now at Grace Bros

Dick Smith has taken over the electronics equipment concessions previously held by audio Shack in Grace Bros' Sydney suburban stores.

The Dick Smith Electronics departments at Grace Bros' stock most of the products sold in Dick's eight electronics enthusiasts' shops around Australia, with special emphasis on electronic products for the home handyman, car buff and hi-fi enthusiast.

Electronic aids for the blind . . .

Braille arithmetic teaching unit

An RMIT (Royal Melbourne Institute of Technology) student has developed a small machine which will enable blind children to practice arithmetic problems and know immediately whether their answers are correct or incorrect.

Designated the "Braille Arithmetic Teaching Unit," the unit comprises a Perkins Braille typewriter interfaced with an electronic arithmetic checking device. Mechanical keys operate circuits connected to an electronic processing unit which checks the student's work. The student hears two tones through headphones, one tone indicating a correct answer, the other an incorrect answer.

A visual display unit displays a record of the number of correct and incorrect answers. It is designed so that, in a classroom situation, a sighted teacher can tell at a glance which pupils are having difficulty.

The unit was designed by Frank Wrobel, a final year engineering student at RMIT. Further information is available from Mr J. Podolak, Department of Communication and Electronic Engineering, RMIT, Box 2476V GPO, Melbourne 3001.

Object locator

A little black box has been introduced by a British company to help blind or partially sighted people find objects . . . simply by clapping their hands.

Called "Homer", the box is placed next to an object — a cup of coffee in this picture — to which the person wishes to return. At the sound of a hand clap the device emits a distinctive "bleep" and continues to do so until switched off.

Homer runs off a standard nine-volt battery and is small enough to be carried in a pocket. It can be used both in and out of doors and has an effective range of six metres in all directions.

Reader enquiries should be directed to Casleham Industries, Collett Close, St-Leonards-on-Sea, East Sussex, TNS38 9QS, England.

First sea trials for wave power machine

Machines harnessing the power of the sea could provide enough electricity to meet half Britain's present consumption, according to expert estimates quoted by a British Energy Minister.

Mr Alex Eadie, Parliamentary Under-Secretary for Energy, said: "Experts have worked out that a 965 kilometre stretch of wave energy machines set off the south-west coast of England and off the north-west of Scotland to capture the energy of the Atlantic waves could in principle, provide about half of the UK's present electricity demand."

After watching the first sea-trials of a new wave power machine off Southampton, he said wave power was "not just a boffin's pipedream, but a tangible, credible proposition."

Renewable energy from waves, tides, the Sun, winds and the heat of the Earth might provide Britain with the annual equivalent of 10 million tonnes of coal by the year 2000. Government support for the country's wave power program more than doubled last year and was now being reviewed again. As Britain moved out of research stages and into development, more money would be needed.

The Southampton trials involved a one-tenth scale model of a series of wave contouring rafts coupled to hydraulic motors and pumps that convert the raft motion into a source of power.

Microwaves could destroy poison wastes

This apparatus, developed at the Lockheed's Palo Alto Laboratories, will detoxify persistent organic wastes and pesticides by bombarding them with microwave radiation.

The system was developed under contract with the US Environmental Protection Agency's Solid and Hazardous Waste Research Division in Cincinnati, Ohio. It detoxifies materials such as PCBs (polychlorobiphenyls, used as a coolant in electrical power transformers and condensers) and the pesticides kepone and phenylmercuric acetate, by passing them through a reactor tube. Microwaves are applied

to the tube, inducing a plasma. The resulting electrical-chemical interaction triggers the decomposition of the toxic material.

The apparatus will handle 4.5-14kg of material hourly and is now undergoing evaluation for various field applications wherein highly toxic, hazardous wastes would be decomposed on site by a portable unit.

TV captions for the deaf

Many readers will recall that, last February, we ran an article on a new TV captioning system developed in America to enable the deaf and partially deaf to benefit more fully from television programs. We have now learnt that a similar system is under development in Britain, based on the recently developed Teletext system.

The British project is based at Southampton University and is jointly supported by the Independent Broadcasting Authority (IBA) and the Independent Television Companies Association (ITCA). The project, expected to take three years and to cost over £50,000, is aimed at establishing the form of sub-titling which would be of most benefit to the deaf, and will include experimental on-air subtitling of programs.

NEWS HIGHLIGHTS

New electron microscope developed by Bell Laboratories

An electron microscope technique being developed at Bell Laboratories can routinely identify and locate, for the first time, minute quantities of elements such as carbon, nitrogen and oxygen inside materials as diverse as tiny microelectronic circuits and human cells.

The technique, called electron energy-loss spectroscopy, sorts out electrons (generated by the microscope) that have been slowed down by interactions with electrons in the material being studied. For interactions with inner-shell electrons, the amount of energy lost is characteristic of a specific element. This permits scientists to identify particular atoms and determine their locations.

Two Bell Labs scientists, David Joy and Dennis Maher, have been developing this technique to identify and locate low-atomic-weight elements that can adversely affect tiny solid-state devices crucial to electronic communications equipment.

The elements being studied include lithium and fluorine as well as boron, carbon, nitrogen and oxygen. All are important as trace impurities or as basic constituents in semiconductor, metallic and biological systems. These elements are difficult to detect, and it is almost impossible to pinpoint their exact locations in a substance by conventional analysis.

Using the new technique in combination with conventional electron-microscope imaging, Joy and Maher have been able to identify a few hundred carbon atoms buried in several hundred billion silicon atoms. Unwanted oxygen, nitrogen and carbon atoms also have been detected and located in silicon integrated circuits.

Although the technique was developed as part of an electronic materials research effort, medical researchers are expected to use it widely for important applications. Already Joy and Maher, working in collaboration with Jonathan Costa and co-workers at the National Institute of Mental Health, Bethesda, Maryland, have been able for the first time to confirm exactly where serotonin is stored in blood platelets. The researchers also found lithium stored in the same parts of the platelets.

Finding the two chemicals in the same place is an important clue to medical researchers trying to discover how lithium functions to control mental depression. Serotonin is a neurotransmitter responsible for communication among nerves in the brain.

ELECTRON energy loss image of a human blood platelet revealing the location of a special form of serotonin containing fluorine. The brightest spots are the areas containing high concentrations of serotonin molecules.

High power Darlington transistor

The world's most efficient high-power transistor has been developed at the General Electric Research and Development Center in Schenectady, New York.

GE's new Darlington transistor, is capable of switching 400 volts and 350 amps on or off in less than one-millionth of a second. Despite its high power handling capabilities, the solid state device requires very little power for activation — an external drive of one-tenth amp will open or close the switch.

The heart of a new device is a silicon chip measuring 9.5mm x 16mm, less than half the size of an ordinary postage stamp. The chip is mounted in a copper package and is cooled from the top through direct contact with a proprietary copper contact system that provides efficient heat removal. During switching, power is uniformly distributed within the device to optimize reliability.

One of the first applications of GE's new power transistor will be in a pair of experimental electric vehicles now under development at the GE Research and Development Center in Schenectady, under a contract with the US Department of Energy.

The twin subcompact cars will incorporate a number of electrical innovations made possible by the new transistor's unique characteristics. For example, as a critical component in an advanced power control system, the transistor will provide smooth and efficient performance, by regulating the speed, torque, and acceleration of each vehicle's DC motor.

Business Briefs:

Soanar distributors for Signetics/Elcoma range

Soanar Electronics Pty Ltd has advised that on July 1 the company became a preferred distributor of the Signetics range of ICs (including microprocessors) and the Philips Elcoma range of ICs and semiconductor devices. Full stocks of the Signetics/Elcoma ranges will be carried by the company's three city branches in Melbourne, Sydney and Adelaide, and by agents in Brisbane and Perth. Brisbane agent is R. A. Venn, 71 Doggett St, Fortitude Valley; Perth agent is Everett Internationa, 17 Northwood St, West Leederville. Head office of Soanar Electronics Pty Ltd is at 30 Lexton Rd, Box Hill, Victoria 3128.

Kenelec changes name

Kenelec Systems, 142 Highbury Rd, Burwood, Vic 3125, has advised that the company has changed its name to Kenelec (Aust.) Pty Ltd. The company has also opened a new office at Suite 3, 745 Brunswick St, New Farm, Queensland.

Hy-Gain back in operation

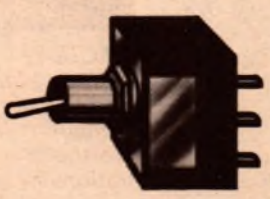
Hy-Gain Electronics is now back in operation following acquisition by Telex Communications of Minnesota, USA.

Hy-Gain entered bankruptcy in January this year after incurring heavy losses derived from the CB market slump. The company registered a 1977 loss of $25.6 million on sales of $50.3 million, compared with a profit of $17.2 million in the previous year.

Hy-Gain recommenced manufacture of their antenna products on April 24 and will continue to operate under the "Hy-Gain" banner. A spokesman for Vicom International, the local importers of Hy-Gain amateur antennas, welcomed the takeover and advised that shipments would start to arrive in Australia around mid-June.

Plessey components. The complete range. (Well almost).

Switches
Rotary, lever key, toggle, thumb wheel, touch activated including illuminated.

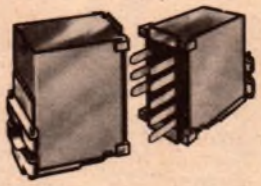


Speakers – Foster & Fostex
Speakers ranging from guitar, woofers, mid range, tweeters, horns, full range and elliptical, all are available.

Optoelectronic devices
Including LDR'c, LED'c photodiodes, phototransistors, photocouplers and 7 segment, alphanumeric and cold cathode displays.

"E" Cell
The "E" Cell device suitable for a number of applications such as repetitive timing and control, pulse counting and memory, timing, current-time integration, use-time measurement.

Service and elapsed time indicator
For trucks and other vehicles, trains and stationary engines – where ever there's a suitable power source to indicate elapsed time and when service is due.



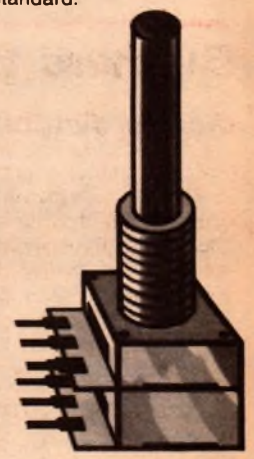
Batteries – Saft
Nickel cadmium (rechargeable) cells and batteries, for domestic, heavy industrial, emergency power, military and aviation.

Sonalerts – Mallory
Electronic audible signals providing a startling innovation in warning devices, producing a penetrating sound by purely electronic means. Circuitry is all solid state for maximum efficiency, lowest current requirements, and highest reliability.

Connectors
A multitude of connectors including the Multicon range consisting of 2, 4, 6, 8, 10, 12, 18, 24, and 33 pole. Also the 159 range of plugs and sockets ranging from 7 to 71 poles. Gold flash on contacts and solder tags for long term protection against tarnishing. Also the 22 range of marine and aviation connectors.

Capacitors
Capacitors for a wide variety of applications, ranging from tantalum, chip ceramic, long-life and electrolytic.

Potentiometers
Moulded carbon track and wire-wound of both commercial and professional standard.



Lamps and indicators
Consisting of filamentary, neon and LED styles designed for all general illumination applications.

Speaker Enclosures
One of the range of Plessey Foster and Fostex speaker enclosures.

Dry reed inserts and relays
Suitable for most switching functions the inserts have proven extreme reliability, long life, and the ability to operate in grossly unfavourable environments.

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only **$350**

Terms available

See the review in MAY 1978 E.A.

EXCLUSIVE!

With every FRG-7 from Dick Smith or dealers, you receive this exclusive 6 page guide to short wave listening – written by Arthur Cushen, MBE – world famous short-wave correspondent and broadcaster.

- Comes with full instructions.
- Operates from mains power or 12V batteries
- Has beat frequency oscillator for SSB & CW reception
- State-of-the-art circuitry: 2 ICs, 22 transistors and 16 diodes.
- Listen to the world: sensitivity better than 0.7uV for 10dB S/N

THE INCREDIBLE FT101E.... WORLD'S TOP TOP SELLING HF TRANSCEIVER –

Why settle for less ?

The *complete* 160M-10M HF amateur radio – just add antenna and either 240V or 12V (yes, it has an inbuilt DC DC converter!). Rated at 260W PEP and the in-built RF speech processor makes it sound even better.
These units are so popular, we probably don't have to tell you about all their fabulous features – but call into D. S. store and we'll be happy to anyway!
Cat D-2860 . . . . . **$895.00**

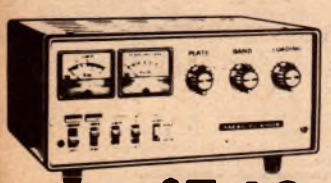
EASY TERMS AVAILABLE TO APPROVED APPLICANTS

WHY NOT BUILD YOUR WHOLE STATION AROUND THE FABULOUS FT-101E

(Left) The QTR24 world clock. Work out at a glance what the time is in all time zones. Every ham should have one.
Cat X-1054 . . . . . **$33.00**

(Right) YD-844A desk microphone. 500 ohm/50k switch makes this ideal for all Yaesu transceivers. Complete YOUR base station with a Yaesu microphone.
Cat C-1116 . . . . . **$44.50**

HOW'S THIS FOR THE ULTIMATE STATION?



FL-2100B HF LINEAR AMP $540

Time proven reliability! The 2100B is world famous for it's GUTS! 1.2kW of muscle – the ideal match for the FT-901D or the FT-101E. Best value linear amp available today!
Cat D-2546

Easy terms available on all Yaesu transceivers to approved applicants. Ask at your store!

Cat D-2854

FT-901 D – ALL MODE ALL HF BAND TRANSCEIVER $1275

Tomorrow's transceiver today . . . All mode operation – yes, even FM! This beautiful Yaesu has to be seen (and heard) to be believed. It's got features others just dream of!

Basic unit: $1275 . . . Add the optional memory unit (Cat D-2858 @ $149.50) and the DC-DC converter (Cat D-2856 @ $75.00) and still pay less than $1500.00 . . .

The acc plug features switchable 12V coupled to the band switch. Use our co-ax relay (Cat D-5210) to automatically switch antennas. WHY PAY MORE?

FTV-250 – 2 M TRANSVERTER $329

FULL 2M operation when used with the FT-901D. SSB & CW for DX & OSCAR enthusiasts – FM for local work – even FM repeaters when memory unit fitted to FT-901D. Covers 144–148MHz, all solid state. Also suits FT-101E.
Cat D-2894

DICK SMITH for AMATEURS

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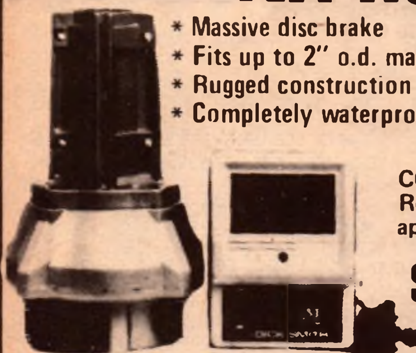

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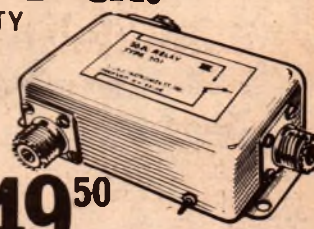

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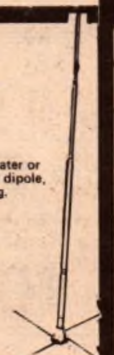

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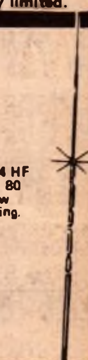

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DICK SMITH ELECTRONICS

Clive Cross: actor, recordist & director

The career of movie pioneer Clive Cross has spanned more than 40 years of cinematic progress. He began as a child extra in the silent era, became a recording engineer in the early days of talkies, and progressed to become a director of documentaries and commercials in the fifties and sixties. Like his father Bert Cross and fellow pioneers Ken Hall and Arthur Smith, he laid a foundation for the current boom in Australian movie making.

by JAMIESON ROWE

After the article on Cinesound pioneer Arthur Smith had been written for our February issue, I was lucky enough to meet three further pioneers of the Cinesound era: Clive Cross, his wife Phyllis and his father A. E. ("Bert") Cross. Mr Cross senior is now in his nineties, and not enjoying the best of health; he was only able to grant me a brief interview, although a very pleasant one.

However, Clive and Phyllis Cross have been able to spare me somewhat more time, and lately I have spent many enjoyable hours talking with Clive Cross in particular, and hearing more about the heydays of Cinesound. Although he is very modest, I believe readers will be interested as I have been to hear about his contribution — first as a sound engineer/recordist and then as a director.

Actually the first job Clive Cross had in the movie business was a youthful "extra" in the silent movie classic "For the Term of his Natural Life", made by US director Norman Dawn for Australasian Films in 1927. Clive played a young convict, in a scene where the heroine visits the blacksmith's shop in Port Arthur gaol.

A lad of 15 at the time, he persuaded his father A. E. ("Bert") Cross to let him stay away from school for a few days, to take part in the film. His father was intimately involved with the production himself, as manager of the Australasian Films studio and processing laboratory. He had been appointed to the position in 1926, because of his very broad experience in motion picture production.

Bert Cross had become a press photographer around 1903, working on the Melbourne Argus. In 1909 he resigned to become a newsreel cameraman with the Pathe Freres company, working on their Gazette. The next year he moved to Sydney, to work on J. D. Williams' short-lived Australian Gazette. When that folded he returned to Melbourne to work on the Gaumont News.

Over the next few years, Bert Cross gained a great deal of experience, not only of newsreel work but of documentary filming and features as well. Then he joined Australasian Films, starting an association which was to last for more than 40 years. Around 1916 he was put in charge of the production studios in St Kilda, and it was from this position that he was transferred to Sydney in 1926 to start and to run the Bondi Junction studio.

After his brief taste of movie making in "For the Term of his Natural Life", young Clive Cross returned to school until the end of 1928. But on leaving school he didn't seek to go into the movie industry, choosing instead to join the Philips company with the idea of pursuing a career in the technical side of radio. He had been interested in radio for some years, and had built up a variety of receivers for relatives and friends.

His radio career didn't last long, however. Following an import embargo placed on radio receivers, headphones and batteries by the Scullin government in April, 1930, Philips made retrenchments. As one of the most recent additions to the staff, Clive was one of the first to go. In June 1930 he found himself without a job.

By this time Arthur Smith had begun to achieve some promising results from the experimental film sound recorder at Bondi Junction, although he was working more or less alone. His colleague Don Knock had departed some months previously, and although

Clive Cross with microphone, Arthur Smith in the van and cameraman Wally Sully on location in late 1931.

Location shooting for "On Our Selection" at Castlereagh in late 1931. Wally Sully and Clive Cross are at the camera, with Bert Cross, Bert Bailey, Ken Hall and Marjorie West at the table in the foreground.

Bert Cross was giving him as much help and encouragement as he could, he had a busy studio and laboratory to run.

When Clive became jobless, his father accordingly suggested that he might like to give Arthur Smith a hand with the experiments — until he found another job. Not that there would be any money in it, because even Arthur himself wasn't on the payroll! It was simply because Arthur could use some help, and Bert Cross knew that his son's interests in music, sound recording and radio would be useful.

By about the end of 1930 they had produced recordings good enough for Bert Cross to bring the work to the attention of Ken Hall, as noted in our February article. And Hall's boss Stuart Doyle signed a contract with Arthur Smith, agreeing to pay him £800 for an improved recorder and production sound system. Thanks to the appearance of a new neon-mercury vapour glow tube from BGE-Osram, the new recorder performed even better than they had hoped.

In fact the results with the new recorder were so good, you may recall, that Stuart Doyle contacted actor-entrepreneur Bert Bailey and arranged that they would make a talkie feature based on Steele Rudd's "On Our Selection", with Ken Hall directing. Production started in June 1931 with the interior scenes, which were filmed in a sound stage they had built in the centre of the studio-cum-skating rink alongside the Bondi Junction processing laboratory.

The camera and sound recorder were kept in step during filming of the indoor scenes by driving them both from synchronous motors, connected to the 50Hz power mains. This method could not be used for the outdoor scenes, however, because they were to be filmed out at Castlere h — miles from the nearest power lin The original plan for these scenes was to use the technique they had used for some of their early tests: a DC motor driving the recorder in the truck, with a flexible shaft to drive the camera from the same motor. But they soon realised that this would be impractical, requiring the truck to be moved each time the camera angle was changed.

The next idea was to return to synchronous motors, you may recall, with a rotary inverter to generate 50Hz AC from a bank of batteries. But when they tried this, synchronisation proved quite unreliable. Shooting ground to a halt; they were frantic.

The idea of studying an old TV book for inspiration came to Clive when he and Arthur were down at Bronte baths. It was the Saturday afternoon of the October holiday weekend, and they were due to begin outdoor shooting on the following Wednesday. After trying to find an answer without success, they decided to take a break and go down for a swim.

When Clive thought of the old TV book, neither of them was very optimistic that it would provide a clue. But Clive said "Look, I'll go and get a penny from my shorts, and toss it up. If it comes down heads, we'll go up and look at the book!"

Luckily it came down heads, because if they hadn't looked at the book "On Our Selection" might never have been finished, and Cinesound stillborn. As it was they went up and looked through the 1930 mechanical-TV synchronisation methods shown in the book, just in case. And as they went through the various methods described, Arthur stopped at one which involved DC motors with tapped armatures. This seemed to have promise, and the more they worked on it the better it looked. By Tuesday night they had it working, and on Wednesday the location shooting went ahead as planned.

For the first few days of outdoor shooting, Clive helped Arthur with the recording. He operated the recorder inside the truck, while Arthur adjusted the recording level from a position outside where he could view the action.

Bert Cross was on location at Castlereagh too, helping Ken Hall with the technical aspects of direction. But suddenly he was summoned back to Sydney — Stuart Doyle had decided to start a talkie newsreel, to be called the Cinesound Review. Bert was to run it, and as his son Clive was as yet the only

CLIVE CROSS — TALKIE PIONEER

person apart from Arthur Smith who understood sound recording, it was not difficult to convince Doyle that Clive should be made newsreel recordist.

"On Our Selection" was not released until August 1932, spending some time in the cutting room. And although it met with immediate success, Cinesound didn't begin shooting another feature for many months. So for more than a year, Clive worked mainly as recordist on the newsreel. He also worked on cinema advertising shorts, precursors of our modern TV commercials, including a series known as "Ad-A-Talks".

Then in April 1933, they started work on Cinesound's second feature "The Squatter's Daughter". He and Arthur both worked as recordists on this film, sometimes together and at other times separately.

Almost as soon as they had finished shooting, Clive found himself hired out to independent producer Beaumont Smith, to do the recording for his production "The Hayseeds". Directed by veteran Raymond Longford, it was made at White City studio. Clive used the sound recorder in the Reo truck, backing it up to the side entrance of the studio.

Then in December 1933 it was back into the Cinesound fold, to help Arthur Smith with the recording of their next in-house feature "The Silence of Dean Maitland". But there was no time to relax, because almost immediately he was hired out again to independent producer Harry Southwell, to record his feature "When the Kellys Rode". Being a horse lover he enjoyed this film greatly, particularly as Harry Southwell had him riding horses as a police sergeant in music background scenes, which were filmed without location sound recording.

All this time he was still involved in recording for the newsreel, and at times things were quite hectic. They often worked over weekends and late into the night, in order to get the weekly reel ready for the theatres in time. Like director Ken Hall, they were often working on location by day for a feature, and travelling into the studio at night to work on the newsreel. There wasn't a great deal of spare time!

In fact Clive and Arthur became so busy that Cinesound put on Roy Blanche, who had previously been with mechanical engineer Bert Wickens. Roy was trained to become their third recordist, to lighten the load.

Further recorders and sound equipment also became necessary, so the two of them formed a small company of their own to produce them. Called Smith and Cross, it soon had a third man on the payroll: Alan Anderson, who later became a fourth recordist and mixer.

Early in 1934 producer Charles Chauvel approached Cinesound for help with his film "In the Wake of the Bounty". He had taken a lot of silent footage on Pitcairn Island, showing the lifestyle of the latter-day descendants of the Bounty mutineers. He wanted to add narration and music to his footage, and also intersperse it with dramatised lip-sync scenes of the mutiny, as "flashbacks".

Clive was delegated to do the recording, which was all done in the studio. When they were shooting the mutiny scenes he chatted between takes with the young Tasmanian actor that Chauvel had found to play the part of Fletcher Christian: Errol Flynn. Although still unknown, he had already made some impact on one or two of the young ladies working in the studio, Clive recalls!

On location for "When The Kellys Rode", in late 1933. At front left is Clive Cross, in police sergeant costume.

The next Cinesound feature was "Strike Me Lucky", with comedian Roy Rene ("Mo McCackie"). Production started in July 1934, and Clive did some of the initial recording. But before shooting finished he left for the United States, on a fact-finding trip. He paid for the trip himself, even though he went on a number of errands while there on behalf of Cinesound! Still, they did agree to continue paying his normal salary while he was away...

His stay in Hollywood was very rewarding, mainly because of the tremendous help and co-operation he received from his friend Carroll "Skipper" Pratt — one of the top recording engineers at the big MGM studios.

Carroll Pratt had visited Sydney in late 1929, to record the first Australian-made talkie — Norman Dawn's "Showgirl's Luck" or "Talkie Mad", which was recorded on discs similar to the Vitaphone system. While in Sydney he had become friendly with Bert and Clive Cross, who had entertained him and shown him around.

When Clive arrived in Hollywood, Pratt returned the courtesy. He and his wife Edie met him at the wharf, and insisted that he stay at their home. Not only that, but with Pratt as his guide and mentor virtually every door was opened to him. At the ripe old age of 22 Clive was able to get a full insight into all of the equipment, techniques and procedures in use at Hollywood's biggest studios.

While he was there, for example, MGM were shooting "Naughty Marietta" with Jeanette MacDonald and Nelson Eddy, and he was able to see how they used the "playback" technique. This had been developed to minimise recording problems in scenes which involved singing. The singing was recorded beforehand, with the singers and orchestra in a recording studio using optimum microphone placement. Then the recording was played back on the set, while the singers — now in costume — mimed in front of synchronised cameras.

Carroll Pratt introduced Clive to John Hilliard and Harry Kimball, MGM's top audio transmission engineers, who were experts on filter design and equalisation. Kimball gave him a lot of valuable information on equaliser design and use, graciously passing on the experience that MGM had accumulated in this area.

He also met Olyn Dupy, the brilliant mechanical engineer who had been part of the original six-man team which perfected optical sound recording at Western Electric's subsidiary ERPI (Electrical Research Products Inc.). Dupy's knowledge of recorder and reproducer design was almost legendary. When the Fox-TriErgon group had tried to claim

sole rights for the use of a flywheel for film stabilisation, in both recorders and reproducers, he found MGM a way around the Fox system in weeks. He had even produced a working demonstration unit for use in court, before the end of the hearing. Needless to say, Fox lost the case!

Ken Hall and Bert Cross both joined Clive in Hollywood in early 1935. Together they went to functions and studied techniques for a brief time. They also ordered some equipment for back projection: the special translucent screen, a set of interlock motors, and a projector fitted with register pins. Then Clive left for home, his bags bulging with notes and small items of useful equipment, and his head full of newly acquired knowledge.

On his return, Clive passed on to Arthur Smith what he had learned from Harry Kimball about equalisation. And he was able to put his knowledge of playback technique into use almost immediately, as he was hired out to independent producer Harry Southwell once again, to record the latter's next production.

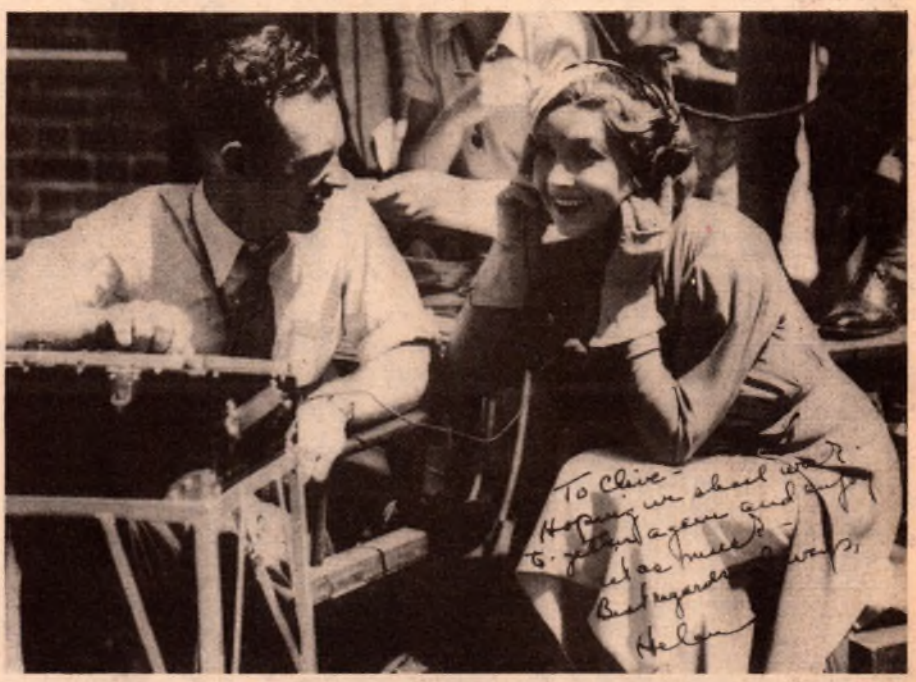
This was "The Burgomeister", a musical adapted from the play "The Bells". The music was scored by Isadore Goodman, who also conducted. Clive recorded the music first, then played it back on the set for the picture shooting. He used a modified theatre reproducer, mounted in a Chevrolet truck. Despite the improvised equipment the results were very good.

The next Cinesound production was "Thoroughbred", which went into production in late 1935 starring American Helen Twelvetrees. A film about horse racing, it had many scenes where they needed to use the back-projection equipment they had obtained in Hollywood.

Over the next three years Cinesound produced a string of features, with Clive as Recording Supervisor and Arthur Smith now free, as Chief Engineer, to concentrate on research, development and maintenance.

For "Tall Timbers", a logging drama made in early 1937, Ken Hall was particularly keen to ensure that the sound of the falling trees in the "timber drive" scenes would be reproduced with full impact. So Clive and Arthur developed a shutter system for the sound recorder, so that the recorded level on the timber drive scenes could be made deliberately higher than the rest of the film.

The idea was that for most of the scenes, the shutters would be used to block part of the recorder light beam, producing a narrow sound track which would play back in the theatres at a certain volume. Then while recording a scene involving an explosion or other loud sound, the recordist would kick a footswitch to open the shutters just before the sound occured. This would widen the track suddenly, recording the sound at about twice the normal volume. At the end of the sound he would kick the switch again to restore the track to its "normal" narrow width.



TOP: Shooting an indoor scene for "Dad and Dave Come to Town" (1938). Clive Cross is at the mixing desk at left, with George Heath on camera and Ken Hall directing (seated). ABOVE: Clive Cross with Helen Twelvetrees during shooting of "Thoroughbred" (1935).

In other words, it was a method of producing volume or dynamic range expansion — simple, yet highly effective.

As much as anything, it was done to counteract the theatre projectionist, who could ruin the dramatic effect of a loud passage by setting the theatre volume control to too low a level. By making most of the track narrow, the projectionist had to have his volume control set to a reasonably high level, to make the quiet passages audible. Then with the shutters opening up the track only a second or two before a loud passage, he didn't have time to defeat the director's intentions!

They were now using back projection quite a lot. It enabled them to shoot rapidly and economically in the studio many scenes which formerly would have required costly location shooting. In mid 1937 they produced "Lovers and Luggers", set on Thursday Island in the

CLIVE CROSS — TALKIE PIONEER

Pacific, and this used back projection extensively. Cameraman Frank ("Cap") Hurley went to Thursday Island in advance, and shot all of the background material.

In late 1937 they made "The Broken Melody", with music by Alfred Hill. This involved extensive orchestral recording, and Clive had to improvise with a timber stage built below the dressing rooms in the outer "skating rink" part of the studio, in order to get a sufficiently "live" recording environment. Despite this the results were very good, and the film received many favourable comments.

From 1937 on, Cinesound produced feature films at the same rate as Hollywood — that is, per production crew. They made "Let George Do It" with the comedian George Wallace, "Dad and Dave Come to Town" with Bert Bailey, "Mr Chedworth Steps Out" with Cecil Kellaway and the then-unknown Peter Finch, "Gone to the Dogs" with George Wallace, and "Come Up Smiling" (initially called "Ants In His Pants") with American Broadway star and comedian Will Mahoney and his wife Evie Hayes.

The location shooting for "Come Up Smiling" was done in July 1938, but Clive wasn't on the job. Nor was Phyllis O'Reilly, a very attractive young lady from the Cinesound editing department. They were away on their honeymoon.

Phyllis O'Reilly had joined the company in May 1931, just before they had started shooting "On Our Selection". She had begun working in the printing department, but later transferred to the editing department to work with editor Bill Shepherd. She also worked with Frank Coffey, on the Noel Monkman production "The Power and The Glory".

After they were married, Phyllis didn't work for a while — in those days, it wasn't quite the thing. However she was asked to return in about 1941, as they were short-staffed and needed help with newsreels, documentaries and war propaganda film production. She became a very skilled and experienced editor.

After returning from his honeymoon, Clive Cross worked on the newsreel as a war correspondent. Later he worked with the US Signal Corps and well known writer-producers Robert Presnell and Jesse Lasky Jnr. Production of Cinesound features stopped with "Grandad Rudd" in 1939, although Charles Chauvel's famous epic "Forty Thousand Horsemen" was produced in the Cinesound studio in 1940.

During the rest of the war the studio worked on newsreels and war documentaries. It was not not until 1945 that they began work on another feature. This was "Smithy", with Ron Randell playing the key role of aviator Sir Charles Kingsford-Smith. Production of this film was financed by Columbia Studios.

In 1947, Ken Hall left on a trip to London and Hollywood, to order new equipment for a planned re-entry of the studio into feature film production. Just before he left he asked Clive to look after the production of a short musical they had planned, on the concerts for school children which were being run by Professor Bernard Heinz for the ABC.

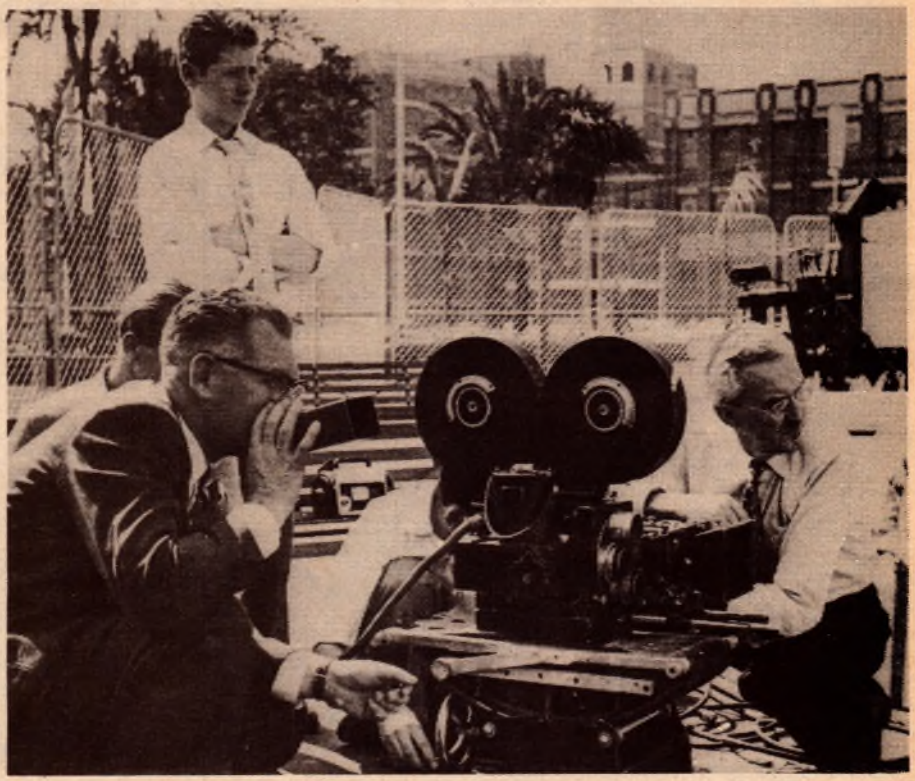
Initially, Clive wasn't too sure just what Ken Hall had meant by "looking after" the film. It soon became clear. He was not just going to supervise the recordings, but to direct the complete production.

He was rather nervous at first about the new responsibilities, but it was flattering to think that Ken Hall had sufficient confidence in him to give him this opportunity. In any case there was a job to be done, so he got stuck into it. There were many unfamiliar problems, but he found himself coming up with answers that seemed to work.

The finished film showed that Ken Hall's confidence had not been misplaced. It was very well received by public and critics alike, and won an industry award. Not only that but the Rank organisation bought it, and distributed it throughout the United Kingdom.

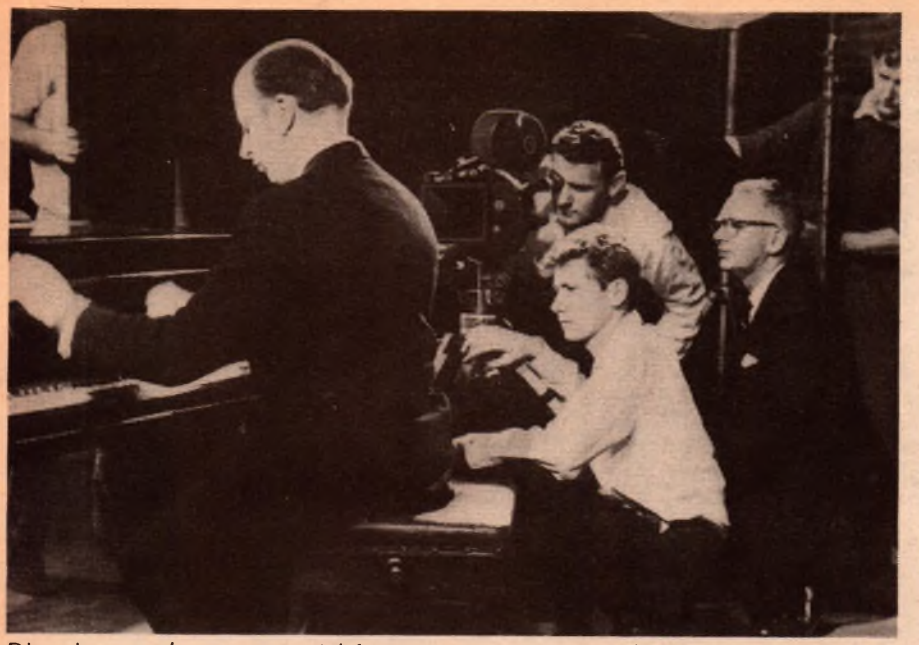
On Ken Hall's return, he complimented Clive on his success with "Professor Heinz ABC's The Children", and told him that he had obvious potential as a director. Unfortunately very soon afterwards there came some bad news for all of them: the company management, headed by Sir Norman Rydge, had scrapped the plans for Cinesound to make further feature films.

It was a bitter blow to all of them, Clive as much as anyone. Still, there was the weekly newsreel and documentaries. And Ken Hall gave him as many opportunities as he could to get further experience as a director. Over the next few years he directed many short films, including "Chance of A Lifetime" with Moira Redmond, "Locating One Wolf" for the navy, "Tomorrow's Headline" with John Meillon, a short for Walt Disney featuring Muriel Steinbeck, and a wine promotion film featuring Rod Taylor. He also directed some dialog for Charles Chauvel's "Sons of Matthew".



Clive Cross directing an ice skating scene at Sydney's Prince Alfred Park, for a Viscount cigarette commercial of the mid 1960s.

A further blow came in 1950, when they learned that the Bondi Junction studio facility had been sold to a soft drink company. Cinesound was moved to an empty cinema which the company owned in Balmain, on the other side of Sydney. It had very poor accessability, and seemed like Siberia in comparison with Bondi. But they pressed on, despite the discouragement.



Directing another commercial for Viscount cigarettes, about 1965. The pianist is Glenn Marks; Clive Cross is at right, alongside the cameraman.

The final bombshell came early in 1957. Discouraged by the way Cinesound had been held back, Ken Hall accepted an invitation from Sir Frank Packer to become head of the National Nine TV network, and manager of station TCN-9 in Sydney. When he left, the Cinesound team felt leaderless. Morale crumbled, and with a wife and two teenage children to support, Clive became quite worried about the future.

Happily about a month later, Clive himself was able to escape from the situation also. During the previous six months he had been assigned by Cinesound to make some TV commercials for Clemenger Advertising, and had become friends with John Clemenger as a result. Knowing the situation at Cinesound, Clemenger offered him a job as television manager.

After carefully weighing the alternatives, he accepted. This started him on a new and very satisfying career, although at the same time a very busy one. He was responsible both for negotiating with TV stations and for the production of TV commercials, many of them for top clients.

For the first few years the commercials were produced using the studio facilities of the TV stations themselves. But by the mid 1960s these facilities were becoming very congested, making production difficult. Accordingly Clive suggested to John Clemenger that they set up their own studio, and Clemenger agreed.

Premises were found, Clive designed the studio facilities and they were built in 1966. John Clemenger Film Productions was born, and began producing a steady stream of commercials.

With Clive at the helm they were very successful. The commercials they produced were of a high standard, and attracted many big clients. One of their commercials for the indigestion remedy "Alka-Selzer" won an industry award, while a series for Godfrey Phillips promoting that firm's "Viscount" cigarettes became an industry benchmark.

For three very hectic years Clive Cross and his team produced an almost continuous stream of commercials. Then in 1969, realising that his health was beginning to suffer from the strain, he decided to retire and take life a little easier.

Nowadays he lives quietly with his wife Phyllis in Bronte, one of Sydney's eastern suburbs — not far from both his father and from his long-time colleague Arthur Smith. Although not enjoying the best of health, he finds great pleasure in music, reading and gardening.

A very modest m n, Clive Cross is inclined to underestimate the roles he played. But it seems to me that like Ken Hall, his father Bert Cross, Arthur Smith, and the rest of the Cinesound pioneers he has every reason to be proud of his work in building up Australia's motion picture industry.

STOP PRESS: Just after this article had been written, I was lucky enough to be invited to spend an afternoon talking with Ken Hall, the well-known director of Cinesound's classic features. One of the things Mr Hall told me was that if Cinesound had been allowed to resume feature film production after the war, Clive Cross undoubtedly would have become one of the main feature directors. That seems to me a fine tribute, from one very talented man to another.

Are negative ions good for you?

Despite a history of contention, there is evidence that small air ions can have remarkable effects on plants and animals. According to researchers, the ion-depleted air in our cities can cause anxiety, make us uncomfortable, and increase the risk of respiratory infections.

by GREG SWAIN

"Air ionisers? . . . . . You must be joking. They've got about as much respectability as pyramid power!"

Well, that was my reaction when the editor gave me the job of writing this article, his interest stirred by the sudden appearance of two air ionisers in our office quite recently. "There has been a lot of serious research into these things," I was told. "Go and find out the facts and then write a story. It should be worth at least two pages!"

And it would seem that he was right, as much as I hate to admit. There has been a great deal of research into the biological impact of small air ions on humans and other life forms. Articles have even appeared in many respected publications, including the British publication "New Scientist", the American journal "Science" and, believe it or not, "Readers Digest".

But let's get down to business. What really are the facts regarding air ionisers?

There is now increasing evidence that air ion concentrations can have remarkable effects on plants and animals. Indeed, research indicates that ion depletion could explain a wide range of human problems, including respiratory problems, headaches and mental fatigue.

Increasing air ion concentrations, on the other hand, can have highly benificial effects on these symptoms, as well as relieving the pain of burns and promoting plant growth, according to researchers. Tests on humans exposed to high concentrations of negative ions are said to show increased mental agility, fewer respiratory problems and, in the long term, reduced incidence of sickness.

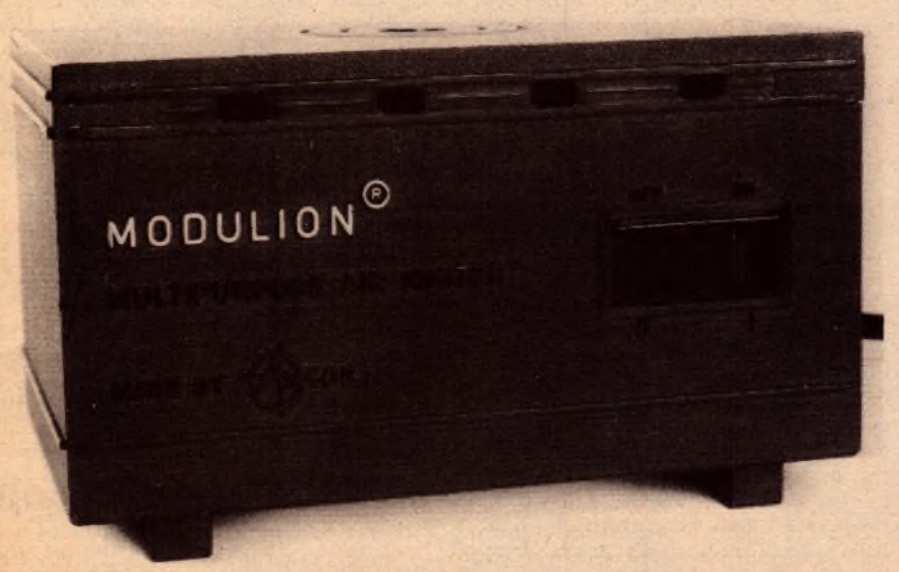
The field of research was pioneered more than 40 years ago by the Russian scientist Tchijevski who, in a long series of experiments, discovered that culture growth rate was dramatically affected by air ion concentrations. Even today, it is the Russians and the Hungarians who are the keenest exponents of air ionisation. In fact, research in the USSR is said to be at such an advanced stage that ionisation therapy is now widely used in hospitals.

The Hungarians, for their part, have fitted more than one thousand public transport busses with air ion generators, claiming a drastic reduction in accident rates.

Research in the United States received a severe setback when, in the mid-1950s, the US Food and Drug Administration banned the sale of air ion generators to the public and, subsequently, for medical applications. The FDA's actions were understandable in the circumstances — companies were selling the machines through intensive advertising campaigns, extolling their efficacy in treating a wide variety of diseases.

But despite the FDA decision, research did continue in the US, and in recent years the whole subject has been able to regain a degree of scientific responsibility. To be fair, the commercial exploitation of 20 years ago is hardly a valid reason for condemning the whole area of investigation.

One of the most respected researchers in the field is Dr Albert Krueger who, for more than 20 years, has conducted experiments at the Air Ion Laboratory of the University of California. Krueger's research has shown that just as negative ions can have beneficial effects, so positive ions can have harmful effects. In fact, the effect of high positive ion concen-



Manufactured in Israel, the Modulion "multipurpose air ionizer" is a personal unit intended for use in the bedroom or on the office desk. Ions are emitted from slots at the top of the case. This unit is not available in Australia.

trations is to cause symptoms similar to those caused by severe ion depletion.

So it is important for the ions to have the right charge if they are to have a beneficial effect!

There is much experimental evidence to support this rather startling claim. In an article published in "New Scientist" magazine in June 1973, Krueger details some of the experiments carried out on mice. He found, for example, that air ion concentrations influence survival rate in respiratory diseases.

Positive ions substantially increased the death rate of mice infected with an influenza virus, as did ion-depleted air. A high concentration of negative ions, on the other hand, decreased the death rate. Krueger postulates that this is due to the fact that positive ions produce contracture of the smooth muscles in the air passages, while negative ions have the opposite effect.

Parallel research by Soviet scientists has shown that mice kept in an ion-depleted environment have a somewhat shorter life span than those kept under more normal conditions.

Reasearch groups have also studied ion effects on learning and conditioned emotional responses in rats. All concluded that negative ions significantly facilitated learning and reduced anxiety. Other tests indicate that positive ions make rabbits aggressive, and that given a choice mice markedly prefer negatively ionised air.

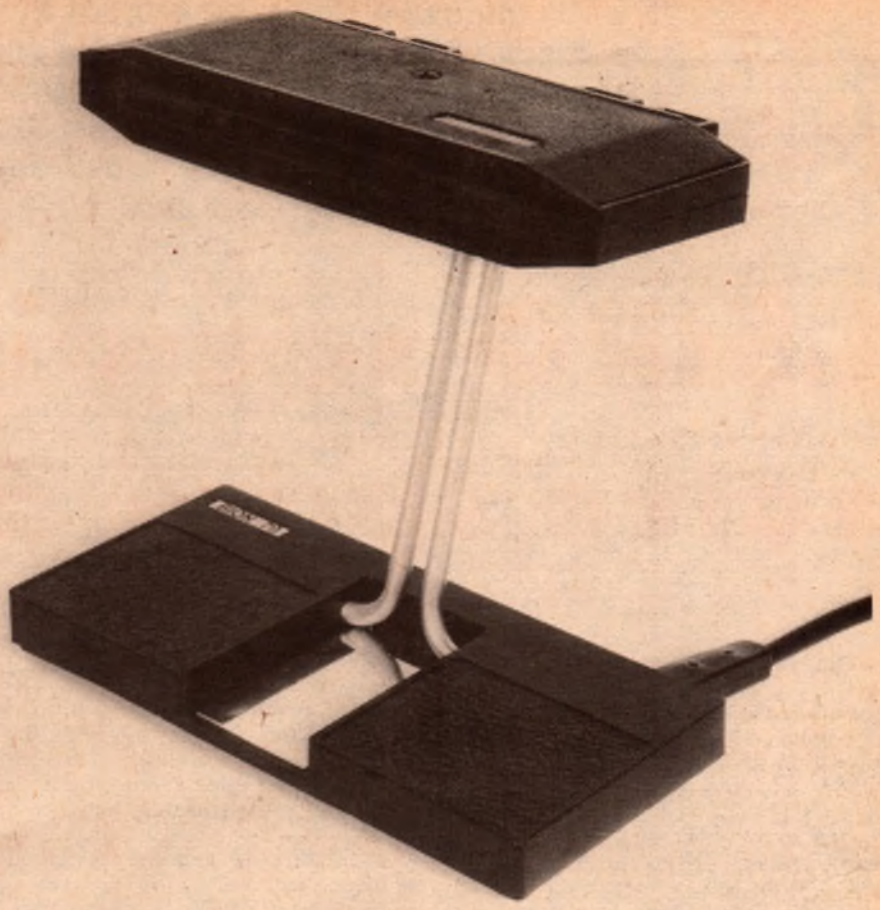
The biological mechanism underlying these reactions is now understood. Apparently, air ion concentrations affect the blood level of serotonin, a powerful neurohormone. This hormone occurs in considerable quantities in the lower midbrain, where it plays an important role in processes such as sleep, the transmission of nerve impulses, and the development of mood.

Scientists have found that negative ions lower, while positive ions raise, blood levels of serotonin. Reduction of serotonin levels in the brain by the negative ions apparently has a tranquillising action.

One of the most dramatic results of this work has been to provide a scientific basis for the fact that certain winds, such as the Fohn in Germany and the Sharav in the Near East, can produce sickness in humans. These so-called "ill winds" are mostly hot and dry, and can adversely affect up to 30 per cent of the exposed population.

The most sensitive individuals become ill up to two days before the winds blow. Researchers who studied the Near East Sharav found that 24 to 48 hours before the onslaught of the wind, and before any other environmental changes, the total number of ions increased (from 1500 ions/cm^3 to 2600 ions/cm^3) and the ratio of positive to negative ions jumped from 1.2 to 1.33.

This shift in ion concentration coincided with the onset of nervous and physical symptoms in weather-sensitive individuals. So it looks as though excess positive ions are the culprits! Further evidence to support this theory comes from the fact that victims experience relief when treated with negative ions, or with drugs that inhibit the production of serotonin in the body.



Another personal air ion generator, this one manufactured by the Hungarian firm Medicor and available in Australia from Wentworth Electronics, 77 Wentworth Ave., Wentworthville 2145. Cost of the unit is $59. A companion unit intended for automotive use is also available for $45.

Other experiments involving humans are yet to be confirmed, although the results obtained thus far appear to be favourable. Krueger, in "New Scientist", states: "There is considerable evidence that ion depletion, such as occurs in offices or crowded rooms, produces discomfort, drowsiness, fatigue, and loss of mental and physical efficiency. Addition of negative ions or both kinds of ions restores comfort and physiological normalcy".

Studies also suggest that, as in the case of mice, man's resistance to influenza and perhaps other infections is increased by inhaling negative ions. In a 1972 test in a Swiss bank, 309 volunteers worked for 30 weeks in an area treated to develop a high ratio of negative to positive ions while a control group of 362 people worked in untreated air.

The result was that the ratio of days lost due to respiratory illness was a staggering 1 to 16!

But why should man, after a million years on this planet, suddenly become concerned about negative ion concentrations in the air he breathes? Well, it seems that modern human activities lead to a severe air ion depletion and, in particular, to an increase in the critical positive to negative air ion ratio. Man often encounters very low air ion concentrations in his cities, a situation due mainly to atmospheric pollution.

The answer, according to Krueger, is to reduce the level of pollution in our cities until the air ion concentration approaches that of clean rural air. Until that day arrives, individuals can correct the situation by employing air ion generators to establish natural conditions in living and working quarters.

Who would stand to benefit most from an air ion generator? According to the claims, mainly those people who suffer compaints such as asthma, bronchitis, hay fever, migraine headaches and mental fatigue. One British company even claims that its air ion generator will relieve common cold symptoms!

In the meantime, we're not committing ourselves one way or the other — at least not until a lot more research has been done. But the subject is certainly an interesting one.

An intensive research project by Australian astronomers has cracked the secret of one of the southern sky's most mysterious objects — Circinus X-1, a cosmic x-ray source. This article tells how scientists were able to explain its strange behaviour, and describes an awesome "close encounter" between a neutron star and a supergiant sun.

CSIRO scientists solve space mystery

The enigmatic behaviour of Circinus X-1, the first cosmic x-ray source to be found in the costellation Circinus, 30,000 light years distant, had defied explanation since it was first detected by NASA satellite-borne x-ray telescopes in 1971-72.

Dr Raymond Haynes, an astronomer with CSIRO's Division of Radiophysics who, with four colleagues, Drs Ian Lerche, David Jauncey, Jim Caswell and Paul Murdin, has proposed an explanation for the odd behaviour of Circinus X-1, says it has been found to be not one object but two — a tiny, incredibly dense neutron star in elliptical orbit around a massive supergiant sun.

Approximately every 16 days, after travelling 320 million kilometres, the neutron star hurtles across the face of the supergiant. Tidal forces exerted by the neutron star pull a million billion tonnes of hot, gaseous matter off the supergiant at each pass.

The fiery tide rains down onto the surface of the neutron star, creating a massive three-day outburst of radiation which is detectable by radio and optical telescopes in the southern hemisphere.

Circinus X-1 yielded its secrets only after collation of an enormous amount of data from combined observations made with CSIRO's 64-metre Parkes radiotelescope, NASA's 64-metre radiotelescope at Tidbinbilla, Sydney University's Fleurs synthesis and Molonglo radiotelescopes, the Anglo-Australian Observatory's 4-metre optical telescope and the UK Schmidt optical telescope.

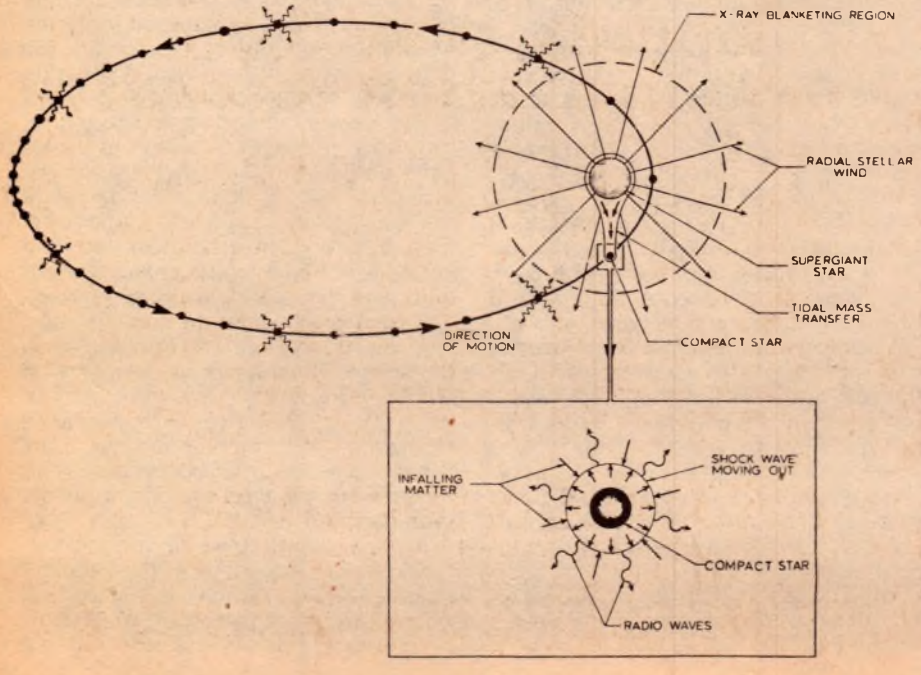
Every 16 days and 14 hours, the x-ray emission from Circinus X-1 climbs to a peak and then, in less than two hours, drops to near zero and remains low for the next two to three days. During this time both optical and radio disturbances occur.

The brightness of the supergiant increases by a factor of about two during the time the x-rays are cut off and radio flares are detected at intervals of about 18 hours. The increase in brightness is due to a swelling of the supergiant's size as the tidal attraction of the neutron star grows stronger.

The first radio measurements of a point source near the position of Circinus X-1 were obtained by CSIRO and Sydney University researchers in 1974-75, using the Parkes and Molonglo radiotelescopes. About the same time, an Anglo-Australian Observatory team at Siding Spring discovered a massive supergiant with an extremely red spectrum near the same position.

Evidence linking the radio source, x-ray source and visible supergiant was obtained in two ways. First, a CSIRO-Sydney University team using the Fleurs synthesis radiotelescope confirmed that the radio source coincided with the position of the supergiant. Then CSIRO scientists discovered the radio source flared up in intensity every 16 days, shortly after the x-ray source turned off.

Recent radio observations by CSIRO and Sydney University researchers using the Parkes and Tidbinbilla radiotelescopes and the Fleurs synthesis radiotelescope defined the pattern of radio flaring at different



This diagram shows the cycle of events. The neutron star is shown in orbit around the supergiant star, with the dots representing equal time intervals of approximately 12 hours. The neutron star accelerates as it approaches the supergiant and swings around it, taking 16.6 days to complete the cycle. It is inside the x-ray blanketing region for about three days.

NASA's 64-metre dish at Tidbinbilla.

frequencies, allowing them to deduce how the radio waves are generated.

Dr Haynes says that during the neutron star's close encounter with the supergiant, the supergiant's stellar wind completely blankets the neutron star's characteristic x-ray emissions. Only after the compact star has moved away from its supergiant companion does the blanketing effect thin out enough to allow the x-rays to "shine" through and be detected by x-ray satellites.

Although the evidence is strongly suggestive that the smaller object is a neutron star, Dr Haynes says there is a possibility that it may be one of the elusive "black holes" predicted by cosmologists.

Such theories predict any star larger than 10 solar masses will undergo complete collapse under its own gravity, so that all matter is crushed to a single point, a "singularity" from which nothing, including light, can escape — a "black hole".

Stars with a mass less than 10 times that of our own sun will eventually collapse under their own gravity into tiny, incredibly dense objects only a few kilometres across in which the spaces within and between atoms no longer exist — neutron stars.

Dr Haynes said astrophysicists were excited by the discovery because their co-operative efforts had not only forced Circinus X-1 to reveal how it "ticks", but had also allowed its future behaviour patterns to be predicted. Two of these predictions had already been verified, adding to the evidence of the supergiant-neutron star pairing.

Dr Haynes said Australian astronomers would now co-operate with the Hartebeestehoek Radio Astronomy Observatory in Pretoria, South Africa, in further investigations of the unique object in efforts to confirm other predictions about Circinus X-1.

Forum

Conducted by Neville Williams

Perfection is no longer sufficient: Your hifi system must be "musical"!

Having used up all the available superlatives and exploited specifications to their credible limits, the hifi fraternity has suddenly discovered the delightfully vague and subjective term: "musical". There's just one small problem: it is very difficult to decide when or whether the term means anything, or nothing!

You have doubtless seen the word used frequently, of late, particularly in the context of "expert panel" verdicts. A number of amplifiers, for example, may all have highly commendable and proven specifications — maybe virtually "state-of-the-art" — but one may be singled out as being noticeably more "musical" than the others.

If clarification is sought, one is likely to be told that the sound seems more "open" or "transparent" or "definitive", or something else of an equally subjective nature.

How does one line up such a verdict with properties which can be measured and documented? Is the verdict soundly based or is it really a figment of the listeners' imagination?

In point of fact, subjective reaction of this rather obscure kind is part of the first class row that is currently going on in the British hifi industry, to do with the subject of equipment reviews, as published. If a reviewer of note (in the opinion of his/her readers) praises or pans a particular item, it can profoundly influence sales — whether or not the published opinion was substantive.

If equipment is evaluated on the basis of observable, measureable figures, everyone knows where they stand. Figures can be checked and verified, or shown to be in error.

But how do you cope with vague, purely subjective assertions?

The trouble is that, if someone maintains stoutly that hifi component "A" is more "musical" than hifi component "B", and you (or others) cannot hear any difference, the possible conclusions are rather embarrassing:

- Your own perception and judgement is less keen than theirs, or
- They are deluding themselves, and/or trying to delude you!

Either way, the problem will remain unresolved unless a carefully arranged comparison test can be set up which will demonstrate the ability or otherwise of the "expert(s)" to reliably pick the subtle difference that they say they hear.

As far as I, personally, am concerned, I am well aware of good and bad sound quality. If it's bad, I fidget; if it's good, I tend to relax and enjoy it, without searching too diligently for things to be unhappy about!

I seem to lack what some others seem to possess: a long-term memory for the detailed texture of a particular musical phrase such that, on hearing it replayed minutes (or even hours) later, they can say that "it sounds marginally better or worse than on the previous occasion".

"The music had a subtle, oriental quality until I substituted Australian-made batteries!" (Adapted from "Radio-Electronics")

I remember, not so long ago, a couple of people assuring me that they only needed to hear one groove of a known disc to tell whether a particular amplifier was driving the speakers; this against a whole range of other top-line amplifiers.

Others have professed to be acutely aware of the difference in sound quality between a bi-radial stylus and their pet hyper — this, that and the other variety!

Asserted with such conviction, who am I to doubt their word?

Yet I have also encountered equally firm opinions from those who were clearly hearing only what they thought they should hear. Like another gentleman recently, who continued to vote doggedly for cartridge "A", unaware that the engineer in control of the test had unobtrusively interchanged it with the cartridge he had professed to dislike!

Such obvious self-delusion aside, it must be admitted that subjective reaction has a place in the evaluation of transducers in particular, because of the difficulty of measuring objectively all of the complicated and inter-related factors to do with electrical, mechanical and acoustic parameters. Even so, one has to be both careful and cautious, proportioning the strength of the statement to the strength of the evidence.

A properly set up panel should be able to offer a verdict more credible than that of an individual listener, if only because of the averaging effect of different ages, tastes and backgrounds. But, even so, their assessments are still open to question and challenge, as witness the attitude of Michael Gerzon, elsewhere in this issue, to the examination of surround sound systems by the American FCC.

In the May 1978 issue of the British journal "HiFi News & Record Review", well known author Gordon King gives as his opinion that "a good deal of rubbish is currently being disseminated with respect to so-called listening assessments".

To emphasise the rather dubious nature of purely subjective assessment, he quotes a "black box" device which he had set up for some months, designed to introduce a controlled amount of even-order harmonic distortion into the signal chain of highly specified amplifiers. Typically, such amplifiers would be substantially free from transient intermodulation distortion (TID) and slewing induced distortion (SID) and would exhibit a measured distortion figure of less than .03 per cent anywhere in the dynamic range. The black box would typically be set to inject 10 times that figure: 0.3 per cent.

Gordon King says that, of the many people who were invited to simply react to the sound, 90 per cent preferred the reproduction with the added distortion. The remaining 10 per

cent either could not hear any difference or could not make up their minds — all this with source signals derived from good quality recordings.

When the same test was done with higher quality source material, eg. a direct FM-stereo broadcast, the sound with distortion added was still preferred, but by a small majority; the minority was swollen by those who now had great difficulty in picking the difference.

The overall results were not markedly affected by changing amplifiers, loudspeakers or listening rooms.

In commenting on these and similar observations, Gordon King makes the point that the source signal for virtually all listening tests has a higher gross distortion content than some of the items (amplifiers in particular) upon which the panel is adjudicating. A system which can expose the source distortion may well be judged less acceptable than one which, for one reason or another, tends to suppress or mask it.

The verdict becomes a vote for fortuitous colouration rather than for true technical accuracy.

Gordon King is certainly not opposed to listening tests but he does maintain that they should be simply part of a procedure which involves a complete consideration of design merit and objective measurements. If all three coincide, there are good grounds for

A BOO-BOO BY BOEING?

TO THE EDITOR:

Pardon me, but I seem to be missing something in the Boeing solar satellite proposal as a means of producing electric power on earth. Setting aside the not inconsequential questions of the efficiency of generating and detecting such enormous amounts of microwave energy, and indeed the feasibility of doing it at all, the inverse square law seems to have been ignored, presumably in the hope that it can be repealed in Washington!

If such a system were to avoid excessive atmospheric attenuation in the 7 to 10 miles of cloud cover it must pass through, a frequency not much higher than 6 gigahertz would have to be selected. Even assuming some sort of earth-to-satellite servo to maintain beam stability between the path ends, it seems doubtful that the beam width could be much less than about 0.1°, or 6 minutes. There would easily be this much random bending due to atmospheric refraction effects.

At 6GHz, a 0.1° beam is produced by a parabolic dish about 100 feet in diameter, for which the gain is about 63 decibels, and the space attenuation is 112.16dB plus 20 log.D in miles. One may reasonably assume that a synchronous orbit is anticipated, for which the range would be on the order of 20,000 miles. The total space attenuation would thus be about 198dB.

If we assume, ignoring the feasibility and efficiency of doing it, that 10 million kilowatts or 100dBW of microwave energy could be radiated from this hypothetical antenna (and the currents flowing in the illuminator of the dish would be enormous), then at the receiving point we would have a mere -98dBW, to which we add the gain of two 63dB antennas (one at each end) to obtain a mere 28dBW, which is something like 631 watts, or about enough to power a toaster.

I suppose that one could assume a higher frequency like 10GHz and accept another 12dB of atmospheric loss and another 4.4dB of space attenuation, and reduce the beam width to something like 1 minute to obtain about 80dB of gain, but from 20,000 miles out there would still be 214.4dB of path loss offset by 160dB of antenna gain, which could push the received power up to about 36kW, this time enough to power a home with 150-ampere 220-volt service.

Possibly one could assume a non-synchronous orbit and deal with only 200 or 300 miles for path loss and pick up some 36dB — except that now we would have use of this energy for only a portion of the time, depending on the orbit, and we would have to maintain in working order a sophisticated tracking system at both ends of the link. At a time when the public is being hyped up over the minuscule leakage from microwave ovens, I shudder to think what its reaction would be to a tracking system wandering out of servo range.

I may be labelled a heretic by my professional colleagues, but to me this whole idea sounds like another technological WPA calculated more to improve Boeing's profit-and-loss statement than to help the energy shortage. For the proposed cost of $80 billion over a 14-year period, we could buy about 40 nuclear power plants, each capable of a safe 1,100 megawatts, occupying a total of only about 1,000 acres of real estate and casting no shadows across the countryside. With some 8,000 quads of energy in the form of depleted uranium at Oak Ridge waiting to be used in breeder reactors, there is no technological reason to prefer the pie-in-the-sky solar-power satellite over the birds already in hand.

R. W. Johnson
Ben Lomond, Calif.

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FORUM: Perfection is no longer sufficient . . .

assurance. If they do not, the reviewer can go looking for the reason.

While I have quoted Gordon King, motivation for the foregoing was provided by a letter from a NSW reader who was reacting, in turn, to an article in another British publication "Popular Hi-Fi". His letter reads:

Dear Sir,

Is a battery musical or not?

Before you write this off as a silly question, please read the attached article.

The subject of musicality has been covered fairly well of late but when a reviewer subjects his readers to the kind of comment as underlined (tongue in cheek?) where will it all end?

I have never considered that a DC supply has a musical character although I must admit that, if a battery is connected across a loudspeaker, it makes a rude plop, as decoded by my ears!

I now wonder whether the "musicality" of car horns is being affected by the brand of battery fitted. It surely opens up a whole new approach to battery replacement!

G. F. (Homebush, NSW)

The article in question centred around certain moving coil cartridges currently on sale in the British market. The copy of the text as supplied by G.F. contained very little technical data, outside a few references to the specifications. But it did abound with subjective words and phrases describing the reviewer's reactions. One cartridge was described in these terms:

"It seemed able to present convincing dynamics but the mid-range was a little recessive and could hardly be described as open. This, combined with a coarse and even strident top end character, did not allow of any real spaciousness of imagery or of the reproduction of ambience from the programme material. Bass was firm but not as well extended as it could have been and not particularly detailed."

Reading on, one learned about another cartridge which suffered from "tizzy top" and another which exhibited "steely treble". In another "the reproduction of ambience and solid imagery . . . just did not come through . . . best described as a veil between the listener and the music".

But the passage which really got to our correspondent G.F. occurred in a discussion of pre-preamplifiers, which are often preferred to a transformer to step up the output voltage from a very low impedance moving coil phono cartridge. Perhaps above all other links in the chain, pre-preamplifiers are open to a detailed measurement of performance, given the right equipment and our review of the Technics unit elsewhere in this issue is an example.

However, the aforesaid reviewer's verdict on one such preamplifier continued thus:

". . . it certainly equalled the Lentek in spaciousness, clarity of detail and transparency. The differences perceived subjectively were extremely subtle and it is likely that they could partially be accounted for by differences in connecting leads or even battery type (Mallories, it seems, regarded as the most musical!)"

Our correspondent had underlined this par and, alongside, had added the query: "Who's kidding who?"

Don't ask us, G.F. Ask the original author!

By sheer coincidence, we had just been through a reviewing exercise with a new Technics moving coil cartridge and its associated pre-preamplifier. Yes, we did listen to the sound but we also took a variety of measurements and we did cross-check our findings to see whether they were consistent and logical.

They were.

The measurement also indicated that distortion and colouration in the pre-preamplifier was so low, relative to the cartridge and signal source, that it could virtually be regarded as "a connecting lead with gain".

We would surely have been kidding ourselves had we gone searching for "extremely subtle" subjective effects in the pre-preamplifier, attributable to connecting leads, batteries or things like that!

But one never knows where suggestions like this will end.

Don't be surprised, next time you go to buy batteries for your portable whatnot, if you're faced with a choice of Mallory "Mozart" cells, or Eveready "Elgars", or National . . . ., National . . . .?

By way of a complete change of subject, many of you will have seen the article in our December 1977 issue describing a Boeing concept for a series of huge satellite power stations in space, collecting energy from the Sun and beaming it in the form of microwaves back to antennas on earth. Presumably, a reference to the concept appeared in the prestigious American journal "Electronics".

While, I guess, that most people would have regarded it as a way-out but rather interesting concept, a Californian reader was moved to work out a few sums and to set out his findings in a letter to the aforesaid "Electronics" magazine. We reproduce it, with acknowledgement, in the accompanying panel.

It seems unthinkable the Boeing engineers would not have been through a similar exercise, but we thought you might like to glimpse an argument at another level.

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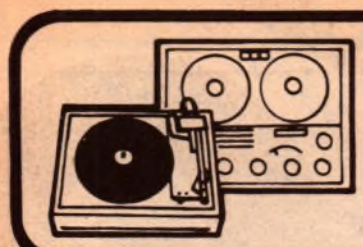

Hi Fi News

THE FUTURE FOR 4-CHANNEL RECORDS & RADIO

PART 3: CALL IT "PSYCHOACOUSTICS"

In this third and final article in the series, the writer puts the case for the British concept of "Ambisonics". Unfortunately, in so doing, he largely continues the familiar theme of roundly criticising the opposing concepts, without really illuminating his own. On the plus side, it would seem that both the BBC and the IBA have been sufficiently impressed by ambisonics to have done parallel work.

by MICHAEL GERZON*

Surround sound seeks to create a convincing illusion for the listener of an all-round directional sound field — this by means of a record or radio reproducing system.

The aove statement needs to be considered alongside some of the confusion which emerges from the hifi press when discussing what some people call "quadraphonics".

First, no system of sound reproduction using just a few loudspeakers can produce in a listening room exactly the pattern of sound occurring if there were actually to be sounds from all directions. This limited number of loudspeakers means that the directional effect has to be an illusion. Thus, good surround sound technology requires the designer to ask how that illusion can best be achieved, subject to practical considerations.

It is not purely a question of electronic design, since the illusion occurs in the ears and brain, and thus requires a study of directional psychoacoustics, ie of the relationship between the objective sound field created in the room via the loudspeakers and the resulting subjective sensation.

Secondly, the definition of surround sound we started with contains no reference to the use of four channels, four speakers or four of anything! The habit of some proponents of surround sound systems of calling their systems "quadraphonic" or "four-channel" is confusing, especially when the system may, at no stage, involve four separate channels of audio information.

Pursuit of a myth that the ideal system of surround sound is "four-channel" led to serious design errors in the early surround sound systems, marketed between 1969 and 1971.

When stereo was commercially introduced around 1956-58, it had been under consideration for 25 years. Its basic principle and technology, including an understanding of psychoacoustics, were established as early as 1931, thanks to the work of the inventor Alan Blumlein.

By contrast, when surround sound was introduced in 1969-71, little previous systematic work had been done, so that it was marketed with inadequate technical development. Commercial pressures forced systems on to the market before the basic principles were understood. This resulted in at least three major competing systems, each with some virtues but also with serious faults that could have been avoided if a few more years development had been allowed before the system standards were "frozen".

Most rooms have four corners so that, in 1969, it seemed plausible that a surround sound system should use four speakers set out in a square, and that four separate channels of audio should be used, one fed to each speaker. The illusion of "phantom" images between speakers was to be achieved by feeding a separate stereo image to each of the four adjacent pairs of speakers.

This "pairwise' system unfortunately does not work as was then expected. Conventional stereo gives a poor illusion of phantom images if the pair of loudspeakers subtends an angle of more than 60° at the listener. Yet the square layout subtends an angle of 90° between each pair. Even worse, if the pair of speakers is to the side of the listener rather than in front, the phantom image illusion fails, as anyone can check by listeningg to a stereo system while facing sideways. Also, the rear speaker pair gives a poorer phantom image illusion than the front pair.

The result is that four-channel pairwise systems give poor results except for sounds positioned at the four corners. This is expecially true for listeners seated away from the centre of the listening area.

JVC's CD-4 system actually conveys four channels on disc. Two channels of audio information are conveyed as conventional stereo signals on the two groove walls, and the other two channels are coded into inaudible ultrasonic signals using a frequency modulation method akin to that used for VHF sound broadcasting. A suitably designed electronic decoder can unscramble this additional information to recover the original four speaker feed signals.

Apart from the limitations of the standard pairwise reproduction method already described, the system has the disadvantage of pushing disc technology to its theoretical limits. As a result, the fidelity is inherently poorer than for normal hi-fi stereo and faulty pressings seem to be more common. Also, it is not practicable to broadcast four separate channels of audio economically with good quality.

Other systems attempt to create an illusion of surround sound while transmitting or recording just two channels of audio information. This is done by "encoding" the original directional effect into just two audio channels, which means assigning sounds in each direction to the two

* Michael Gerzon of Oxford's Mathematical Institute is the prime mover behind the development of Ambisonics. The article, in slightly condensed form, is reproduced by arrangement with "New Scientist", London.

Perfection... from Nakamichi

If you believe that perfection is a thing of the past, take a good look at the Nakamichi 410 Preamplifier, 420 Power Amplifier and 430 FM Tuner – the most elegantly compact, best performing trio of components on the market today.

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Each, of course, embodies world-famous no-compromise Nakamichi engineering and quality construction ... with the distinctive "feel" of meticulous manufacture. So, if you're limited by space or budget, but unwilling to compromise on quality or performance, nothing could be more perfect.

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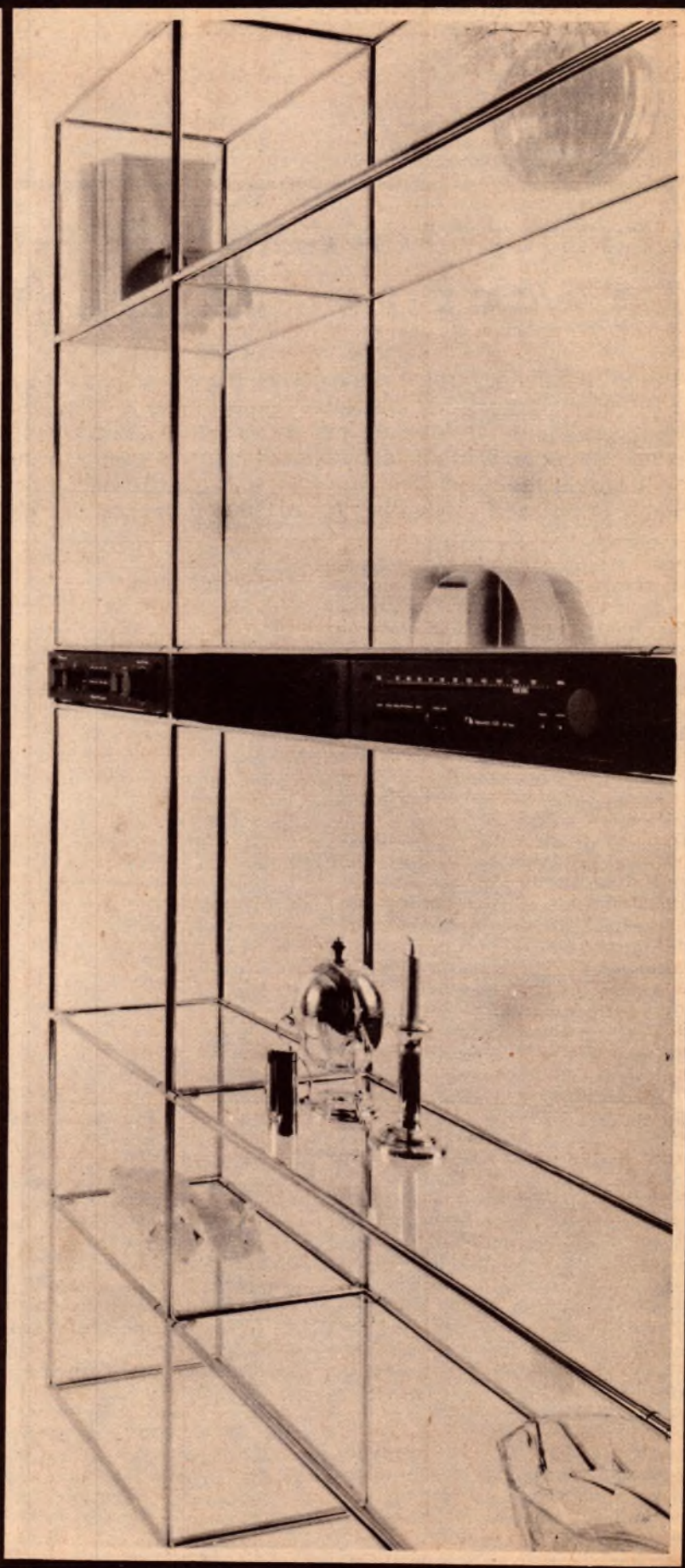


channels with relative intensities and relative phases characteristic of that direction. Two-channel surround sound encoding systems differ in the way they assign these relative phases and intensities.

The ordinary stereo owner, listening to an encoded two-channel programme, hears a stereo effect, although it might sound a little different from that of a purpose-made stereo disc. The listener to surround sound is equipped typically with four speakers and amplifiers, along with an apparatus called a decoder that processes the input signals to produce four output signals that — hopefully — create an illusion of the all-round directional effect originally intended.

Many different considerations determine how good a system is. It is not enough to assert that the stereo reproduction of a given system sounds "good", one needs to know on what type of material it sounds good. A system in general use has to handle such varied requirements as classical music with concert-hall-ambience, all-round pop, easy listening music and radio drama. If a system fails badly on one type of material (when heard in any of mono, stereo or surround listening modes), it has to be rejected as unsuitable for general use.

Listeners using mono radio sets will clearly require that no sound should disappear or become excessively attenuated relative to other sounds. In this respect, both the SQ and QS systems are poor, in that sounds originating from the rear come out weakly or not at all in mono. Proponents of the SQ system suggest the use of a "forward oriented encoder" specially designed to overcome this problem, but it is then found that due-rear sounds are mislocated 180° at due front in surround decoding. The forward oriented encoder is one of at least six different encoding options offered by SQ so that producers can decide for themselves which collection of faults they prefer!

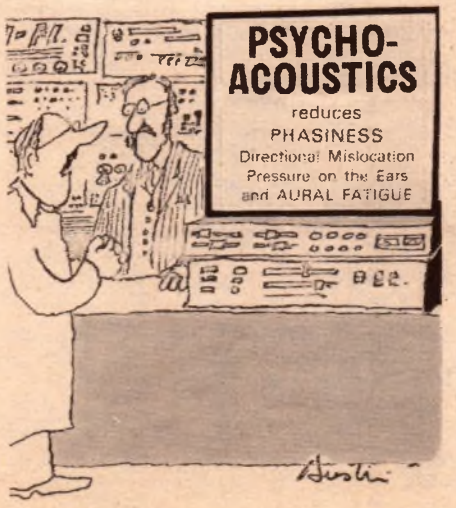
The stereo sound of a system is extremely important to existing users of hifi equipment, and is one of the areas that has required careful investigation in the past few years. If the phases of the signals in the two stereo channels differ too much, the reproduction takes on a quality called "phasiness". In excess, this quality causes a sensation of "pressure on the ears" which can greatly reduce listening pleasure.

Broadly speaking, both SQ and QS give stereo in which front-stage encoded sounds have no phasiness but rear-stage sounds are very phasey. Additionally, QS gives a rather narrow front-stage presentation in stereo, while the SQ system reproduces very wide front stages with the edges of the (say) orchestra folded back over toward the middle of the stage if the orchestra happens to occupy more than the front quadrant.

Issued recently by the Central Office of Information in London, this picture shows the new "System 4-40 All British music centre". Said to be the outcome of two years of research, it is equipped for "Ambiophony" — which would seem to be remarkably difficult to pronounce, let alone to use as a marketing term! It has provision for connecting four loudspeakers.

The BBC designed its H system not to give excessive stereo phasiness for any sound direction. Experience with several months' of experimental broadcasts has led to further refinements that now yield considerably less phasiness and a wider overall stereo stage than in the early stages.

Most decoders for two-channel systems have been designed to imitate the results of pair-wise four-channel. Right from the start, such decoders are likely to give a poor phantom-image directional illusion. Since one cannot get four distinct channels from two, most of the decoders use s"logic" or "variomatrix" techniques. They use a detection circuit which works out at each moment where the dominant sound is located, and pushes the whole reproduced sound field towards that dominant direction. In effect, the loudspeakers away from the dominant direction are turned down. Such decoders thus constantly (and very rapidly) turn the gains of speakers up and down. The resulting effect can give a sharp sense of direction with dominant sounds, but causes quieter sounds in other directions to wander.



"... and just to think of all those pills that I needn't have taken!"

In the presence of many sounds in many directions, the direction "logic" detection circuit cannot deduce a dominant direction, so that the decoder then acts as a simple linear matrix curcuit. Under these conditions, the variable decoder will only sound good if a simple matrix decoder does. It is possible to design good simple decoders for most two-channel systems, but not for SQ. This is because SQ was designed so that a simple decoder would reproduce conventional stereo from the front pair of speakers for front-stage sounds provided the rear speakers were switched off, and similarly good rear-stage stereo provided the front pair were switched off!

Unfortunately, a non-variable decoder has to have both front and rear switched on, and the phasor theory of directional hearing developed by Bauer in the early 1960s can be used to show that severe phase-interference effects occur between the front and rear pair in a simple SQ decoder. This effect, which is very audible, means that at each level of sophistication of design, image wandering or "pumping" is more audible on variable SQ decoders than for other two-channel systems.

There can be no doubt that the continual variation in information reaching the ears makes all variable decoders tiring to listen to over extended periods. This "listening fatigue" is not conducive to long-term musical pleasure, which is the prime object of the whole exercise.

The NRDC Ambisonics project has

developed a series of decoders for two-channel systems designed not to imitate pairwise reproduction, but to provide the optimal subjective directional illusion consistent with low listening fatigue. They have been designed to satisfy not just one or two of the mechanisms used by the ears to localise sounds, but a whole range (see New Scientist, vol 69, p 222). These decoders are designed so that they can be used with any rectangular shape of loudspeaker layout, and not just a square, so as to fit most domestic rooms and a control is provided to adjust for the layout in use while retaining the optimal directional illusion.

Just what the traveller ordered: This new alarm clock radio can fill the role of a conventional bedside unit, with two important differences: it is handily small and it operates from internal batteries. The clock is quartz operated with a liquid crystal display and a push-button lamp for night-time peeking. The alarm function can trigger either the AM/FM radio or a tone and the radio has a 1-hour "sleep" timer. (Details from Toshiba-EMI (Aust.) Pty Ltd, 16 Mars Road, Lane Cove 2066.

While relatively few people will be able to accommodate it, six-speaker hexagonal-layout reproduction gives even better results than four, since the extra speakers allow a more precise control of the subjective qualities of the reproduced sound field.

These developments in the technology of psychoacoustic decoding have been made possible by detailed mathematical modelling of many of the mechanisms of sound localisation, together with theorems deduced from these models that indicate the precise conditions under which the various mechanisms agree with one another.

These theories also predict the nature of the remaining defects due to the use of any given number of channels or loudspeakers. In particular, the shortcomings of various methods of encoding and decoding can be analysed, showing for example that (except for material confined just to the four corner positions), the optimal number of channels for the encoding in order to feed four louspeakers is just three.

These mathematical methods also show that, of the existing encoding systems, SQ is unique in that it is the only system for which no decoder satisfying ambisonic psychoacoustic criteria exists — the assumption that such a decoder can be designed leads to a mathematical contradiction.

It is not possible to get the optimum reproduced results unless the recordings used are as good as possible. The NRDC Ambisonics project has developed a refined and psychoacoustically optimised studio technology for this purpose. Many of the earlier broadcasts in the BBC experimental series gave relatively poor surround sound results, primarily because for economic reasons they had to use essentially stereo studio technology not optimised for surround sound. One expects that as new studio technology comes into general use, and as producers and balance engineers learn the practical rules of the new medium, these initial teething troubles will be overcome. While ambisonic studio technology can also be used to make SQ recordings, the SQ encoding destroys many of the distinct advantages for such studio technology.

Systems using extra "half" channels, despite their limited frequency range, when they have suitably designed decoders give a considerably improved directional illusion, which on optimised program material surpasses that of pairwise four-channel systems. Because of the small information content of the half channel, it can be recorded on disc or broadcast without using impractically sophisticated technology and little quality penalty. Since the mono, stereo and two-channel surround listeners' equipment does not respond to the added half channel, it can be added at a later stage of development without disrupting the results obtained by listeners equipped with two-channel decoders.

The BBC has conducted the most extensive comparative series of tests of surround sound systems in the world, which is generally recognised as setting a very high standard in the design of repeatable psychoacoustic experiments. It is very difficult to design tests of subjective results that give the same results when repeated, yet some recent tests by the BBC almost exactly duplicated the results of two-year-old tests. In addition, some of the psychoacoustic data obtained by the BBC has been confirmed elsewhere by independent tests using different procedures. Notably, BBC data on the audibility of phasiness in stereo has been confirmed by experiments at NHK (Japanese radio). The BBC tests have tended consistently to give a poor rating to the SQ system, with systems close to HJ consistently getting the highest rating among two-channel systems.

A much shorter series of tests by the American FCC has recently been published. Unfortunately, these tests show a high degree of internal inconsistency, and suggest for example that out-of-phase stereo images are sharper than in-phase! This inconsistency is thought to be a consequence of it being necessary for the FCC to follow inadequate test procedures used in an

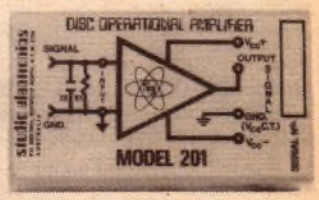
HIFI NEWS — Continued

earlier test series by the NQRC (National Quadraphonic Radio Committee) so that results could be compared.

Obviously aware of the problems of interpretation thus caused, the FCC has gone to great pains to give exhaustive details of test procedures and results. It would thus be unscrupulous to quote results of the FCC tests out of the detailed context in whch they are given. A biased selection of results from the FCC tests could, for example, be used to "show" that the SQ system came out as either the "best" or the "worst" system. Also, not noted in the FCC report is the wide range of decoder costs, with the SQ decoder used costing about 10 times as much as that of the BBC matrix H, so that comparable quality levels in the different systems were not being compared.

The next few months will see the commercial release of the first 2½ channel ambisonic discs, and there is reason to expect that some users of existing will adopt the proposed BBC/NRDC joint HJ encoding tolerances. This standard is the only one designed to work well on the widest possible range of program (and not just crude four-corner effects) in mono, stereo, two-channel and 2½-channel surround modes, and is the result of perhaps the most comprehensive theoretical and experimental research program of any system, involving six years of intensive research beyond that behind the standards of any other available system.

Special quality hifi components from Studio Electronics



Backed by over 20 years of experience in the professional audio field, Studio Electronics Pty Ltd has announced the release of a professional quality preamplifier with input provisions for phono, tape and tuner, mono or stereo, but with no tone control facilities. The manufacturers say that they have concentrated their effort on achieving low distortion, a high S/N ratio and a very flat frequency response, including switchable head amplifiers to suit moving coil or other types of magnetic cartridge. Designated as model 351, the new preamplifier uses professional quality plug-in modules, as pictured above. The company's address: 3 Burwood Road (or PO Box 1055), Burwood North, NSW, 2134. The Company advises that distributorship for their products is available in some areas.

SANSUI HIFI PRODUCTS: A newly formed company, Vanfi (Aust) Pty Ltd is the sole Australian distributor for products manufactured by Sansui Electric Co of Japan. The company is being headed up by Mr C. J. (Clarrie) Pearce, who is well known in the hifi industry. The Melbourne headquarters, under Mr Geoff Brown is at 162 Albert Rd, South Melbourne (Tel (03) 699 5473). The Sydney operation, under Mr Don Oates is at 5, No 5 Northcliff St, Milsons Point (Tel (02) 929 0293). A complete new product range is to be released in Australia involving about 50 items.

3rd Consumer Electronics Show: Sydney

Arranged by Riddell Exhibition Promotions Pty Ltd, the third annual Consumer Electronics Show will be held, this year, at the Sydney Showground. The show will be open to the public from July 13 to July 16, during specified hours, with sessions for the industry only, during the mornings and on July 17.

Previous CE Shows have been held at the Sydney Hilton Hotel but, this year, a larger venue had to be found, to accommodate the anticipated 30,000 plus visitors. The one viable alternative was the Sydney Showground and the use of its two largest pavilions: the Manufacturer's Hall and the Commemorative Hall. A bonus will be the availability of parking and a more generous move-in, move-out time before and after the exhibition.

Mr Kevin Cooksley, CES Manager, says that his organisation will be carpeting the passageways between the stands in both halls, and installing decorative overhead awnings and display material to further enhance the atmosphere at the exhibition. He is confident that exhibitors will co-operate with sophisticated displays, some having already indicated their intention to instal soundproof booths for hifi demonstrations.

Although CES has yet to have its third birthday, it is already being regarded as the appropriate time and place to release new lines. At the time of writing, two months ahead of the exhibition, the list of participating companies is already three pages long, with a number of companies taking multiple stands. From the list, it would appear that the greatest emphasis will be on audio-hifi but other consumer electricals are represented.

By way of example, six new lines in the Philips range will receive major exposure, including a front loading cassette deck, an advanced turntable, a slim-line tuner-preamplifier, "passive radiator" headphones, a power amplifier and a reel-to-reel recorder.

Pye will be showing their long awaited Diotran range of audio products and Sony will be releasing some exciting new turntables and a revolutionary cassette deck.

The Consumer Electronics Show will be open to the public from 1pm to 10pm on Thursday and Friday, July 13 and 24; between 1pm and 6pm on Saturday 15, and on Sunday between the same hours. Entrance fee will be $1.50.

For the trade only, the hours will be from 10am to 1pm Thursday to Sunday inclusive, and on Monday 10am to 6pm.

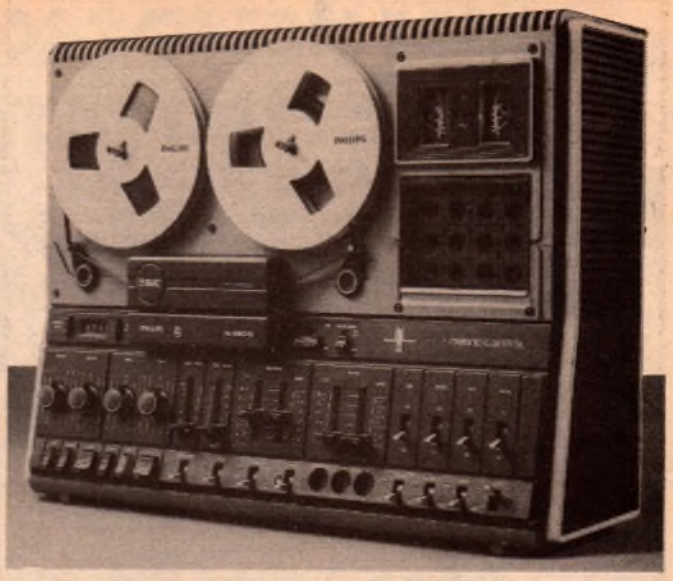
On Saturday evening the official CES dinner will be held at the Hilton Hotel, at a cost of $22 per head to cover meal, bar and entertainment.

Over and above the exhibition to the trade only, activities on Monday, July 17 will include an industry conference in the Showground Ford Pavilion between 9.30am and 3.45pm. Papers to be presented include:

- "Retail Sales Promotion" — Terry Bissaker, freelance marketing consultant and contributor to Mingay's Retailer and Merchandiser.
- "Consumer Legislation Relating To The Electronics Industry" — Alan Lowe, Assistant Commissioner, Operations, NSW Department of Consumer Affairs.
- "The Characteristics Of The Successful Small Business" — Professor Alan Williams, Professor of Commerce, University of Newcastle.
- "Electrical Retailers Do Not Have To Sell" — Joseph Byrnes, Group Director of Diversified Financial Services.
- Final Paper by an international guest speaker.
- Chairman's summary and close.

Industry Conference participants will be charged $18, which will also cover morning and afternoon tea, buffet lunch and drinks.

For further information about any aspect of the Consumer Electronics Show, contact Riddell Exhibition Promotions Pty Ltd, 166 Albert Rd, South Melbourne 3205. Telephone (03) 699 1066.



The Philips N4506 is a new 4-track hifi stereo tape recorder with three drive motors and at-a-touch solenoid control. Speed options are 19, 9.5 and 4.75cm/sec, selectable by a single switch. With three long-life heads, the N4506 offers facilities like mono or stereo, multiplay, echo during record, mixing, before/after monitoring and post fading. Performance specifications are excellent.

The new Philips AF877 turntable with "direct control" electronics and a long list of eye-catching features.

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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Marantz 1152DC stereo amplifier

Stereo amplifiers in the range of about 75 to 100 watts per channel are large and rugged. A particularly rugged example is the Marantz 1152DC which has a rated power of 76 watts per channel with total harmonic distortion of 0.03% across the spectrum from 20Hz to 20kHz.

Like other Marantz amplifiers produced in the last few years, the Marantz 1152DC was designed in the USA but built in Japan. This shows first in the styling, which is different from most Japanese designed equipment. The satin-gold anodised aluminium front panel gives an impression of heaviness and is unusual these days in its symmetrical control layout.

Overall dimensions of the 1152DC are 416 x 152 x 345mm (W x H x D) including knobs, feet and rear projections. Mass of the unit is 14kg.

Rotary controls are provided for input selector, tape monitor, tape copy, mode selector, contour and volume. Sliders are provided for the three tone controls, bass, mid and treble and the balance control. Nine push-buttons control subsidiary functions such as tone control turnover and defeat, muting, filters, speaker switching and power. There are two microphone sockets and a stereo headphone socket.

On the rear panel, the various inputs and outputs are neatly grouped in a logical way. Two tape decks can be connected, either via RCA or DIN sockets. Spring-loaded terminals are provided for connection to loudspeakers.

Internal layout of the amplifier is complex and tightly packed, with very little in the way of signal wiring — all that is accomplished by the interlocking PC boards. In fact, most of what wiring there is involves the high current section of the circuit, power supply, loudspeaker switching and output transistor circuitry.

The Marantz 1152DC fully conforms to Australian standards in the mains wiring, a three-core flex and three-pin plug being fitted.

We did not have access to the circuit diagram at the time of writing so we were unable to evaluate any detailed aspects of the design. The power amplifier output stages are fully complementary, however, with four parallel-connected output transistors in each channel.

A relay in the loudspeaker circuits provides loudspeaker protection in the event of an amplifier fault and also mutes the unit at switch-on and switch-off. As well, the 1152DC has electronic protection against short-circuits, overdrive and other excessive loading.

A commendable feature of this amplifier is the provision of steep slope high and low cut filters. At 18dB/octave below 15Hz, the low filter is particularly effective. Marantz quote on 18dB/octave slope for the high filter and so it is for frequencies above 20kHz. However, in the range of more immediate interest, from 9kHz, the actual slope is closer to 10dB/octave with a cut of 15dB at 20kHz.

Less worthwhile, in this reviewer's opinion, is the provision of the Contour control. This gives a variable Loudness boost characteristic and is an attempt to provide the user with a loudness adjustment which takes into account variations in signal source, loudspeaker efficiency and room parameters.

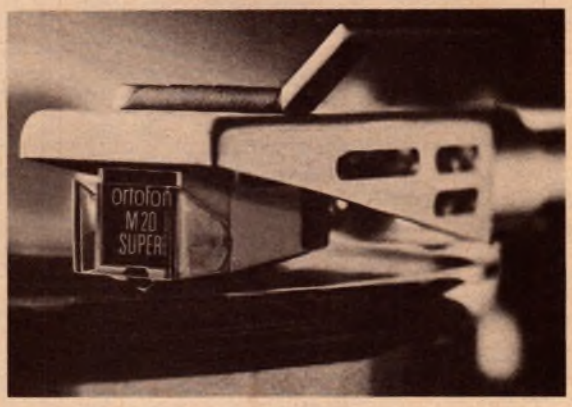
Along with a number of other manufacturers, Marantz characterise their 1152DC by giving separate specifications for the power amplifier and preamplifier. Since the large majority of users are interested only in the integrated performance, all our tests are made with signals fed to the relevant preamplifier inputs.

Power rating of the Marantz is quoted for both 8 and 4 ohm loads. For the 8 ohm case, power is rated at 76 watts per channel with both channels driven over the range 20Hz to 20kHz and for a total harmonic distortion of less than or equal to 0.03 per cent. For the same conditions, power into 4 ohm loads is 95 watts per channel with THD less than or equal to 0.06 per cent.

Much of the performance of the amplifier is characterised in the set of distortion curves we have plotted. These show total harmonic distortion versus power at 1kHz and 20kHz and intermodulation distortion using the

WHAT GOES IN MUST COME OUT.

Ortofon professional cutter head type DSS 732 in action.



Latest from Ortofon is the M 20 Super—a unique magnetic stereo cartridge, based on our exclusive world-patented Variable Magnetic Shunt (VMS) principle.

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With this in mind, we at Ortofon concentrate our activities in two areas only: the production of sophisticated cutting equipment for making master records—and the manufacture of the finest pick-up cartridges to play the discs which they produce.

Most of the major record companies use Ortofon cutters. And because it is only natural that the manufacturer who knows most about making the records should also know most about playing them, our cartridges for many years have been the choice of professionals and discerning music lovers throughout the world.

Ortofon do not make turntables, amplifiers or loudspeakers. We put all our experience into developing advanced products to cover the two most critical sectors in sound reproduction: the cutting and the playback of records.

For us accuracy in sound is more than just a slogan.

It's our reason for being in business.

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SMPTE method with 50Hz and 7kHz mixed in 4:1 ratio. These curves were taken after a one-hour pre-conditioning at 40 per cent of maximum power output. (This is close to the maximum power dissipation condition for the amplifier.)

Both channels were driven during the test and a regulated 240VAC power supply was used. The curves show that the Marantz comfortably meets its power ratings although it exceeds its rated distortion at 20kHz with high power levels. The curves show a rising characteristic at low power levels. This is not due to cross-over artefacts but to the increasing noise component of the THD measurement.

Maximum power at onset of clipping with both channels driven is 88 watts into 8 ohms, 132 watts into 4 ohms and 51 watts into 16 ohms. With one channel driven, the respective figures were 98, 156 and 54 watts. Distortion is slightly higher for the 4-ohm loads than for 8-ohm loads and slightly lower for 16-ohm loads.

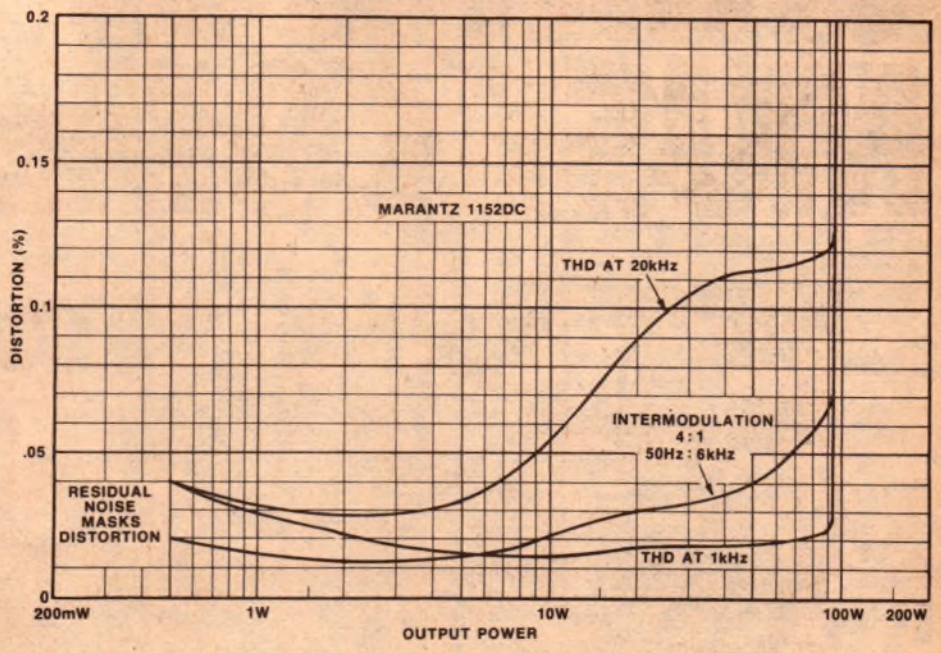
Frequency response for the Auxiliary, Tape and Tuner inputs is -1dB at 10Hz and 50kHz. RIAA equalisation is within +0.2dB from 20Hz to 20kHz. Signal-to-noise ratio for the high level inputs is 83dB unweighted with respect to 76 watts into 8 ohms and the phono s/n ratio is 72dB with respect to the same power and a 10mV/1kHz input with a typical cartridge connected. Phono overload at 1kHz was 300mV rms.

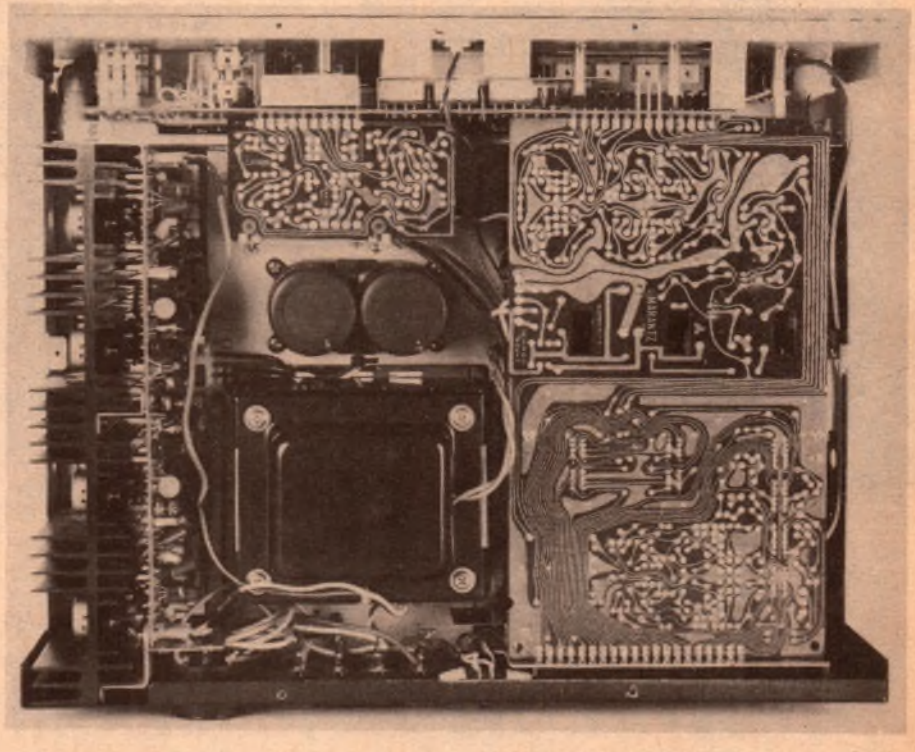
With regard to the label "DC amplifier" on the face plate, it appears that this applies to the power amplifiers alone. The combined amplifierhas the frequency response quoted above. Nevertheless, the amplifier protects the loudspeakers against damage from DC signals by the relay system mentioned above. If the user has problems with the protection system, due to DC offsets or low frequency signals, the amplifier can be switched to AC coupling via a slide switch on the rear panel.

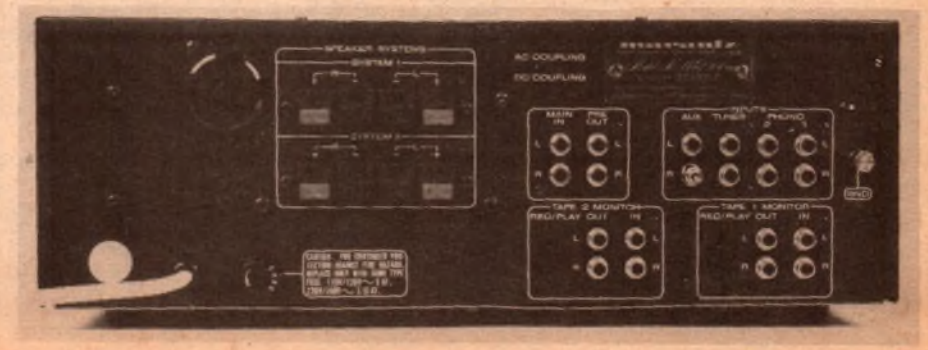
Separation between channels, with tone controls defeated, was40dB at 10kHz, 59dB at 1kHz and 76dB at 100Hz. With tone controls flat and not defeated, the figures change slightly to 45dB, 68dB and 74dB, respectively.

Tests for stability with capacitance up to 1uF shunting the load revealed no problems. Nor did listening tests. The Marantz 1152DC is an excellent power amplifier, ruggedly built and well protected against abuse.

Recommended retail price of the Marantz 1152DC stereo amplifier is $559. Further information on Marantz equipment can be obtained from high fidelity retailers or the Australian distributors, Auriema (Australasia) Pty Ltd, 32 Cross Street, Brookvale, NSW 2100. (LDS).







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ACT/02 T

The Technics moving coil cartridge & preamp.

When I headed back from Japan a few months ago, one of the interesting items in my luggage was a production sample of the new Technics 300MC moving coil stereo phono cartridge. It remained largely something to look at until Haco Distributing Agencies made available a new companion item, the SU-300MC pre-preamplifier.

For many years, the majority of magnetic phono cartridges on the market have combined fixed coils with some means of varying the magnetic flux through them, moving magnet, variable reluctance, etc. In general, these approaches offer simpler construction, higher output voltage and the opportunity to achieve high compliance and low tip mass.

However, despite the impressive specifications of even middle-of-the-road modern cartridges, the mystique of the alternative moving coil principle has lingered.

Interest in moving coil cartridges has blossomed anew over the past year or so, more or less coincident with the emergence of the idea that hifi equipment should sound "musical" rather than merely look good in objective tests.

Certainly, the new generation of moving coil cartridges has exacerbated arguments about "musicality", as well as highlighting again the traditional difficulties of the breed:

- A practical coil is heavier, more frail and more difficult to suspend and move than a component in the magnetic circuit. In practice this adds up to limited compliance and increased tip mass.
- There are greater problems in providing a user-replaceable stylus.
- The available signal output voltage is severely limted.

In practical terms, low output voltage is the most immediate of the foregoing problems. In the Dynavector cartridge (see our September 1977 issue, p27) the manufacturer's answer was to wind the coil with 200 or more turns of incredibly fine wire (11 microns dia.) in order to achieve a nominal output of 2mV at 1kHz (5cm/sec).

Not too many manufacturers have elected to follow this course, preferring to use fewer turns of thicker wire and, in most cases, to provide appropriate step-up transformers — one for each channel. This leads to a further problem in that practical transformers may be rejected as prone to hum pickup and questionable in terms of ultimate-fi standards.

Technics have taken yet another approach in staying with a relatively low impedance moving coil, but relying on direct amplification provided by a special "ultra low noise" pre-preamplifier stage. Such a stage has been included in the latest top-of-the-line Technics equipment.

The SU-300MC pre-preamplifier, as pictured, is an add-on unit intended for those who wish to use the 300MC moving coil cartridge with existing equipment.

Shown above is the new Technics 300MC moving coil cartridge, ready mounted in a standard plug-in shell. Its output of around 150uV is not sufficient to drive a normal amplifier but the Technics SU300MC prepreamplifier (left) can readily bridge the gap.

Measuring 245mm x 140mm x 43mm (not including feet, knob and connectors) it has a satin brown finish, to render it as unobtrusive as possible. It is self-contained, operating from six D-type cells with a rated drain of 45mW (50mA).

RCA sockets at the rear allow it to accept the normal phono leads, a second pair of leads serving to couple it to the phono sockets on the existing conventional amplifier. A single knob on the front panel has an "off" position, a battery check position involving a small LED indicator, and an "MC" position. In the "off" position, an internal relay routes the phono leads straight through, so that a conventional magnetic cartridge can be substituted for non critical listening.

The SU-300MC has an input impedance of 47 ohms, a rated gain of 28dB and a frequency response which is ruler-flat from 30Hz to 70kHz, with droops of less than 1dB at 20Hz and 100kHz. The -3dB points are at 8Hz and 300kHz. Rated S/N ratio (IHF A) is 78dB relative to 250uV and 70dB relative to 100uV. Total harmonic distortion (including noise) is shown in the published curves as between .003 per cent and 0.01 per cent, depending on input voltage.

Tested in our laboratory, the SU-300MC appeared to meet all these specifications. By way of comparison with conventional systems, we measured the S/N ratio relative to 10mV input to the main amplifier, with the pre-preamplifier input shorted. The unweighted figure came out at just over 80dB, indicating that the SU-300MC system bears direct comparison with a conventional good quality system intended for a conventional good quality magnetic cartridge.

Thus assured, we proceeded to test the 300MC cartridge and its pre-preamplifier as a system.

Like other phono cartridges in the National/Technics range, the 300MC is well packaged and comes ready mounted in its own headshell.

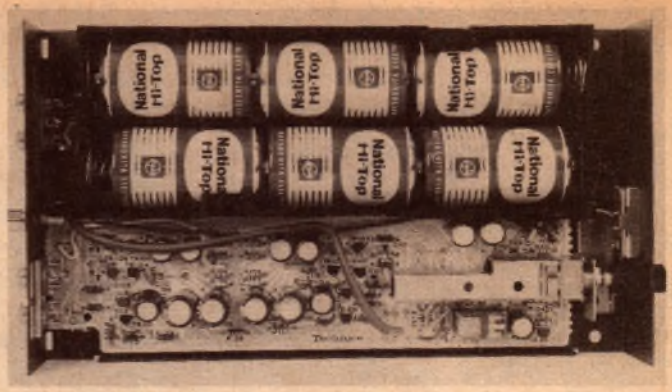
With the pre-preamplifier still turned off and the MC300 therefore switched straight through to the phono input on the main amplifier, the latter needed to

be turned full up to obtain even modest listening volume. In these circumstances, the S/N ratio was poor, as would be expected, with a normal preamp struggling at full gain to amplify a signal in the 0.1 to 0.2mV region.

In short, the MC300 cartridge will be directly useable only if you have a system with in-built moving coil cartridge facilities, or a conventional amplifier with a front end of quite unconventional merit!

Switching on the SU-300MC pre-preamplifier changed that situation dramatically. The available output signal jumped to 2.8mV from a 5cm/sec test track, and the effective signal to noise ratio to 71dB unweighted, with respect to 10mV. The signal level is directly comparable with that from conventional high quality magnetics, while the noise figure was only 1dB below that which could be measured from the same amplifier, when connected directly to a medium impedance cartridge.

Recommended tracking weight for the cartridge is two grams ±0.3 but indications were that there was little room for the downward tolerance. At two grams, there was slight mistracking of the +12dB drum test track on W&G 25/2434. On STR 110, it coped with +15dB but not +18dB.



An inside view of the SU-300MC pre-preamplifier. Supply is from internal batteries. Comparable Technics circuits use five or more transistors in each channel.

While these characteristics may be acceptable, they fall short of what is offered by alternative conventional magnetics, including examples from the same manufacturer. The National EPC-100C for example, a moving magnet design, offers a 50 per cent greater compliance and a tracking force of 1.25 grams.

In terms of frequency response, the output was within ±1dB from about 9kHz to about 60Hz. Below 60Hz there was a slight rise to about 2.5dB in the 20 to 30Hz region. At the top end, the response began to rise at 10kHz, reaching a broad peak of 8dB at 16kHz, but being still above reference at 20kHz.

While this kind of response would yield readily to a treble control, it is possible that the cartridge may need to be loaded by more than the 47 ohms offered by the SU-300MC pre-preamplifier. Unfortunately, the only available cartridge brochure was entirely in Japanese and, while we could see two references to 15 ohms, what the references were we had no way of knowing.

Again, trying to interpret the Japanese specifications, it would appear that the manufacturer's rating is within 1dB at 1kHz for channel balance, with 25dB of channel separation at 1kHz and 20dB at 10kHz. The channel balance was, in fact, of the expected order 9kHz and within about 2dB above that figure. Separation did not appear to be quite as good, being closer to 20dB at 1kHz and a couple of dB less at the top end.

Summing up, the SU-300MC pre-preamplifier is virtually above reproach in terms of objective measurements but the MC300 cartridge itself still reflects what we referred to earlier as the "problems of the breed".

What of its "musicality", the subjective quality of the available sound?

Listening to it, we agreed that the bass was very well sustained and defined. The middle register was also "transparent" but opinions were divided as to whether this was an intrinsic quality or whether the middles were picking up a bonus in definition from the prominence higher up. As for the prominence itself, notably in the 14-18kHz region, its significance obviously varied with the source material, the loudspeaker system in use, and the hearing acuity of the listener.

We agreed that the MC300 sounded fine. In the available listening time, however, we were not able to generate any real conviction as to how it compared with top-flight conventional cartridges in terms of those subtle, subjective qualities that audiophiles are currently arguing about.

We gather that Haco are planning to market the cartridge and preamplifier as a package and, while the final price is still subject to the determination of duty, etc, they are confident that it will be easily the most economical MC/preamplifier combination ever offered in Australia.

For further information: Haco Distributing Agencies Pty Ltd, 57 Anzac Parade, Kensington, NSW. Telephone (03) 662 1222. (WNW and LDS).

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Windmill power for Australia: Pt 2

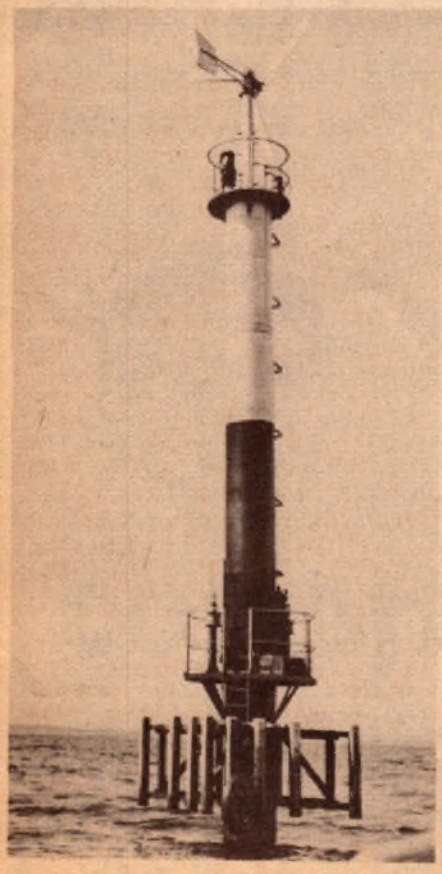
Siting Windmills

In part 1 of this article, it was shown that wind plants connected to a grid are already likely to be economically viable as fossil fuel savers. In this, the second part, we consider possible sites for wind generating plants on a state by state basis, and give basic details on building your own wind generator!

by JOHN ANDREWS

In Australia we are mainly concerned with comparing the cost of wind power with that of fossil-fuelled power stations, in particular coal!

From part 1 of this article it is clear that wind plants connected to the grid are already likely to be economically viable as fuel savers. However, all such calculations assume no inherent value to a fossil-fuel in the ground; eg. the cost of coal to the SEC in Victoria is the cost of digging it up. This in effect treats fossil fuels as inexhaustible, and distorts the comparison with renewable energy sources such as wind power.



WIND POWER on a small scale — locally manufactured Dunlite wind generator mounted atop a marine navigation aid. The Dunlite machine is particularly suited to low power applications (max. output 2kW) in remote locations.

Lovins has suggested the use of long-run marginal-cost pricing of fossil-fuels as a way round this problem, and as a way of taking into account the value of non-renewable fuels to future generations. In this scheme, energy is priced now according to what extra prices supplies will cost in the long run. A thorough investigation of this pricing scheme is needed in Australia, since if adopted it would certainly mean oil and natural gas would be priced much higher, making wind power including storage economical when substituted for these fuels to generate electricity.

The price of coal would rise too, and if we fixed this price now according to what electricity will cost in the long run, in the limit we arrive by definition at the cost of wind-generated electricity, since coal supplies will eventually run out and we will have to use wind power. Importantly, the money raised by taxes on non-renewable fuels to set them at their 'long-run cost' could be used to finance research and development into wind power and other renewable energy sources, and to provide financial incentives for their use.

The relative economics of renewable and non-renewable sources of energy supply could thereby be radically transformed in favour of the former.

Wind power is also economical today in Australia when used to obviate the need to extend the grid in many rural areas. Currently, the cost of grid extensions to the consumer benefiting is greatly subsidised. If the consumer is willing, this subsidy could be given instead as a grant towards installation of a wind-electric generator with suitable storage facilities.

State-by-State Review of Wind Resources

South Australia

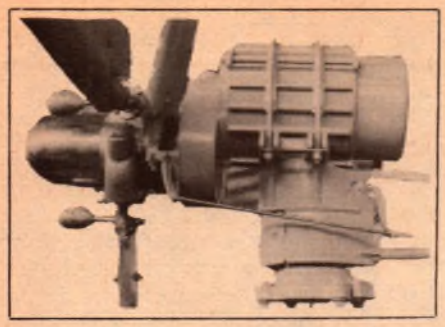
SA is one of the best suited of all the states for large-scale utilisation of wind power. It also has one of the greatest needs for wind-generated electricity since at present natural gas supplies around 50 per cent of the energy input to electricity production. Supplies of gas are likely to become severely depleted in the 1990s or before. SA's coal reserves are small compared with the rest of Australia's.

The state's wind potential is exceptional because it has considerable lengths of coastline which feel the full thrust of strong west to south-westerly winds, blowing, as if in a channel, between migrating anticyclones to the north and cyclones to the south. Mullett points out that this lane of wind exists continually and moves during the year between latitude 30°S and 40°S. Mariners call this lane the "Roaring Forties".

In his submission to the Ranger Inquiry, Atkinson stated:

"An example can be given of a fairly well sampled area on the west coast of South Australia from Sleaford Bay to Streaky Bay bounded by the Penong-Port Lincoln railway. By spacing 200ft (60m) diameter turbines in this area so as to avoid screening, in excess of 3500 x 10^6 kWh (3500GWh) of energy per annum could be obtained from an installed capacity of 1 x 10^6kW (1000MW, about the capacity of a large coal-fired power station). The Coorong region (Meningie-Kingston) would realise 2000 x 10^6kWh (2000GWh) for 0.6 x 10^6kW (600MW) of installation. Yorke Peninsula gives a similar pattern."

Atkinson concluded that the Penong-Port Lincoln proposal alone would "save approximately 60 per cent



DUNLITE WIND GENERATOR (top and right) consists of an alternator driven by a variable pitch propellor through a gearbox, together with AC-DC rectifier and voltage regulator circuitry. The machine employs a brushless commutator, has a maximum output of 2kW and employs a standard 3-blade 4-metre diameter propellor. Output voltage can be specified between 12 and 110V. Dunlite can also supply wind powered generators with maximum outputs ranging from 5W to 100W, having recently taken over this equipment range from Quirk's. For further information, contact Dunlite, Member of the Philips Group of Companies, 28 Orsmond St, Hindmarsh, South Australia.

of fossil fuels used by the Electricity Trust of South Australia in 1974".

Electricity from these coastal wind plants could be fed into a grid, or perhaps more conveniently converted to hydrogen which could then substitute for natural gas in electricity generation.

A private company, the Aerodyne Corporation, plans to build a test group of six 75kW Darrieus wind electric generators on the Yorke Peninsula in 1978, which should provide direct evidence of local cost factors and the feasibility of large-scale wind power for SA.

Western Australia

With much of its long ocean coastline in the path of the roaring forties (Geraldton to Eucla), WA also has considerable wind power potential. Since the state is in the unhappy position of using fuel oil for about a third of the energy input to electricity production, it will soon need a replacement source of supply. Wind power could well be the best candidate. Wind generators on the Bunbury to Albany coastline would be close enough to Perth to allow high-voltage grid-line transmission.

Victoria

At half today's level of electricity consumption and provided coal was not used in quantity for conversion to oil, Victoria's brown coal reserves would last 100 years or longer. There are a lot of 'ifs' there, and since coal is not the most benign substance either to mine or to burn, there is no room for complacency.

It is recommended that the Federal Government begin immediately a feasibility study for a prototype 2MW wind generator for coastal or off-shore siting, and later initiate investigation of a similar machine for lower wind speed, ie. inland, operation. The State Electricity Commission of Victoria should participate in this study.

Musgrove has proposed in the "New Scientist" that depleted off-shore oil wells and natural-gas fields in the North Sea could be used to store hydrogen produced by sea-borne wind generators. The same pipes used to bring the oil and gas ashore could then be used for the hydrogen. It would be interesting to study the Bass Strait oil and gas deposits with this aim in mind.

In the short term in Victoria, an aim should be to phase in wind systems as old coal-fired and oil-fired power stations reach the end of their useful lives.

NSW (incl. ACT) and Queensland

These states have considerable coal reserves which supply most of the energy used for electricity generation, but it is uncertain how much coal will be exported over coming years. Hence the general position with regard to wind-power development is similar to Victoria's. Queensland and NSW electricity authorities could therefore usefully collaborate in the proposed federal study of the potential of a 2MW wind plant, especially with a view to its use in isolated outback towns.

Northern Territory

Being within the tropics and encountering the occasional cyclonic wind which would probably take any wind generator away with it, conversion of sunlight to electricity may prove the more suitable course for the NT.

The low population might reduce the land areas required by centralised schemes such as solar-power towers (25 hectares of mirrors to supply 10,000 people at today's level of electiricity usage) to acceptable levels. Solar cells could certainly be used for electricity generation and would operate at high load factor during the year.

Wind Power and Decentralisation

The concentrated energy available in fossil fuels has facilitated the congregation of people into our large sprawling cities, and the associated concentration of capital and control. As our material standard of living has risen, these urban areas have become regions of incredibly intense energy conversion. If we attempt then to meet anywhere

near today's urban energy demand from a diffuse energy source such as the wind, we must necessarily collect energy from a large number of units and then 'pipe' it back to the cities.

The assumption of maintenance of present urban settlement patterns in Australia (one of the most urbanised countries in the world) thus leads to a mode of deploying wind power involving arrays of large wind generators along suitable coastal areas and some high inland mountain ridges, generally remote from centres of population. While each 2MW wind plant is tiny in energy terms compared to a modern 1000MW power station, each plant must be coupled, via hydrogen or a grid, to a large centrally coordinated distribution system. Such a wind power system, by itself, would not promote, nor conversely prevent, greater decentralisation of political and economic control.

But given a widespread desire to use renewable-energy sources such as the wind, the problems of meeting even half present electricity demand in large urban areas could be used as an additional argument in favour of decentralising our population distribution. To the extent that people were willing to settle in country towns and rural areas, wind power could indeed provide the technical means of their achieving greater political and economic autonomy. If windmills mainly supplied local demand, distribution losses would also be minimised.

To keep our options for the future open, there is, I believe, a need to begin full-scale research and development of the following broad types of wind generators in Australia:

- a 1-2MW wind plant for use with a grid or hydrogen-based system;
- intermediate-sized plants — 100kW for industrial, agricultural, and possibly for supplying electricity to large cooperatives; and
- 1-25kW plants for use at isolated houses, farms and small rural cooperatives and communes.

There is also an urgent need for a full survey of the wind-power resources in Australia, as a basis for future decision-making.

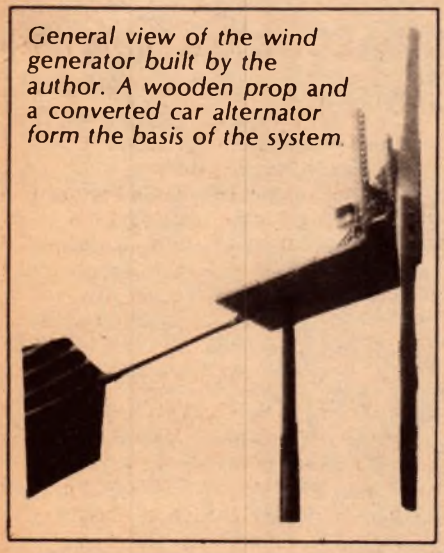
Building a Wind Generator

. . . making the propellor and rewinding the alternator

One of the best ways to find out about wind power is to make a small wind-electric generator for yourself. It also makes an excellent school project. The two most difficult steps are making a propeller, and then matching it to a generator or alternator. Here I'll deal only with these two tasks as many alternative technology books adequately cover other aspects.

Propeller

The following is a description of how to make a wooden prop 6ft in diameter, taken largely from the January 1944 edition of **Practical Mechanics** (hence the non-metric units!).



General view of the wind generator built by the author. A wooden prop and a converted car alternator form the basis of the system.

The first essential is a sound board of uniform thickness with the grain running along the length, 72 x 4 x ¾in. Douglas fir is the best timber but well-seasoned ash is a good substitute.

Find the centre and drill a ¼in hole for testing the balance by hanging the prop on a nail in the side of the bench. It should return to the horizontal from any position, and it is essential that this test be done and any deviation corrected after each separate operation in making the propeller. It is not sufficient to balance the finished prop by removing some timber at random from the heavier side.

Mark the board as shown in Fig. 1, and saw off the shaded portions, cleaning the saw cuts with a plane. Along each trailing edge mark off the distances shown in the table, measured from the back surface of the board, and join them with a pencil line.

To form the driving slope, the front of the prop must now be planed down so that a flat smooth surface connects the original edge CD of the board to the pencil line all the way along the blade. The space GFC can best be scooped out with a spokeshave. The flatness of the new surface is tested with the edge of a ruler, and should be fairly true all the way along. Fig. 1 shows the cross-section of the blade at various points.

This completes the driving slopes. Now the back surfaces must be shaped for the lowest possible air friction. The dotted lines on the cross-section diagrams show the final shape of the back surface, which is planed to a smooth curve with a "blunt" leading edge and decreasing rapidly away to a point along the trailing edge, the maximum thickness of timber being about one-third of the width of the blade from the leading edge at all points.

To reduce the weight of the outside portions of the prop, and to maintain the correct proportions between thickness and width, some timber has to be removed from the back before shaping to the streamline section described.

Lay the propeller with back uppermost and put two or three blocks of timber underneath the front face to act as supports, since the driving slopes will not lie flat on the bench. Plane the board, keeping a flat surface, until it changes from its original thickness at the centre to about half its thickness at the end of each blade. The streamline curve illustrated by dotted lines in Fig. 1 can now be worked on to the back of the blades.

Cut the tips of the blades to the shape indicated and the prop is ready to be sandpapered. This should be continued, from coarse paper to fine, until the whole propeller has a glass-like surface. Particular attention should be given to the blade tips, where the speed is greatest.

The leading edge should be

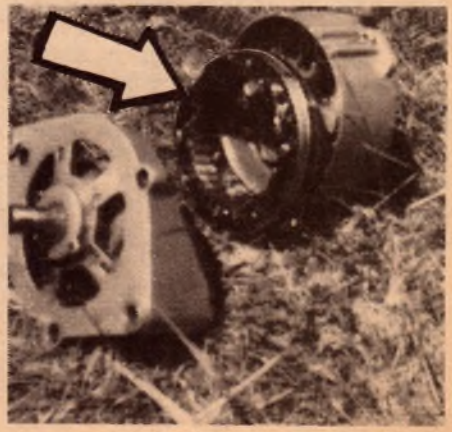


Fig. 2: disassembled Bosch 420 Watt alternator. Arrow points to the stator.

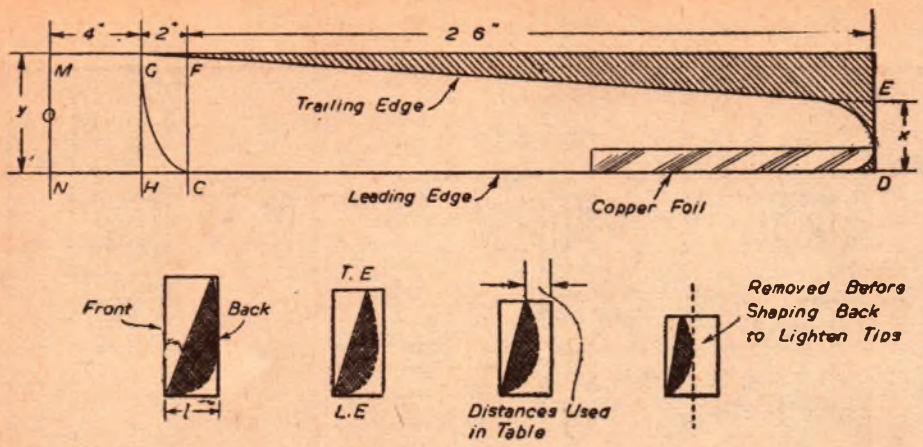


Fig. 1: propellor details, x = 3in; y = 4in; l = 0.75in. The curve of the leading edge remains the same at each section.

protected for the last 12 inches of its length by light copper or aluminium foil. The foil is bent to fit the shape of the blades perfectly, extending back about ¾in on the blade, and fixed by about six small wire staples, passed through tiny holes drilled in the foil and timber, and clenched on alternate sides. This protection is almost a necessity, otherwise the timber comes to pieces along the leading edge after several months working.

Give the prop at least two coats of outside varnish, leaving a week to dry between each coat. Enlarge the central hole to fit. Attach a ¼in thick metal plate with similar central hole to the centre of the prop with two ¼in bolts positioned about 2in either side of the centre. Cut a key slot to accommodate the key on the alternator axle. Remove the pulley wheel from the alternator and bolt the propeller onto the axle with a nut and spring washer.

Rewinding the Alternator

Unfortunately 12 volt car alternators and generators operate over an rpm (revolutions per minute) range unsuitable for direct coupling to the prop described (and most others). I used a Bosch 12 volt 35 amp (420 watt) alternator obtained from a car wrecker, so let's look at how to modify this type.

The Bosch alternator is designed to start charging a battery when it gets to 960rpm, and its maximum rotational speed is about 15,000rpm. This contrasts with the propeller described which rotates at about 300rpm in a 5.4m/s (12mph) wind, speeding up to 900rpm in an 11m/s (25mph wind).

If then we want our wind generator to begin charging in a 5.4m/s (12mph) wind, we have to change the alternator's characteristics so that it generates 12 volts at around 300rpm.

The way to do this is to rewind the stator coils, the fixed coils surrounding the rotating central field windings (see Fig. 2) with about three times as many turns of smaller diameter wire. The alternator will then generate about thee times the voltage as before at a given rpm. But less current will flow and the maximum power output is lowered (which doesn't matter anyway, since we could only expect a maximum of 200 watts from a 6ft prop).

The easiest path is to pay for an alter-

Table 1: Propeller carving details

Distance from centre of board (in)	Distance from back surface on trailing edge (in)
2	.75
3	.75
4	.75
4.5	.25
5	.10
6	.06
7	.06
8	.06
9	.10
10	.20
11	.24
12	.26
13	.28
14	.30
15	.31
16	.32
17	.34
18	.36
19	.39
20	.40
21	.41
22	.41
23	.41
24	.42
25	.42
26	.44
27	.50
28	.55
29	.57
30	.58
31	.59
32	.60
33	.60
34	.61
35	.62
36	.62

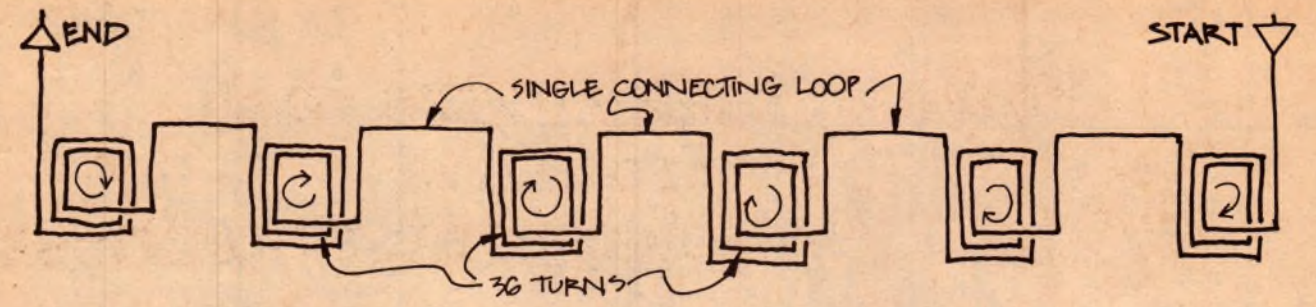


Fig. 3: basic coils to wind. Each of the six coils has 36 turns and all coils are wound in the same direction. Wind three series of coils like this.

nator repair firm to do the rewinding. I contacted Electrowind Sales and Bearings Pty Ltd, 146 Argus St, Cheltenham (telephone 550 1033) in Melbourne and they said it would cost about $10.

This firm kindly let me watch their chief coil rewinder, Tonie Hancock, as he rewound my alternator. A painstaking do-it-yourselfer could do the job, but it's not easy. Here are the basics of the method used.

First note carefully where the stator leads are soldered onto the rest of the alternator, then remove the whole stator and strip its present windings.

Wind three series of six coils, each series as shown in Fig. 3, using the former shown in Fig. 4. Wind 36 turns of 0.63-0.67mm diameter enamelled copper wire on each coil. All coils must be wound in the same sense (all clockwise or anticlockwise, it doesn't matter). The line of coils in Fig. 3 can be obtained by carefully folding out one turn of each coil as it is taken off the former. Sellotape the coils to hold them together temporarily.

The coils are then manipulated into the slots on the stator assembly as shown in Fig. 5. Tap in wooden wedges to hold the coils in place in each slot. The "out" leads of the coils are insulated and all soldered together. Make sure no wires protrude into the tunnel, and flatten and neaten up the coils by pressing them with a flat piece of wood.

Test for continuity and shorts, coat with a baking varnish such as Shellac, and bake the whole assembly.

The "in" leads can now be soldered to the appropriate tags on the alternator assembly (connecting to the diodes) and the alternator reassembled. It's then a good idea to get an auto-electrical firm to test the alternator. Find out at what rpm it will start to charge a 12 volt battery, and its maximum power output.

Mine started to charge at around 400 rpm, but disappointingly only gave a maximum power output of 70 watts. Connected to the propellor it began to charge at wind speeds a little over 12 mph. It's not going to generate much power, but at least IT WORKS!

Reprinted from "Chain Reaction" Vol. 3 No 3 1978, quarterly publication of Friends of the Earth, Australia.

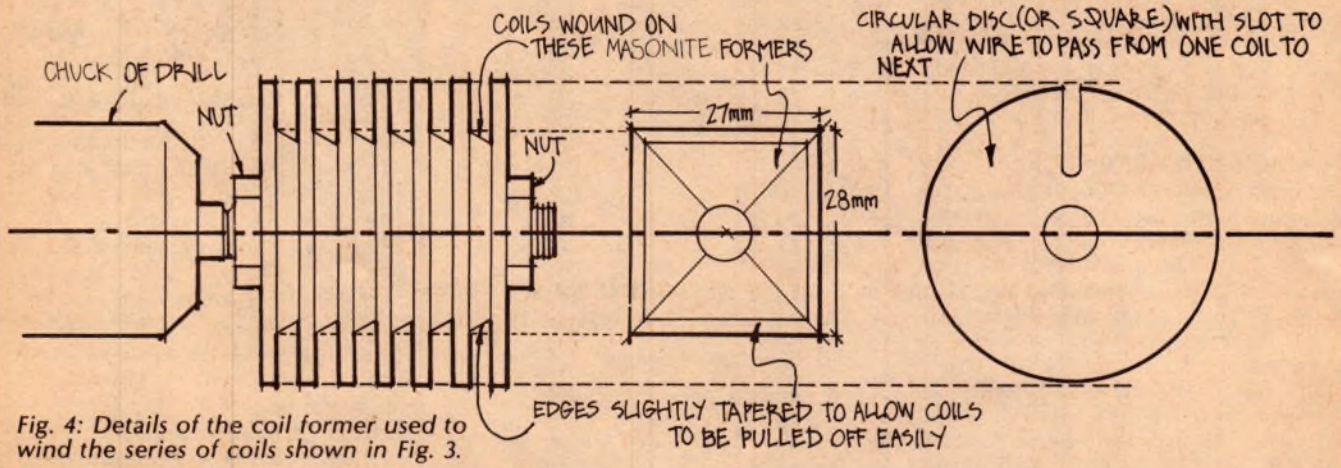


Fig. 4: Details of the coil former used to wind the series of coils shown in Fig. 3.

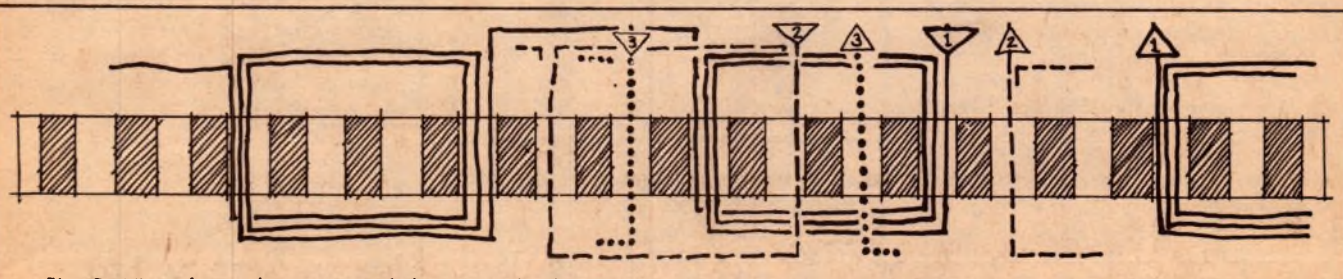


Fig. 5: View from the centre of the stator looking outwards at the metal poles (shaded). Starting with coil 1, manipulate each series of six coils into the slots, as shown. Alternator should charge at around 400rpm.

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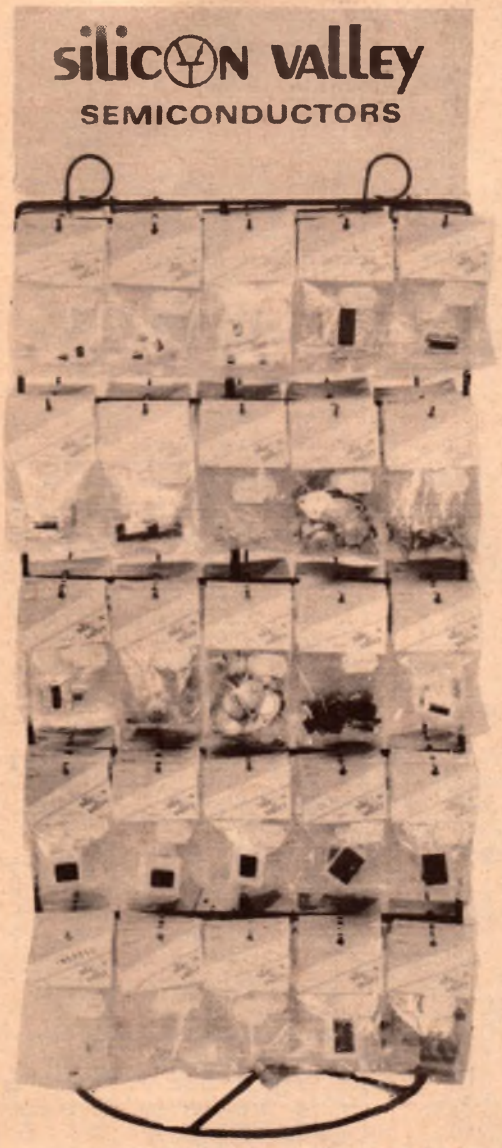

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by DAVID EDWARDS

The 10 games provided on this new video game unit are football, hockey, gridball, target tennis, squash, basketball, solo squash, solo basketball and solo target. All of the games are similar in nature, with the players controlling one or two bats, and attempting to make a ball pass through an opening or a goal mouth.

Each player has a joystick pot, and can move his bat over the full screen area. Handicapping is provided by ball speed and bat size options. Each bat can be individually selected to be either large or small. In all games, the ball starts at low speed. In the high speed mode, it will switch to high speed after nine consecutive hits by the players, if a goal has not been scored.

The direction at which the ball rebounds from the bat is determined by where the ball hits the bat. The bats are divided into five segments, each segment defining a different rebound angle. The zones (listed from the top of the bat) provided rebound angles of 40° up, 20° up, 0° (horizontal), 20° down and 40° down.

Scoring is automatic, and is colour coded to the player's bats. Thus the score for the white bat is shown in white, while that for the black bat is shown in black. The games terminate when one player reachers a score of 15. Tones of 500Hz, 1kHz and 2kHz are produced for a 32mS period when the ball hits a wall, a bat or a goal respectively.

Further details of the various games are provided in the accompanying diagrams.

Turning now to the circuit diagram, we can discuss the circuit implementation. Clock signals for the LSI game chip are provided by a single transistor oscillator, which is tuned by means of a slug and coil.

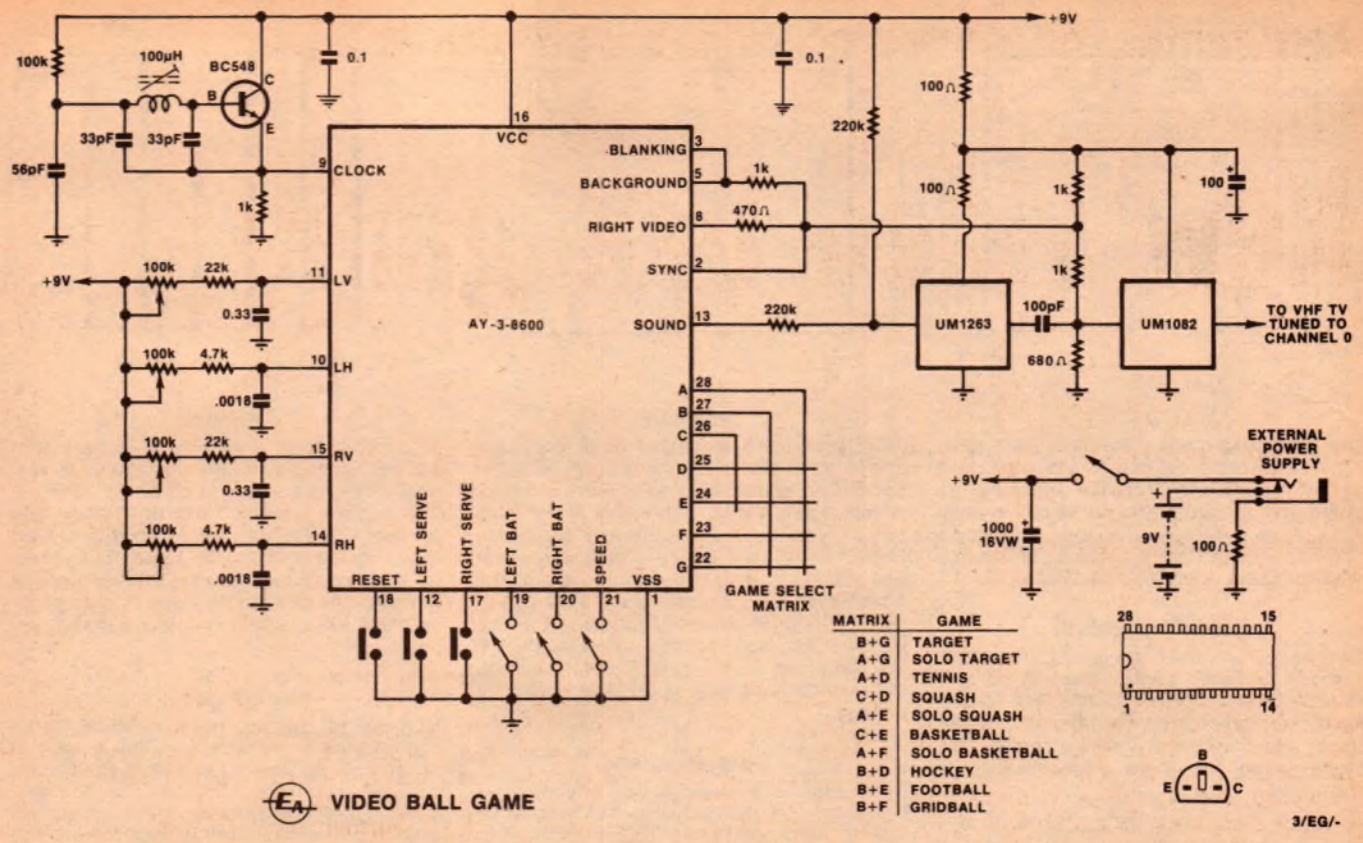
Not much information is available about the AY-3-8600 game chip itself, although it is fairly obviously a digital device. Game selection is by means of a matrix of momentary contact push switches. This means that the front panel is rather forbidding, but is fairly economical, as this type of switch is quite cheap.

A further three momentary contact switches are used for the master reset and the left and right serve controls, while three miniature toggle switches are used to select bat sizes and the ball speed. Toggle switches rather than slide switches have been used because they are much easier to mount in the front panel.

The video output signals are summed and attenuated in a resistive network, and applied to the input of the UM1082. This is a pre-assembled VHF modulator unit, which produces an output signal on Australian chanel 0. A 100 ohm and 100uF RC combination is used to decouple the supply rail, preventing intermodulation between the clock oscillator and the chanel 0 oscillator.

The second UM1263 module is a 5.5MHz frequency modulated os-

Do not be confused by the array of switches shown in this picture, operation of the game is quite simple.



cillator, and is used to generate the sound signals. The attenuated sound signal from the chip is applied to the input, and the FM signal from the output is mixed directly with the vision signals, and applied to the UM1082.

The bat control signals are developed from the joystick controls using RC circuits. The capacitors are periodically discharged, and the time taken for them to reach a reference charge determines the bat positions. This time depends on the setting of the relevant joystick pot.

The complete circuit requires a 9V supply, and this can be provided either by an internal battery or an external mains power supply. A 1000uF electrolytic capacitor is used to ensure a low supply impedance, while a 100 ohm resistor in the negative supply line of the external power pack minimises any mains ripple.

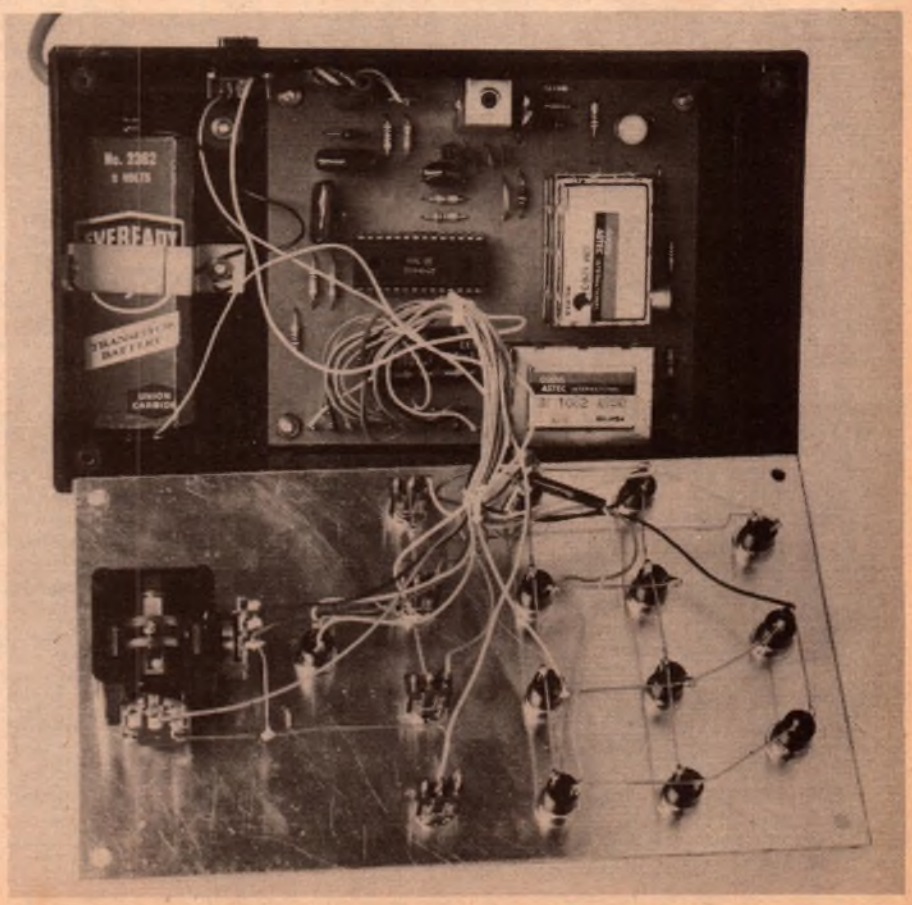
The unit is constructed in two plastic boxes, one large and one small. The large box, which measures 196 x 113 x 60 ohm contains the main circuit board and control switches, as well as one set of player controls. The second box, measuring 83 x 54 x 28mm, contains the second set of player controls, and is attached to the first box by a length of four-way shielded cable.

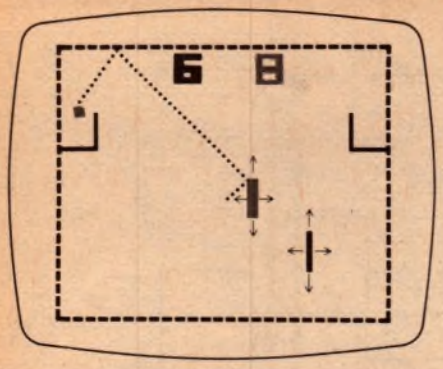
Connection to the TV set is made by a length of 75 ohm coaxial cable, which plugs into an RCA socket on the side of the main box. A socket is also provided for the external power supply.

Construction should be within the

ABOVE: All of the components shown in the circuit diagram are accommodated on single PCB assembly.

BELOW: The vision and sound modulator assemblies are soldered directly to the PCB, as can be seen in this photograph.



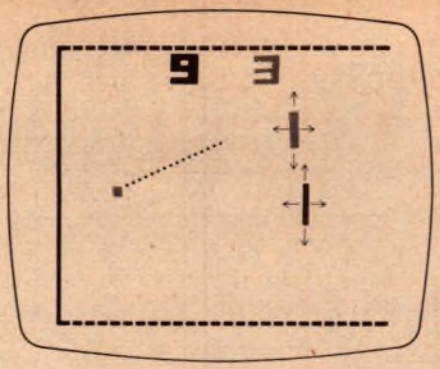


Basketball

The basketball games use the closed playing area as shown above. The players must deflect the ball and cause it to enter the top of the goal to score. The game starts when both players depress the service buttons. The ball moves from the serve point with a random angle in either direction.

Solo Basketball

Solo basketball is a one player game which utilizes only the left basket. The right counter displays the number of hits the player makes without scoring while the left counter shows the number of baskets made. Play starts when the right serve button is depressed.

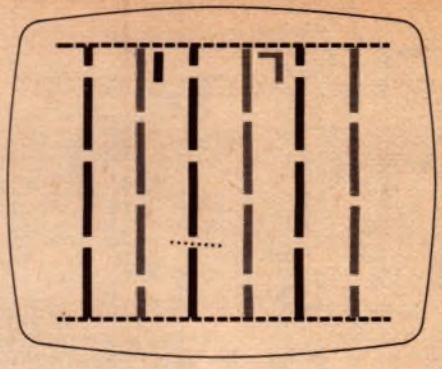


Squash

This game uses a playing area as shown above. Each player can move over the whole court. The game will start when the player whose service it is, depresses his service button. The ball moves off with a random angle toward the front wall. The colour of the ball will change to the colour code of the next player to hit the ball. Should the wrong player intercept or be hit by the ball it will be considered a fault. Points will only be given if won on player's own service. Points won on opponents serve will only cause a service change.

Solo Squash

This game is a single player squash. The right score counts the number of successive hits in the current game (to a maximum of 15), the left score the number of volleys played.

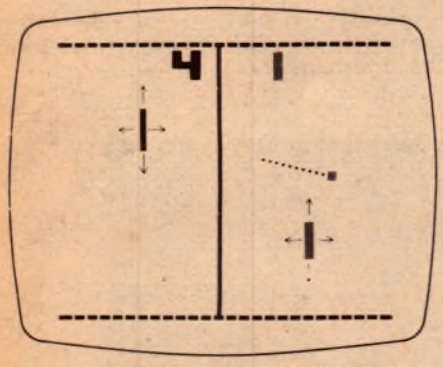


Gridball

This game uses a playing area as shown above. Each player has three sets of vertically moving barriers to block the ball from approaching his end and opening in the barriers to permit the ball to advance toward the opponent's end. The game starts when both players have depressed their service buttons. The ball moves away from the face off point with a random angle in either direction.

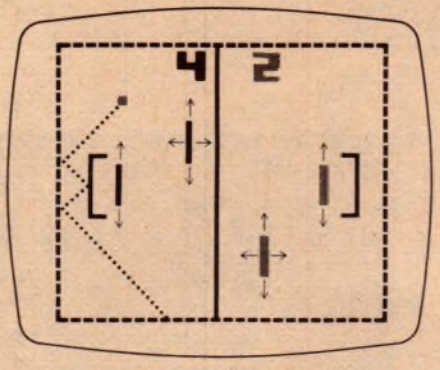
Target

Both target games have a black target square which moves across the screen at random. The players have individually controllable crosshairs. The object of the game is to align the crosshairs on the target, and then to press the trigger (serve) button. The score shows each player's tally of hits.



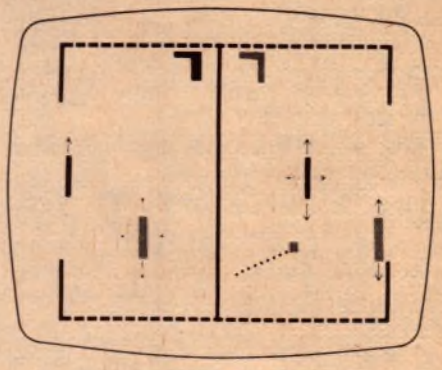
Tennis

This game uses a playing area as shown above. Each player can only move around his side of the court. The game will start when the player whose turn it is to serve, depresses his service button. The service will automatically change every five points scored. At service the ball will move away from the service point with a random angle but always toward the net.



Hockey

This game uses a playing area as shown above. The forwards on both sides have freedom to move over the entire playing area. The goal keepers will be locked in the horizontal axis in front of their respective goals but will move in the vertical axis in the same manner as the forwards.
The game starts when both players have depressed their service buttons. The ball will move away from the face off point with a randomly selected angle in either direction.



Football

This game uses a playing area as shown above. The motion of the players is as in the hockey game. The game will start when the loser of the previous goal depresses his service button. The ball will move away from the kickoff point with a randomly selected angle but always towards towards the goal of the winner of the previous goal.

Solo Target

This is a one player game. The left counter shows the number of misses, while the right counter shows the number of hits.

---

capabilities of most enthusiasts, as all components apart from the controls mount on a single printed circuit board. This is coded 77vbg7, and measures 122 x 101mm. It is mounted using machine screws and nuts on the bottom of the main case.

The UM1082 modulator unit is fitted with an RCA socket as the output connector, and the board has been laid out so that this can be accessed through a clearance hole in the side of the case. The first step in construction should be to determine the position of this hole, and also the board mounting holes.

Next mount the battery and the external power supply socket, using the photographs as a guide for positioning. The battery must be mounted on its largest side, to allow for the joystick control.

We made the front panel of the prototype from "Scotchcal" photosensitive aluminium, and have provided a full sized reproduction of the artwork used elsewhere in this article. By the time you read this article we hope that

suitable commercial panels will be available.

Use the front panel as a template to drill the required holes in the front panel. When mounting the joystick, remember to allow clearance for the edge of the box.

After mounting the switches on the front panel, use the wiring diagram as a guide, and wire all the switches together. If you orientate the switches as shown in the diagram, you will minimise the number of crossovers.

The oscillator coil can now be assembled. Wind 100 turns of 30 B&S gauge enamelled copper wire onto the former, anchoring the start and finish with small pieces of plastic tape. The coil can be jumble wound without affecting performance. If you are not using heat strippable wire, use a small piece of emery paper to remove the insulation from the wire ends, being careful not to break it.

After inserting the completed coil into the base, pass the stripped wire ends into the appropriate pins. Then insert the base into the board, and solder it and the stripped wires to the board. Insert the slug into the coil former, using a piece of elastic to ensure the slug remains fixed in position. Complete the assembly by fitting the metal shield can.

Now fit all the remaining components to the board, taking care to insert polarity-conscious devices correctly. We recommend PCB pins for all the external connections, so these can be inserted at this point.

Do not fit the AY-8600 at this stage, and do not remove it from its protective wrapping or conductive foam. Use either a 28 pin IC socket or Molex connectors so that it can be fitted to the board only after all other wiring has been completed.

Use rainbow cable to make the connections between the front panel and the PCB, allowing sufficient length so that there is access to the board when it is fitted to the case. Then fit the battery, and complete the remaining wiring.

After ensuring that the power is switched off, insert the AY-3-8600. Then

List of component parts

SEMICONDUCTORS
- *1 AY-3-8600 TV game IC*
- *1 BC548 NPN transistor*
- *1 UM1263 sound modulator module*
- *1 UM1082 vision modulator (channel 0) module*

RESISTORS (all ¼W)
- *3 100 ohm, 1 470 ohm, 4 1k, 2 4.7k, 2 22k, 1 100k, 1 680 ohm, 2 220k*
- *2 100k joystick potentiometers*

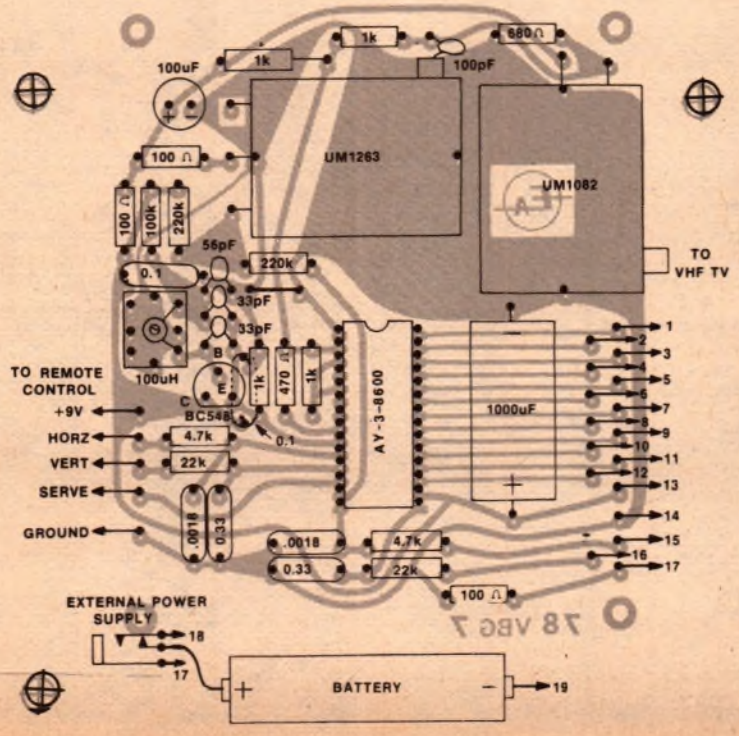
CAPACITORS
- *1 1000uF 16VW axial lead electrolytic*
- *1 100uF 16VW PCB mounting electrolytic*
- *2 0.33uF polyester*
- *2 0.1uF polyester*
- *2 0.0018uF polyester*
- *1 100pF ceramic or polystyrene*
- *1 56pF ceramic or polystyrene*
- *2 33pF ceramic or polystyrene*

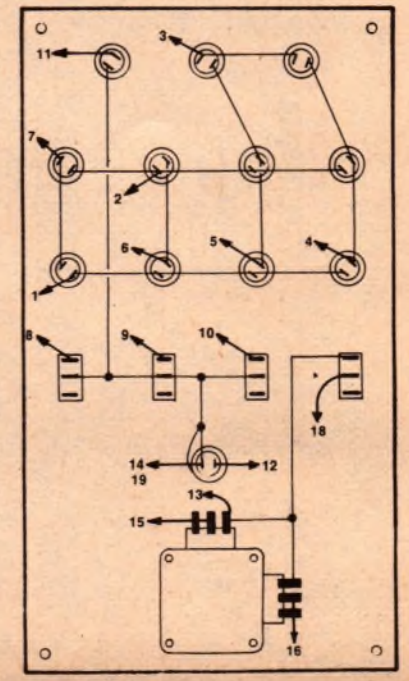
MISCELLANEOUS
- *1 printed circuit board, coded 78vbg7, 122 x 101mm*
- *1 9V battery, Eveready 2362 or similar, with connecting clips*
- *1 2.1mm DC input jack socket with suitable metric screws*
- *13 miniature momentary contact push switches*
- *4 SPDT miniature toggle switches*
- *1 plastic "zippy" box, 196 x 113 x 60mm*
- *1 plastic "zippy" box, 83 x 54 x 28mm*
- *2 meters four way shielded cable*
- *1 front panel (see text)*
- *1 5mm subminiature coil former (722/1)*
- *1 6 pin base to suit (5027/6PBL)*
- *1 shield can to suit, 13 x 13 x 20mm (7100)*
- *1 type F16 4mm ferrite core to suit*
- *2 cable clamps*
- *1 aluminium bracket*

Solder, tinned copper wire, rainbow cable, 30 gauge B&S enamelled copper wire, machine screws and nuts, self tapping screws to suit joystick pots, PCB pins, 2 14-way strips molex IC connector pins.

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.

Use this combined overlay and wiring diagram to aid in assembly of the project.





Video ball game

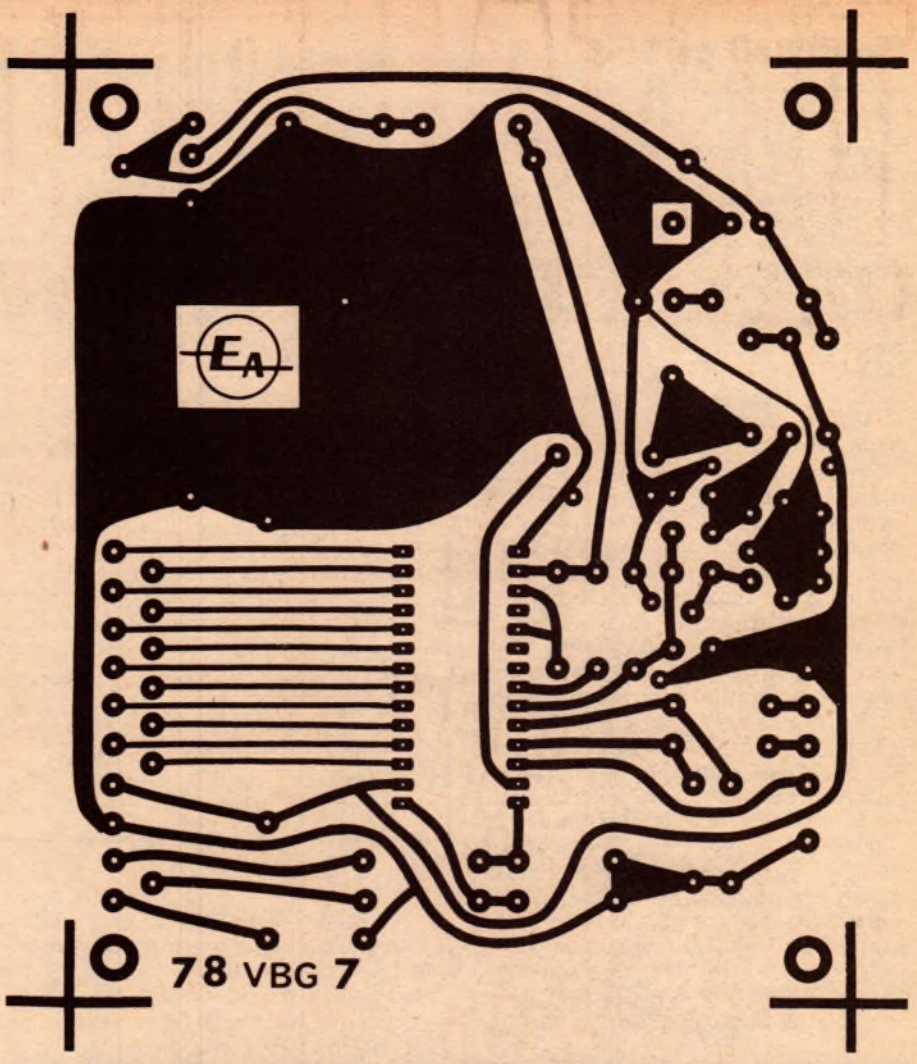
connect a TV set tuned to channel 0 by a suitable cable, and switch on. You will probably be greeted by some sort of picture. If not, adjust the fine tuning of the TV set. Then adjust the oscillator slug till you obtain a stable picture. Start with the slug well into the coil, and slowly screw it out.

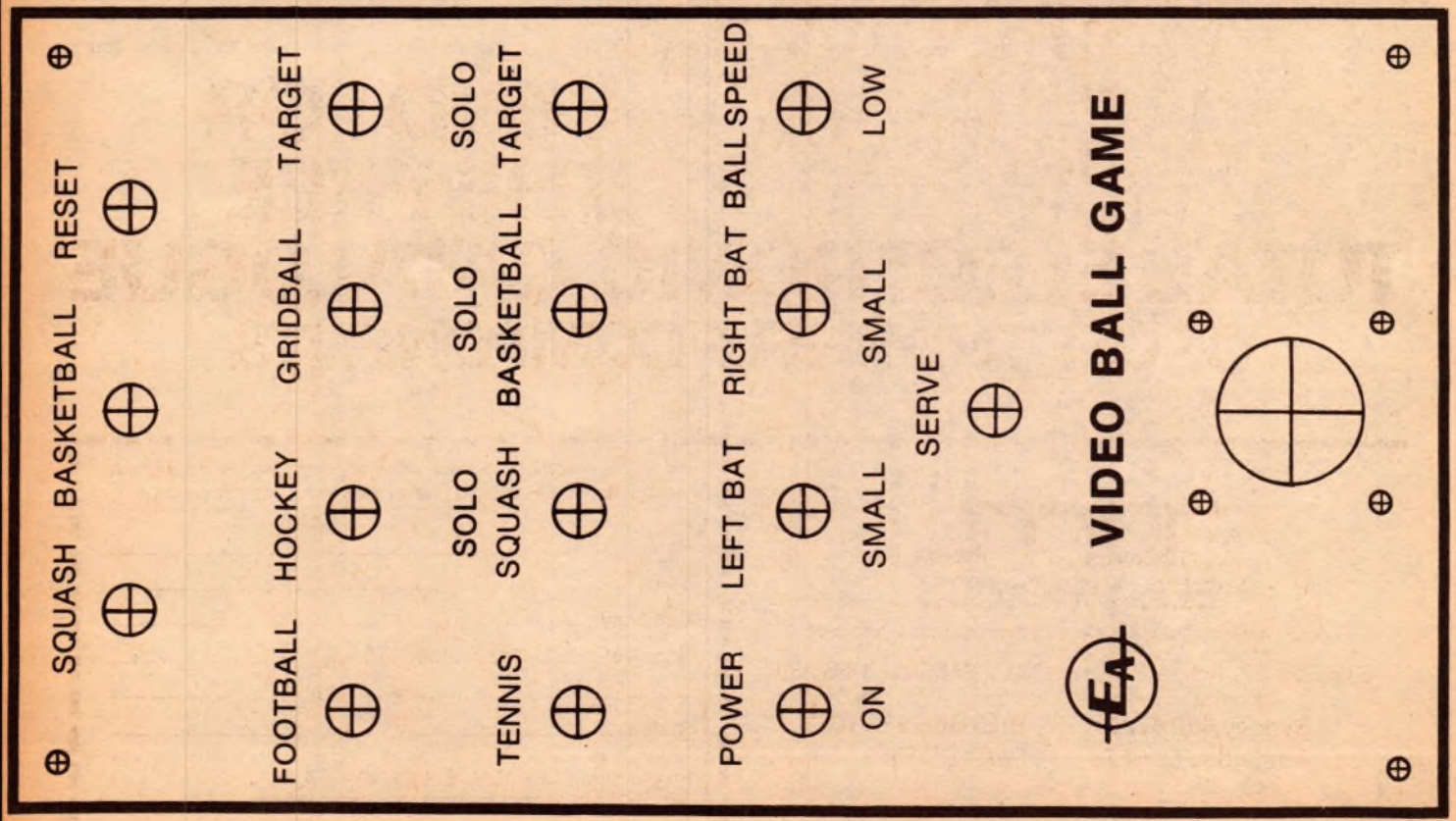
Now readjust the fine tuning to obtain the best definition of the picture elements. Check the operation of all the controls, including the game selection switches. Selection of the two target games may require several pushes of the appropriate switches; this is normal.

If the sound is distorted, you may need to adjust the frequency of the sound oscillator. To do this, remove the clip-on cover from the UM1263, and carefully adjust the slug of the tuning coil. Use a non-metallic tool for this.

After you have checked out the operation of the game, fit the front panel to the box, and commence to enjoy yourself. If you are unable to achieve satisfactory operation, check for wiring faults (dry joints, solder bridges or misplaced components), and for incorrect tuning of the master oscillator or TV set.

The two diagrams on this page are reproduced actual size, and can be copied or traced as desired. Commercial boards and front panels should be available in due course.





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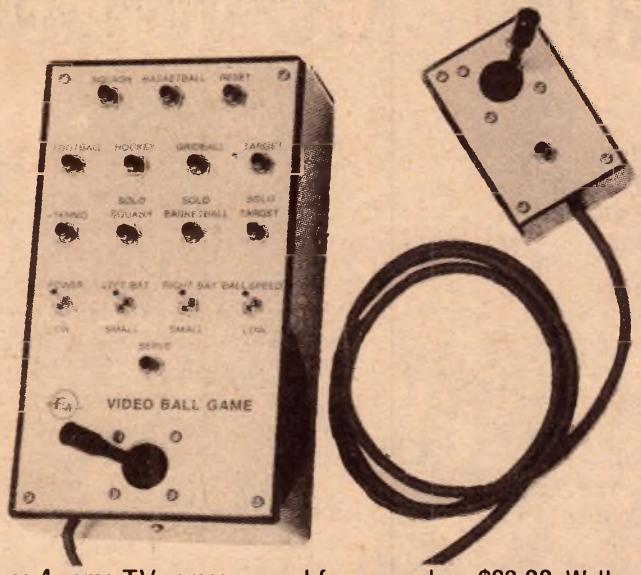

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See EA July 1978

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* 4 way joystick bat control – both bats move sideways as well as up and down.
* 2 bat sizes – each player's bat size can be changed independently.
* Sound comes through the TV set's speaker.
* Incredibly easy to build from complete kit. Pre-built and pre-aligned video and sound modules make construction so simple even a raw beginner could build it.

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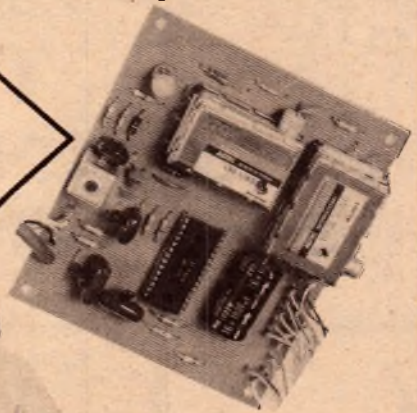

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UM 1082	Video modulator	Cat. K-6040 $3.00
UM 1263	Sound modulator	Cat. K-6042 $4.50
PC board for 10 game TV game		Cat. H-8344 $3.95
AY-3-8600	10 game chip	Cat. Z-6852 $15.00
AY-3-8500	4 way bat control chip for ETI Selector game (ETI Nov.'76)	Cat. Z-6850 $8.90
AY-3-8760 TT	ETI Motor bike stunt game chip (ETI June '78)	Cat. Z-6854 $19.50

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DICK SMITH ELECTRONICS

Utility preamp for film & tape dubbing

Here's a little utility preamplifier design featuring flat response and gain smoothly controllable between almost unity and about 30 times. It is especially suitable for use in level matching when you are dubbing from film sound tracks to tape, and vice-versa.

by JAMIESON ROWE

If you do any work with tape recording and sound movie equipment, you'll know that there are quite often a few hassles whenever you have to transfer or "dub" recordings from tape to film, film to tape or even just tape to tape. The first hassle is generally with interconnecting cables and connectors, as Murphy's Law seems to ensure that every different piece of equipment uses different connectors and/or wiring standards!

Then, when you finally get the various pieces of equipment hooked together properly, you generally find that there is a level mismatch. Again Murphy's Law seems to operate: the output level from the source equipment always seems to be either too high, or too low for the input of the destination equipment. Not much, perhaps — just enough to produce marginal overload, or poor signal to noise ratio.

Although only an amateur movie enthusiast, I have struck this sort of problem quite a few times in the past, and have generally used "ad hoc" and rather inelegant solutions. Things like using a voltage divider, and feeding the signal into a mic input instead of the high level input. However when I had to make a dubbing recently, and these makeshift techniques didn't give satisfactory results, I decided it was time to solve the problem more elegantly.

Of course there generally isn't too much of a problem where a signal is a little too large for the medium- or high-level input you wish to feed it into. Here a simple voltage divider or potentiometer may be used to cut it down, without sacrificing signal-to-noise ratio or frequency response, and without introducing distortion.

The problems tend to arise when the signal is too small. If you cut it down even further and feed it into a microphone input (assuming one is available), chances are that you will significantly degrade either the signal to noise ratio or the distortion, or both.

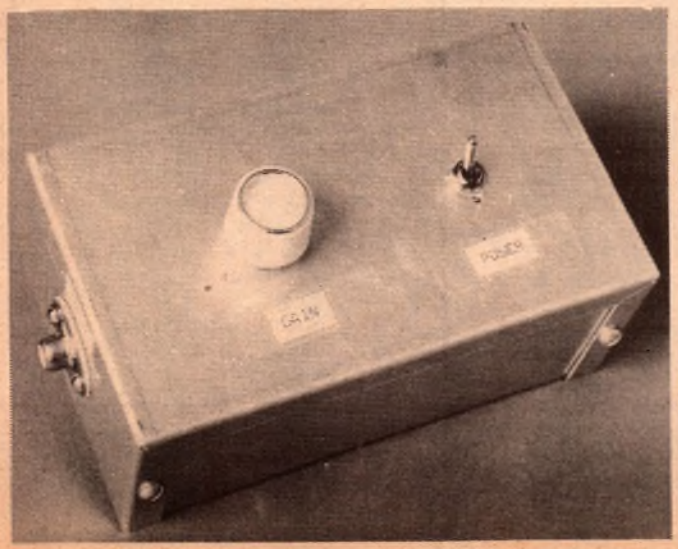
The real answer is to use a low noise preamplifier, with just enough gain to build the signal up to optimum recording level when fed into the medium- or high-level input.

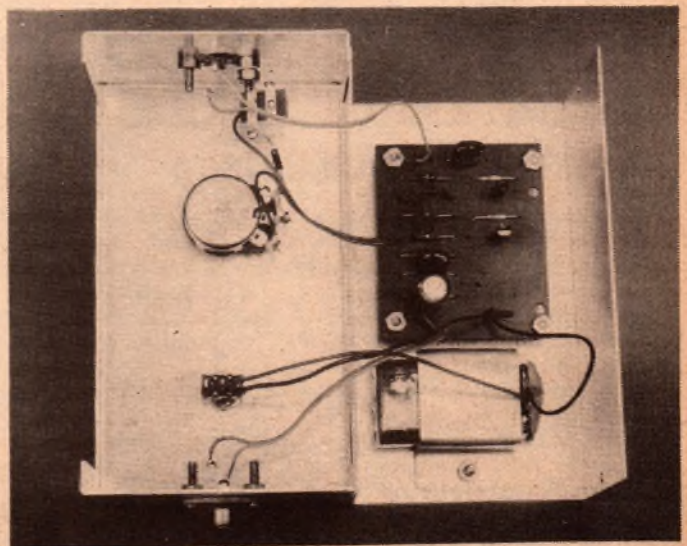
The little preamp described here has been designed to do just that. It has a gain adjustable between about 1.5 and 30 times, which should be more than adequate to cope with the majority of level matching situations. It also has very low noise output, typically 74dB below 250mV output at all gain settings.

The frequency response is virtually flat over the audio range, and 3dB down at about 50Hz and 30kHz. Harmonic distortion is low; being less than 0.25 per cent at 250mV output and 1kHz for maximum gain, and lower again for lower output levels or lower gain. Input impedance is about 70 kilohms, while output impedance is only a few hundred ohms.

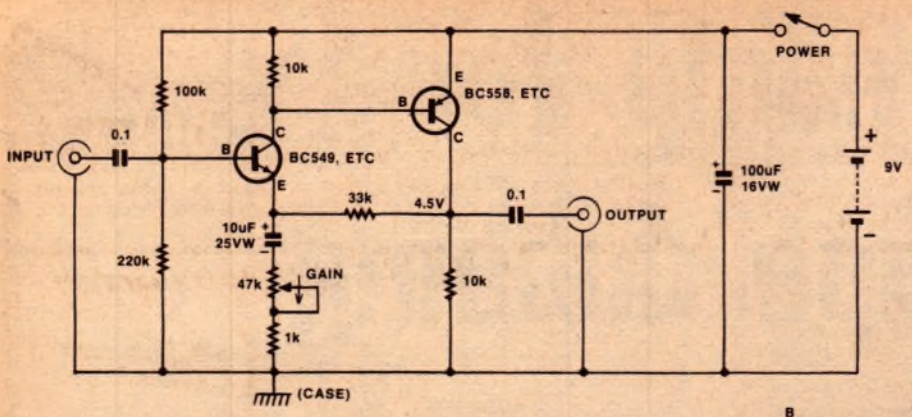
As you can see the circuit is quite straightforward. It uses only two low-cost transistors in a circuit configuration we have used on a number of previous occasions. A low-noise NPN transistor such as the BC549 drives a PNP transistor such as the BC558, with direct coupling and 100 per cent negative DC feedback for quiescent point stabilisation.

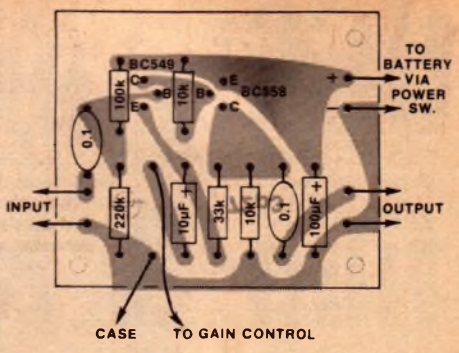
The gain of the combination is adjusted by varying the AC negative feedback, by means of the 47k pot in series with the 10uF bypass capacitor on the first emitter. With the pot at maximum resistance, there is heavy negative feedback and the overall gain is little more than unity. Turning the pot to



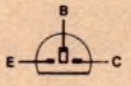


Most of the components in the preamp are supported by a small PC board, housed in a low cost metal utility box.





UTILITY RECORDING PREAMP



The preamp circuit is quite straightforward, as you can see. At top right is the PCB wiring diagram, while the actual-size PCB etching pattern is shown at right for those who make their own.

minimum resistance gives minimum feedback and maximum gain.

This type of feedback gain control is ideal for a utility preamp, as the distortion and signal to noise ratio both tend to improve as the gain is turned down. With a conventional volume control, either distortion or noise tends to rise when the gain is reduced to cope with larger signals, depending on whether the control is connected at the input or the output of the preamp.

The 1k fixed resistor in series with the gain control pot sets the maximum gain level of the preamp. If desired it can be reduced in value to give a higher maximum gain, but I would not recommend reducing its value below 330 ohms (giving a maximum gain of around 100). If you go any further the distortion and drive capability will deteriorate.

Incidentally, although the output impedance of the preamp is only a few hundred ohms, it should not be fed into loads of less than about 20k ohms. Lower values will tend to cause increased distortion. This should not be a problem, as most tape recorders and movie projectors will have an input impedance of 50k or higher.

Power for the preamp comes from a small 9V battery. As the drain is only about 500 microamps, the battery life will be very close to the shelf life. Using a battery obviates hum troubles due to mains wiring and earth loops, and is the most economical approach for a unit of this type.

As you can see, the preamp is built up on a small PC board measuring only 62 x 53mm. It is actually a PC board which we have used for a number of previous preamps, and is coded 72/p3. PCB suppliers should have it in stock, and be able to supply it on request.

There is only a handful of parts, assembled as shown in the wiring diagram and the photographs. Note that I have used RCA-type phono connectors for input and output, but you can easily replace these with another type if preferred.

The original preamp is housed in a small utility box, measuring 133 x 77 x 54mm and coded "LMB No. 780". It was obtained from Dick Smith Electronics, who have it listed under catalog number H-2325.

When you finish the assembly of the preamp, it should be ready for use straight away. Before pressing it into service, however, it might be a good idea to measure the voltage across the 10k output stage collector load resistor, to check that it is approximately 4.5V. If this is so, all should be well; if not, look for a wiring error, dry joint or faulty component.

There's not much in the preamp, and it should only take you a couple of hours to put together. But it can come in very handy when you have to do some hurried dubbing!

THE PARTS YOU'LL NEED:

1 PC board, 72/p3; 62 x 53mm
1 Utility box, 133 x 77 x 54mm
1 9V battery (216 or equivalent) and connector lead
2 RCA-type phono sockets
1 Miniature SPST toggle switch
1 BC549 or similar transistor
1 BC558 or similar transistor
2 0.1uF LV polyester capacitors
1 10uF 25VW electrolytic or tantalum
1 100uF 16VW electrolytic
1 1k ¼W resistor
2 10k ¼W resistors
1 33k ¼W resistor
1 100k ¼W resistor
1 220k ¼W resistor
1 47k linear pot
1 Small knob
Nuts and bolts, connecting wire, scrap metal for battery clamp, etc.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for the prototype. Components with higher ratings may be used, providing they are physically compatible. Components with lower ratings may also be used, providing the ratings are not exceeded.

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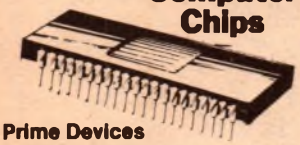

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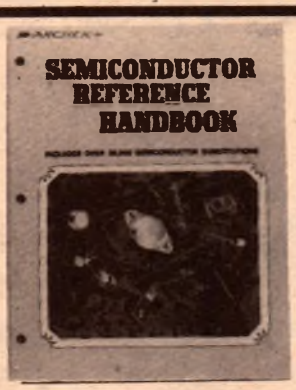

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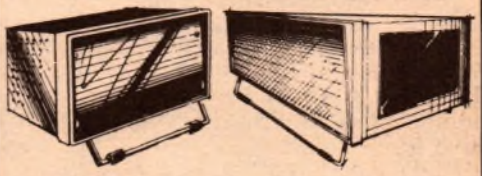

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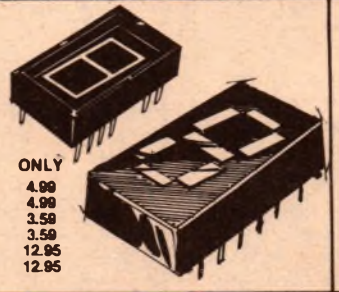

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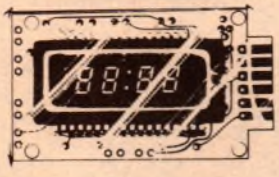

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Simple transistor tester checks both bipolars & FETs

Intended mainly for checking bipolar transistors and FETs, this simple transistor checker can also be used to test most other discrete semiconductor devices. It is easy to build, low in cost, and provides an excellent way of becoming familiar with basic device operation.

by GREG SWAIN
& DAVID EDWARDS

The design of this simple transistor/FET checker can hardly be considered new. It was originally described by Jim Rowe in August 1971 and, over the years, has proven an immensely popular project. Literally thousands have been built!

Recently, we decided to take another look at the unit with a view to updating it. The circuit is still perfectly valid, but the original method of construction is now dated and not quite in tune with '78.

In particular, the diecast metal box used to house the prototype is now quite expensive, its cost being out of all proportion to the total cost of the project!

Our approach has been to re-design the unit into one of the low cost plastic "zippy" boxes. At the same time, we have designed a small printed circuit board (the original used tagboard) and provided the unit with a front panel to match our recent RLC Bridge and Audio Oscillator projects. Total cost of the updated unit should be well below that of comparable commercial testers.

Despite is basic simplicity, the unit is capable of making most of the practical tests normally required when experimenting with transistors or servicing transistorised equipment. It can test both bipolar transistors and FETs, in addition to diodes, SCRs and PUTs. And it is capable of providing a detailed insight into device performance when required.

Thus it can be used for such purposes as the selection and/or matching of bipolar transistors on the basis of current gain, or of FETs on the basis of zero-bias current and transconductance.

Apart from its practical uses as a testing instrument, it also offers a simple and straightforward means whereby a beginner can gain a valuable first-hand insight into practical device operation. There is nothing quite as effective in dispelling some of the mystery of transistors or FETs, as hooking a device up to the checker, and demonstrating to one's own satisfaction that it really does perform as the theory book describes!

The checker can also be used to demonstrate what happens when a bipolar transistor is connected to the supply "the wrong way around", or when the drain and source of a FET are reversed, or the effect on leakage and saturation currents when the temperature rises. All this from only 17 basic parts: a meter, a battery, three toggle switches, one pushbutton, five diodes, and six resistors.

The tests performed by the checker are straightforward. For bipolar transistors, it first measures the leakage-saturation current Iceo, the collector-emitter current which flows when the base is left unconnected. It then applies a known base current to the device, and measures the resulting change in collector current. This gives an indication of the DC current gain, or DC beta.

The test for Iceo is a good preliminary check for bipolar transistors, because there are few faults in this type of device which do not cause a significant increase in Iceo. And those few faults which do not show up in this test will generally make themselves quite apparent in the gain test. Thus although an open circuit in the base, collector or emitter-lead will not show up in the Iceo test, it will certainly become evident in the gain test, as a zero reading!

Actually the checker is designed to test for both Iceo and gain at two alternative current levels. It can test for Iceo on a 0-1 mA scale, and then apply a 2-microamp base current to observe the current gain on what becomes virtually a 0-500 scale. Alternatively it can test for Iceo on a 0-10 mA scale, and then apply a 100 uA base current to observe current gain on what then becomes a 0-100 scale.

A low-cost plastic "zippy" case was used to house the prototype.

The advantage of the two current levels is greater flexibility. The lower current tests are appropriate for modern low power silicon transistors, which tend to have very low Iceo combined with quite high DC beta figures at low current levels. On the other hand the higher current tests are more appropriate for higher power silicon transistors, and many of the older germanium devices. These tend to have a higher Iceo, and a lower DC beta. The higher power silicon devices also tend to display a more realistic DC beta figure when tested at the higher current level.

For FETs, the checker first measures the zero-bias channel current Idss, the current which flows between drain and source when the gate is either left open-circuited or connected to the source. A reverse gate bias of approximately 1.2 volts is then applied, and its effect in reducing the drain source current may be seen. This gives a measure of the device transconductance (gm). The transconductance is not indicated directly, but may be readily calculated by dividing the observed drop in channel current by 1.2.

The test for Idss is a very useful one for checking FETs, as Idss is one of the main parameters which determine the DC behaviour of a FET in most circuits. It is also a parameter which varies quite significantly among currently available devices, and is therefore an important one to be taken into account when selecting or matching FETs. The transconductance check is also a very useful test, both for straightforward "good-bad" testing, and for selection and matching.

As with the bipolar transistor tests, the FET tests may be performed at either of two current levels. These are in fact the same two current levels used for the bipolar tests, with a meter sensitivity of either 1 mA or 10 mA respectively. With most FETs the 10 mA range will be the more appropriate, as most of the useful devices currently available have an Idss falling within the range 1 mA-10 mA. However the 1 mA range may be useful for checking devices with a very low Idss, and/or a high transconductance.

With the FET tests, the reverse gate bias voltage remains constant at 1.2 V for both ranges. This means that the ranges may be selected purely on the basis of convenience in reading the channel current. It is thus possible to switch from the 10 mA range down to the lower range if the transconductance of a device is sufficient to reduce its current from greater than 1 mA to well below this figure.

Diodes may also be tested on the checker, both for reverse leakage/saturation current Ir, and also for forward conduction. These tests are usually sufficient for "good-bad" testing. As before both a 1 mA and a 10 mA meter range are available for both tests. This makes it possible to test virtually any type of rectifier diode likely to be met, whether of silicon or germanium.

Other types of diode may also be tested, such as varicap diodes and varactors. It will be possible to test "zener" diodes, but only those having a breakdown voltage above the 9 volts applied by the internal battery of the checker.

Although the checker has basically been designed to test bipolars, FETs and diodes, it can also be used to test various other devices if a little ingenuity is used. Thus it is possible to test sensitive low power SCRs, for example, by connecting them to the checker as for an NPN transistor (anode corresponding to collector, cathode to emitter, etc.), and noting if the device triggers into conduction when current is applied to the gate via the gain test button.

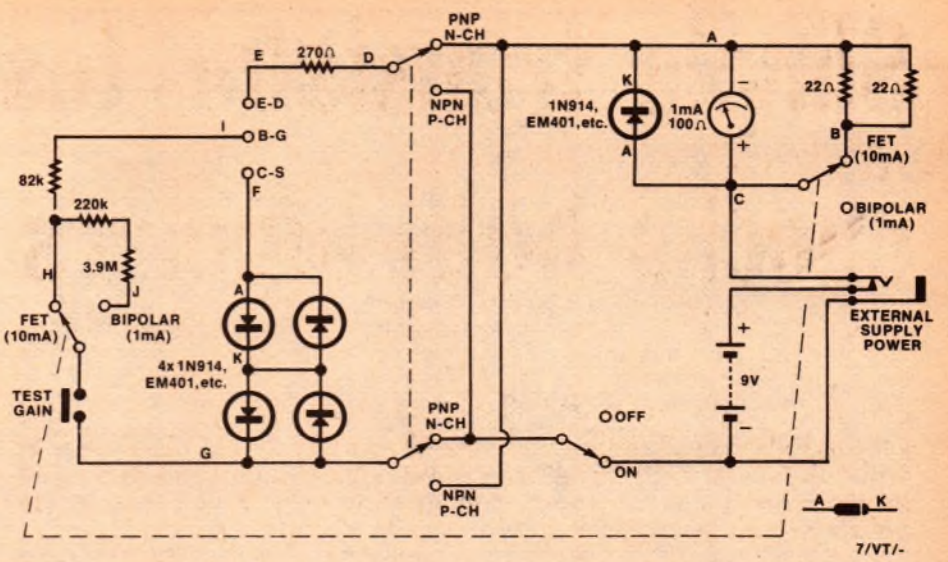
Higher power SCRs may be tested in a similar fashion, but in this case an external resistor may have to be connected between the anode and gate to provide sufficient triggering current to initiate conduction.

Programmable unijunctions or "PUTs" may be checked in much the same way as low power SCRs, but with the anode and cathode reversed so that they correspond respectively to the emitter and collector of a bipolar. The polarity switch in this case should be set to the "PNP" position.

Refer now to the circuit diagram of the Transistor Checker.

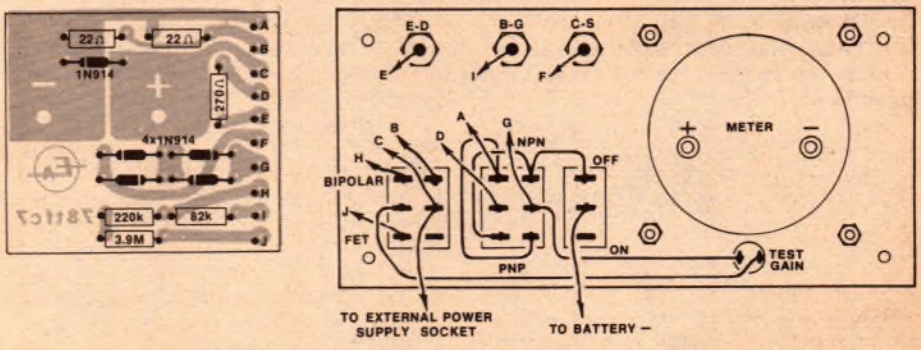
Basically, the unit consists of a 9V battery and a 1mA meter movement in series, connected via a polarity reversing switch to the pair of terminals marked "E-D" and "C-S". The first of these terminals connects to the emitter of bipolar transistors, or alternatively to the drain of FETs; similarly the other terminal connects to the collector of bipolars, or the source of FETs. Note the converse way in which the terminals are used for the two different types of device. The reason for this will be explained shortly, along with the reason for the four diodes in series with the "C-S" terminal.

The third terminal is that marked "B-G", intended to connect to the base of



SIMPLE TRANSISTOR-FET TESTER

Despite its simplicity, the circuit will perform most of the useful tests on the majority of modern discrete semiconductor devices.



The component overlay pattern shows the PC board from the component side.

bipolars, or the gate of FETs. This terminal connects via the "gain test" button and a selected resistance to the side of the reversing switch which leads to the "C-S" terminal.

The "FET-Bipolar" switch has two poles, one of which merely serves to connect two 22 ohm resistors as a 10mA shunt across the meter in the "FET" position. The other pole of the switch selects the value of the resistance in series with the "B-G" terminal.

The purpose of both the 270 ohm resistor in series with the "E-D" terminal, and the single diode in parallel with the meter, is to protect the latter in the event of a complete short-circuit between the "E-D" and "C-S" terminals. With these components in circuit the meter is effectively protected from any possibility of electrical damage due to shorts either in the device tested, or due to accidental touching of the test leads.

When a bipolar transistor is connected to the checker, its collector is connected to the "C-S" terminal. Because the current drawn by a bipolar device is largely independent of the actual value of collector voltage, rather like a pentode valve, the four diodes in series with this terminal have virtually no effect upon device operation. They merely reduce the effective battery voltage between collector and emitter to about 7.8 volts (9V less 1.2V, the voltage drop of the two forward-biased diodes).

The bipolar device therefore draws its normal Iceo when connected into the checker with the polarity switch set to the correct position and the battery switch moved to "ON". The current will be read on the meter either on the basic 1mA scale, or on an effective 10mA scale if the "FET-Bipolar" switch has been set to the FET position.

Then when the "gain-test" button is pressed, the base of the device will be connected to the collector supply rail via a resistance producing either 2uA or 100uA of base current, depending upon the position of the "FET-Bipolar" switch. The meter therefore indicates the normal DC beta of the device on an effective scale of either 0-500 or 0-100.

The very same circuit is arranged to perform the tests on FETs simply by connecting these devices to the checker in the converse manner. The drain is connected to the "E-D" terminals, while the source is connected to the "C-S" terminal. This has the effect of placing the four diodes in series with the source lead, where their voltage drop may now be used to provde a reverse bias.

When a FET is connected into circuit it initially draws its zero-bias current Idss, which may be read on either the 10mA meter range or the 1mA range as appropriate. Pressing the "gain-test" button then has the effect of connecting the gate to a point which is reverse-biased with respect to the source, by the substantially constant 1.2V drop across whichever two of the diodes in series with the source are conducting, according to the selected polarity.

The reason why four reverse-parallel connected diodes are used in series with the "C-S" terminal is that this arrangement provides a substantially fixed 1.2V drop regardless of polarity, without requiring additional poles on the polarity switch.

Note that although the resistance in series with the gate of the FET will vary according to the position of the "FET-Bipolar" switch, this does not affect the tests as the gate of a FET does not normally draw significant current. The function of the "FET-Bipolar" switch is only to adjust meter sensitivity and the series resistance in the base/gate lead, for base current adjustment in the case of bipolar transistors.

The "Bipolar and "FET" positions marked for this switch are those that will normally be the most appropriate for the majority of devices of each type. However, as explained above, both positions can be used for either device type, depending upon requirements.

Diodes are tested on the checker by connecting them between the "C-S" and "E-D" terminals. The way in which they are connected is not important. In one position of the polarity switch the diode will be forward-biased, and the meter should accordingly give a full-scale reading — unless the diode is defunct. In the other position of the switch the diode will be reverse-biased, and the meter will read the reverse current Ir. With most diodes this should be a very low reading, even on the 1mA range.

As can be seen from the photographs, construction is quite straightforward. All components, with the exception of the switches and input sockets, are mounted on a small printed circuit board measuring 58 x 51mm and coded 78tfc7. The board, in turn, mounts directly across the meter terminals.

Commence construction by fitting all the hardware to the front panel. The front panel of the prototype was made from photosensitive aluminium, but we assume that commercial panels will be available shortly after this article appears. The battery sits directly under the front panel switches, and is packed in pieces of scrap foam to prevent short circuits and to hold it in place.

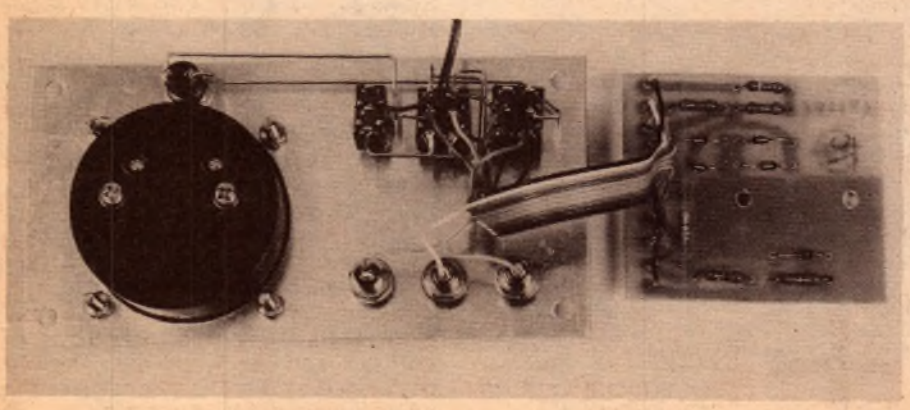
Refer to the combined overlay and wiring diagram when wiring up the unit. PC stakes are used to facilitate connections from the board to the front panel switches and sockets. The connections are run in rainbow cable, while tinned copper wire is used for inter-switch wiring.

The meter used is a Japanese made 52mm rectangular movement of a type which is widely available (model

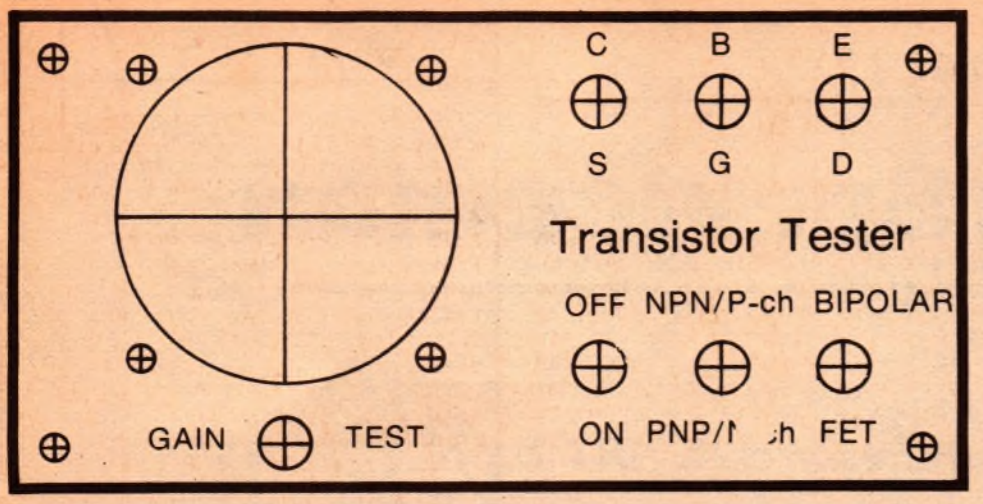
PARTS LIST

1 case, 130 x 68 x 41mm
1 screen-printed front panel
1 1mA meter, 52 x 49mm rectangular
1 9V battery, Eveready 216 or similar
2 DPDT miniature toggle switches
1 SPST miniature toggle switch
1 momentary contact pushbutton switch
1 PC board, 58 x 51mm, code 78tfc7
5 1N914, EM401 or similar silicon diodes
1 2.1mm DC input jack socket plus suitable metric screws
6 resistors: 2 x 22 ohm, 1 x 270 ohm, 1 x 82k, 1 x 220k, 1 x 3.9M (all ½W)
3 banana-type sockets and plugs, for test leads
Hookup wire, PCB pins, battery clip solder, tinned copper wire

NOTE: Components with low ratings may be used provided their ratings are not exceeded. Components with higher ratings may also be used if physically compatible.



The PC board mounts directly across the meter terminals.



Here is an actual size reproduction of the front panel artwork.

MRA45B). It is mounted directly on the front panel, with the "gain-test" pushbutton immediately beneath it.

Since the circuit runs from a 9V supply rail, it can be also powered from one of the now commonly available "plugpack" power supplies. A special input jack socket is used for the external power supply, and this should be mounted in the end of the case furthest from the meter. Constructors may, however, consider this feature as optional.

Operating the checker when it is completed should present few problems, as the control switch markings clearly show the various functions. However, one type of testing situation where the user may need guidance is where the polarity of the device to be tested is not known.

The circuitry of the checker is such that checking a device with the polarity switch in the incorrect position will generally not cause damage to either the device or the checker. However, there is still the problem of interpreting the readings obtained, in order to decide the correct polarity.

In most cases the readings given by the checker are themselves the best guide to the correct polarity. With bipolar transistors, incorrect polarity is usually indicated by an abnormally high Iceo reading, together with a DC beta reading which is either very low or effectively zero. Hence, if this combination of readings is obtained, the idea is to change to the other polarity and see if the results improve. If they do, then the original polarity was clearly wrong; but if the results are the same as before, then either the device is a dud or you have its connections jumbled.

With FETs an incorrect polarity setting generally does not show up in the Idss test, because the channel of most FET devices is symmetrical and conducts equally in either direction. However, incorrect polarity will immediately show up when the "gain-test" button is pressed: the meter reading will increase rather than decrease, revealing that the gate is being forward-biased instead of reverse-biased. This effect should always be taken as a sign that the polarity switch has been set to the incorrect position.

There may be some occasions, when testing bipolar transistors, where it is difficult to decide whether the leakage/saturation current Iceo is acceptably low, or "too high". This matter is one for which there is no simple answer, because a "good" germanium device may have an Iceo many times higher than a "faulty" silicon device — particularly if it is a high-gain power type.

Temperature also plays a part. With germanium devices Iceo roughly doubles for every 8-10 degrees C rise in temperature, while with silicon devices it doubles for every five degrees C rise. Also the Iceo of a device is roughly proportional to its gain, so that the gain should also be taken into account.

In general any silicon bipolar transistor which produces a significant Iceo reading on this checker, at any normal temperature, should be regarded as suspect. All except the very high-gain, high-power types should give virtually zero reading, even on the 1mA range.

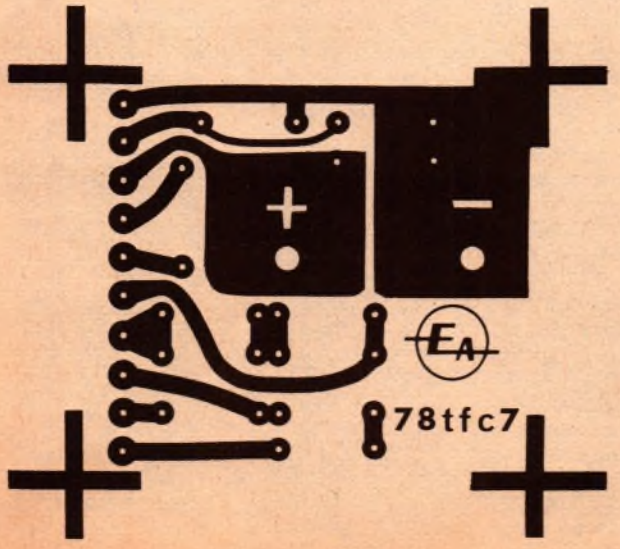
Unfortunately no similar rule-of-thumb can be given for germanium devices, some of which may exhibit quite a high Iceo. The best plan with these is to compare them with a known good device, if one is available. Failing this, all you can do is make the decision on the basis of the gain check. If the current increases quite substantially when you press the gain button, then the device is probably a good one.

Whether the device is a silicon or germanium type, make sure that it is cool before testing it. A device just unsoldered from a circuit and still quite warm can give an abnormally high leakage reading, even though it may be quite normal.

Finally, a brief note about comparing the device parameters as measured by this checker with those given in manufacturers' data. If you want to do this, and there is no reason why you should not, the main thing to watch is the symbols used.

For bipolar transistors, if you cannot find Iceo listed for the device you are concerned with, trying looking for Ico' — the two are identical. If this is not listed either, the data may alternatively give Icbo or Ico, the collector-base saturation current. But as this is equivalent to Iceo divided by the gain of the device, it is not hard to convert between the two. Most manufacturers use the symbol hFE to represent DC beta, so that it is the figure or figures listed under this symbol which should be used for comparison.

Where FETs are concerned, the symbol Idss is almost universally used for zero-bias drain current, so that there should be no problem with that parameter. But be careful where transconductance is concerned, as two different symbols are used: Yfs and gmo. Fortunately, the definitions of both are sufficiently close to the test performed by our checker to make the figures comparable in practice.



At left is an actual size reproduction of the PCB pattern.

The Serviceman

How dangerous is that colour set's EHT supply?

Most of us — and I include myself in this — tend to regard shocks from EHT systems as a harmless nuisance; an occupational hazard which we react to by muttering appropriate curses and casting doubts upon the lineage of the particular set. Within a few minutes we will have forgotten about it.

At least that was my attitude until recently when the experience of a colleague made me stop and think a bit harder about the situation. Is the EHT, from colour sets in particular, as harmless as we have tended to believe?

My colleague was working on a colour TV set which, unknown to him at the time, had been tampered with in an apparently innocuous manner by the technician who had worked on it previously. A common difficulty when trying to measure EHT voltage is that the plastic cover over the ultor connector is often quite stiff and resists any attempt to push a probe underneath it.

Apparently such was the case with this set and the technician had hit on the bright idea of pushing a pin through the EHT lead insulation (with the set switched off!) and making connection via the pin. Then, when the job was finished, the pin was removed. All of which, as I said before, seems innocuous enough.

The next time the set needed service it was my colleague who landed it. He was sitting on a stool with his left hand resting on the set or, more precisely, on the metal casings of the three colour amplifier transistors. He had a CRO connected to the set and was observing a particular waveform when he decided that an observation of another part of the set, using the CRO's second beam, might be beneficial.

He reached across the set for the second CRO lead and, in doing so, brushed his wrist against the EHT lead close to the spot where the previous operator had left the pinhole in the insulation.

To use his own words, "The spark lept out to meet me and gave me a terrific wallop across the chest." Apparently it was so severe that it produced a violent pain in his chest for several minutes.

His workmates were naturally concerned but he insisted that he would be all right in a few minutes, and tried to ease the discomfort by deep breathing. This did seem to help and, in about five minutes, he felt well enough to get on with the job and not to think much more about it. He was rather disturbed to discover, however, that two of the transistors on which his hand had been resting had been destroyed internally.

Even so, he had virtually dismissed the incident by the end of the day. The only snag was that in the early hours of the following morning he woke with violent chest pains and was rushed to hospital with a severe heart attack. For the next week he was confined to the intensive care ward, hooked up to innumerable monitors, while doctors diagnosed his condition. After that he spent another fortnight in the recovery section.

That was some months ago, and he is back at the bench now, working, as he puts it, "... with one hand in my pocket". Understandably, he is determined not to get another belt.

Did the shock cause the heart attack, or was it purely coincidence? Or was it the last straw that broke the camel's back? There is no way to be certain, of course, but he feels that it was more than coincidence.

In any case, a lesson to be learned from the incident is the danger which can be caused by damaging EHT lead insulation, no matter how slightly. It can easily prove a trap for the next serviceman.

But the more important lesson is the need to exercise more care in our everyday work, and to stop regarding EHT voltage as inconvenient but essentially harmless. Granted, the reasoning to date has seemed valid enough; EHT voltages from TV sets, ignition systems and the like were generated by circuits having a high internal impedance. In other words, almost any kind of a load on the system — including one's body — would reduce the voltage to only a fraction of its nominal value, and the current which would flow would be proportionally small.

This may have been true for ignition systems and monochrome TV sets, though even here I suspect we may have been taking unnecessary risks. With the advent of the colour set we may well have moved into a new danger bracket.

Taking the voltage, just for a start. Monochrome sets ran at about 15kV; perhaps 17kV in a few cases. Colour sets run at around 25kV and up to 27kV in some cases. Granted, voltage is not the whole story, but it is an important part of it.

Now consider the current and/or internal impedance aspect. A monochrome tube has a single beam running at around 200uA. A colour tube has three beams which, because of losses incurred by the shadow mask, usually run somewhat higher. Collectively, they could demand up to 1mA from the EHT supply and it is designed to supply this.

More than this, such power supplies are designed to maintain the EHT voltage within close tolerances at these relatively heavy loads, either by employing regulator circuits or by basic design. Either way the effect is the same; the internal impedance of a colour tube EHT supply is significantly lower than that of its monochrome counterpart.

Added to this, in my colleague's case, was the energy stored in the final filter capacitor, as provided by the tube itself. Small though this capacitance may be, it can still deliver a nasty bite on its own, as anyone who has experienced it will agree.

All of which may have taken us from what might well have been a borderline situation anyway into one of positive danger. And just because there have been no local fatalities so far, it does not mean that it couldn't happen.

Even if we concede that my colleague had a predisposition to a heart attack, it is no reason to say, "It can't happen to me". Because who among us can say

for certain that they do not have a similar predisposition? I, for one, don't want to find out about it that way.

Which brings me to another point: Laymen in particular, but also some of us who should know better, tend to take the attitude that, because they have received a shock from a certain device or circuit, and are still alive then it is incapable of killing.

The fallacy of this is obvious. We sometimes experience a shock via random and quite inefficient paths, particularly on the "earthy" side, and it does little more than tickle. Get caught with your other hand on the chassis, or in wet shoes on wet concrete, and it could be a very different story.

I was talking to a professional photographer recently, while he was setting up some elaborate flash units in his studio. He commented that he had received some shocks off these units, but he obviously regarded them as nothing more than a nuisance.

They were large units, probably running to 500 joules or more, and would have employed storage capacitors in the thousands of microfarads region, normally working at 500V. With internal impedances measured in fractions of an ohm, capacitors like this can melt wires and bite chunks out of screwdriver blades with greatest of ease. I know, I've seen it happen.

Yet when I tried to impress on him that his equipment could deliver a lethal shock he laughed in a manner which I can only describe as derisive. His comment was, "If that thing can kill people then I'm dead, because I've had plenty of shocks from it." Realising that I was bashing my head against a brick wall I dropped the subject, but I hope he doesn't find out the hard way.

To get back to more everyday subjects, here is my prize "curly one" for the month. See if you can pick it.

Many times in the past I have warned against the hazards of assuming that, because a particular piece of equipment meets all its specifications on the bench, it will perform satisfactorily in the customer's home. And, by implication, that the serviceman's responsibility has ceased. In fact, stories about customer disatisfaction due to this cause are legion.

This story is another such case, but the technical explanation is interesting in its own right. It involved a stereo amplifier installed in a small restaurant, and the owner complained that it periodically suffered from loss of volume and gross distortion in one or other of the channels.

Apparently it had quite a history of such behaviour, and a similar history of service calls, by various servicemen, each of which proved to be equally ineffective in the long term.

Sensing a sticky one, I questioned the owner carefully to try to establish some kind of pattern. Was one channel more prone than the other? Was it worse in hot or cold weather? Did it occur at regular intervals? and so on.

I drew a blank on all of them. As far as I could determine there was no pattern of any kind. Either channel would simply fail for no apparent reason and, on a few occasions, both had failed together. And, as far as I could determine, on each occasion the servicemen had taken the amplifier back to his shop and, presumably, given it the once over and established that it was working correctly. Also, it would seem, it continued to work correctly when it was returned to the owner — until the next time, that is.

The set-up was not particularly elaborate. It consisted of a 10W per channel commercial stereo amplifier, located in the bar, one pair of speakers in the same area, and two more pairs in the restaurant proper.

In passing, it is worth adding that the owner was not one of those who inflicts objectionable levels of sound on a captive audience; on the contrary he insisted on running the system at only a fraction of its available output which, spread over three speakers, provided only a soft background.

It must have been my lucky day — or Murphy's day off — because for once an intermittent decided to show up when I arrived. It was just as the owner had described it, one channel well down and distorted. Since it seemed that the amplifier had already been well and truly done over I decided to check out the speakers and speaker wiring first.

I was in the bar, near the amplifier, and I simply reached up and lifted the speaker cabinet off the wall, intending to remove the back and check the wiring. But that was as far as I needed to go. Immediately I lifted the speaker clear of the wall the distortion vanished and the volume returned to normal.

The effect was so clear cut that I immediately put the speaker back in position to see what would happen. Sure enough, the distortion returned, and I don't mind admitting that it took me a few minutes to wake up to what was happening.

When I did — would you believe it was the wallpaper? Yes the wallpaper; it was short-circuiting the two speaker terminals which were exposed on the back of the cabinet. And in case you haven't heard of short-circuiting wallpaper before (I hadn't) this variety appeared to be coated with a metallic based paint. (This paper had been used only in the bar.)

After that the cure was an anti-climax; a piece of insulation tape over the terminals and I had solved the problem in two minutes flat. Not that I am boasting; I just happened to be the lucky one. Not only was I able to observe the fault in action, but I also had the advantage that a fairly complete history had been built up about the system by the time I encountered it; enough to make me realise that it was unlikely to be the amplifier.

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GENERAL ELECTRIC

Electronics and the metric system

Australia is now well on the way to using metric units for all forms of measurements. It is important, therefore, that we not only now use metric units exclusively, but that we also express these units in accordance with accepted standards. This article is intended to guide those in the electronics industry on the correct use of metric units.

by PETER O'NEILL, B.E. (Hons.)

Senior Adviser,
Metric Conversion Board.

The International System of Units (SI) is the most modern system of units of measurement available in the world today. Almost every country either uses this system or is committed to its use. Australia, by virtue of the Metric Conversion Act of 1970, is converting to SI and it is expected that this will be its sole system of measurement (with a few exceptions) by 1980. Already much of industry is converted.

Unfortunately there are some who do not know, or do not apply, the rules. Microfarad, to quote one example, can be seen presented as mf, mfd, μf, μF, μ and u. Only one is correct (μF) and only one should be used to provide ease of reading and recognition and to prevent error.

To help all those involved in specifying or describing electronic circuitry and components the following notes are provided to show how units should be stated. In addition, a selection of commonly used units and typical applications has been compiled.

Correct presentation of metric units

The following points should be noted when using metric units.

- Instead of using a comma to denote a thousand in numbers leave a space between each group of three digits:
  3 000 000 NOT 3,000,000
  Numbers with four digits may be written with or without a space: 4200 or 4 200. Except in tables, the former is preferred.
- A thin space should be left between number and unit symbol:
  20 A NOT 20A
  An exception is when expressing temperature:
  25°C NOT 25 °C
- All unit names and prefixes are written in small letters and without initial capitals. The degree Celsius is the only exception:
  metre, watt, volt
  NOT Metre, Watt, Volt.
- All symbols use small letters:
  m (metre), g (gram), s (second)
  except those derived from proper names:
  H (henry), Hz (hertz), V (volt), °C (degree Celsius)
  and the symbols for the prefixes:
  M (mega), G (giga), T (tera),
  and L for litre
  thus metre (m), volt (V), megawatt (MW), millilitre (mL)
  NOT
  metre (M), volt (v), megawatt (mW), millilitre (ML)
- Some symbols derived from proper names incorporate two letters to distinguish them from other symbols:
  thus Hz (hertz), H (henry)
  Wb (weber), W (watt)
  The second letter so used is lower case:
  Hz, Wb NOT HZ, WB
  but F (farad), A (ampere)
  NOT Fd, Amp
- The prefix symbol is attached directly to the units symbol and a space or dot is not used between them:
  mm NOT m.m.; kg NOT k g
- The prefix symbol should always be accompanied by the symbol on which it operates:
  μF NOT μ; kΩ NOT k NOR K
- A prefix symbol should not be attached to a unit name:
  μWb NOT μweber
- Full stops are not used following unit symbols except at the end of a sentence —
  e.g. kg, mm etc NOT kg., mm., etc.
- The product of two units in compound symbols is indicated by a dot or space:
  A.h, kW.h NOT Ah, kWh
- The correct pronunciation of kilometre is 'kill-o-metre' not 'k'lom-etre'.

The Metric Conversion Board would be pleased to check any draft material before publication or use to ensure that metric usage is correct.

Alternative symbols

In some typesetting systems, some symbols may be unavailable. In such cases, the following alternative symbols should be used:

micro	u
square millimetre	sq mm
cubic centimetre	cu cm
cubic metre	cu m
revolution per minute	rpm
degree Celsius	C
ohm	ohm
kilohm	kilohm
megohm	megohm

Prefixes

A prefix is attached to a unit to indicate a multiple or sub-multiple of the unit:
milliwatt is one thousandth of a watt
kilowatt is one thousand watts

Prefixes likely to be encountered include:

Prefix	Symbol	Meaning
giga	G	10^9
mega	M	10^6
kilo	k	10^3
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

'giga' is pronounced with a hard 'g' as in 'give'.

Rounding

If conversion of imperial quantities is necessary, try not to make the metric numbers any more precise than the original numbers. If the existing number is a rounded 10 inch, then a rounded 250 millimetres is usually accurate enough, rather than 254 mm. Decimal places should be avoided unless they are significant.

Metric Quantities and Units for Electronic Applications

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL	CONVERSION FACTOR AND REMARKS
Length	Cable Wavelength Antennae	metre	m	1 ft = 0.3048 m
	Instrument cases Speaker boxes Speakers Printed circuit boards Panel meters Amplifiers Turntables Sheet thickness	millimetre	mm	1 in = 25.4 mm For overall dimensions state height x width x depth e.g. 40 mm x 125 mm x 200 mm For surface dimensions state length x width e.g. 100 mm x 50 mm Do not use gauge
	Groove depth Surface finish texture	micrometre	μm	1 μin = 0.0254 um
	Distance	kilometre	km	1 mile = 1.609 km
Area	Panel space	square millimetre	mm^2	1 in^2 = 645.2 mm^2
Volume	Freight volumes	cubic metre cubic centimetre	m^3 cm^3	1 ft^3 = 0.028 32 m^3 1 in^3 = 16.39 cm^3
	Capacity Liquid volume	litre millilitre	L mL	1 ft^3 = 28.32 L 1 gal = 4.546 L 1 pt = 568.3 mL 1 fl oz = 28.41 mL
Volume Flow	General use Gas and liquid	cubic metre per second litre per second millilitre per second	m^3/s L/s mL/s	1 ft^3/s = 0.028 32 m^3/s 1 gal/s = 4.546 L/s 1 in^3/s = 16.39 mL/s
Time	Elapsed time	second millisecond	s ms	
	Pulse width	microsecond nanosecond	μs ns	
Rotational Speed	Turntables Records Electric motors	revolution per second	r/s	
		revolution per minute	r/min	r/s is preferred wherever possible
Frequency	Operating frequency Response Range	hertz kilohertz megahertz gigahertz	Hz kHz MHz GHz	the plural of hertz is hertz
Velocity	Motor speed Tape speed	metre per second millimetre per second	m/s mm/s	1 ft/s = 0.3048 m/s 1 in/s = 25.4 mm/s
Mass	Freight mass	kilogram	kg	1 lb = 0.4536 kg
	Small instruments Cartridges	gram	g	1 oz = 28.35 g
Force	Spring force	newton	N	1 lbf = 4.448 N
Pressure Stress	General use	pascal kilopascal megapascal gigapascal	Pa kPa MPa GPa	1 lbf/ft^2 = 47.88 Pa 1 lbf/in^2 = 6.895 kPa 1 $tonf/ft^2$ = 0.1073 MPa 1 $tonf/in^2$ = 0.015 44 GPa
Temperature	Temperature value	degree Celsius	°C	°C = 5/9 (°F -32)
	Temperature interval	kelvin	K	°C should not be used in compound units e.g. W/m.K NOT W/m°C; 1 K = 1°C
Thermal Rating	General use	kelvin per watt	K/W	
Energy	General use	joule kilojoule megajoule	J kJ MJ	1 ft.lbf = 1.356 J 1 Btu = 1.055 kJ 1 kW.h = 3.6 MJ

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Metric Quantities and Units for Electronic Applications

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL	CONVERSION FACTOR AND REMARKS
Power	General use	watt milliwatt	W mW	
	Motor ratings	kilowatt	kW	1 hp = 0.7457 kW
	Residual noise	microwatt	μW	
Current	General use	ampere milliampere	A mA	
	Sensitivity	microampere	μA	
Potential Difference	Voltage	volt millivolt kilovolt	V mV kV	
Resistance Impedance	General use Impedance	ohm kilohm megohm gigohm	Ω kΩ MΩ GΩ	NOT kiloohm NOT megaohm NOT gigaohm
Capacitance	General use	farad microfarad nanofarad picofarad	F μF nF pF	
Electric Charge	General use	coulomb	C	
	Storage batteries	kilocoulomb ampere hour	kC A.h	1 A.h = 3.6 kC
Inductance	Self-inductance Mutual inductance	henry millihenry microhenry nanohenry	H mH μH nH	The plural of henry is henrys
Conductance	Admittance Susceptance	siemens	S	The plural of siemens is siemens The siemens replaces the mho
Magnetic Flux	Magnetic circuits	weber milliweber	Wb mWb	1 Mx (maxwell) = 10 mWb
Magnetic Field Strength	Magnetic circuits	ampere per metre	A/m	
Magnetic Flux Density	Magnetic induction	tesla millitesla	T mT	1 G (gauss) = 0.1 mT 1 Wb/m² = 1 T
Electric Field Strength	Testing of electrical parameters such as dielectric strength	volt per metre	V/m	
Luminous Intensity	Bulbs and tubes	candela	cd	Not changed
Luminous Flux	General use	lumen	lm	Not changed
Quantity of Light	General use	lumen second	lm.s	Not changed
Luminance	Measured brightness	candela per square metre	cd/m²	1 foot-lambert = 3.426 cd/m² 1 stilb (sb) = 10^4 cd/m² 1 cd/ft² = 10.76 cd/m² 1 lambert = 3183 cd/m²
Illuminance	Ambient lighting Illumination	lux	lx	1 lm/ft² = 10.76 lx 1 lm/ft² = 1 foot-candela
Luminous Efficacy	General use	lumen per watt	lm/W	Not changed

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Winning entry in BWD/EA oscilloscope competition

Adjusting transmitters with a CRO

by R. WATKINS

Present day regulations call for very tight transmitter specifications to ensure that interference is kept to a minimum on crowded bands. Among the items needed to meet, and maintain, these specs, a CRO — a good CRO — is essential. This article describes how a CRO is used to check AM and SSB transmitters.

An oscilloscope of the calibre of the BWD 539D is an essential instrument for servicing all HF transmitting equipment. As an instantaneous, peak reading measurement device, the oscilloscope is ideally suited to monitoring the complex waveform generated by SSB and AM transceivers.

TESTING AM TRANSMITTER PERFORMANCE: The envelope pattern and the trapezoidal pattern are most commonly employed. The trapezoid pattern is generally more useful, but both methods have special advantages and a test procedure which enables both types to be available is recommended.

The test connections for the envelope pattern are shown in Fig. 1. The ideal method is to employ a dummy load with an attenuated "monitor" output facility connected to the vertical amplifier channel 1 input of the oscilloscope via a low impedance coaxial line. If a "terma-line" dummy load is not available, a simple pickup loop placed near the transmitter output tank circuit does almost as well. In either method, the transmitter should NOT be tested into an antenna and cause interference to other users and services.

By applying a sine wave of 1000Hz to the microphone input socket and keying the transmitter on, an envelope pattern will be observed on the oscilloscope. Adjustment of the time base, to approximately one quarter of the audio frequency, and the trigger stability will be necessary to achieve a stable pattern. Then adjust the vertical amplifier gain of the oscilloscope to achieve a pattern of suitable height to fill the screen adequately either side of the zero axis. Any distortion of the modulated envelope will then be easily detected and may be analysed.

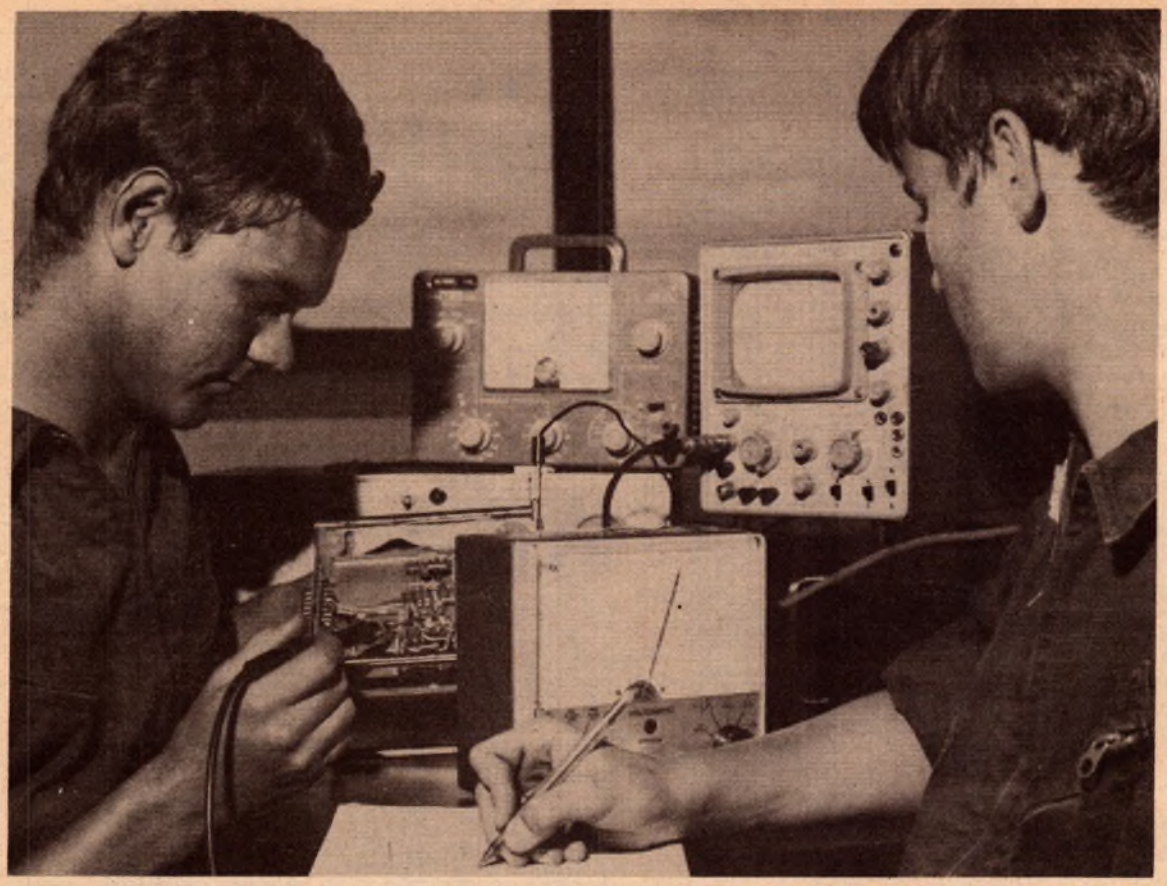
Overmodulation can be observed by comparison of the height of the display of the unmodulated carrier to that of the modulated carrier. Overmodulation in the upward direction is indicated by the modulated pattern being greater than twice the overall height of the unmodulated carrier pattern. Overmodulation in the downward direction is indicated when gaps appear in the display pattern at the horizontal reference axis.

Audio amplifier/modulator distortion versus RF amplifier non-linearity distortion can be determined by utilizing the BWD 539D dual race capability. By applying a sample of the audio signal (1000Hz) from the modulator stage to the No. 2 channel of the oscilloscope, whilst retaining the RF modulated signal on the No. 1 channel, a direct comparison of the two signals may be made.

The trapezoidal pattern test requires the connections as shown in Fig. 2. In this test the audio signal from the modulator stage is applied to the sweep or horizontal circuit while the RF input is applied to the vertical circuit as before. With the BWD 539D, it is simply a matter of switching off the timebase, using Ch.1 and 2 to achieve identical X-Y operation.

With the transmitter keyed on and modulated by 1000Hz, a wedge shaped display will be seen on the CRO. This pattern represents a graph of the characteristics of the modulated amplifier of the transmitter. If the sides of the trapezoid are straight, the amplifier has linear characteristics. Curvature of the sides of the trapezoid indicate non-linear characteristics. The greater the curvature, the greater is the non-linearity.

One hundred per cent modulation is indicated when the wedge is twice the carrier height at one end and the sides come to a point on the horizontal axis at the other end. Over modulation upward is indicated by increased height, greater than twice carrier height at one end and over-modulation downward



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by an extension line along the horizontal axis at the pointed end.

TESTING SSB TRANSMITTER PERFORMANCE: The most widely used method of testing SSB transmitters is the two-tone test. Details of a two-tone generator were published in "Electronics Australia", November 1977.

The two-tone SSB waveform is generated by combining two audio tones of equal amplitude and separated in frequency by approximately 1000 to 2000Hz (500Hz and 2400Hz are commonly employed). The two-tone signal is then injected into the transmitter balanced modulator. One sideband is then suppressed, leaving the SSB waveform shown in Fig. 3a.

(Editorial note: This pattern is sometimes misinterpreted, because of its superficial similarity to the classic amplitude modulated envelope. In fact, it is an interference pattern between the two RF sidebands generated by the two audio tones. Note particularly that the troughs in the pattern represent a cross-over point and do not follow the normal sine wave shape.)

The generation of the two-tone envelope can be represented vectorially. When the two vectors, representing the two audio frequencies, are exactly opposite in phase, the envelope value is zero. When the two vectors are in phase, the envelope value is a maximum. This generates a two-tone SSB envelope with a repetition frequency equal to the difference between the two audio tones (Fig. 3b). The test set-up for two-tone testing is shown in Fig. 4.

Transmitter performance may be gauged by observing and analysing the two-tone envelope. If no appreciable non-linearities exist in the transmitter amplifier/s, the resulting envelope will approach a perfect double sine-wave (superimposed) pattern.

As the distortion increases, so do spurious products and the waveform displayed becomes less of a sine-wave function. Transmitting operation and tuning should be suspected if any noticeable departure from a sine-wave display is observed.

The types of distortion which may be observed are:—

(i) Flattopping — due to excessive drive to an amplifier stage, causing saturation. Automatic Level Control (ALC) is employed to overcome this problem.

(ii) Crossover distortion — usually caused by incorrect biasing of a linear amplifier stage at low levels of signal. Increasing the quiescent collector current reduces this distortion.

(iii) Carrier leak — caused by imbalance of the balanced modulator stage. This will appear as a small sinusoidal waveform superimposed on the two-tone waveform. Proper balancing of the modulator

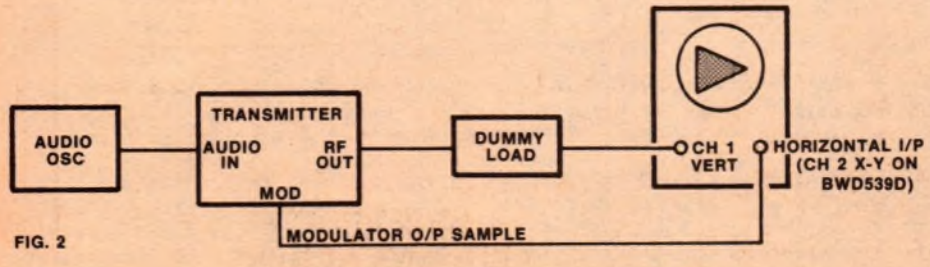


FIG. 2

Fig. 2. This arrangement is also suitable for AM systems. RF is fed to the vertical deflection plates, and the modulating signal to the horizontal plates. The resultant trapazoidal pattern can reveal a great deal about the transmitter.

Winner of BWD/EA competition

The BWD Oscilloscope Competition was announced, and details, given, in the December 1977 issue of "Electronics Australia". The object was to describe how to use a modern CRO — such as the BWD 359D — for servicing and adjusting transceivers up to about 30MHz.

Entrants were required to submit and article" . . . in a form suitable for . . . publication" and ". . . typically able to fill three pages of the magazine, including diagrams and/or photographs."

The winning entry, as judged by senior staff members of the magazine, was Mr R. Watkins of Duncraig, Western Australia. Mr Watkins has worked in radio and electronics since leaving school 18 years ago. His experience has included radio-telecommunications work in Western Australia, a service business in London, a period with Decca (UK), and currently with the Department of Transport in control of the Decca Navigation systems in north-west of Western Australia.

He holds an amateur licence (VK6ZBD), and his other interests are music, boating, fishing, and water skiing.

Mr Roy Watkins (right) being presented with the BDW 539D oscilloscope by Mr Ian Lobley, General Manager of Cairns Instrument Services, Perth. Looking on is the firm's Senior Sales Engineer, Mr Ian Smith. Cairns Instrument Services are the Western Australian agents for BWD Electronic Pty Ltd.

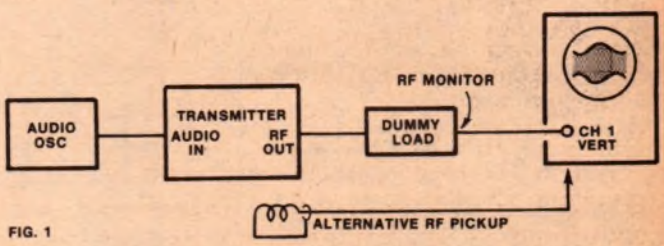


FIG. 1

Fig. 1. One of the simplest set-ups, this arrangement gives a "modulated envelope" pattern which is easily interpreted. The CRO normally locks on the audio component.

stage will eliminate this fault. Some transmitters have a carrier re-insert facility. This should be checked first to ensure that it is off or at minimum setting.

(iv) Sideband Suppression — By using a single audio tone of approximately 1000Hz in place of the two-tone signal, the suppression of the undesired sideband may be observed. If the transmitter exciter is operating correctly, a single-tone input will produce a single-frequency output and the waveform will appear to be a normal unmodulated carrier. If the sideband suppression is not adjusted correctly, the waveform will have the appearance of an amplitude-modulated carrier.

POWER AMPLIFIER LINEARITY: The oscilloscope as a linearity tracer is shown in Fig. 5. Two SSB signals are connected, via detector circuits, from the input of the power amplifier to the horizontal input of the oscilloscope and from the output at the amplifier to the vertical input of the oscilloscope. A two-tone test signal is normally used but any modulation, including voice modulation, may be used to provide a satisfactory pattern. A perfectly straight diagonal line on the oscilloscope will result if the amplifier has no linearity or distortion problems.

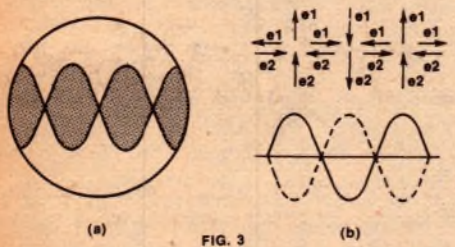


Fig. 3. A typical pattern from an SSB two-tone test. This pattern should not be confused with that in Fig. 1.

TRANSMITTER POWER OUTPUT: The two-tone test is of special importance as it is from this signal that the power output from an SSB system is determined. An SSB transmitter is rated in Peak Envelope Power (PEP) with a two-tone signal.

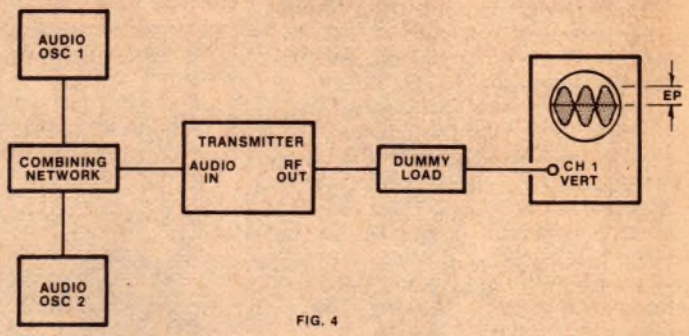
The output power of an SSB transmitter may be calculated by measuring the peak voltage (Ep) of the two-tone signal developed across a resistive load with the oscilloscope. As power is equal to the voltage squared divided by resistance:—

$$PEP = \frac{(.707\ Ep)^2}{RL}$$

The test set-up for measuring power output requires that the oscilloscope be connected across the input to a resistive dummy load as depicted in Fig 6. A suitable "T" connector is used for this purpose. Adjust the vertical amplifier gain to give a suitable pattern on the oscilloscope. The amplitude of the pattern is then measured and from this, the peak voltage reading (Ep) is achieved. Assuming the resistance of the load is known, the peak envelope power may now be calculated.

The oscilloscope, the BWD 539D in particular, is an excellent and invaluable instrument for the serviceman and hobbyist alike, for all applications of modern electronic equipment servicing.

Fig. 4. The two-tone test set-up for SSB systems. The audio oscillators and the combing network are usually built into a single instrument.



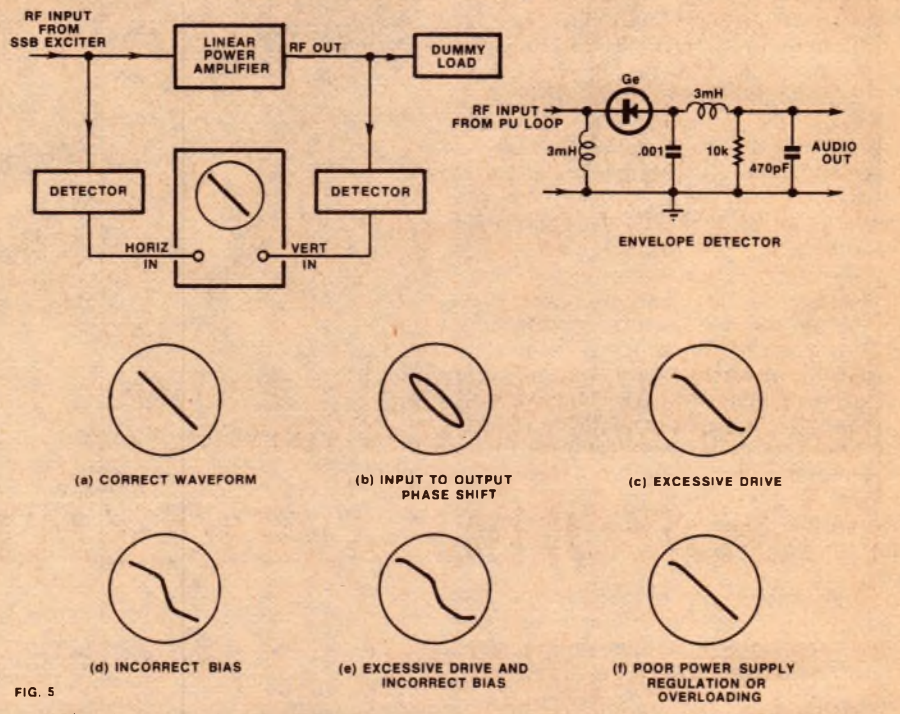


Fig. 5: Checking amplifier linearity. In this set-up the CRO is used to compare the signal fed to the amplifier with the signal delivered by it. The patterns produced by the various forms of distortion are shown, some in combination.

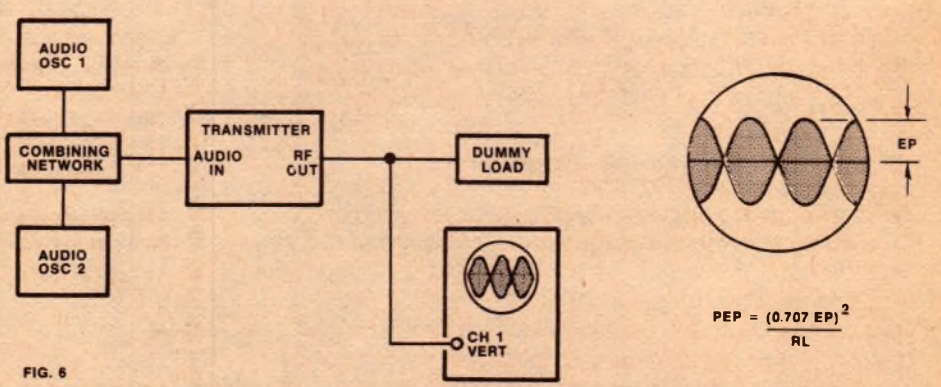


Fig. 6. Measuring the power output from an SSB transmitter is not quite as simple as with an AM system, but this diagram shows the set-up and the calculations required to do it. A calibrated CRO is essential to give an accurate Ep figure.

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LINK-11S. Link editor which links the modules created by the PAL-11S into a load module ready for execution on the H-11. The module is loaded into the H-11 via the Absolute Loader.

Absolute Loader. Loads absolute binary tapes into the H11 memory for execution.

ODT-11X. Lets you debug the programs which you have created. Permits modifying and controlling program execution "on the fly" for quick, efficient debugging.

IOX. Executive program permits I/O programming without developing device-driving programs. Links to your programs using the LINK-11S. For use with high speed paper tape reader/punch and line printer.

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EA's Jim Rowe reports on US hobby computer show:

PERCOMP '78

During his recent trip to the west coast of the USA, EA Editor Jim Rowe attended the PERCOMP '78 personal computer convention in Long Beach, California. Here is his first-hand report:

There have been quite a few "small computer" conventions in the last couple of years, particularly in the USA. However this year's Percomp '78 was planned as the first convention in Southern California to be devoted exclusively to "personal and small business" computer systems and applications. It was held at the newly completed convention centre on the waterfront at Long Beach, about 30km south of downtown Los Angeles and just across from the old "Queen Mary" ocean liner which is now used as a hotel and tourist attraction.

The convention was held on the Friday, Saturday and Sunday of the last weekend in April, and I was thus able to attend just before returning home. For most of the sessions I was lucky enough to have the company of my good friend Charles Griffin, a professional and very experienced computer consultant, who was particularly interested to see the current state of the art in the small systems area.

Like most such conventions, Percomp '78 consisted basically of two main aspects: an exhibition, and a series of lectures and seminars.

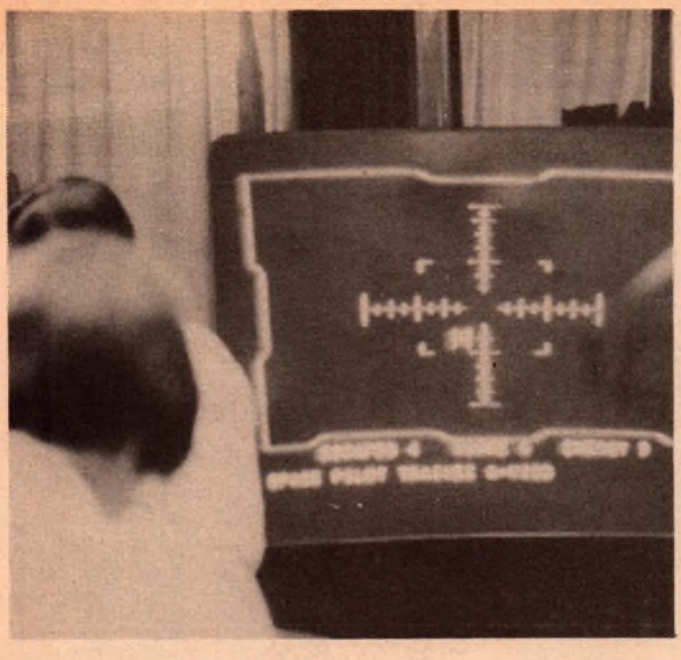
The exhibition was fairly large, with about 80 exhibitors. On the lecture side, there were a number of different series, with parallel running so that at times you had to choose between as many as four different topics. It was not possible to attend all sessions.

In the time available, we attended a representative selection of lectures and seminars, with topics which were quite diverse: from aspects of semiconductor chip reliability to the design of a home security system based on a microprocessor.

Like technical lectures throughout the world, they varied considerably in terms of preparation, presentation and interest level. The best lectures were of a high standard, although to my mind no higher than many presented at Australian conventions and club meetings. The content did not seem to be significantly in advance of our local lectures, either — reassuring, as we Australians tend to assume that we are always trailing the USA.

On the exhibition stands, there weren't too many surprises for anyone who had been reading the US computer hobby magazines. About the only new things I spotted were a microcomputer based "intelligent" exercise bike, a new integrated small system called the Edixy "Sorcerer", and a single-board hobby system from Synertek called the VIM-1.

The exercise bike is called the "Dynavit", and is made by a firm called the TLF Corporation of Littleton, Colorado. Not much data on it was available as yet, but as far as I could determine it monitors such body parameters as pulse rate and blood pressure, and compares these with your performance on the bike. If you key in your age and weight, it will rate you for physical fitness. Quite a fancy device, although at around $1900 it will perhaps



TOP LEFT: Colour projection TV adds drama to a "space war" game on the Technico Inc stand. TOP RIGHT: Ms. Jeanne Soderman demonstrates the "Dynavit" computerised exercise bike. ABOVE: Professional computer consultant Mr Charles Griffin, leaving with an armful of further reading. ABOVE RIGHT: TRS-80 systems attract much interest on the Radio Shack stand.

be a while before there's one in every home.

The Sorcerer system is made by Edixv, Inc, of Sunnyvale, California. It is fairly obviously going to be a competitor for such systems as the Tandy TRS-80 and the Commodore PET, although price of the basic system is somewhat higher. Based on the Zilog Z80 chip, it has an inbuilt keyboard and video interface, and comes with 8K of RAM and 12K of ROM containing a monitor and BASIC interpreter.

The VIM-1 system is based on the 6502 chip. On a single PCB, it has a small keyboard and LED display together with inbuilt TTY and tape interfaces.

There was a lot of interest in the "Radio Shack" stand, where about six of the TRS-80 systems were available for use. The TRS-80 has obviously made just as big an impact in the USA as it has done here — particularly as they have already released there a floppy disc and two different printer peripherals. There is also a somewhat greater range of applications software available.

I didn't see a Commodore PET on any of the stands, nor any of the Ohio Scientific systems. But there were many of the items familiar from computer journal advertisements: the Computalker speech synthesiser, the SSM music synthesiser, the Apple II system, and a host of add-on memory and interfacing boards — many but not all of them S-100 bus compatible.

Most of the US computer hobby magazines had stands, and at the "Kilobaud" stand I had the pleasure of meeting its Editor, John Craig. We had a very friendly chat, and compared notes on producing technical magazines. John reads EA regularly, and it was gratifying to learn that he believes our microcomputer articles compare very favourably with those in the more specialised magazines.

There were a few less technical stands, too. One was selling helium-filled aluminium-foil balloons(!), while another offered "hologram" pendants and other jewellery made using a laser. And there were the inevitable stands selling hot dogs, cola drinks and popcorn.

Although things were a little quiet on the Friday, they soon warmed up. On the weekend itself attendances were quite high, suggesting that Percomp will take its place among the regular computer conventions.

MODEL 100A
LOGIC ANALYZER

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- ☐ STATIC OR DYNAMIC DISPLAY OF TRUTH TABLES
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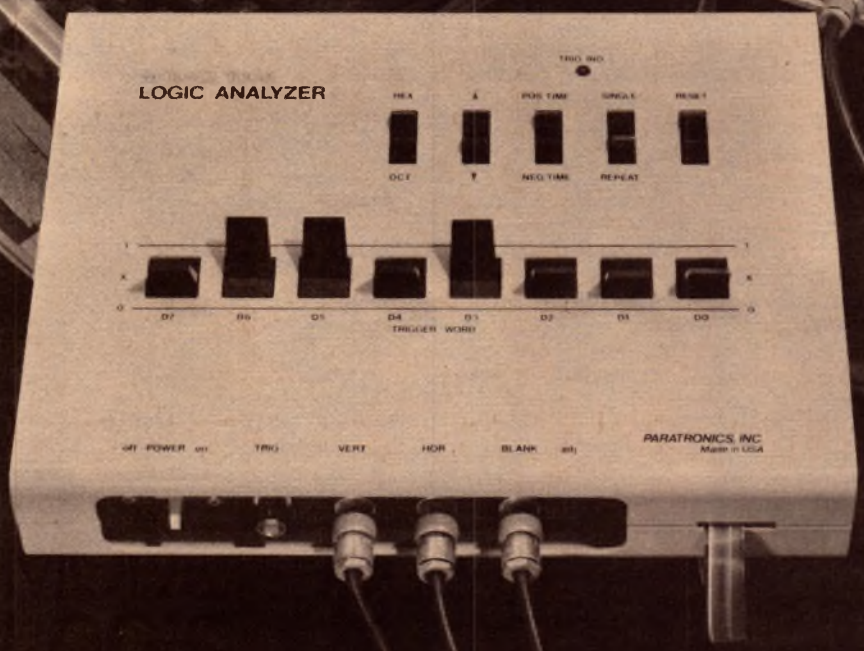

PARATRONICS, INC.

The Model 100A Logic Analyzer converts an ordinary oscilloscope into one of the most useful digital testing, analysis, and development tools available. It is ideal for applications requiring an in-depth exploration of hardware and software performance. Use it to trace computer program flow, examine the contents of ROMs and other memories, check counter and register operations, and monitor I/O sequences. An input data rate in excess of 8 Megabytes/second assures compatibility with most microprocessors and general purpose digital systems.

The Model 100A provides data domain analysis features not possible using an oscilloscope alone. It will capture data before or after a trigger word, and display the associated truth tables statically or dynamically in your choice of hexadecimal or octal formats.

The low cost of the Model 100A permits engineering companies, educational institutions, and hobbyists to take advantage of data domain analysis to support a variety of advanced development, training, and troubleshooting applications.

The Model 100A is easy to operate and will interface directly with most common logic families including TTL, Schottky, CMOS, MOS, and DTL. Connection to the system-under-test is accomplished using a color-coded flat ribbon cable terminated in gold-plated "universal" pin connectors.

A 100-page owner's manual provides extensive information on theory of operation as well as educational, production testing, field service, and general digital applications. The analysis procedures for seven popular microprocessors are also included.

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Companion to Paratronics Model 100A:

Trigger expander for logic analysers

Although designed primarily as an add-on unit to enhance the triggering capabilities of the Paratronics Model 100A Logic Analyser, described last month, the Model 10 Trigger Expander may also be used with other logic analysers. It can also be used alone, as a word-recognising trigger unit for oscilloscopes. Like the 100A, it comes as an assemble-it-yourself kit.

by JAMIESON ROWE

As we noted last month, a new type of test instrument is evolving to cope with the problems of analysing the operation of modern digital systems: the logic analyser. And although many of these new instruments are designed to use a standard oscilloscope (or 'scope) for display, they provide a number of important facilities which are generally not available on a 'scope itself.

One such feature is that they generally have rather more input channels than a typical 'scope: from eight to 24, or even 32. They also have the ability to trigger from a specified bit pattern, and to store a number of patterns occurring both before and after the key pattern.

Some analysers display the stored information as a column of waveforms (either real or synthesised), rather like a 'scope with a very large number of channels. These are generally known as time-domain analysers.

Others display the information in the form of a truth table, showing only the binary values of the bits in each pattern. These are generally known as data domain analysers.

Although well down the scale in terms of cost, the Paratronics model 100A logic analyser reviewed last month provides many of the features of more expensive analysers. A data domain unit, it uses a standard 'scope for display — although the 'scope must be capable of providing an X-Y display.

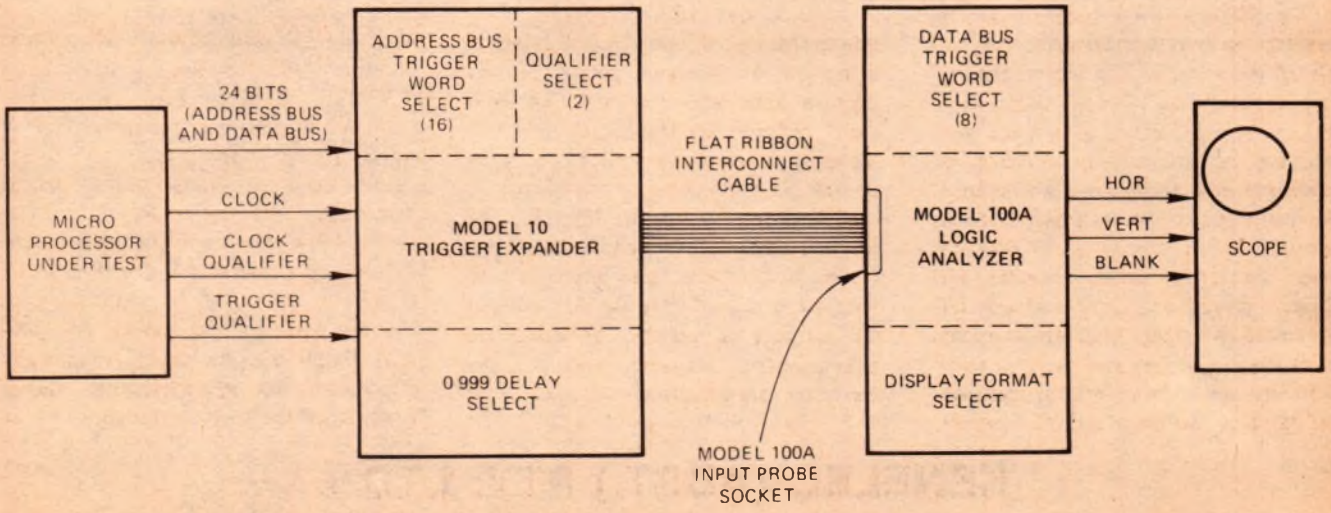
By itself the 100A is an eight-channel analyser, and may be programmed to recognise and trigger on any desired eight-bit pattern or "key word". It then displays on the 'scope screen a truth table, showing the key word together with either the 15 words immediately before it, or those immediately after it.

A front panel switch allows you to select which group is displayed. Other switches allow selection of single shot or repetitive modes, whether the display truth table is grouped for octal or hexadecimal interpretation, and whether the rising or falling edges of the clock/strobe pulses are used to synchronise triggering.

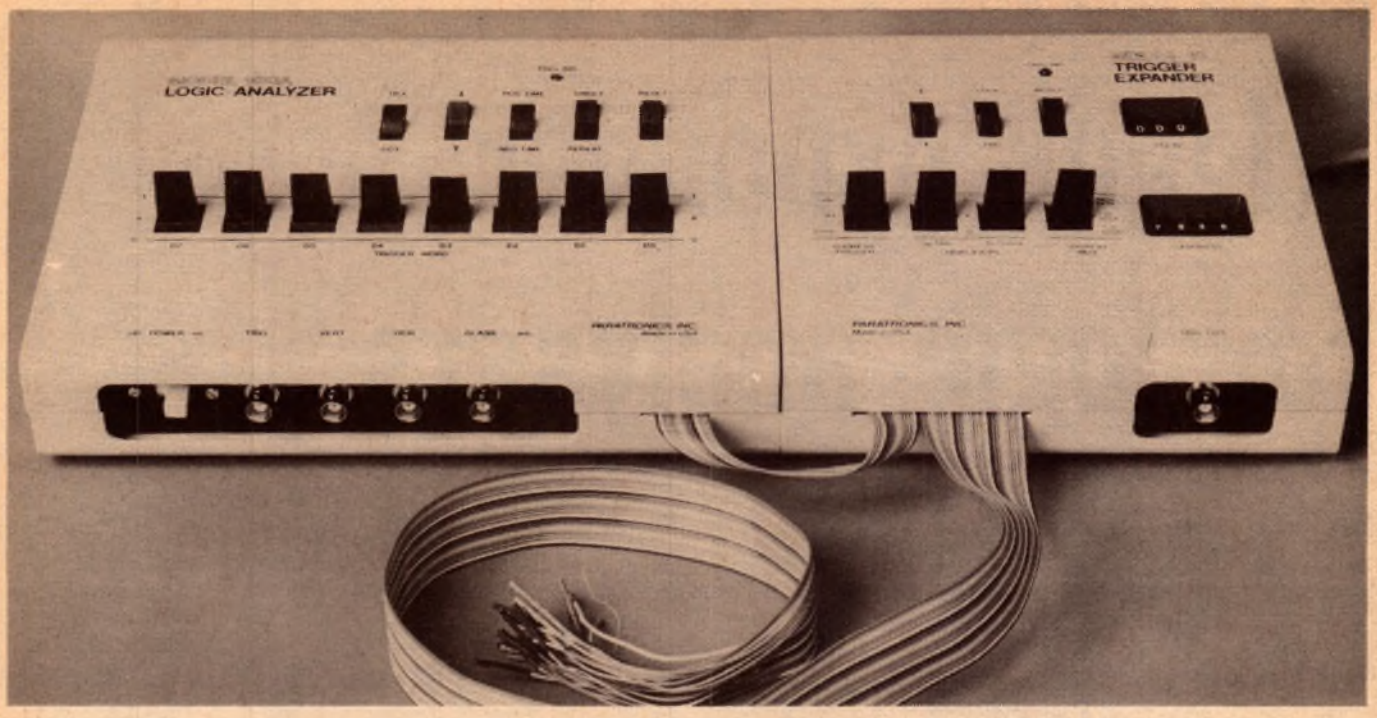
The 100A also has a trigger output, capable of being used to trigger the timebase of a 'scope for waveform analysis. It may therefore be used as a word-recognising trigger unit, for time-domain analysis.

These facilities make the 100A a very useful instrument, well suited for servicing and development of digital systems, and for analysis of microprocessor operation. But it does have its limitations, not the least of which is the relatively small number of input channels.

To provide a way of enhancing the capabilities not only of the 100A, but of other similar analysers as well, Paratronics Inc. has produced the model 10 Trigger Expander. This provides a number of additional facilities, including effective expansion of the trigger word from eight to 26 bits and programmable digital delay of from 0 to 999 clock/strobe pulses or key



How the Paratronics 100A analyser and 10 trigger expander are used to analyse system operation.



When assembled, the model 10 may be combined with the model 100A analyser to form a compact and highly flexible system analyser.

word cycles.

Perhaps the most obvious feature of the model 10 is the 16-bit word recognition facility, used to supplement the eight-bit circuit in the basic 100A analyser. The additional facility may be used either in conjunction with the eight-bit circuit, in place of it, or disabled to make the eight-bit circuit operate alone.

If selected, the desired 16-bit pattern to be recognised is set up on a bank of four thumbwheel switches, coded in hexadecimal. The switches are labelled "address", because in most applications it will be convenient to connect the additional 16 bit inputs to the system address bus lines, and those of the original eight-bit circuit to the data bus lines.

A separate switch is used to enable and disable the 16-bit circuitry, so that by using this switch in conjunction with the eight bit switches on the model 100A, the combination of the two instruments may be set for eight-bit, 16-bit or 24-bit word recognition.

Further flexibility again is provided by two additional single-bit input channels. One is labelled "clock qualifier", and may be used to allow triggering of the analyser only on specific clock/strobe pulses, using a select signal from the system under test (such as read strobe, write strobe, or I/0 strobe).

The other input is labeled "address qualifier", and may be used to allow triggering only when the designated address is read from or written into, etc — again using a control signal from the system under test. Each of the two qualifier inputs may be set for either logic polarity, or disabled if not required.

The model 10 provides a digital delay facility, so that the trigger signal used to initiate storage of data words in the model 100A's display memory may be delayed with respect to the key pattern recognition time. The delay is set by means of a bank of three thumbwheel switches, coded in decimal and hence providing for delays of from 0 to 999 units.

Two different delay units may be selected, for added flexibility. Using a separate switch, the delay period may be set in either clock/strobe cycles or in trigger word events. The former allows you to "walk" the display along in time, using the strobe pulses as time markers, while the latter allows you to examine the situations at successive trigger events — so that you can see what happens the Nth time around a program loop, for example.

Needless to say, this dual-mode delay facility adds greatly to the potential of the analyser system.

As the model 100A is only capable of storing and displaying 16 eight-bit words, the model 10 also includes a display multiplexer. At the flick of a switch this lets you store and display either the data word, the upper address byte or the lower address byte at will — without moving input probes.

Although designed primarily to go with the model 100A analyser, the model 10 trigger expander will also mate with other logic analysers such as Paratronics' own model 150 "S-100 Bus Grabber" and the model 500 "Scope-A-Lyser". It will also work with the Hewlett-Packard model HP 1600.

In addition, the model 10 may be used alone, as a word-recognition trigger unit for a 'scope. All of the facilities of the model 10 are available, so that the 'scope effectively becomes a time-domain logic analyser with 16-plus-2 trigger input channels, and a dual-mode digital delay facility. When used alone, the model 10 requires a separate 5V/300mA power supply.

When used with the model 100A, the model 10 may be physically mated with it by means of an optional base plate. This makes the two into an easily handled single instrument.

Like the model 100A, the model 10 comes as an assemble-it-yourself kit, complete with a comprehensive manual dealing with both its assembly and its use. Price of the model 10 kit is $229 plus tax, the same as that for the 100A kit.

Paratronics agents Kenelec Australia kindly made available a sample kit for the model 10, so that I am able to give you a first-hand report on the kit and its assembly, as well as the operation of the final unit.

As with the model 100A kit reviewed last month, I found the model 10 kit to be complete apart from the 'scope cables. The two PC boards are of high-quality fibreglass, and appear to be well made.

Following the assembly instructions carefully, and without hurrying unduly, it took me about 3½ hours to assemble the model 10 and mate it with the model 100A. The assembly instructions are quite clear, although the step directing you fit the ICs to the PC boards seems to be out of order. It should really be step 15, instead of step 20, so that the ICs are added before the boards are stacked in the case.

When finished the model 10 worked

(Continued on page 125)

INTRODUCING MULTI-P 2650

The easily affordable expandable multi-purpose home computer. Based on the new 2650 Mini Computer described in E.A. May, 1978, the MULTI-P 2650 is the first Australian designed home computer available ASSEMBLED AND TESTED ready for use. All you have to do is connect a T.V. set and any low cost cassette recorder and the system is ready for use. Using the resident "PIPBUG" minitor you can enter your own programs in machine language or better still, you can select programmed tapes from the large 2650 program library and load programs of your choice. The MULTI-P is supplied with the invaluable 2650 programming course and a test cassette which contains sample computer games for you to play.

Technically speaking the MULTI-P 2650 is manufactured and serviced locally by Applied Technology Pty. Ltd and is based on the popular Signetics 2650 microprocessor. The main CPU board is as described in E.A. May, 1978 and utilises the latest 4K RAM chips. The basic version of MULTI-P 2650 is supplied with 1K RAM and provision has been made to add a further 3K by plug ging more RAMs into the sockets provided and is housed in a specifically designed case providing room for further expansion to be described in E.A. in the near future. The VDU has also been described in E.A. Feb., 1978 and produces an easily readable 32 character by 16 line display. The input to the computer is via the full function keyboard which also controls the cassette interface and the reset functions. The power supply is designed around a special transformer which can apply 10A at 5V, 1A at +12V, 1Aat −12V to provide for any future expansion.

The MULTI-P 2650 is supplied with complete technical documentation including detailed assembly language programming/technical manual, sample programs to run and the 2650 programming course.

MULTI-P 2650 . . . . . **$375.00** with 1K RAM
. . . . . **$450.00** with 4K RAM

TV SET NOT SUPPLIED

INDIVIDUAL KITS

2650 MINI COMPUTER: as described in E.A. May, 1978 this kit includes all PCB components, 1K RAM, PIPBUG, 2650 and sockets for all ICs **$89.50**

EA LOW COST VDU: As described in E.A. Feb., 1978 this set of kits can be used as a complete terminal for any microprocessor system. BASIC VDU (includes xtal, plated thru PCB, all components and assembly/troubleshooting manual) . . **$99.50**
MODULATOR KIT . . $4.50

ASCII KEYBOARD/ENCODER KIT (supplied with all components including UART and ENCODER but not transformer) **$39.50**

KEYBOARD KIT: KB04 . . . . . **$59.50**

CASSETTE INTERFACE. R.E.C.I. (complete with full instructions and test tape for easy accurate alignment) **$22.50**

HEAVY DUTY TRANSFORMER: AT4120 . . . . . **$19.75**

2650 PROGRAMS

Games Tape 1: play games like astrotrek, number guessing, nim, hangman, chomp, target shoot etc. **$12.75**

Games Tape 2: NEW RELEASE—This cassette includes software for fascinating games such as funny farm races, solitaire, biorythym, lunar lander, mindreader, etc. **$12.75**

Utility Tape 1: contains very useful programs for rapid loading, relocating programs, finding programs, etc. **$12.75**

2650 USERS GROUP

For the complete enthusiast we recommend joining the 2650 USERS GROUP. Membership fee entitles each user to a complete listing of all the programs at present in the library as well as many useful hardware notes. Members also receive updated programs periodically. **$40.00**

STOP PRESS

2650 PROGRAMMING COURSE **$12.50**

Designed by 2650 experts to assist the 2650 user in the first steps of programming at the machine language level. The course starts by explaining and using all of the 2650's monitor program (Pipbug) commands. It goes on to assist you to write a number of programs and explains each individual step used. The programs have been specially designed to use a great many of Pipbug's sub-routines. This is an ideal starting place for those wishing to learn computer programs, and will lead you eventually into Course 2 (available later) which explains assembly language etc. and then on to Course 3, Basic Language (available later).

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Microcomputer News & Products

Computer Fair '78

An exhibition to be known as Computer Fair '78 is planned by the Australian Computer Society as an integral part of its 8th Australian Computer Conference, to be held in Canberra from August 28 to September 2. The Fair will echo the main theme of the conference itself, "Computers in the Service of Society".

Exhibitors will be able to sell direct to the public, and it is expected that a wide variety of consumer-orientated products will be on display. The Fair will be held in the Albert Hall, on the south side of Lake Burley Griffin and a short walk over Commonwealth Avenue Bridge from the main conference area.

While catering for the computer professional, the Fair will be designed to appeal especially to the general public and the computer hobbyist. Exhibition space has already been allocated to computer hobby clubs, with this in mind.

Exhibition space was still available at the time this issue went to press, at cost levels from $200 up for the week.

Enquiries regarding the Fair may be directed to its Manager, Dr Bill Caelli, c/o ACS-8 Conference, PO Box 448, Canberra City, ACT 2601.

DSE micro kits

Dick Smith Electronics has advised that their stores currently have available kits for many of the microcomputer projects described recently in the magazine. These are listed as follows, with DSE catalog numbers and prices in brackets after each: 2650 Mini Computer, May 1978 (K-3447, $115.00); Cassette Interface, April 1977 (K-3465, $24.50); VDU video display board, February 1978 (K-3460, $97.50); VDU encoder board, April 1978 (K-3464, $39.50); VDU video modulator, April 1978 (K-3462, $4.50).

Also available are individual items and components for microcomputer enthusiasts, such as an ASCII keyboard assembly (X-1180, $55.00), a metal case for our VDU (H-3130, $24.50), and chips like the 2650 microprocessor (Z-9201, $28.50) and the 2608/CN0035 "PUPBUG" ROM (Z-9309, $19.75). The picture shows the 2650 Mini Computer with the Low Cost VDU, as assembled from DSE kits. Note, however, that the TV receiver is not supplied as part of the VDU kit.

All kits contain all necessary parts as specified in the original parts list, including mounting hardware, wire and solder. Full instructions are included, in most cases comprising reprints of the original EA construction articles.

Logic tester

A new logic tester designed to eliminate the need for a 'scope in digital system servicing has been produced by Colrose Electronics, of 13 Freda Street, Netley, South Australia. The model CLT001 performs the following functions:

1. A 3-digit frequency counter with frequency range from 1Hz to 9.99MHz.
2. Frequency ratio meter for checking performance of counters, etc.
3. Logic probe with the ability to indicate Tri-state logic levels, and to operate with both TTL and CMOS logic. Ability to "catch" short pulses, as short as 25ns.
4. Duty cycle indicator, capable of comparing high-level and low-level time durations.

The tester measures 91mm x 65mm x 54mm, and has a mass of 190g. It has an input impedance of 100k or more, and is powered by the circuit under test (4.5V minimum, 15.5V maximum).

Further information, including details on price and availability, and available from Colrose Electronics as the above address.

Japanese system

An integrated personal computer system claimed to be competitive with the Tandy TRS-80 and Commodore PET systems is now in production at Sord Computer Systems, Inc. in Japan. Called the M100 Personal Computer, the new system appears to be a scaled-down version of the firm's established S200-series small business systems.

The Sord M100 comes in a single case, with integral keyboard and power supply. It includes an inbuilt video controller and buffer, for use with an external TV receiver or monitor. Cassette tape interfaces are also built in, as are an 8-bit parallel interface and two 8-bit analog to digital conversion inputs for joystick interfacing.

The system is based on the Zilog Z-80 microprocessor, and has an 8k BASIC interpreter resident in ROMs. Either 16k or 32k of RAM may be supplied, and the system may also be expanded as desired via an S-100 edge connector. A 2-octave D-to-A output with speaker is inbuilt, also.

Options available include a colour graphics display controller, an S-100 bus extension cabinet and a monochrome TV monitor.

Further information on the M100 is available from Abacus EDP Services Pty Ltd, 66-68 Albert Road, South Melbourne 3205.

Clubs in NZ

There are now apparently three computer clubs operating in New Zealand. Only very brief information is available, as follows.

NZ MICROCOMPUTER CLUB: Apparently the largest club, centred in Auckland. Meets monthly at the Auckland Technical Institute. Mail address Box 6210, PO Auckland.

WELLINGTON MICROCOMPUTER CLUB: The only information available at present is the mail address: Box 1581, PO Wellington.

CHRISTCHURCH: The only information we have received is the following name and address: Paul Campbell, 50 Francis Avenue, Christchurch.

This information came to us from "Comshare No. 2", a NZ personal computing magazine produced by Chris Sullivan, 8 Galsworthy Place, Bucklands Beach, Auckland, NZ.

Classical Recordings

Reviewed by Julian Russell

Deller — "a whole new field of enjoyment"

THE ART OF ALFRED DELLER — Thirty-two of his special favorites with Mark Deller (counter-tenor); Desmond Dupre (lute); The Deller Consort; Oriana Consort Orchestra; Wenzinger Consort of Viola; Leonhardt Baroque Ensemble; and Walter Bermann (harpsichord). Vanguard Mono/Stereo VSD 729/30.

Before I go further, I think it only proper that I should inform readers of this column that I do not like counter-tenors. I do not like the tone they produce that too often sounds like a big choirboy whose voice is about to break. And there is an atmosphere about their musical activities, whether they sing solo or in consort, that usually leaves me with a niggling feeling. Even a performance I heard some years ago at Covent Garden of Britten's Midsummer Night's Dream was spoilt for me whenever Oberon, cast as a counter-tenor, was on the stage.

But my personal prejudices aside, I have for many years, together with lots of other musicians, owed Alfred Deller a debt for his having introduced us to many enchanting 16th and 17th century songs that we would probably otherwise have missed.

One of the first musicians of this century to reawaken interest in the music of the 16th and 17th centuries was Peter Warlock (Philip Helsetine) who spent much of his all too brief life digging up various forgotten manuscripts from English museums. One of the composers Deller features in this production is John Dowland, and in his book on the English ayre Warlock wrote:

"Exactly how Stephen Dedalus contrived to acquaint himself with the works of Dowland 20 years ago is not very clear; for although he would have found plenty of Byrd, Farnaby and Tomkins in the Fitzwilliam Virginal Book — that precious miscellany of English keyboard music which, long known to students of musical manuscripts by the quite erroneous title of Queen Elizabeth's Virginal Book, was at length printed and published in 1899 — the songs of Dowland and his fellow lutenists were still inaccessible to the general public.

"It is a remarkable thing that all the various other kinds of music that were flourishing at the end of the 16th and the beginning of the 17th centuries — the Mass, the Anglican service, the anthem, the madrigal, the instrumental fantasia, and the various dance forms — should have received attention at the hands of modern editors and historians before the acccompanied song or ayre, the simplest of all musical forms then in vogue and the one most likely to win popularity in another age.

"The exquisite lyrics from the song books which were hailed with such delight when A.H. Bullen first published them in the 'eighties were all taken direct from the music books in which they were originally printed; and these song books are, for the majority of the lyrics, the only sources. But until the last few years the music associated with these poems has been strangely neglected, and musicians are only just beginning (Warlock was writing in the early 1920s) to realise that we have here a body of English song which any country at any period of history might well be proud."

And thanks are due to Alfed Deller who for years has been "popularising" many of these songs, so that all enthusiasts of the period have become acquainted with a whole "new" source of pleasure. And these he — and sometimes his consort — always sing with exquisite taste based on vast study of the subject.

The present double-disc album is divided into four parts — Traditional Songs, English Madrigals and ayres, European and vocal music, and Vocal Music of Purcell. Some Deller sings solo with lute accompaniment, some with his consort and a few with a small orchestra which resembles, as closely as possible, the type of accompaniment used in the originals. Among those in the second section you will find the works of some composers nearly forgotten by the general public. Incuded are the works of Wilbye, Weelkes and Parsons, together with nowadays such better-known ones as Morley, Dowland and Byrd.

In a note on the back of the cover you will find an anonymous statement that describes Deller as follows: "an innate ability to comprehend and interpret the great masterpieces of the Ars Nova, his mastery of the subtleties of phrase in the rich repertoire of the Renaissance, his unrivalled understanding of 17th century music, combined with the genuine virtuosity which the music of these ages demands make him one of the great interpretative musicians of modern times."

All this is exemplified on the two discs and I find it difficult to add further praise especially since I have already overrun my space on this subject. But I must add that despite the revelation of my prejudice against counter-tenors mentioned above I can enthusiastically recommend this production, not only to music scholars, but also to those others to whom it should open up a whole new field of enjoyment.

London Philharmonic plays Elgar

ELGAR — Sea Pictures. Song Suite. Yvonne Minton (mezzo-soprano) with the London Philharmonic Orchestra conducted by Daniel Barenboim. Overture. In The South. The LPO conducted by Barenboim. CBS Stereo Disc. SBR235884.

I still retain all my old affection for the music of Elgar and all my old response to "Sea Pictures". However I do not think that these warmly inspired songs are heard quite at their best on this disc. Yvonne Minton has a lovely voice which she seldom fails to use expertly. Her musical intelligence and her general intelligence too — is of a very high order.

In her interpretation of Sea Pictures she uses all these gifts in a way that cannot fail to charm, concentrating for the most part on their lyrical beauty. But these songs need something more than this — an inner feeling of the surge of the sea. But I feel sure that this splendid singer, when she develops her great gifts even further, will endow "Sea Pic-

tures" with this wider interpretative quality.

For instance, the more mature and bigger framed Janet Baker treats them almost in the manner of Lieder, paying more attention to projecting the feeling and meaning of the words than does Ms Minton in this set. Please don't get me wrong. I enjoyed her performance vastly and have no desire to disparage it. But I have a feeling that in a few years she will interpret them in a manner closer to the composer's intentions, introducing here and there a still better wedding of words and music. I except the final song, "The Swimmer", in which Ms Minton is faultlessly dramatic — and very excitingly so.

Janet Baker, for HMV, had the advantage of an accompaniment provided by Barbirolli. Minton has Barenboim who is, at present, by no means the equal of the other recently deceased master. I should not be surprised to learn that many listeners prefer the alluring freshness of the Minton voice to the weightier beauties of Baker's so don't let me put you off from listening to this disc — at least the vocal side.

Elgar's "In The South" overture is as strictly put together as the composer's other fine overture, Cockaigne. Both works have the same episodic quality. An ideal performance welds these episodes together into a symphonic whole while still preserving the narrative quality of the music. True, Elgar is treating vastly different subjects but the argument still holds. Barenboim fails to do this, emphasising instead the episodic character of the work.

In other words, his reading is just a little too fussy, a point that is never disguised by the record's engineering that is certainly not up to the best CBS almost invariably offers. You will understand easily what I mean about Barenboim's interpretation if you can find a pressing of Elgar's own old mono recording of "In The South" and listen to the difference.

But I think your chances of coming across the Elgar performance is very slight indeed — unless it has been reissued, an enterprise that would be well worth undertaking.

☆ ☆ ☆

SCHUBERT — Symphony No. 8 (Unfinished). Symphony No. 5 in B Flat. Concertgebouw Orchestra conducted by Bernard Haitink. Philips Stereo Cassette 7300513.

On this cassette Haitink, whom I usually admire enormously, disappointed me in his performance of the "Unfinished". All through he is strangely heavy-handed and uncommitted. He gives the impression of being satisfied to leave everything to his fine orchestra without any effort to reveal his own opinion of this admittedly overplayed symphony. Not that he ever departs from the score but most of the time his tempos sound very much on the slow side, and at a slow pace there is too much resemblance between the two movements that comprise the work.

It is not often that Haitink is heard on an off day, but he was certainly having one here. I also found, soundwise, that too much emphasis is placed on the bass, a difficult fault to remedy on most equipment. This recording's eccentricity is also noticeable in the much lighter and usually delectable 5th Symphony. Haitink seems unmoved by its dainty subtleties and again makes his performance sound very much like a run-through by a fine orchestra well acquainted with the work. The result is a strangely dull performance from this usually entirely admirable conductor.

If you are looking for an alternative coupling of these symphonies I have no hesitation in recommending the Bohm/Berlin Philharmonic production, even though this is now over 10 years old. I find it preferable in almost every way.

☆ ☆ ☆

GREIG — Peer Gynt Suites Nos. 1 and 2. Four Norwegian Dances. English Chamber Orchestra conducted by Raymond Leppard. Philips Stereo Cassette 7530 513.

If you haven't already worn out your response to these one-time hackneyed pieces here is as good a performance as you'll find around at present. The English Chamber Orchestra sounds rather more weighty than might be expected from a chamber orchestra. In some items it assumes almost symphonic proportions, though always to good effect.

Leppards reading is full of colour and, when necessary, vigour. He plays both Peer Gynt Suites, Nos. 1 and 2, so that those who know pieces only from Palm Court performances, or from a piano score, will find items they have probably never heard before.

The always welcome Norwegian Dances were not orchestrated by Grieg himself but by Hans Sitt, who made an excellent, colourful job of them. To me these are always worth an occasional "listen", and those who hear them from this cassette will not be disappointed. The sound is good though strangely there is again a hint of too much prominence in the bass, but nothing like that mentioned in the Schubert Symphonies reviewed above.

Lighter Side

Reviews of other recordings

Devotional Records

SONGS WE BELIEVE IN. The Proclaimers. Stereo, Fable FBSA-016. (CBS release).

Originally formed around the youth group of the Rosanna Baptist church, the Proclaimers are now much more widely based and specialise in proclaiming the Gospel through their music at an interdenominational level.

The music here is arranged and produced by Geoff Hales and draws much of its inspiration from the negro Gospel sound. So, while the titles are familiar, even traditional, the treatment is refreshingly different and of a kind that should readily bridge the gap between generations:

Jesus Christ, What A Man — He's Got The Whole World In His Hands — Just A Closer Walk With Thee — Every Time I Feel the Spirit — One More Mountain To Cross — Beautiful Isle Of Somewhere — On The Wings Of A Dove — Didn't He Shine — Jesus, Lover Of My Soul — How Great Thou Art — Blessed Assurance.

Credit is due all round for the recording: to Geoff Hales for his smooth and refreshing arrangements; to the Proclaimers (a mixed choir of 23 singers); to the Bill Armstrong Studios where the recording was made and to the engineers responsible for the balancing and mixing. In short, an album that should win ready acceptance. (W.N.W.)

☆ ☆ ☆

ALL MY FRIENDS ARE SINNERS. Sally Hilder. Stereo, Galilee GA-2001. (Distributed by Spotlight Music Pty Ltd. From Galilee Recordings, 17 Hay St, West Ryde 2114).

Produced in Australia and handsomely packaged in a double fold jacket, this brand new album is aimed primarily at the youth gospel market. The sound is predominantly soft rock, with Sally Hilder doing the vocals and backed by electric piano, synthesiser, guitars, reeds, flutes, drums and a mouth harp. I gather that an impression of muted strings in some tracks was achieved by multi-tracking of the synthesiser — effective and much less expensive than the real thing!

But while the sound is modern, the predominant theme is Calvary: On A Cross — Have You Heard The News — Procula — Waggoner & Jones — Two Of Me Walking In One Man Blues — Praise To The Lord — Alone In The Garden — Simon's Song — Trinity — Father In Heaven — Bringing To You — I Wish I'd Never Known — On A Cross.

The complete lyrics are reproduced on the inside of the jacket, which is just as well, because of the way the tracks have been mixed — deliberately, I assume. Sally Hilder sings with intense feeling but she is rarely featured, tending to be a part of the total orchestral sound — albiet an "instrument" that enunciates the words. So you'll find yourself following the lyrics as printed.

Technically, the sound is very clean and, if you're receptive to some Australian rock Gospel, as distinct from the steady diet of imported material, you could enjoy this one. (W.N.W.)

☆ ☆ ☆

GREAT HYMNS, The Huddersfield Choral Society, conducted by Wyn Morris. Stereo, World Record Club WRC S/5630.

By sheer coincidence, I listened to this record within hours of a lengthy discussion about traditional hymns and their ability to communicate to rising generations. And, while it is easy enough to point to time-worn melodies and dated lyrical imagery, the great hymns of the past certainly do communicate at the level of worship:

Onward Christian Soldiers — The Lord's My Shepherd — Through The Night Of Doubt And Sorrow — When I Survey — Jesus Shall Reign — Guide Me O Thou Great Jehovah — All People That On Earth Do Dwell — Saviour Blessed Saviour — All Hail The Power — Abide With Me — Jesus Lover Of My Soul — Far Above The Highest Heaven — God Be In My Head.

The tunes are the great tunes that one would expect — Crimmond, Rockingham, Rimington, Cwm Rhondda, etc — and the background of each track is given on the jacket.

Technically, I would judge the recording to be a fairly old one, with modest stereo and rather light on bass. But with modest top cut and some bass boost, the Huddersfield Choral Society singing comes through to much better advantage. And, if you have simulated quad, you'll find that it adds further to the realism.

In short, if you like these old hymns, you'll enjoy them anyway but the recording is one that can be helped by judicious use of those extra knobs on the amplifier. (W.N.W.)

Instrumental, Vocal and Humour

AN EVENING OF CLASSICAL FAVOURITES. Vol 1. 3-record set. Fontana Gold Label Series stereo 6545 039/6/5. Distributed by Phonogram Pty Ltd.

Some considerable time ago, when stereo was still a novelty to most people, I purchased a 12-record set of light classical music. With hindsight, it was perhaps the best value for money I ever obtained from record purchases. It proved to be an excellent introduction to the world of classical music. And so it was with considerable pleasure that I relived some of that early experience with this Fontana 3-record set. It has many of the selections of the 12-record set I referred to and they are of uniformly high quality in terms of performance and recording standard.

Some of the selections are: The Thieving Magpie (Overture); Poet and Peasant (overture): On Wings of song; Chorus of the Hebrew Slaves; (None But The Lonely Heart; Humoresque; Song of India and Hora Staccato.

This is an album which can be recommended as very good value for money. (L.D.S.)

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.).

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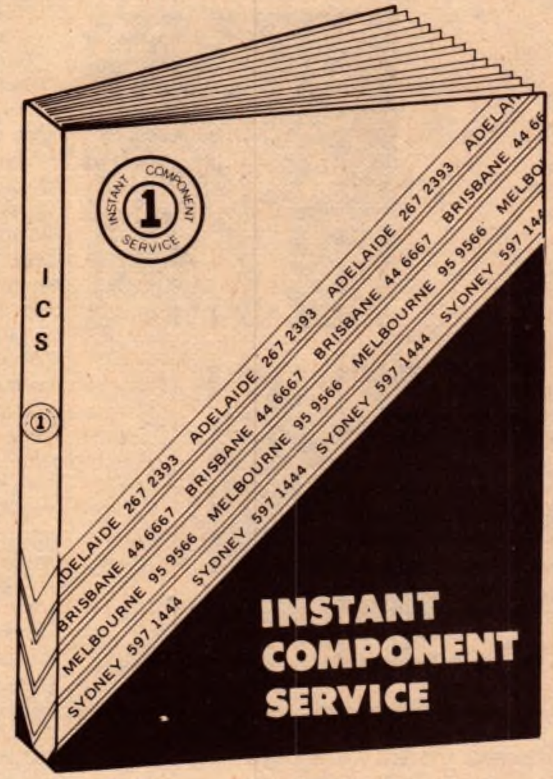

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LIGHTER SIDE — Cont.

HANDEL. Water Music. Music for the Royal Fireworks. Academy of St Martin-in-the-Fields directed by Neville Marriner. Argo stereo ZRGA. 697. Distributed by EMI (Australia) Ltd.

These two works must be the best known of Handel's output merely because they seem to be inevitably presented together. Really they have nothing in common, except for the composer. The Fireworks suite is the sort of piece that was (and still is) turned out for royal occasions and many a monarch must have endured it in stoic fashion. If you like music which conjures up grandeur, its fine, but otherwise rather meaningless, to my mind. The Water Music is a different matter entirely.

There are three Water Music Suites, in G Major, D Major and F Major. The F Major suite is characterised by exciting French horn passages while the D Major makes equally stirring use of trumpets and horns. The G Major makes use of flutes and recorders in a more intimate style. They really make very pleasant listening.

A major attraction of this particular version of this Handel coupling is the world-renowned orchestra of the Academy of St Martin-in-the-Fields directed by Neville Marriner. I need not say any more about the standard of performance. Recording quality is excellent. (L.D.S.)

☆ ☆ ☆

THE STORY OF STAR WARS. From the original soundtrack. Stereo, 20th Century Fox L-36496. Festival release.

Visually, this is quite an impressive production, with its colorful double-fold jacket and a full colour Star Wars picture book inside.

Having not seen the picture at the time, I put the disc on the turntable expectantly, hoping for some kind of compensation. But alas, I was to be disappointed.

The narration by Roscoe Lee Brown sounds quite muffled and this, plus the sketchy outline and the rapid succession of names, noises and voices soon left me well behind. To sort out the goodies from the baddies, I should really have gone back to the beginning but, by then, I'd lost interest.

Those who saw Star Wars have assured me that they enjoyed it and, to them, the album could undoubtedly come alive, by way of a reprise. But, as a substitute for the real thing . . . sorry!

I guess I'll have to go and see the film, after all, or wait for it to come up on television!

P.S. I no longer own the record. It was purloined by a couple of friends who are "Star Wars" fans. They went all gaga over it — and the picture book! (W.N.W.)

☆ ☆ ☆

BIG HITS OF THE 70's. Enoch Light and others. Volume 3. Project 3 stereo L 45783/4.

Those who used to buy albums of "Enoch Light and the Light Brigade" will notice some large differences in this latest effort by Enoch and his current colleagues who are modestly termed "many of the world's greatest musicians". Whereas earlier Light albums were characterised by excellent recording quality and bright, original instrumental arrangements, this cannot be said for the album under review. The recording quality is generally mediocre and the arrangements are mostly duplicates of the original hit tunes. For example, the track "Dancing Queen" sounds exactly like the same number from an "Abba" album. Even the distortion sounds the same!

On the album, the music is said to be "Fabulous for dancing, marvellous for listening". I would modify that to "Great for mindless gyrations at a disco, marvellous listening for the cloth-eared". Enoch must need the money! (L.D.S.)

☆ ☆ ☆

I'M GLAD YOU'RE HERE WITH ME TONIGHT. Neil Diamond. CBS Records SBP237052.

Neil Diamond fans will welcome this latest offering on the CBS label. Included among its elevent tracks is the hit song "Desiree", a stunning powerhouse rock number which received quite a deal of airplay when first released.

The other track titles are: Free Man in Paris — God Only Knows — Let the Little Boy Sing — I'm Glad You're Here With Me Tonight — Lament in D Minor — Dance of the Sabres — You Don't Bring Me Flowers — Once in a While — Let Me Take You In My Arms Again — As If.

As is common with Neil Diamond releases, an orchestra is used to provide

DIRECT-TO-DISC STEREO

PETER APPLEYARD PRESENTS. Stereo, Limited Edition; Salisbury Laboratories SALS D2D-001. (Distributed by Concept Audio Pty Ltd, 13 Rickard St, Narrabeen, NSW 2101. Tel. (02) 913 2455),

There are a string of firsts about this album: the first direct to disc recording to be submitted to us for review; the first such disc to be produced either by the Canadian Salisbury Laboratories, or by Peter Appleyard, a musician well known in Canada and America; the first such disc we have seen pressed in pure white quadradisc quality vinyl; the first venture into this marketing field by Concept Audio.

After all that, it had better be good, and it is just that!

How it compares in subtle detail with top quality discs made from intermediate master tapes, from film tapes or digital masters is something that can sustain any number of arguments. Sufficient to say that the sound quality is very good indeed, with no hint of distortion and no hint of background noise. And this observation holds in the context of a fairly wide dynamic range — much wider, for example, than is involved in the Japanese Audio Lab recordings reviewed elsewhere.

In fact, it is quite a varied program: "Open The Gates Of Love" (strong emphasis on percussion) — "A Face Like Yours" (jazz guitar) — "You Put The Shine On Me" (saxophone and woodwinds) — "Pavanne Pour Une Infante Defunte" (harp and flugelhorn) — "Mambo" (latin, piccolo and percussion) — "Swinging Shepherd Blues" (vibes) — "Who Needs It" (rock vibes) — "Night Journey" (trumpet, trombone and brass).

They're all top musicians, and they would need to be, remembering that they have to do four numbers straight for the 15-plus minutes on each side, without fluffs and with no more than the usual brief silence between the end of one number and the beginning of the next.

The disc will cost you $18.95 but for this you will get some excellent group performances, a conversation piece visually and sonically, and something to argue about until further notice! (W.N.W.)

COMPANY ADDRESSES: Some of the albums reviewed in these columns from time to time are on labels which may not be known to local music shops. In most such cases we include an address from which the albums can be ordered, either direct, or by local record and music supply shops.

LIGHTER SIDE — Cont.

the musical backing, this in addition to the keyboards, guitars, drums and percussion of the Neil Diamond Band.

The quality of the review album was excellent, with good stereo balance. In summary, a polished performance from a fine vocalist. (G.S.)

☆ ☆ ☆

ENCOUNTERS OF EVERY KIND. Meco. Millennium Records. DXL1 3050. RCA release.

American record producer Meco Monardo, recently took John Williams Theme from Star Wars and turned it into a world-wide disco hit. As a logical follow-up, Meco has put Williams' Theme from Close Encounters through his disco music machine.

The album has Meco travelling through the various ages: from the distant past, to the present and beyond. Side 1 consists of five tracks which are unified to form a continuous beat. Side 2 consists of five tracks which are unified to form a continuous beat. Side 2 consists of four individual tracks with the closing track being Meco's disco version of Theme from Close Encounters.

This album surely gives us a different form of disco music. Star Wars gave Meco his first hit under his own name; now Close Encounters should follow up this success. (D.H.)

SPECIAL QUALITY ALBUMS FOR AUDIOPHILES

Pictured are two of eight Audio Lab recordings forwarded recently for our evaluation by M.R. Acoustics or P.O. Box 110, Albion, Qld, 4010.

According to M.R. Acoustics' director, Colin Robertson, Audio Lab is one of the leading producers of audiophile records in Japan, with a worldwide reputation for quality.

With a deliberate purist approach, Audio Lab always records in actual auditoria rather than in studios and relies on natural rather than artificial reverberation. They do not use direct-to-disc recording, with its attendant problems, but concentrate on producing the best possible two-track stereo master tape, thereby avoiding the need for mixing down to a second generation source tape.

And, last but not least, for the transfer to disc, Audio Lab uses the technique developed for CD-4 discrete of cutting with both the tape and the disc running at half speed.

☆ ☆ ☆

BECAUSE OF YOU. Okihiko Sugano Presents. Stereo, Audio Lab ALJ-1046. (From M.R. Acoustics, as above).

I gather that Okihiko Sugano is the Managing Director of Audio Lab, as well as being a recording engineer in his own right, a musical director and a reviewer of records and equipment.

Musically, this recording is a "soft lights and sweet music" combination of clarinet, piano, bass and percussion, with a 40-odd minute presentation of established favourites: The Blue Room — After You've Gone — Where Or When — Isn't It Romantic — China Boy — Stars Fell On Alabama — Because Of You — Liza — Time On My Hands — La Cucaracha — Stranger On The Shore.

I can quote the titles because they are all in English, on both the jacket and the label. With one exception, everything else is in Japanese. The exception is the technical data, which indicates the use of top quality equipment.

In line with this and the claims made for Audio Lab recordings, the sound is notably clean and notably free from background noise: pleasant music for relaxation, right there in your living room, out of complete silence.

Unfortunately, Audio Lab albums are not cheap: 2500Y (around $A10) in Japan and $14 recommended retail in Australia. You'll have to make up your own mind in that point. (W.N.W.)

Pictured above are two of the Audio Lab albums currently being released in Australia by M.R. Acoustics. Others in the series will be reviewed later, in these columns.

☆ ☆ ☆

SIDE BY SIDE 2. Kazuo Yashiro Plays Bosendorfer & Steinway. Stereo, Audio Lab ALJ-1042.

This is another very pleasant "soft lights and sweet music" album that you can leave playing away in the background, while eating, chatting or relaxing. There's a Bosendorfer piano on one side and a Steinway on the other, with rhythm bass and a little help from guitar and drums.

Again, it's a generous 40+ minute program of established favourites: She's Funny That Way — If I had You — So Tired — Again — C'est Magnifique — My Silent Love — When I Grow Too Old To Dream — Lover Man — Joy Spring — Day Dream.

With the limited dynamic range characteristic of "cocktail piano", it's not very demanding material and that's a further reason why the sound should be — and is — completely clean. And the recording, is dead quiet. (W.N.W.)

SAX APPEAL. Boots Randolph. Monument stereo L 36461. Distributed by Festival Records Pty Ltd.

"Sax Appeal" has a driving beat which is a suitable accompaniment for monotonous chores such as treading wine, breaking concrete or other tasks requiring rhythmic muscular effort. It is eminently suitable as disco material. Recording quality is good. At just under 30 minutes, the playing time is short, however.

Ten tracks are featured: Willie And The Hand Jive — I Write The Songs — Honky Tonk — Memphis — Homemade Ice Cream — Shame, Shame, Shame — Ode To Billie Joe — Raunchy — Blueberry Hill — Jive Talkin'. (L.D.S.)

☆ ☆ ☆

PIANO COCKTAIL. Tonny Eyk & His Quartet. Stereo, Image (Astor) ILP-4952. (Also on Musicassette 4ILP-4952).

Privately, I've always envied the seemingly effortless ease with which some musicians are able to play cocktail style piano: rippling, modulated improvisation, yet with never a harsh note and never a beat out of place. And Dutch pianist Tonny Eyk does it so well, with backing from guitar, bass guitar and drums.

On the two sides are excerpts from 28 piano favourites, distributed over the 10 tracks. Here's a sampling: A Room With A View — I'll Walk Alone — Little Man You've Had A Busy Day — For Me And My Gal — Tres Palabras — Anniversary Waltz — Red Roses For A Blue Lady — Deep Purple — Deed I Do — Intermezzo — Once In A While — Life Is A Song.

As music to eat by or relax to, it's very pleasant and the sound quality is fine. One I can thoroughly recommend. (W.N.W.)

☆ ☆ ☆

THE JOY. Toni Brown & Terry Garthwaite. Fantasy Records L 36466. Festival release.

Toni Brown and Terry Garthwaite are two mature women, who both write and sing. The result is tracks of folk, blues, country, jazz and funk. Each track possesses a clear, distinct harmony, with excellent musical backing.

Together, their sound lies somewhere amongst Janis Joplin, Karen Carpenter, Stevie Nicks and Helen Reddy. To stand comparison with these four renowned female singers, their sound has to be dynamic.

The ten tracks on the album can be characterised as Funky: Come Running — Till Your Back Ain't Got No Bone — Morning Man — Wrap the World. Ballad: You Don't Owe Me Spring — Beginning Tomorrow — Steal Away. Country: On The Natch. Sensuous: Feel Like Heaven — Snow.

Altogether, the album is superb, with joyous vocal and musical arrangements. (D.H.)

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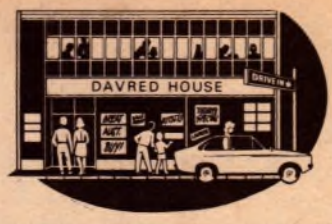

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Ring converter for automatic telephone exchange

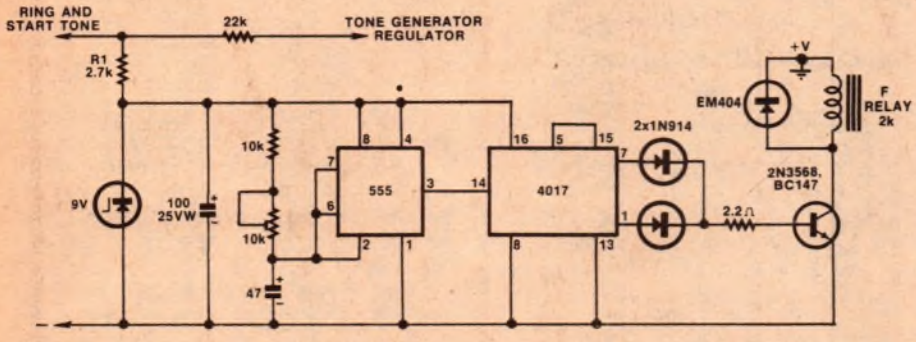


FIG. 1

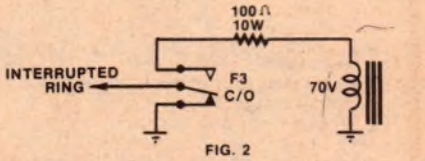


FIG. 2

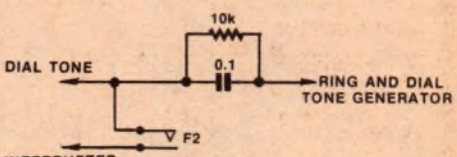


FIG. 3

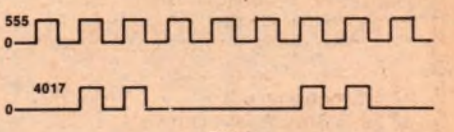


FIG. 4

For the past two years I have had the novelty and the convenience of an Automatic Telephone Exchange designed by Graham Leadbeater. Additions by Mr Leadbeater and improvements by Mr N. J. Diener have also been included. Ever since building the exchange, which has worked without a single fault, I have felt that the ringing did not sound authentic. Many would consider it an advantage but I prefer it to be similar to the standard Telecom instrument.

Perhaps other readers may wish to alter their exchanges along the lines which I have done. The interconnections are minimal and I carried them out in a few minutes. The circuit is made up on a small printed circuit board with all the components mounted on it. The F relay control wires are cut and the E relay is no longer required.

The 555 clocks the 4017 decade counter which is wired to reset at the 7th count. Outputs are taken off pins 7 and 1 through diodes to the base of Q1. Thus the relay steps on the 4th and 6th counts. This gives the required timing.

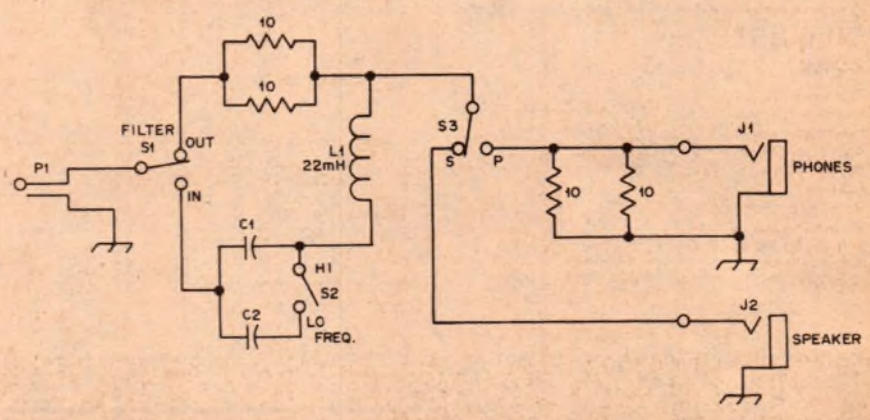
There are two other minor alterations needed. The F3 contact is changed over as shown in figure 2 for correct ringing. The F2 contact is a normally open contact instead of normally closed. This gives the correct interruption to the ring tone and this is shown in figure 3.

The power supply for the unit may be taken off the main supply separately through a dropping resistor R1, or it could be taken from the 9 volt supply to the ring and dial tone generator. However, in the latter, some adjustment may be necessary to the 2.2k dropping resistor in that circuit. A spare normally open contact is also required on B relay, if this method is used. My power supply is 32V and the value of R1 is 2.7k.

(By Mr W. J. Graham, 8 Verdun Street, Surrey Hills, Victoria 3127.)

Passive CW filter to improve receiver selectivity

There should be little reason to question that many home-built and low-priced commercial receivers are unable adequately to separate code signals in today's crowded bands, especially at contest time. Amateurs who find themselves in this situation would do well to consider the advantages of a simple passive filter. Here is an audio bandpass filter designed for connection between the normal speaker jack on the receiver and an external speaker or pair of headphones. The filter has a half-power bandwidth of about 70Hz but rolls off gradually so that it does not ring.



A series inductance-capacitance combination is connected in the hot line to the external speaker. At resonance, the LC combination looks like a resistance of about 5 ohms, with the result that the signal amplitude is reduced by about half. At lower frequencies the filter looks like a large capacitive reactance, while at higher frequencies is resembles a large inductive reactance. Either situation will produce large attenuation.

A switch selects either 760Hz or

1070Hz as the frequency of resonance.

Worth mentioning, is that if this filter is used to back up a crystal or other type of filter in the receiver, the peak frequencies must be tailored to match. This can be done by capacitance adjustment.

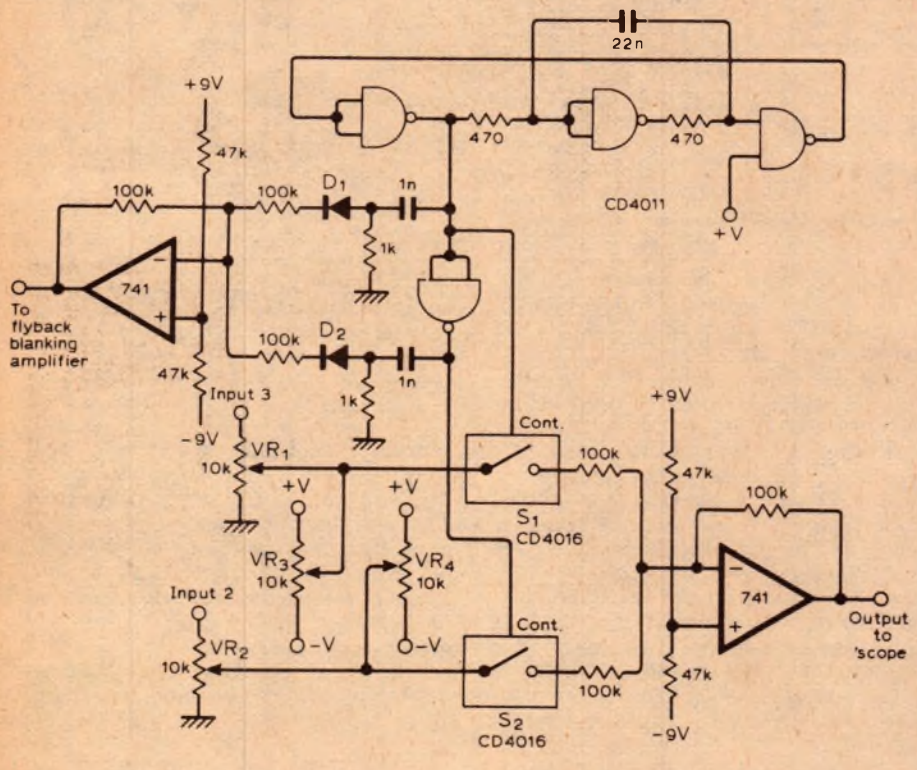
When the filter is switched out, a 5 ohm 1 watt series resistor is substituted for the LC circuit. While unnecessary, this refinement produces about the same attenuation for all frequencies as the filter attenuation at resonance. Switching the filter in will not appreciably affect the signal level at the resonant frequency, but will discriminate against undesired signals and materially reduce noise.

A very low resistance termination is required to make the filter sharp, since increasing the terminating resistance directly reduces the series circuit Q. The level is adequate for headphones of average sensitivity.

The mechanical arrangement is so unimportant that no layout is included here. Inexpensive to build this filter is a simple device which will improve the selectivity of a receiver without requiring modification of the set in any way. The frequency stability of the receiver however, should be such that the signal remains within the passband of the filter.

(By Frank Noble, W3MT, in "QST".)

Trace doubler for single beam oscilloscopes

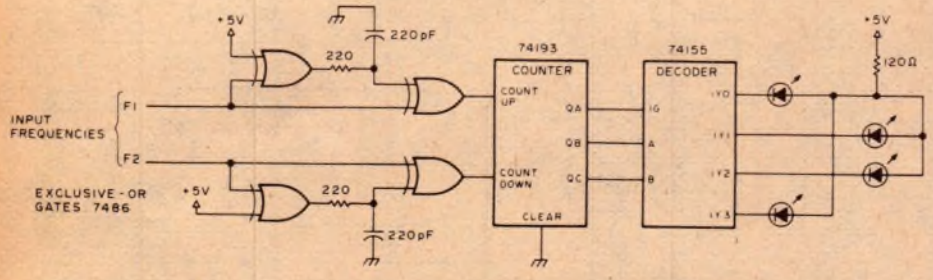


The 4011 forms an astable oscillator with a frequency of 53kHz. Two out-of-phase pulse trains are fed to the 4016 which alternately switches two inputs into the unity gain mixer amplifier. The output of the 741 is then fed to the oscilloscope.

Input levels are controlled by VR1 and VR2, and the position is controlled by VR3 and VR4. The remainder of the circuit is used to blank the beam between sweeps by differentiating the oscillator outputs to produce spikes. Positive spikes are then mixed and inverted by the 741 which drives the flyback blanking amplifier.

(By J. S. Paterson, in "Wireless World".)

Beat frequency indicator



This circuit uses LEDs to display the beat frequency of two tone oscillators. Only one LED is on at a time, and the apparent rotation of the dot is an exact indication of the beat frequency. When f1 is greater than f2, a dot of light rotates clockwise. When f1 is less than f2, the dot rotates counterclockwise and when f1 equals f2, there is no rotation.

(From "73".)

PARAMETERS/ELECTRONICS AUSTRALIA

GRAND INSTRUMENT CONTEST No 3

SPOT THE DOT AND WIN...

$250 value

Here's this month's simple challenge — spot the dot and the Trio CO1303-D scope could be yours!

When we first plugged the prize scope in, the timebase was switched to external and only a dot appeared on the screen. All you have to do is spot where it appeared on the coupon below.

All entries will be placed in a container and the first correct coupon pulled out wins the Trio scope. The second correct entry pulled out will win a B&K 2800 digital multimeter. If there are no correct entries the winners will be the two closest dots in the estimation of the editor of Electronics Australia.

1st. PRIZE

TRIO 1303D Oscilloscope value $250

Sensitivity:
10mV/Div.
Bandwidth:
DC - 5MHz
Sweep Range:
10Hz - 100kHz

HOW'S YOUR ENTRY FOR CONTEST 1 (May E.A.) GOING?

2nd. PRIZE

B&K Digital Multimeter worth $150

A handy 3½ digit, auto zero instrument offering 1% accuracy and high/low ohms for in circuit accuracy. Measures AC & DC voltage and current and resistance. 1 mV resolution.

ENTRY COUPON

Parameters/E.A. Grand Instrument Contest No 3

SPOT the DOT

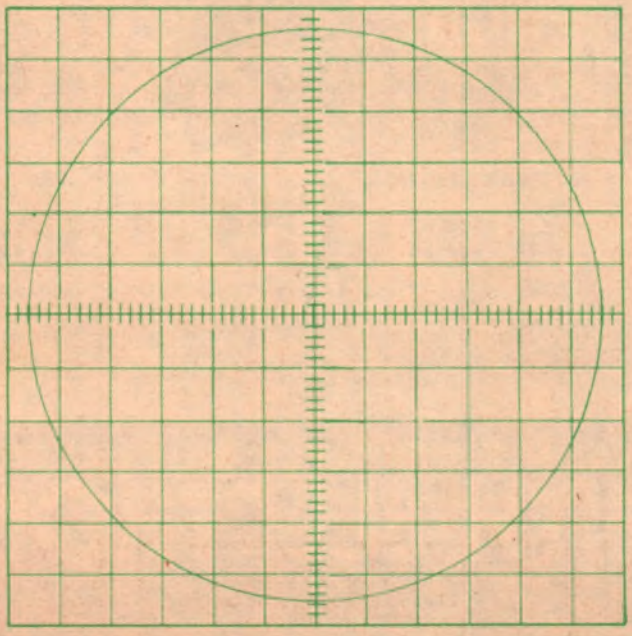
Simply pen a dot on the screen where you think the trace appeared. Fill in your name and address and mail the coupon to:

Parameters/Electronics Australia
Grand Instrument Contest No 3
P.O. Box 163,
Beaconsfield, N.S.W. 2014

All entries must be in by August 7th when the winners will be chosen.

The decision of the editor is final and no correspondence will be entered into.

Permit No TC 959A issued under the Lotteries and Art Unions Act.



NAME _____

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ADDRESS _____

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Where do you normally make your electronic purchases?

_____

I agree to abide by the rules of the contest -

Signed: _____

So why are we slashing our CB prices?

Let's face it: no matter how much we warn people about so-called 'bargain' sets, there will still be some who buy them simply because they're cheap. "Forget the risks .. . forget the facts . . . saving a couple of dollars is all that matters . . ."

We think it's important that you don't fall for the 'bargains'. To try to help you, we are prepared to slash our prices to a level which gives you a tremendous saving — but also gives you a fully guaranteed and fully backed set.

Of course, we're not trying to match the price the liquidators put on sets — they aren't trying to stay in business and provide you with a service. Before you go and buy a 'cheapie' CB, weigh up the consequences.

They just aren't worth the risk.

HERE IS THE SPECIAL OFFER:

SAVE $30 ON THE DELUXE WASP

was ~~$129.50~~

NOW $99.50

REMEMBER ALL THESE SETS HAVE DICK'S TWO YEAR WARRANTY!

Incredible range, incredible performance. Deluxe features you just don't find on other sets. Like an RF gain control to help you overcome very strong signals — but still have enough sensitivity for very weak stations (e.g. overseas). And there's the easy to-read LED digital channel readout — instantly telling you what you're on. No more squinting. If you want a real CB, you want the Wasp. Don't get stung by the others. The Wasp: a CBers CB.

Cat D-1520

SAVE $20 ON ANY OF THESE SETS

WAS ~~$99.50~~ $79.50

NOW:

The Bumblebee: the most easy-to-use CB going. It's the ideal set for the new CBer — or for Mum in the other car. Full power output, top range from such a tiny set. Now outstanding value, too! **Cat D-1510**

WAS ~~$139.50~~ $119.50

NOW:

Midland 857: a world respected brand name (Midland is the world's No. 1 CB radio) and now an oustanding price. All the features of those high priced sets with just one thing missing — the high price tag. **Cat D-1429**

WAS ~~$149.50~~ $129.50

NOW:

Midland 882C: ask an old pirate what his first rig was: odds are it's the 882C. More of these sets sold than any other model — and no wonder. Outstanding performance, top class receiver & transmitter section. **D-1436**

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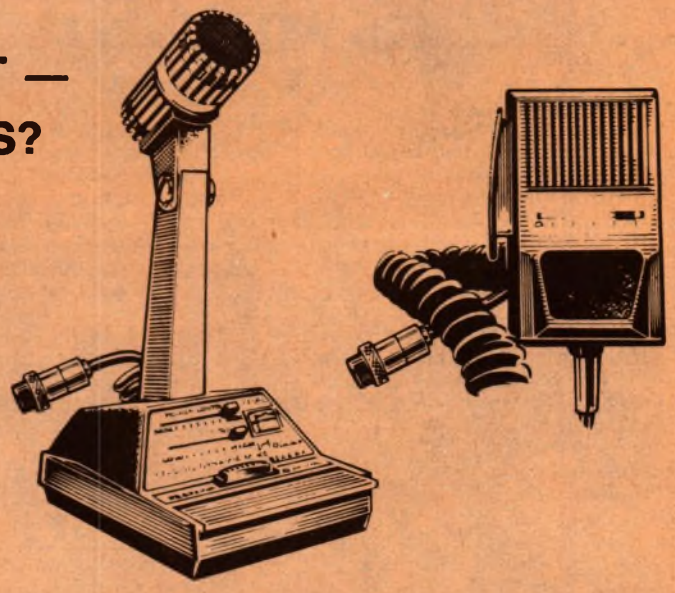
DICK SMITH ELECTRONICS

The Australian CB SCENE

FROM CARBON TO ELECTRET — & WHAT ABOUT POWER MICS?

What is the difference between a crystal, a dynamic and an electret microphone? What is a "power microphone" and can such a device really increase the power of your transmission? This article answers these and other related questions. Apart from anything else, it may be a handy bit of theory if you are studying for your novice amateur exam.

by NEVILLE WILLIAMS



On the left is a new Densei desk type power microphone for use in base stations. It has its own slider-type gain and tone controls, output level meter, push-to-talk bar and transmit lock-on slider. Nominal output level is —25dB and response 250-8000Hz. It is available from Dick Smith Electronics (cat. no. C-1112) for $45. On the right is a new noise cancelling power microphone (cat. no. C-1108, $29.50) from the same source. The output level is preset to — 36dB.

Countless articles have been written on the subject of microphones and one could fill a very large book simply talking about the various types that have made their appearance over the years. Our purpose here is to discuss only those types which have been widely used for 2-way radio and which may crop up in the context of CB and amateur band "nattering".

Many early 2-way radio systems used "carbon" microphones, largely as a carryover from telephone technology. They were cheap, plentiful and robust, so why not?

SINGLE-BUTTON CARBON MICROPHONES

A traditional telephone style carbon microphone has a flexible diaphragm, usually about 30 to 40mm in diameter, supported by a rigid housing and protected by some form of frontal grille. Behind the diaphragm and attached to the housing is a small tube, loosely filled with tiny granules of carbon. The granules are retained in the tube by a contact disc at the rear and by a conductive disc or piston at the front, attached to the flexible diaphragm.

The microphone is so designed that the piston attached to the diaphragm is insulated from the rear contact disc, the only electrical connection between the two being provided by the carbon granules. When the diaphragm is at rest, the resistance through the granules is stable at a few hundred ohms. However, when the diaphragm vibrates, in the presence of sound, pressure on the carbon granules is alternatively increased and decreased and the resistance through the granules varies accordingly.

This basic and most common type is classically described as a "single button" carbon microphone.

In practical circuit applications a voltage is applied to the microphone (ie across the granules) and the variation in their resistance with incident sound causes a variation in the current through the microphone. This varying current represents, in effect, its output signal.

Because of their almost universal use in telephones, carbon microphones were cheap and plentiful. In addition, they were (and are) rugged, and are characterised by relatively high audio output. It was fairly natural that they should have been used widely in early 2-way radio systems.

However, on the debit side, simple carbon microphones tend to have a rather peaky response, due to resonance effects in the necessarily stiff and heavy diaphragm assembly. The distortion is also rather high and there is some inherent noise, due to the uneven flow of current through the carbon granules. Again, carbon microphones are position sensitive — how the granules happen to be resting in the cup — and they deteriorate somewhat with age.

While the above shortcomings have not prevented carbon microphones from being used, to this day, in telephone systems, they were never highly regarded by designers of mobile radio equipment.

CRYSTAL & CERAMIC TYPES

With carbon microphones out of favour, so-called "crystal" microphones became popular for a while.

Simple communications style crystal microphones are often assembled, like carbon microphones, with frontal grille and diaphragm mounted in a small housing, to form a complete module or "insert".

Inside the module, the apex of the diaphragm is attached to one corner of a thin slab of rochelle-salt crystal, which is otherwise anchored to the main casing. As the diaphragm vibrates with incident sound, it stresses (ie slightly bends) the crystal, with a rather convenient result:

Rochelle salt crystal is one of a number of substances which exhibit the so-called "piezo-electric" effect. If it is

At last, reliable, convenient CB communication.

The Philips 40 channel FM 320 UHF. It's what CB radio is coming to.

This ultra-high frequency unit is made here by Philips – Australia's largest manufacturer of two-way radio equipment. With its arrival, CB radio in Australia reaches maturity. Why? Because current CB legislation provides for the allocation of 18 channels for AM/SSB use. Philips FM 320 UHF, with 40 channels, more than doubles this availability.

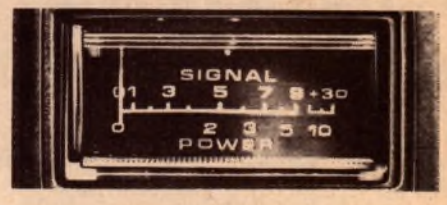
But that's not all. Because UHF operates on FM, interference such as static, vehicle ignitions, industrial activity and electrical storms will have little effect on reception. Every CBer knows that such interference plays havoc with 27 megahertz equipment, while these rigs provide television interference of their own.

Again, UHF does not generate any television interference as it operates on FM.

In city areas, Philips FM 320 UHF takes the uncertainty out of CB communication. High-rise buildings, bridges and other structures won't affect reception clarity or constancy. In effect, the UHF signal passes through the concrete canyons, instead of bouncing around them.

In conditions of heavy air traffic, Philips FM 320 UHF will capture the strongest signal on a given channel and temporarily silence any other which would otherwise cause interference. On the open road, mobile operators won't be interrupted by foreign "skipping" signals.

The Philips FM 320 UHF features Phase loop synthesiser and 5 watt RF output. A 40 channel L.E.D. readout selector can be push-button operated one channel at a time, or continuously until the desired channel is selected. Built-in remote control change on the microphone allows safe mobile operation. Channel changes are accompanied by an audible "click". Many more exciting features are built-in, like automatic call channel reset.



You can choose from a 15 cm quarter-wave tuned high gain type aerial, or perhaps the most universal aerial, the co-axial dipole. Its independence of a ground plane allows positioning almost anywhere on a vehicle.

That's the Philips FM 320 UHF– Australian built and backed by Philips. It turns CB radio into a reliable, convenient communication facility.

Philips UHF
It's what CB radio is coming to.

Philips also offer single-side band and de luxe AM units for 27 MHz CB operation.

EA

To: **Philips Consumer Products Division**
Post Office Box No. 308,
Clayton, Vic., 3168.

I'm interested in the better communication opportunities offered by UHF CB radio. Please send me a brochure on the Philips FM 320 UHF CB.

Name: .....

Address: .....

..... Postcode: .....

☐ Tick here if also interested in Philips AM or AM/SSB equipment.

PHILIPS

We want you to have the best

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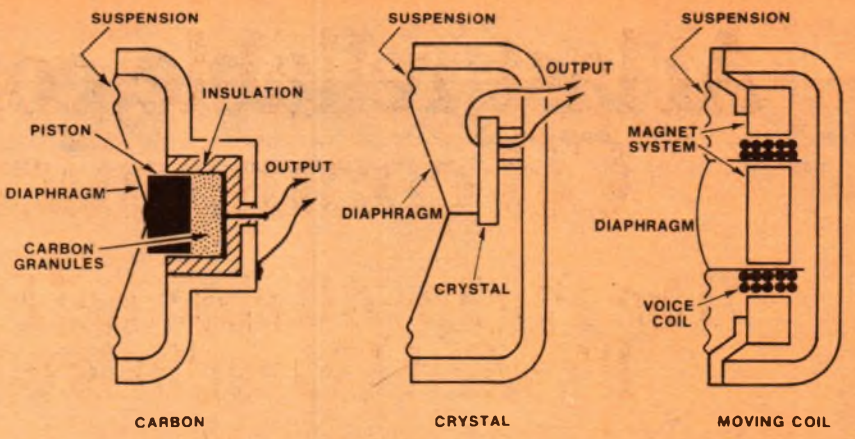


Illustrating the basic principles of three of the microphone types discussed in the article. Of the three, the moving coil microphone (right) is now by far the most commonly used in mobile radio equipment, being almost universal in CB transceivers. However, "electret" microphones are making an appearance in the market, particularly as desk units for base station use.

stressed in certain ways, a potential difference will appear between opposite surfaces and this can be sensed if foil electrodes attached to wires are cemented to the appropriate faces. Thus sound waves striking the diaphragm, stress the crystal and cause a resultant audio signal voltage to appear between the two output leads.

Simple crystal microphones still tend to be peaky in their response but they exhibit less distortion and are free from the "frying" noise of carbon granules . On the other hand, their effective output is much lower than that of a carbon microphone, so that more audio amplification is required. In addition, they are intrinsically high impedance devices and are more appropriate to the valve era than to present day transistor circuitry.

But the main hassle with crystal microphones arose from their sensitivity to heat and humidity. In mobile service, many a crystal "melted" inside a car, locked and left in the open, or from being left on a seat in the full heat of the sun.

This particular problem was overcome by substituting a synthetic ceramic element for the natural crystal, but only at the expense of even lower signal output and high characteristic impedance.

DYNAMIC (MOVING COIL) MICS.

Next in order came the type which has become by far the most popular for 2-way radio: the "dynamic" microphone. It was the logical outcome of earlier attempts to exploit the magnetic principle by way of various "moving iron" types.

A dynamic microphone can be thought of as rather like a miniature dynamic loudspeaker. It has a tiny flexible diaphragm which may be conical, flat or dome-shaped, to which is attached a small cylindrical coil. This "voice" coil is suspended in an intense magnetic field provided by a magnet assembly. When the diaphragm — and coil — vibrates in sympathy with incident sound, a signal voltage is developed across the coil and is made available as the audio output signal.

The reasons for the popularity of the modern dynamic microphone are not hard to discover:

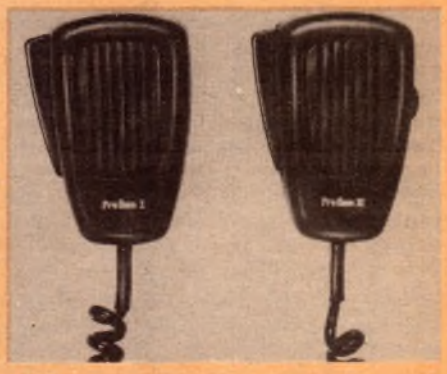
- Mass produced in the form of modules or inserts, they are relatively inexpensive and robust.
- The very light, freely suspended diaphragm assemblies give a much flatter response than either simple carbon or simple crystal inserts.
- Like the crystal insert, they are free from inherent noise, and their distortion is even lower.
- With a characteristic impedance in this region 150 to 400 ohms, they are well suited for use with transistor circuitry.

Early dynamic microphones were either "low impedance" types, with voice coils of 45 ohms or less, or were converted to "high impedance" with the provision of an in-built step-up transformer. Most current types, used for 2-way radio and tape recorders, have medium impedance voice coils, which supply signal direct to the first transistor.

27MHz AM & SSB CB TRANSCEIVERS FROM PHILIPS

While Philips' biggest push is behind UHF CB, the company is offering two imported 27MHz transceivers, with full Australian type approval. The AM101 (left) is an 18-channel AM unit, with phase locked loop channel selection ensuring a frequency tolerance within ±0.005 per cent. It has an LED channel display, AF and RF gain controls, noise limiting, mute and metering which indicates received signal strength, relative RF power output and SWR. The receiver is a double-change superhet with a rated sensitivity of 0.7uV for a 10dB S/N ratio; RF power output is 4W. The AM201 has the same silver and grey panel styling but is a full AM/SSB unit, with the additional control facilities which SSB renders necessary. RF power output and other specifications are in accordance with Australian standards RB249. Both transceivers carry a six month warranty and are backed by Australia-wide Philips service facilities.

The Australian CB SCENE



Electret hand microphones from Audio Telex Communications Pty Ltd, 54 Alfred St, Milsons Point 2061. The Procom I (left) sells for $31.05. The Procom II 'right) has a variable gain amp and sells for $44.99.

CAPACITOR AND ELECTRETS

The one type of microphone which could threaten the complete dominance of the dynamic is the modern "electret". It is a development of the very long-established "condenser" or "capacitor" microphone, which has always been esteemed for its audio quality.

A traditional condenser microphone would never have been considered for mobile use by reason of cost, and relative frailty, plus the need for a DC polarising voltage and a very high gain preamplifier stage. But modern technology has made possible a capacitor type microphone which does not need a polarising voltage and which can be made small and robust, and complete with in-built battery powered preamplifier: it is referred to as the "electret" microphone.

As many will have noticed, electret mics. are now widely used with portable tape recorders, the obvious inference being that they offer better speech and music quality for a given dollar outlay. Since this is hardly a factor for 2-way radio speech communication, it is not very likely that the electret will supplant the robust and well established dynamic for vehicular installations. However, they may easily find their way into base stations, where there is a more obvious place for "trendy" microphones — whether or not they are warranted!

"POWER" MICROPHONES

Speaking of the "trendy" one of the most obvious aspects in the CB area is the common resort to so-called "power" microphones.

Curiously, the name is much older than the present con-

SCALAR IN QUEENSLAND

The Scalar Group has announced the commencement of a sales office and factory in Queensland. A new company, Scalar (Qld) Pty Ltd has been incorporated to provide the Queensland communication industry with local access to the complete range of the Scalar Group's products.

Design and manufacture has commenced in Brisbane of many of the antenna product lines, which were formerly manufactured in Melbourne for the Queensland communication market. It is the intention of the company to manufacture antennas for Queensland in Queensland and also as a back-up technical and manufacturing facility for its NSW outlets, providing a technical consultative service, improving delivery schedules and minimising freight costs.

The company is under the management of Mr Brian Robinson, whilst Mr Terry O'Meara, Technical Manager, is in charge of the design and manufacturing facility. (The Head Office is Scalar Industries Pty Ltd, 18 Shelley Avenue, Kilsyth 3137 Vic. Phone [03] 725-9677).

notation, dating back towards — if not to — the 1914-18 war. In those days, audio amplifier technology was fairly primitive and successful radio telephony depended on the most direct possible use of the output from the microphone. "Power microphones" of the era were very heavy, very rugged carbon types, which could be used in high current circuits and subjected to very high acoustic input: shouted speech, above the hubbub on a warship, for example!

A modern power mic. is a much more genteel device, usually a conventional dynamic insert (it could be an electret) with an in-built transistor preamplifier. It normally has a press-to-talk switch, which serves both to energise the transmitter and to switch on its own internal preamplifier. It may or may not have supplementary controls like a transmit lock-on switch, a gain control and a speech tone control.

The pholosophy behind using a power microphone is that, having its own in-built preamplifier, it can provide a larger audio signal than the plain microphone normally supplied with a transceiver. Therefore the transmission must sound louder — or such is the assumption!

The thinking ignores the fact that all modern transceivers have their own in-built speech preamplifiers, with ample gain to cope with the signal from a normal dynamic microphone under ordinary hand-held conditions.

Moreover, most transceiver preamplifiers have in-built automatic gain control or speech amplitude limiting which inhibits the tendency towards over-modulation should the operator speak very closely or very loudly into the microphone. When correctly adjusted and used with the microphone supplied with the unit, modulation should come very close to, but not exceed, the 100% limit in normal usage.

If a "power" or "gain"microphone is connected to the transceiver in place of the regular unit, any of a number of things may happen:

- Between words or sentences, when the extra gain may not be adequately limited, background noise may become more intrusive. As such, it is a liability, particularly when transmitting from a noisy vehicle, and must be considered.
- A modest increase in microphone input level may push the transceiver gain or peak limiting hard enough to get a fuller speech envelope, without obvious overmodulation

CB POWER MICS: THE LEGAL POSITION

CB transceivers are type-approved on the assumption that they will be used with the microphone supplied by the manufacturer or, at most, with its electrical equivalent. Further, that adjustments affecting modulation be not tampered with, except by authorised personnel.

The fitting of a power microphone is therefore an unauthorised modification and invalidates the type approval covering the particular transceiver. The only way in which a transceiver so fitted could qualify for renewed approval would be for the internal circuitry to be readjusted so that modulation could not exceed previously intended limits, with the power microphone set at full available gain.

This would completely obviate any advantage — and also any disadvantage — arising from their use!

Why then are power microphones available to CB operators? This is yet another aspect of the anomalous situation where it is not illegal to import of sell power microphones. It is only illegal for CB operators to use them without official sanction.

Technical discussion elsewhere on this page should be read in this context.

or objectionable distortion. This represents an increase in "talk power" that can be an advantage.

- A large increase in microphone signal level may push the transceiver limiting circuitry to a degree that the speech envelope becomes grossly distorted, leading to a loss of intelligibility — to the point where the power mic is hindering rather than helping communication!
- In addition to the observed effect on recovered speech, driving the modulation circuitry beyond the intended limit may easily increase the spurious radiation from the transmitter, aggravating or actually causing interference into nearby television receivers or other equipment.
- In an extreme case, overmodulation or modulation with square (ie, flattened speech) waves may lead to overheating and device failure in the transmitter's output circuits — a failure not usually covered by manufacturer's warranty.

In the light of the foregoing, one can only question the wisdom of many rising CB enthusiasts, who get together enough money to purchase a transceiver, and then spend a further amount on a power mic, on the assumption that every transceiver needs one. (This, in addition to the legal complication detailed earlier.)

As often as not, the fitting of a power mic. simply leads them into a round of difficulty and uncertainty. This is especially true if the power mic. has no provision to vary its internal gain.

Where there is such provision, as on the more pretentious types and on most of those intended for base station use, it is wise to use the additional gain sparingly until observation indicates that you are achieving optimum "talk power" without objectionable distortion, without obvious signal spread or "splatter" and — above all — without local TVI.

It may be appropriate to mention, in passing, that there is no restriction on the use of power microphones by licenced amateurs. However, precisely the same technical problems could arise if an amateur fitted such a microphone to a commercial transmitter and failed to take the necessary steps to prevent over-modulation.

NOISE CANCELLING MICROPHONES

One final point. on which some may be wondering: what is a noise cancelling mic?

The term may be used, unprecisely, to refer to a directional microphone — one which tends to favour sounds from in front and to reject sounds from other directions. Such a mic. can be of some value in noisy situations, provided it can be used back-on to the noise source. This is easier said than done in an enclosed space, such as noisy room or vehicle, becasue the noise tends to reflect from all directions.

More correctly, a noise cancelling microphone is one where the whole microphone assembly is so shaped that distant sounds tend to reach the front and rear of the diaphragm in equal intensity and in similar phase, thereby tending to cancel one another out. In other words, sound waves, which push the diaphragm simultaneously from front and rear, end up by not moving it at all!

However, a sound originating from very close to the microphone may have more immediate access to one side of the diaphragm and be less subject to cancellation. This fact, plus the very proximity of the close source, gives it an increased advantage over ambient noise. In short a noise cancelling facility is a matter of acoustic design rather than the nature of the transducer, which can be carbon, crystal, dynamic or electret.

A noise cancelling characteristic is a useful feature in aircraft or noisy road vehicles but is of little practical significance in quieter surroundings.

AMATEUR RADIO

by Pierce Healy, VK2APQ

Wireless Institute of Australia federal convention

This month's notes contain details of the WIA federal convention, including comments by Mr E. J. Wilkinson from the P & T Department, who was guest of honour at the convention. There are details of a YRS amateur radio weekend, together with repeater and club

The WIA federal convention was held in Melbourne 22nd-24th April, 1978. Delegates representing all divisions and federal executive were present.

Here is a short resume of some of the main points, as received from federal headquarters.

The guest of honour was Mr E. J. Wilkinson, first assistant secretary, frequency management branch, of the Postal and Telecommunications Department.

Mr Wilkinson answered a wide range of questions from convention delegates. He spoke about preparations for WARC 79 and complimented the WIA on the case presented to the Department on behalf of the amateur service. He mentioned the government concern at the lawlessness and piracy that existed through the use of unlicensed equipment, the ease of acquiring such equipment, and the studies being made into the problem. It was hoped that the new Act, estimated to be introduced around autumn 1979, will help to eliminate the problems.

The federal president, David Wardlaw VK3ADW, has been invited to attend the ITU CCIR special planning meeting in October 1978, as a member of the Australian delegation. He and Peter Wolfenden, VK3ZPA, will also be attending the IARU Region III conference in Bangkok later this year.

The federal council re-elected the same executive members for 1978/1979, except that John Bennett, VK3ZA, replaces Jim Lloyd, VK3CDR.

It was agreed that, at future conventions, the central organisation should pay attendance expenses for an alternate councillor from each division to the same extent that expenses of the federal councillor are paid.

Reports from various sub-committees and officers, as well as agenda items relating to organisational matters, membership recruiting, publicity and finance, were discussed at length.

On present indications it was stated that no increase in federal dues appeared necessary and final decision be deferred until the end of August, 1978.

AMATEUR RADIO WEEKEND

Amateurs and intending amateurs who want the opportunity to meet other amateurs and operate amateur equipment, are invited to attend a big amateur radio weekend in the Blue Mountains.

The WIA NSW Division education service, incorporating the Youth Radio Service (YRS), is organising a weekend where amateurs, students and newcomers will be able to get together for a weekend of radio and social activity.

Previous YRS activity of this type included people of all ages from eight to 70 years. Accommodation is available for 160 persons. The cost is $15 per person or, for family groups, husband $15, wife $10, children $5 each. Separate rooms or dormitory accommodation is available.

Contact Bill or Mildred Newton, 64 Valley Road, Epping, NSW 2121, telephone (02) 85 6321.

The venue is St Marys Education Centre, Western Highway, on the Sydney side just before the Katoomba Railway station.

The action begins on Friday 28th July, 1978 at 8.00pm and concludes at 4.00pm Sunday 30th July, 1978.

VHF REPEATER NEWS

Applications have been made for three new repeater licences in NSW. These are:

Channel 7 (146.35MHz in — 146.95MHz out) to be installed at Terry Hie Hie in the hills south east of Moree under the call sign VK2RMI. Testing is expected about now.

Channel 15 (147.95MHz in 147.35 out) to be located at High Range west of Mittagong under the call sign VK2RHR. At present under construction.

Channel 602 (146.025MHz in 146.625MHz out) to be located in the Maitland areas for RTTY (Baudot only) under the call sign VK2RYY. Testing is expected about now.

A repeater is being planned for the NSW far south coast, in the Mimmatabel area. It is under construction and will be testing on channel 3 (146.15MHz in 146.75MHz out).

The Blue Mountains Amateur Radio Club have their channel 9 (147.65MHz in 147.05MHz out) repeater in operation from Medlow Bath.

RADIO CLUB NEWS

Club secretaries are advised that preparations are being made to compile a 1978 amateur radio club directory for publication in December, 1978.

Details should be sent in the same format as in past years. Closing date is 18th October, 1978.

JESMOND & DISTRICT ELECTRONIC & COMMUNICATION CLUB: A new electronic club formed in February, 1978 provides a new approach for Newcastle residents interested in electronics and radio. The club has facilities in the rear of the Regal theatre at Birmingham Gardens.

A practical class is held from 1.00pm to 3.00pm and a YRS elementry class from 3.00pm to 5.00pm each Saturday. An experimenting group (basic electronics) is conducted from 4.00pm to 5.30pm each Monday.

The patrons of the club are: Ald. J. Cummings, Mr C. Jones MP and Mr K. Booth MP. Office holders are: President — Keith Hutchison, vice-president — Grant Gamage, secretary — John Murphy, treasurer — Ron Clifford, education officer — Leo McKenzie, VK2AAQ, equipment officer — Peter Hutchison, Committee members — Harold Whyte, VK2AHA and John Redman, VK2JE.

Meetings are held on the first Monday of each month in the club room at 7.30pm. Contact the president on

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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.

New Release — FRG-7000

Advanced Communications Receiver . . . for the discerning radio enthusiast

Yaesu, the leader in quality communications equipment, proudly introduces the FRG-7000: a high performance general coverage receiver for the discriminating shortwave listener.

Features:

• **Full MF/HF Coverage** . . . from 0.25-29.9 MHz, with provision for SSB and AM voice, as well as CW reception.

• **Digital Frequency Display** . . . gives resolution to 1 kHz, using large, bright LED's for maximum readability.

• **Digital GMT/Local Clock** . . . can be set to your local time plus GMT time. Just flick a switch for selection of the desired time.

• **CPU Clock Timer** . . . clock contains a timing feature that activates the receiver and internal relay contacts. Set the time you want to start and stop recording, hook up your tape recorder, and your FRG-7000 will do the rest.

• **Advanced Technology** . . . an FET front end provides excellent sensitivity, and the "Wadley Loop" heterodyne oscillator yields rock-solid stability.

• **AM Noise Limiter** . . . provides noise-free reception in the AM mode, and the amplified Automatic Gain Control circuitry minimizes distortion due to fading.

• **Human Engineering** . . . ease of operation is ensured by careful selection of positions for controls and switches. You'll never own a receiver that's easier to use.

GENERAL

• **Frequency range:**
0.25 — 29.9 MHz
• **Modes of operation:**
AM, SSB, CW
• **Sensitivity:**
SSB/CW — Better than 0.7 μV for S/N 10 dB AM — Better than 2 μV for S/N 10 dB (400 Hz 30% modulation).
• **Selectivity:**
SSB/CW ±1.5 kHz (−6 dB), ±4 kHz (−50 dB)
AM ±3 kHz (−6 dB), ±7 kHz (−50 dB)
• **Stability:**
Less than ±500 Hz drift for any 30 minute period after warm-up.
• **Antenna requirements:**
Random wire for 0.25 — 1.6 MHz 50 ohm unbalanced feed for 1.6 — 29.9 MHz
• **Speaker impedance:**
4 ohms
• **Audio output:**
2 watts
• **Power requirements:**
100/110/117/200/220/234 VAC, 50/60 Hz
• **Power consumption:**
25 VA
• **Size:**
360(W) x 125(H) x 295(D) mm
• **Weight:**
Approx. 7 kg

JAS 7778-55

Our years of handling and specializing in this equipment have enabled us to build up a fund of knowledge and technical experience, backed by a comprehensive range of spare parts and service facilities. We don't just sell a set, our concern extends throughout the life of your equipment.

Contact us for details of other Yaesu equipment plus the accessories required to complete your station.

All equipment from Bail's carries a full 90-day warranty and complete service back-up.

Prices and specifications subject to change without notice.

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Yaesu Agents in Australia since 1963

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	WILLIS TRADING CO., 429 Murray Street, Perth 6000	Ph. 21 7609
S.A.	FARMERS RADIO PTY. LTD., 20 Stanley St., Plympton 5038	Ph. 293 2155
TAS.	G. T. ELECTRONICS, 131 Westbury Rd., South Launceston 7200	Ph. 44 4773
	PRINS RADIO, 123 Argyle Street, Hobart 7000	Ph. 34 6912
N.S.W.	Aviation Tooling, STEPHEN KUHL, 104 Robey St., Mascot 2020	Ph. 667 1650
	Amateur & Novice Comm. Supplies, W. E. BRODIE, 23 Dalray Street, Seven Hills 2147	Ph. 624 2691
	DIGITRONICS, 186 Parry St., Newcastle West 2302	Ph. 69 2040
	RIVERCOM, Sid Ward, 9 Copland St., Wagga Wagga 2650	Ph. 21 2125
QLD.	H. C. BARLOW, 92 Charles St., Aitkenvale, Townsville 4814	Ph. 79 8179
	MITCHELL RADIO CO., 59 Albion Rd., Albion 4010	Ph. 57 6830
A.C.T.	QUICKTRONIC, Jim Bland, Shop 11, Altree Crt., Phillip 2606	Ph. 81 2824, 82 2864

AMATEUR RADIO

telephone (049) 57 4633 or secretary on (049) 57 5560 for further details.

WAGGA AMATEUR RADIO CLUB: During the John Moyle Memorial National Field Day contest (February 1978) members of WARC manned two field stations. One group operated from the Wagga repeater site on Mt Flackney under the call sign VK2BXD. They scored 2605 points for HF contacts, and 723 points for VHF contacts.

The second group was located at Wantabadgery on the bank of the Murrumbidgee River, call sign VK2WG. They scored 4593 points for HF contacts and 232 points for VHF contacts.

Both groups reported having an excellent weekend.

The novice training course is progressing well, and all students should be well prepared for the P & T Department examination in November. This opinion is based on a recent unscheduled theory examination.

Fourteen club members form the core of the Wagga WICEN organisation which is affiliated with the Volunteer Rescue Organisation. For further details contact Sid Ward, VK2SW on telephone (069) 21 2125.

The annual south west zone convention will be held in Wagga over the October, 1978 holiday weekend.

CENTRAL COAST AMATEUR RADIO CLUB: The annual general meeting was held on the 7th April, 1978 in the club rooms, Dandaloo Street, Kariong. In his report the retiring president Ray Wells, VK2ZSX, noted that the club had gained 53 new members during the year, due in the main to the novice licence instruction classes organised by the club. Ray was re-elected president for 1978-1979.

The treasurer's report showed the club in a sound financial state.

The repeater committee reported that the major task during the year was the move to the Somersby site. This had shown a commendable club spirit, some members spending hundreds of hours on the task. There had been 27 maintenance visits to the repeater during the year, it being necessary to replace valves twice and in some cases three times. The standby batteries also failed due to old age and have been replaced, and a power supply has been installed for float charge operation.

The CCARC WICEN organisation was called upon three times during the preceding 12 months, and communications were provided for an event held by the Endurance Riders Association.

Based on the running costs of the club, fees were set at $8 for ordinary members; $4 for pensioners and students; $2 for wives of members.

Meetings are held on the first and third Fridays of each month in the club rooms. Further details via the channel 3 repeater, VK2RAG, or from the secretary Suzanne Wells, PO Box 238, Gosford, NSW 2250.

ORANGE & DISTRICT AMATEUR RADIO CLUB: The Oberon Apex two day motor cycle reliability trial gave the society's WICEN group some valuable experience over the weekend 22-23rd April, 1978.

The primary aim of the exercise was to provide communications in case of injury to the riders. It also allowed continuous details of riders' positions to be transmitted to race headquarters, and so expedite compilation of the final results.

A base station was set up near the start/finish point with the race officials. Eight field stations were set up to provide communications to check point officials. Two radio nets were established, one on 146.00MHz FM the other on 144.20MHz SSB. The 146.00MHz antenna at base was a 14 element vertical Yagi and the 144.20MHz antenna a 16 element horizontal phased array.

Communications to all stations was excellent, even into very difficult locations. Twenty-one WICEN members participated in the exercise.

The ODARS net is held each Wednesday evening at 8.00pm, on 3.573MHz. All amateur stations are welcome, the aim being to provide a friendly on-air forum for amateurs in the western districts of NSW. Each session is under a controller using the call sign VK2AOP/P.

Once the net is formed the stations are called in rotation. Transmissions are kept short and the net usually runs for about 45 to 50 minutes.

Monthly meetings of the ODARS are held on the first Friday of the month in the Orange Technical College, Sale Street, Orange at 7.30pm.

Novice classes are held at Orange and Parkes and new students are always welcome.

Orange — Friday nights, Orange Technical college, 7.00pm to 9.00pm. Parkes — Tuesday nights, Anglican Youth Centre, 7.30pm. For further details write to the secretary, ODARS, PO Box 1065, Orange, NSW 2800.

ILLAWARRA AMATEUR RADIO SOCIETY: At the April, 1978 meeting a cheque for $400 was presented to the president of the NSW division WIA. The money was the proceeds of a raffle held to raise funds toward WIA participation in WARC 79 and expressed the generosity and initiative of members of the IARS.

Steps have been taken to improve the channel 5 repeater, VK2RAW, with the installation of a new antenna higher up the hill.

The moonbounce project co-ordinator, Lyle Patison, VK2ALU, reports that a recommendation has been made that the 10 metre dish antenna and associated equipment be moved from west Dapto to another University of Wollongong site to the west of the city. A preliminary check indicates that the location should be suitable for the moonbounce project to continue. However, the problem will be to transport the heavy equipment, and assistance of anyone experienced in that field is being sought.

WESTLAKES RADIO CLUB: The annual report of the director Keith Howard, VK2AKX showed that the membership of WRC reached 285 during the year and indications are that it will continue to increase. The addition of a modern communications room and financial independence were two major achievements during the same period. Future plans include the updating of furniture in the classroom and provision of a new classroom block. The channel 10 repeater, VK2RWR, is a reality.

Equipment installed included a Kyokuto 2 metre FM transceiver and a TS520 HF transceiver.

Publication of the novice manual continued with nearly four thousand being distributed during the year. A commercially printed version is now being produced.

Through its monthly newsletter the club has involved itself in the broader issues of amateur radio. On the education side, classes for juniors have gained good results in YRS awards. Evening classes for novice, limited and full licences have been held on four nights a week for most of the year, and there has been a better than usual pass rate in all examinations for which the club prepared candidates.

The balance sheet shows the club assets at $15,000. For details of activities and membership requirements contact the secretary, Eric Brockbank, VK2ZOP, PO Box 1 Teralba, NSW 2284. Telephone (049) 58 1588.

MID SOUTH COAST AMATEUR RADIO CLUB: At the first annual meeting Frank Hill, VK2HQ was re-elected president and John Telfer, VK2BTQ re-elected as vice-president, with Don Reed, VK2ADR as secretary/treasurer.

The club membership has now grown to 60, spread over a wide area. The channel two repeater VK2RMU has been in operation for 12 months.

The Lyrebird newsletter, editored by John Telfer, VK2BTQ and published by Bill Gelvin, VK2JJ is 16 foolscap pages of interesting and informative comments and articles covering a wide range of amateur subjects.

For information regarding membership and club activities write to PO Box 113, Milton NSW 2538 or telephone (044) 55 1077.

MOORABBIN & DISTRICT RADIO CLUB: In addition to a drive to recruit new members, by publicising amateur

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radio, the MDRC committee are encouraging more local amateurs to become members. The MDRC is one of four clubs that share a modern club room complex in Turner Road, Moorabbin, Victoria. The other clubs are Pigeon fanciers, archery and flyfishers. Each club has its own room and share a large hall and catering facilities.

MDRC meetings are held on the third Friday of each month at 8.00pm and arrangements are in hand for a combined club social function to be held in November, 1978.

Honorary membership of the MDRC is available to overseas amateurs who make two-way contact with five MDRC club members. Australian amateurs must contact 14 MDRC members.

Further details from the secretary, Glen Percy, VK3ZQP, 22 Cotswold Crescent, Springvale South, 3172, telephone (03) 547 2895.

WESTERN SUBURBS RADIO CLUB: At the annual meeting held in March, 1978, Tom Page, VK3AGH was elected president and Stan Taylor, VK3NGH secretary.

The WSRC VK3AWS caravan and annexe was on display at the "Life be in it" family day outing at the Greenvale reservoir near Melbourne last Easter Monday. Plans are in hand for a larger display next year when it is anticipated that 10,000 people will attend the outing.

Novice licence classes are being conducted by the club.

Full details from the secretary, Stan Taylor, VK3NGH, telephone (03) 460 5299.

GEELONG AMATEUR RADIO CLUB: In spite of inclement weather members achieved very good results in the 1978 John Moyle Memorial National Field Day. They convincingly won the multi-operator phone section by nearly trebling the score of second and third place-getter.

All bands from 3.5MHz to 144MHz were used from the portable location on Mt Cowley, using the club call sign VK3ATL/P. The contacts made (1971) were worth 12,852 points.

The GARC have decided to sponsor an award. The format and type to be based on suggestions made by members.

WESTERN AUSTRALIA VHF GROUP: Following an invitation in the March, 1978 news bulletin to participate in a mystery project, comes a report on the project from the April, bulletin. The mystery project at the March meeting was a 70cm fox hunt, DF gear having to be made on the spot, with wood (for handles), wire, earpieces, staples, capacitors, etc provided in a pile on

AMATEUR RADIO

one table.

Seven teams of two to four people rapidly formed and set to work making "snoop loops". The fox was located in the bush near the driveway on Wireless Hill near the meeting rooms. The winners were the team consisting of VK6DS, VK6ZHM and VK6NR.

The WAVHFG meets on the fourth Monday of each month, at 8.00pm, at Wireless Hill Museum building. Further information from David Laws, VK6DS on (092) 364 1558.

WIA YOUTH RADIO SERVICE

The NSW YRS supervisors bulletin for April, 1978 lists 39 clubs affiliated with the scheme; an increase of nine during March. It seems possible that this figure will increase considerably by the end of the year.

In February a circular was sent to every high and central school in NSW, setting out the aims and activities of the YRS. So far the response has been encouraging.

During February 130 novice training kits were sold. These kits are available from WIA Education Service, D. Wilson, 63 Superior Avenue, Seven Hills, NSW 2147. The cost is $15 posted to anywhere in Australia.

Also reported in the bulletin is the note that at least 20 students who attended novice licence classes during the past year have gained their licence. Those listed were members of — St Edmond's School for Blind Boys (2); Marist Brothers Boys High School, Eastwood (2); Maitland Radio Club (4); Taree Radio Club (8); Blue Mountains Radio Club (4).

INGLEBURN HIGH SCHOOL CAREERS DAY: At the invitation of the science master Bob Knight, the writer, VK2APQ, assisted by Col Christiansen, VK2BCC, demonstrated amateur radio from a portable station set up at the school on the 2nd May, 1978.

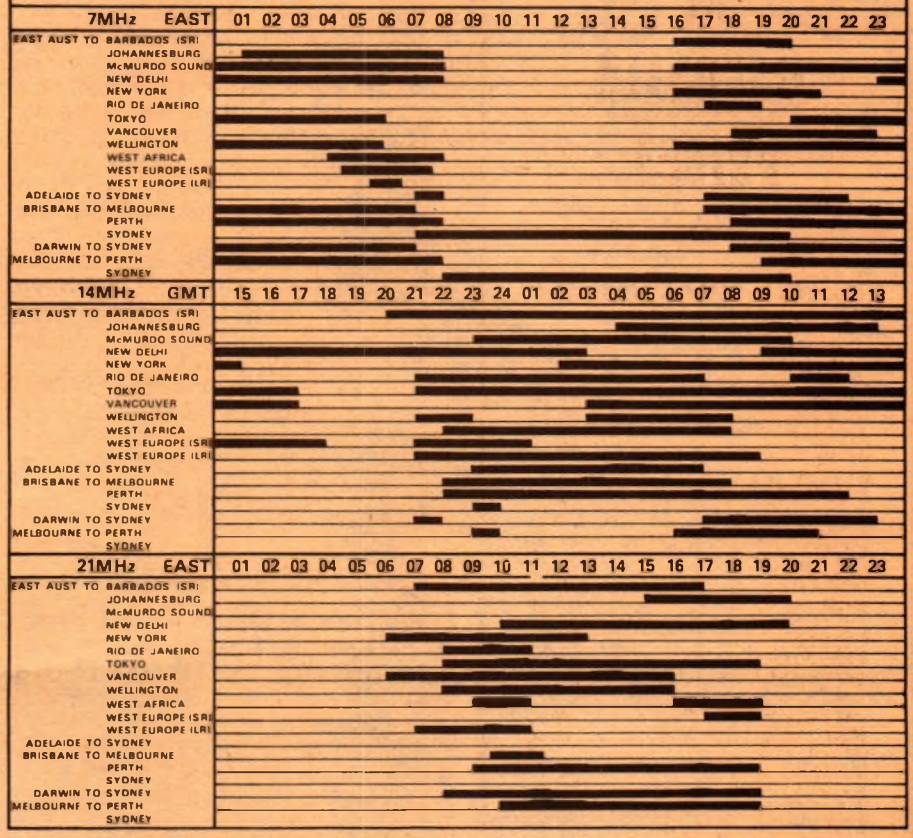
The aim of the Careers Day was to give senior students, particularly those finishing their school life at the end of 1978, an opportunity to obtain information about employment and what would be required of them in occupations they may favour.

About 30 professional and trade organisations manned information booths to answer questions. Students from eight schools in the surrounding districts visited the centre during the day and the number is believed to have been in excess of 1000.

The opportunity was taken to demonstrate various aspects of amateur radio and explain to numerous interested students how amateur radio as a hobby could assist them in careers in electronics and associated fields if that was where their interest lay.

IONOSPHERIC PREDICTIONS FOR JULY

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. 7.78



Several local and DX contacts were made to demonstrate what amateur radio really is. Both SSB and CW modes were used.

Leaflets on WIA YRS activities were distributed.

AUSTRALIAN CLUB DIRECTORY

A new club directory is being prepared for publication in December 1978. Deadline is October 18, 1978. Details should be sent in the same format as in previous years.

Club name: West Australian Institute of Technology Amateur Radio Club.
Club call sign: VK6PD.
Meeting place: WAIT, Hayman Road, Bently, WA.
Day and time: Each Wednesday at 7.30pm.
Affiliation: WIA; VHF Group; WA Repeater group; Student Guild.
Net frequency: Nil.
Contact: Secretary at meeting place of club or members.

Club name: West Australian VHF Group (Inc).
Club call sign: VK6WH and VK6VF/P.
Meeting place: Group Headquarters, Wireless Hill Museum, Cnr Almondbury Road and McCallum Crescent, Ardross.
Day and time: Fourth Monday of each month (December excluded) at 8.00pm.
Net frequency: All two metre FM channels monitored.
Contact: Postal, PO Box 189, Applecross, WA 6153. Telephone David Laws, VK6DS, (09) 64 1558.

Club name: Boy Scouts Amateur Radio Club.
Club call sign: VK6TJ.
Meeting place: Scout Hall, Busselton, WA.
Day and time: Tuesday evenings at 8.00pm.
Affiliation: Not stated.
Net frequencies: Operates on most amateur bands.
Contact: Secretary, Neville Hollands, 40 Reynolds Street, Busselton 6280.

Make pcb's, panels etc. at home!

YOU can make fully professional quality PCBs and front panels, etc at home — without special facilities or equipment. Let Dick Smith show you how easy it is — with a little help from

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Scotchcal from Dick Smith comes as either: Thin, adhesive-backed aluminium sheet, or Thin, orange-coloured plastic film.

These are both coated with a photo-sensitive emulsion which is exposed by ultra-violet light (the sun is ideal).

The aluminium sheet is usually used for front panels, name plates, etc, while the film is intended for transfering artwork into a form which enables exposure of panels, printed circuit boards, etc. Both products use the same developer, which is simply wiped on with a soft cloth or cotton wool.

NOTE: NO DARKROOM REQUIRED!

PHOTO-ALUMINIUM FOR PANELS AND LABELS

Either red or black emulsion, grey (aluminium) background. Simply expose to ultra violet light through suitable transparency (or artwork on clear or translucent film) and develop. Image is negative of artwork (clear areas remain, black areas develop away). Supplied with a FREE sheet of polyester material on which you can draw your artwork. 250 x 305mm.

RED emulsion, single sheet. Cat H-5692 .. .. $6.00
BLACK emulsion, single sheet. Cat H-5694 .. .. . $6.00

EXPOSURE FILM — FOR PANELS OR PCB's

Exposure and development identical to above process, but the base material is a clear polyester film. The image is orange, opaque to UV light. Ideal for exposing above or PCB resist. Also supplied with FREE artwork layout sheet. 250 x 305mm.
Cat H-5690 .. .. .. single sheet $3.90

SCOTCHCAL DEVELOPER

Suitable for either film or aluminium, enough for many sheets of material. Simply swab on with cloth or cotton ball.
Cat H-5696 .. .. $1.00

MATERIAL FOR MAKING PRINTED CIRCUIT BOARDS

As well as our Scotchcal range, we also offer everything for the easy manufacture of PCB's. Blank board, etchant, photo-resist, developer, touch-up pens, etc. You can make PCB's at home up to commercial quality — in a fraction of the time they used to take.

PHOTO—RESIST (POSITIVE)

For photographically transferring the printed circuit board pattern on to the blank PCB. Positive acting, so it's ideal for prototypes from 1:1 tapes & pads, etc. Exposed by UV light. Enough resist for around 240 square inches of board.
Cat H-5720 .. .. $3.75

POSITIVE DEVELOPER

Develops above resist. Washes off the unwanted section. 80g pack makes up to solution — instructions enclosed.
Cat H-5724 .. .. $1.85

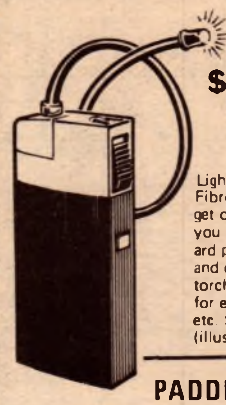
PHOTO—RESIST (NEGATIVE)

Similar to above resist, but is negative acting. Ideal for use with exposure film above to obtain patterns from magazines. Enough resistor for approx. 240 square inches.
Cat H-5722 .. .. $2.75

NEGATIVE DEVELOPER

Already made up in solution, enough to develop around 50g of negative photo resist.
Cat H-5726 .. .. $3.00

WOT'S NEW?



$3.95 X-1085

LITE-PROBE

Light right where you want it! Fibre-optic torch allows you to get over, under, up into, anywhere you need light. Takes two standard penlight batteries (not supp.) and can also be used as normal torch if required. A great idea for experimenters, servicemen, etc. Small enough for the pocket (illustration approx ½ size).

Having trouble with IC circuitry? Test clip brings out pins to where you can easily attach probes, leads, etc. Spring loaded for positive contact, should be in every hobbyists tool box! 16 pins — use with all DIL ICs up to 16 pins.

IC TEST CLIP

$2.95

W-4600

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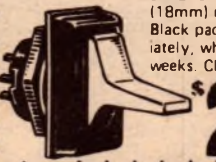
FREE POWER! SOLAR CELL

Z-4825

Straight from space research — these little solar cells are ideal for the experimenter. We've checked them up to 60mA in bright sunlight, with no load voltage up to 0.55V. Series or parallel them for greater output. Fantastic value.

PADDLE SWITCHES



Beautiful new switches will really make your project look pro! Piano-key-type paddle, DPDT 3A/240V switching. Through-hole (18mm) mounting from front. Black paddles available immediately, white (as shown) within 2 weeks. Classy!

$2.40 S-1393

4-WAY MAINS POWER BOX

$16.50 P-5610

Throw away dangerous double adaptors. Power box plugs into wall socket and gives you 4 switched sockets where you need them. Each double pole switched and safety shuttered, too. Every one needs extra power at times. Here's the safety way to get it!

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AND FIND OUT WHAT YOU MISSED!

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LAST MONTH:

A MULTI-TAP LOW VOLTAGE TRANSFORMER FOR ONLY $3.25 — NORMALLY $6.75

SAVING $3.50

WHAT'S THIS MONTH'S SPECIAL? CALL IN AND FIND OUT YOURSELF!

Pre-cut high quality PC blanks with copper (1oz laminate) on one side. Available in fibreglass or bakelite.

Size (mm)	Material	Cat No.	Price
150 x 75	Bakelite	H-5500	65c
150 x 150	Bakelite	H-5505	$1.20
300 x 300	Bakelite	H-5510	$2.95
150 x 75	Fibreglass	H-5540	$1.00
150 x 150	Fibreglass	H-5545	$2.10
300 x 300	Fibreglass	H-5550	$5.20
Double sided 1oz laminate			
228 x 150 °	Fibreglass	H-5560	$3.50

Blank 18 gauge aluminium sheet — ideal for making up heat sinks, small chasses, etc. Also use with rub-on lettering for your front panels, etc.

298 x 298mm	Cat H-2560	$2.00
149 x 149mm	Cat H-2558	$1.00

Ferric Chloride etchant for PCB's, etc. 4 oz jar to make up etching solution.

Ferric Chloride	Cat H-5652	$1.90

Dalo touch-up pen, with unique ink that is also a resist to most common etchants. Ideal for repairing tracks in photo-resist (dust spots, etc) or for marking out simple PCB patterns. Valve-tip for fine ink control.

Dalo 33 pen Cat T-5170 .. .. $2.25

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Incredible scoop purchase of 3.58MHz clock crystals — big quantity buy enables us to sell them at less than half normal price!
Cat K-6031 .. .. Was $6.50 .. .. $3.00

AWA DIRECT DRIVE TURNTABLES — Only a few left!
See our advert on page 108 of June E.A. — this never-to-be-repeated offer is too good to miss out on. But you had better phone before coming in to the store — stocks may have already sold out! Don't dilly dally, pally.
Cat A-3072 .. ..$159.00

INSTANT MUSICIAN! You have to hear it — rhythm box gives a choice of 12, is ideal for bands, parties, etc. It is outstanding value at the price — compare others around. 240V.
Cat. F-3114 .. .. $115.00

CB ANTENNA ELIMINATOR won't give the game away — makes your car less of a target for the light-fingered lot. Uses your standard car radio antenna for the CB — and you can listen to both at once if you wish. Ideal for commercial travellers, etc, who aren't allowed to drill another hole in the car!
Cat D-5516 .. .. $24.50

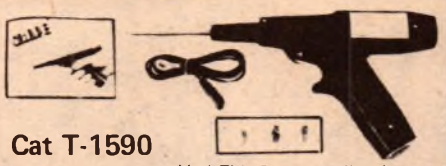
SAVE $30.00!!

Look what we found — hidden in a corner of the warehouse! Incredibly handy DC digital voltmeters — with the display in the probe, right where you want to see it! They sold like hot cakes at $89.50 — we thought we'd sold out. Because they've been removed from our computer memory we can't afford to have them lying around. So we're prepared to knock off an incredible $30.00 just to make sure they ARE sold out! But be quick — strictly limited stock. First in, first served!

$59.50

SPECIAL OFFER!

Buy this Scope cordless iron for only $45...



Cat T-1590

Yes! This Scope cordless iron was real value at $45.00 — now you get the iron PLUS a matching charger for the same low price. That has to be the bargain of the year . . . Handy Scope iron goes with you on the job, no trailing wires or power problems to worry about. Easily available spare parts (uses Miniscope bit) and now the plug-pack charger to go with it. It's ideal for the serviceman, for the technician, for the hobbyist, for YOU. This offer is valid only for the month of July (or until stocks run out) and is not applicable in states where it contravenes consumer laws.

and we'll give you this $12.25 charger FREE!

Cat T-1592

$12.25 JULY ONLY

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Wotsa Gozinta? Itsa thingamejig ya put thingsinta, of course!

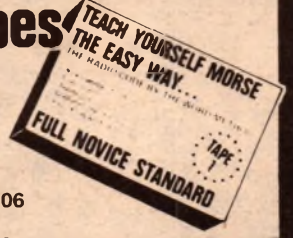
Yes! The handiest carry box we've seen around. It's ideal for the handyman, the hobbyist, the service technician . . . even the wife for a sewing box, or for the fisherman, the mechanic . . . the list goes on and on. Neat, fold-away sections (2 trays and 15 compartments) Sturdy carry handle and lockable catch. 42 x 23 x 20cm. It's a little bottler!

Cat H-2600

BUY ONE FOR MUM, TOO . . .

$17.50

2 tapes $7.90



Cat D-7106

WANT YOUR NOVICE LICENSE?

You know what the biggest hurdle is — the Morse Code. Dick's Morse tapes will help you get that coveted piece of paper. Starts off with the letters then forms them into words so you aren't learning the hard way. Ideal for the beginner or for exam practise. Two tapes — white is tape one and yellow tape two.

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YAESU

REMEMBER — THE CONTEST CLOSES IN JULY — AND YOU NEED TO THINK ABOUT YOUR ENTRY SO DON'T DELAY!

CONTEST CLOSES 28TH JULY

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NEW FANTASTIC TV GAME (See July E.A.)
10 games — sound — on screen scoring . . .
See our full page advert and the constructional article in this issue for full details of this exciting project.
Complete kit, including instructions .. Cat K-3472 .. $49.50
SEPARATE PARTS:

PC Board (only)	Cat H-8344	$3.95
Fully built RF modulator	Cat K-6040	$3.00
Fully built audio modulator	Cat K-6042	$4.50
AY-3-8600 IC	Cat Z-6852	$15.00

TRANSISTOR TESTER (See July E.A.)
See this issue for full details.
Full kit with instructions: Cat K-3052 .. .. .. $17.90
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Although we do not produce a full kit for this project, all parts are normal stock lines at our branches:

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ICOM IC-701 HF transceiver offers many features

The Icom IC-701 is an HF transceiver covering all the Australian HF amateur bands, in the popular modes, at up to 200W, with phase locked loop frequency control, digital read-out, variable bandpass tuning, and a host of other features designed to simplify operation in today's crowded bands.

As an example of the present state of the art, the IC-701 is well up in front, and emphasises the tremendous advances made in recent years. Not the least impressive aspect is the small size, considering the facilities and performance figures it offers. It measures 111mm (H) x 241mm (W) x 311mm (D), and weighs 7.3kg.

It covers the six amateur HF bands from 1.8MHz to 29.7MHz plus 15MHz (receive) for WWV, and offers a host of facilities. It operates from 13.6V DC and requires 18A for 200W input. The modes available are SSB (USB or LSB), CW, and RTTY (FSK).

A separate power supply (IC-701PS) is available and was used for the tests described here. It operates from 240V and delivers 13.8V at 20A. It is supplied in a matching case and measures 110mm (H) x 180mm (W) x 260mm (D).

Frequency selection is by a phase locked loop synthesiser, giving 100Hz steps displayed on a six digit LED readout. The frequency ranges are: 1.8MHz-2MHz; 3.5MHz-4MHz;7MHz-7.5MHz (7.3-7.5 receive only); 14MHz-15.2MHz (14.35-15.2 receive only); 21MHz-21.5MHz; 28MHz-30MHz (28-29.7 transmit range).

Some of the receiver features include: a band pass tuning control, noise blanker, "hang" AGC for SSB signals, a 10dB attenuator to control very strong signals, receiver incremental tuning (RIT), and a combination ±250Hz band pass filter and audio active filter for CW.

The transmitter section features optional VOX control, with anti-VOX circuit, speech compressor, semi break-in CW operation, SWR measurement, and CW monitor (900Hz). Among the features common to both sections are, two VFOs, each with a memory, remote control facilities via a 24 pin rear socket, two speed tuning and dial lock facility, and versatile terminal arrangements on the rear panel to facilitate connecting auxiliary devices.

Many of these features are self-explanatory, but a few are worthy of special mention. The two VFOs can be used in various configurations. The transmitter can operate on (either) one and the receiver on the other, with both frequencies being stored in the respective memories, and each displayed as it is used. Alternatively, both rransmitter and receiver can operate from (either) one, while the other is used to search for a better channel, even on another band. The original frequency is held and immediately available.

The receiver incremental tuning permits the receiver frequency to be shifted up to 800Hz either side of the transmit frequency, without disturbing the latter. Useful for net working.

The frequency selector knob drives a slotted disc mounted between a pair of infra-red LEDs and a pair of phototransistors. This avoids mechanical contacts with their problems of wear, noise etc.

Frequency progression is normally in 100Hz steps, with one full rotation of the tuning knob equal to 5kHz. For more rapid progression a switch at lower left of the tuning knob changes the rate to 10kHz per step.

The set's most ingenious single feature is almost certainly the pass band tuning system; a variable selectivity system controlled by a single knob on the front panel. The manual gives a lengthy and detailed explanation, using figures and diagrams, but the following broad description explains the general principle.

The basis of the system is two stages of IF conversion. From a 1st IF of 9.0115MHz the signal is up-converted to 10.7500MHz, then down-converted to the original 9.0115MHz. The point about this operation is that the same local oscillator is used for both conversions so that, even if this oscillator frequency is varied, the input and output remain at 9.0115MHz.

The local oscillator is crystal controlled at 19.7615MHz, but made variable over ±1.5kHz by a variable capacitor in parallel with it. As already stated, this does not shift the 3rd IF (9.0115) but it does shift the 2nd IF (10.75), and this is where the pass band is determined.

Both the 1st IF and the 2nd IF are fitted with bandpass crystal filters having virtually identical shape and a bandwidth of ±1.2kHz. When the 2nd IF is centred on 10.75MHz (local oscillator 19.7615) these two filters are exactly aligned, one with the other, and the full 2.4kHz bandwidth is available.

When the 2nd IF is shifted, by varying the local oscillator, it produces the effect that the two filters no longer line up, and only those sections of their bandpass which overlap will pass signals.

When the bandwidth is decreased one side of the passband remains fixed and the other side moves towards it. Either side may be moved, depending on which way the local oscillator is shifted, at the discretion of the operator. His decision, in turn, would be governed by whether the signal is upper or lower sideband and on which side the interference is occuring.

For SSB signals the bandwidth can be reduced by1.5kHz, and for CW the system is set automatically to reduce the bandpass to ±250Hz.

In practice, the system was found to be very effective.

No fault could be levelled at the layout of the controls which appear to be right-hand orientated. However, some may experience minor difficulty with the small control knobs and switches and a tendency to mark the escutcheon plate with the fingernails. Reference markings on the control knobs could be improved. The meter is

Continued on page 118

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SHORTWAVE SCENE

by Arthur Cushen, MBE

Radio Nederland Celebrates 50 Years of Operation

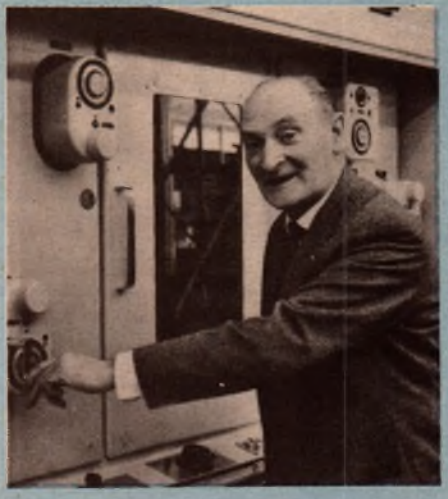
The Happy Station of Radio Nederland this year celebrates its 50th Anniversary. This station has the distinction of being the longest running regular broadcaster on short-wave.

In 1928 Edward Startz, then working at the experimental station of Philips Radio at Eindhoven, Holland, began the broadcast which was heard in Java and which proved that world-wide short-wave transmission on a regular basis was indeed a possibility. This was soon followed by regular broadcasts of the Happy Station over Radio PCJ, and since 1946 has been a regular Sunday feature of Radio Nederland.

Edward Startz conducted the session up to December 1969, when he retired and Tom Meyer took over as compere of the program. Eddy Startz had many famous sayings and features in his Happy Station program, and his wide knowledge of languages enabled him to make station identifications which helped listeners other than those who understood English.

When I met him in 1969 at Radio Nederland studios he was confident of carrying on for several years but, with ill health, he retired at the end of that year and died in March 1976. He has left a wealth of items, souvenirs and other material, and Radio Nederland is at present organising a special display in their studio building as a tribute from the Happy Station to its original compere.

In the autumn of 1928, Edward Startz began a regular broadcasting service which started in Eindhoven and it is this event which, exactly 50 years later, is being commemorated. The anniversary is of special significance to this organisation, since the development of short-wave radio is closely linked with the history of Radio Nederland.



The late Edward Startz photographed during a visit to the transmitters of Radio Nederland which carried the Happy Station program to a world-wide audience.

The idea of using short-wave radio for communications soon caught on in other countries. Great Britain, with ties throughout the world, started its Empire Service in 1932, and a German world service was initiated as far back as 1929 with a transmitter located at Zeesen and radiating with the strength of 8kW.

Today, the Happy Station program is broadcast every Sunday to Australia and New Zealand at 0730-0825GMT on 9715 and 9770kHz, and 0830-0925GMT on 9715kHz. As from July 1, a complete program will be carried by satellite from Hilversum to the relay station at Bonaire from which these transmissions originate.

The Happy Station program in November will make a special feature of its 50th anniversary.

SBC ON SSB

The Swiss Broadcasting Corporation at Berne is now broadcasting its English programs to North America on single side band. Two broadcasts are being carried on a 30kW transmitter from Schwarzenburg, using a log periodic aerial. The transmissions are from 0145-0215GMT on 11780kHz and 1315-1345GMT on 177040kHz.

A conventional AM signal used in normal broadcasting consists of a carrier, an upper sideband and a lower sideband. The carrier contains no information. To transmit information, whether speech or music, all that is needed is only one of the two sidebands, since both contain the same information. In SSB transmissions, the carrier and one of the sidebands are eliminated.

An SSB signal occupies only half the bandwidth that a normal AM signal does. Distortion caused by selective fading is reduced, as is interference between stations. Finally SSB transmission requires less power to achieve the same result.

Careful fine tuning is essential for a quality signal. The Swiss Broadcasting Corporation is keen to receive reception reports and these should be sent to Mr Paul Badertscher, Head of the Technical Department, Swiss Broadcasting Corporation, CH-3000, Berne 15, Switzerland.

ENGLISH FROM CAIRO

The latest schedule of broadcasts in English from Radio Cairo shows the use of some new frequencies for their five daily transmissions which cover the Far East, Africa, Europe and North America. The broadcasts are 0200-0330 on 6230 and 9475; 1215-1330 on 17920; 1715-1845 on 15255; 2030-2200 on 11790; and 2230-2345GMT on 9805kHz.

The Arabic transmissions, which are broadcast 24 hours of the day, are carried on many frequencies. Transmissions on the 19 and 16 metre bands are as follows: 15135 1100-1525; 15175 0700-1500; 15210 0700-1500; 15475 0600-1900; 17760 1300-1830; and 17745kHz 0600-1500GMT.

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.

RADIO NZ SCHEDULE

The Shortwave Service of Radio New Zealand has made a late frequency change for the transmission period up to September 2.

The transmission is well received in Australia. The present schedule is as follows: 6105 1800-2045 and 0500-1030; 11800 1800-2015; 15130 0400-0730; 15380 2025-0345; and 17710kHz 2100-0445GMT.

The above transmissions are to the Pacific. The broadcast to Australia is on 9620kHz 0745-1030GMT. The "DX World Program" is broadcast on the first Sunday of each month at 1015GMT and "Letter Box" on the third Sunday at the same time.

RADIO RENASCENCA

The Portuguese gospel station Radio Renascenca has announced plans to cover all of Portugal with a new medium-wave network. However, the first objective is to reach all groups of Portuguese emigrants throughout the world on short-wave. Transmitters for this purpose were purchased in November 1977, and delivery will be made by the end of 1978. Radio Renascenca expects to be on the air on short-wave at the beginning of 1979, according to the BBC Monitoring Service.

ENGLISH FROM INDONESIA

English broadcasts from Jakarta are often reported, and according to "Tune In", an additional English program is now broadcast 0100-0200GMT on 7195 and 11780kHz. At 0200GMT, there is a broadcast in Indonesian.

Another Indonesian station which now broadcasts in English is Radio Republik Indonesia, Sorong, on 4875kHz. This station has been heard with an English program 1230-1300GMT on Saturday, and during this 30 minute broadcast there is a mailbag session in which letters from listeners are answered.

ENGLISH FROM KIEV

Broadcasts in English from Radio KIEV Ukraine are carried in three transmissions and a new frequency plan is in operation until the end of October. In common with other international broadcasters a move to the higher frequencies has been made.

The first broadcast in English is at 2030GMT and is beamed daily to Europe on 11830, 9775, 9630kHz. Two transmissions are broadcast to North America and give good reception during our afternoons. The first transmission is at 0030GMT on 15405, 15180, 11780 and 9600kHz. The second broadcast at 0300GMT is on 15425, 12060, 12050, 12030, 11780 and 9775kHz.

Reception on 9775kHz has been good during the 0300GMT transmission. This frequency replaced 9610kHz which also had been providing a strong signal. Listener reports are requested to Radio KIEV, Kiev, Ukraine, USSR.

BROADCASTS FROM NORWAY

The transmission for evening reception in Australia by Radio Norway at Oslo is now broadcast on 9590kHz 0700-0830GMT, while additional frequencies are 15135 and 15175kHz. English is broadcast on Sunday from 0800-0830GMT. The broadcast 0500-0630GMT also gives good reception and is carried on 11895, 15175 and 17795kHz.

Each Sunday, in "Listeners Corner," interesting questions from listeners throughout the world are answered on the subject of life in Norway. Letters from listeners should be sent to Listeners Corner, Radio Norway, Oslo 3, Norway.

NEW SOFIA FREQUENCY

Radio Sofia, Bulgaria, is using the new frequency of 15135kHz from 2130-2200GMT for a broadcast in English. This new channel suffers interference from KTWR, Guam.

Radio Sofia has also been noted in English at 1930GMT on 9700 and 11720kHz, while at 2130GMT the station announces that it is using 9530 and 9765kHz. However, one of these is replaced by the unannounced frequency of 15135kHz. The service to North America is 0000-0100 on 9705 and 0430-0500GMT on 9765kHz.

Further information indicates that at 2130GMT 11750 is used as well as 15135kHz, while at 2400GMT they are using 15330 for a further broadcast to North America.

LISTENING BRIEFS
EUROPE

POLAND: Warsaw has been heard in English on two frequencies in the 49 metre band during the afternoon. Signals on 6095 and 6135kHz are both well received 0300-0330GMT, and are followed by a program in Polish.

SWITZERLAND: Berne is using three frequencies in the 13 metre band and one of these, 21585kHz, is well received up to sign-off at 2245GMT. The broadcast has been heard as early as 2000GMT and is beamed to South America. A broadcast in Portuguese was noted at 2030, in Spanish at 2100 and in German at 2130GMT. The frequency of 21570kHz is used with English 1530-1600GMT, and then continues in other languages up to 1800GMT.

HUNGARY: The English broadcasts from Budapest to Australia are transmitted daily 1030-1100GMT on 6040, 7155, 9585, 11910, 15160, 17715 and 21525kHz. The broadcasts to North America, heard in our afternoons, are 0200-0230 and 0300-0330GMT (except Monday) on 6080, 6160, 9585, 11910, 15225, and 17710kHz, except that at 0300 6160 is replaced by 6105kHz.

VATICAN: English from the Vatican Radio to North America has recently been retimed and is now broadcast 0200-0215GMT on 6015, 9605 and 11845kHz. The transmission for Australia is heard 2210-2225GMT on 7235, 9615 and 11705kHz.

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A short spindle is supplied for single record play records.

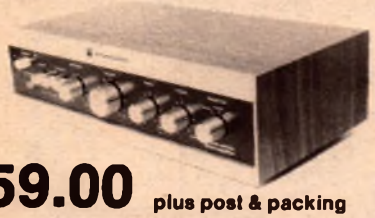
Precision engineering is reflected in the styling of the SL65B, which is elegantly finished in black and silver.

POST AND PACKING EXTRA Send SAE for details
NSW $2.75 Vic., SA & Qld $4.75
Tas., WA & NT $6.00 (Reg. post $2.00 extra)

BASE & PERSPEX COVER FOR GARRARD OR B.S.R. UNITS $29.50 EXTRA PLUS FREIGHT.

NEW STANDARD PM-403 W-24 WATT STEREO AMPLIFIER AT LESS THAN TRADE PRICE

MANUFACTURED BY STANDARD RADIO CORPORATION — A MAJOR JAPANESE ELECTRONIC MANUFACTURER.



$59.00 plus post & packing
NSW $3.50
VIC., QLD, SA $5.00
WA, TAS. $6.50 (Reg. post $2.00 extra)

SPECIFICATIONS:
Continuous power 12 watts R.M.S. per channel at 8ohms. (24 watts) at 1KHz
Harmonic distortion at 1KHz 0.5% to 10 watts
Power bandwidth 20-20,000Hz at 8ohms
Frequency response 15-40,000Hz
Signal to noise ratio Aux. 70db Mag. 60db.
Bass control ±10db at 100Hz **Treble control** ±10db at 10,000Hz
Input sensitivity Mag. 2.5mv, Cer, 150mv. Aux 100mv, Tape 500mv.
● TAPE MONITOR SWITCH ● LOUDNESS CONTROL ● SPEAKER SELECTOR SWITCH
● HEADPHONE JACK ● SEPARATE BASS & TREBLE CONTROLS ● BALANCE CONTROL
Dimensions 13½" by 8" by 4" high SUPPLIED IN WALNUT FINISHED **CABINET WITH OPERATION INSTRUCTIONS & SCHEMATIC DIAGRAM**
READ REVIEW ON THE STANDARD PM-403W AMPLIFIER IN NOV. 77 ISSUE OF E.A.
Send SAE for full specifications.

SPECIAL PACKAGE OFFER

STANDARD PM-403W AMPLIFIER — TWO GOODMAN-FOSTER SPEAKER KITS AND GARRARD SL65B CHANGER WITH SHURE MAGNETIC CARTRIDGE $155.00.

(Cabinets for speakers and changer not supplied.) Freight and packing extra per rail or air freight.

NEW GOODMAN-FOSTER 3-WAY 4-SPEAKER HI-FI SYSTEM

$39.00 PER KIT

Frequency Range 45 to 22,000 cycles. Power rating 25 watts RMS Imp-8ohms. Supplied in kit form (less cabinet) each kit comprises two English Goodman 8" bass units. Foster 5" mid range. Foster 1" dome tweeter crossover components Ocodensers and inductance innabond, speaker fabric and plans of cabinet. Cabinet dimensions 23" x 13" x 10". **CABINENTS AVAILABLE.**

Post & packing extra: NSW $2.70; VIC, SA, QLD, $4.70; WA $5.70. (REGISTERED POST $2.00 EXTRA IF REQUIRED) cabinents available.

NEW MAGNAVOX — MV50 — 50 WATT SPEAKER SYSTEMS

As featured in Feb. 1976 Issue of Electronics Today

Complete kit of parts (less cabinet) comprising Magnavox 10-40 10" bass unit. 625 mid range 6" two XJ3 dome tweeters, crossover network, innabond, speaker silk and plans of cabinet.

$82.00 PER KIT — freight extra per rail or air freight. Cabinet available. 830 System also available.

NEW STANDARD B.S.R. C123 RECORD CHANGERS

$20.00 LESS THAN ½ LIST PRICE

Fully automatic turntable plays up to six records automatically and single records automatically or manually as required. 11" turntable. Bias compensation. Cue & pause control. Record speeds 331/3, 45 and 78 rev/min. Finished in black with silver trim. Player and changer spindles supplied. Fitted with ceramic cartridge. Post & packing extra. NSW $2.70; Vic., Qld., SA $3.70; WA $4.70 (registered post $2 extra if required).

Spare cartridge and stylus for above $3.50 (list price $10.00)

B.S.R. STEREO PLAYER MODEL P-128B $39.00 WITH SHURE M75CS MAGNETIC CARTRIDGE

LESS THAN ½ LIST PRICE

PROFESSIONAL SERIES

Auto or manual operation. 3 speed. 11½" diecast turntable 4 pole shielded motor. Slide-in cartridge carrier. Counter-balanced pick-up arm. Fine stylus force adjustment & bias compensation. Damped lever type cue & pause control. Diamond styles. **Post and Packing extra.**

NSW $2.75 VIC, SA & QLD $4.75; Tas. WA & NT $6.00 (reg. post $2.00 extra)

SHURE MAG. CARTRIDGES

New Shure M75-6 Magnetic Cartridges with diamond stylus **$12.50** POST FREE

GARRARD M.82 $57.00 TRANSCRIPTION CHANGER

Supplied with Goldring Magnetic Cartridge with Diamond Stylus. Post & packing (Reg. post) NSW $3.60, Vic., SA, Qld $4.74, Tas $5.50, WA & NT $5.80

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Rola twin cone Hi-Fi speakers. Freq. range 40 to 13,000 cycles power rating 30 watts. Imp-8ohms. Post & Packing: NSW $2.50. Interstate $3.50. **$16.50**

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LAST YEAR, WE SOLD A SIMILAR MODULE BUT WITHOUT ALARM AND SWITCHES FOR $32.50!

JUST LOOK AT THESE FEATURES:

* 12 volt operation with quartz crystal – incredible chronometer accuracy. Protected against accidental reverse polarity.
* Requires only 3.8mA with readout off – operate for a year off torch batteries. Uses only 79mA (approx) with readout on.
* Large fluorescent readout. Can easily be seen in daylight.
* No wiring required for standard operation – supplied complete. Just connect the leads to a 12 volt supply.
* Ideal for car, boat or aircraft operation.
* 12 hour operation – can be converted to 24 hour operation (requires one resistor).
* Audible alarm supplied – bells, lights, etc can be controlled by adding a relay.
* Seconds can be displayed by adding a simple switch (instructions supplied).
* Seconds count can be zeroed to allow for stop watch type operation. Ideal for boat races and auto rallies.
* Power failure indication – tells you if clock was turned off.
* Can be operated off AC power with a 12 volt adaptor.
* Accurate to one tenth of a second per day!

COMES WITH A SIMPLE, YET HIGHLY DETAILED 4 PAGE INSTRUCTION MANUAL SHOWING CIRCUITS FOR TIMERS, ALARMS, RELAY SWITCHING, STOP WATCHES, POWER SUPPLY INFORMATION, 24 HOUR AND SECONDS DISPLAY DETAILS, ETC.

ONLY $19.50 MODULE ONLY.

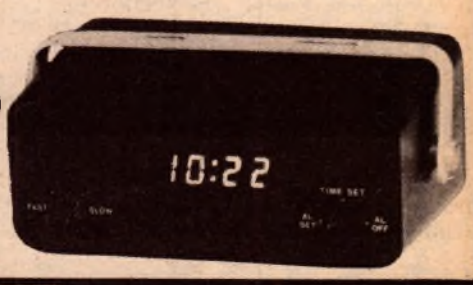
Cat X-1045

SPECIAL OFFER

The above clock module, complete with attractive case, front panel bezel and mounting bracket. Ideal for mounting on the dashboard of your car, truck, plane or boat. Ready to go – simply connect to power!

$24.50

Cat X-1047



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New Products

THE NATIONAL DR48 COMMUNICATIONS RECEIVER

The National DR48 pictured below is an eye-catching communications receiver, that will fascinate anyone interested in listening around the radio spectrum. It covers the medium-wave broadcast band, the FM broadcast band (mono only) and the complete "shortwave" spectrum from 1.6MHz to 31MHz, for three modes: AM, SSB and CW.

The DR48 can most easily be visualised as three fairly distinct receivers sharing certain common elements: power supply, audio system, speaker, housing and various subsidiary items. That way, the numerous facilities on the panel each assume a logical role.

A block diagram in the user manual, which comes with the receiver, indicates the three major functional sections.

The FM broadcast section (88-108MHz) has its own antenna input and front end (bandpass RF, oscillator, mixer), its own 10.7MHz IF amplifier, and its own demodulator with optional AFC. It shares only the audio system, power supply and the accompanying audio end facilities. No provision is made for stereo decoding and this fact, plus the specifications available, suggest that it is aimed at the "what's on the air" type of listener, rather than the "ultimate-fi" fan.

A second major section, covering the AM broadcast band, is virtually a straightforward single-change 455kHz superhet, with a tuned ferrite rod antenna supplemented by terminals for an external long wire. The section has its own RF amplifier stage, its own oscillator and mixer, and feeds into a 455kHz IF channel, followed by an AM detector. As before, the signal passes to the common audio system.

The same basic stages are used to cover SW1, the range between 1.6MHz and 3MHz but the user has access to facilities which are not normally found on a single-change dual-band superhet.

For example, the 455kHz IF channel offers two orders of selectivity, selectable by a switch on the front panel. For normal AM reception, the switch can be left in its "Wide" position (-6dB at ± 2.5kHz, -60dB at ± 15kHz). To help cope with inter-channel interference, the "Narrow" option cuts the bandpass by about 2:1. Other options include ANL (Automatic Noise Limiter), and an AM/CW.SSB switch which brings in the BFO and substitutes a product detector — essential features in a worthwhile communications receiver.

Incoming signal strength is indicated on an S-meter, when can double as a voltage check, when the DR48 is operating from internal batteries.

The receiver functions so far outlined, FM-BC-SW1, share a common tuning dial and knob, along with the S-meter, and are grouped alongside the loudspeaker grille. Also on this left-hand portion of the panel is the AFC switch, Selectivity switch, ANL switch and AM/CW.SSB switch. Below them are the volume, bass, treble and BFO pitch controls and, to the left, the power switch and jacks for external speaker/phones, tape recorder access and auxiliary audio input.

The more unusual aspects of the DR48 centre around the remaining short-wave bands SW2 to SW8, which cover the range 3.0MHz to 31MHz in 4MHz segments. Most of the relevant controls are grouped at the right-hand end of the panel, and involve band selector switches, a two-speed tuning knob, a multi-scale dial, a fine frequency vernier and a digital readout of the frequency to which the set is tuned.

For these bands, SW2 to SW8, a third and distinct front-end is involved, beginning with alternative antenna terminals and coaxial input, then into a tuned RF amplifier and the first mixer stage of a double-change superhet configuration. The first IF is 2MHz and this is subsequently converted by a second mixer to 455kHz; from here, the signal passes through the 455kHz channel mentioned earlier, with its facilities for variable selectivity and for resolving CW and SSB signals.

A single variable frequency oscillator sweeping 5MHz to 9MHz serves for all 7 short-wave channels in this section. The oscillator output is used directly for SW2, beating with the incoming frequency range 3MHz to 7MHz to produce the 2MHz first IF.

For the remaining short-wave ranges, the same 5-9MHz output from the oscillator is heterodyned by the output from a selection of four crystals, in what National refer to as "pre-mixers", to provide the required local frequency for the first mixer in the signal chain; in short to provide the "first oscillator" frequency.

While, at first encounter, this might suggest a Wadley loop system, and therefore automatic cancellation of frequency drift, it would appear not to be the case from the block diagram. Stability must therefore depend heavily on the performance of the VFO, with any tendency to drift being common to all seven bands.

In fact, we did notice clear evidence of frequency drift on the short-wave bands, when listening to Morse code and SSB transmissions, necessitating an occasional nudge to the tuning knob. On the credit side, however, it must be admitted that the slow speed vernier is very smooth, giving almost leisurely tuning of short-wave AM transmissions.

An interesting — and dominating — feature of the DR48 is that the frequency to which the receiver is tuned on any band SW2 to SW8 is displayed automatically on a 5-digit readout, with the last digit showing 1kHz increments. The display is locked to an internal 5MHz crystal, making it independant of drift in the VFO and also obviating the necessity for calibration reference frequencies.

The dial scale which is provided for the bands SW1 to SW8 is therefore largely redundant, except to give a visual clue to the band in use when the digital display has been switched off to conserve battery drain or the display elements themselves.

And this brings us to the generalities: the DR48 can operate from three power sources: the AC mains, an external 12V source, or 8 internal 1.5V cells. Nominal power drain is 10W and nominal audio power output 3W maximum, delivered to an in-built 10cm 4-ohm loudspeaker. Dimensions are 482(W) x 200(H) x 354(D)mm, and weight 8kg without batteries.

In summary, our reaction to the DR48 tended to be critical, at first, because we had become conscious of residual frequency drift on the shortwave bands 2 to 8. We would still have that reservation for amateurs or others who might want to use the receiver for long periods on CW, SSB phone, or teletype.

However, when we changed hats and adopted the role of a dedicated listener to the radio spectrum, the DR48 came into its own, with convenient coverage of the AM broadcast and FM band, and the unfamiliar (to most) region between 1.6 and 3.0MHz. And, on the higher frequency bands, the digital readout and dual vernier dial made it very easy to find one's way around — and that included the amateurs and CBers operating on SSB around 27 to 30MHz.

For all this, you must expect to pay around $470 but, as we said at the outset, you get "an eye-catching receiver that will fascinate anyone interested in listening around the radio spectrum". (WNW)

ICOM IC-701 HF Transceiver-continued

easily read.

At the rear is the power inlet, antenna socket, Morse key jack, external speaker jack, terminal for transverter, receiver antenna input, output for separate receiver or pre-amplifer, and CRO or panadaptor outlet. This latter is fed from the 9.0115MHz IF system. There is also a 24 pin accessory socket for remote control devices and RTTY connection.

The transceiver is designed to work into an antenna impedance of 50 ohms, unbalanced. A standard PL259 connector is provided.

The adjustment of each amplifier mixer, etc. for each band of the transmitter is initially set at the factory and no tuning is necessary before going to air. If adjustments do become necessary the procedures are well documented in the instruction manual. All controls are easily accessible.

A number of semi-permanent adjustments are provided under an access cover on top of the set. These include such functions as VOX gain control, VOX delay, anti-VOX level, SWR switch, RTTY shift switch, CW monitor level, etc.

For phone, press-to-talk or VOX may be used. The speech processor proved satisfactory for DX work and good reports on audio quality were received.

An inbuilt cooling fan comes into operation only when the temperature exceeds a predetermined level as detected by a monitoring circuit. Should overheating occur the fan will turn at a much higher speed and the frequency display will flash.

No laboratory type checks were made against the performance figures quoted in the instruction manual, but the subjective reaction was that it would have no trouble in meeting them. This was in spite of the fact that the unit had been circulating for some time as a demonstration model, and might well have needed a touch-up.

The on-air tests used half-wave dipole antennas for 3.5MHz and 7.0MHz bands, and a three element tri-band Yagi for 14MHz, 21MHz and 28MHz bands. These were very satisfactory, and even a very makeshift inverted "V" 14.0MHz dipole, at a portable location, gave very good results.

In the opinion of the reviewer, the IC-701 is a masterpiece of solid state amateur equipment, solidly built with high performance capabilities. This is the result of a 12-day on-air trial, during which all bands, except 1.8MHz, were used under varying propagation conditions and in SSB, CW and RTTY modes.

Reports from local and DX stations left little to be desired and seemed to substantiate the claim "If you can hear them you can work them".

The IC-701 is supplied complete with a well illustrated instruction manual, a large schematic circuit diagram, and a printed board layout in colour. The price quoted is $1160, without the power supply.

A remote control head is also available. This connects to the rear accessory socket, and can be used to change bands, select frequencies and scan.

The test unit was made available by Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Victoria 3205, and further information may be obtained from them. (P.H.)

Locally manufactured digital gaussmeters

Combining ease of measurement with high accuracy, the range of digital magnetic field measuring instruments (gaussmeters), manufactured locally by Daley Electronics Pty Ltd, is designed to measure steady and alternating magnetic fields over the range 10 to 20,000 Gauss.

The three models in the range feature 3½-digit liquid crystal displays, Hall Effect sensing devices, and battery operation. Four interchangeable probes are available to measure both transverse and axial magnetic fields.

Factory calibration is available in either Gauss or Teslas. Once calibrated, no further calibration is required either before use or when the probes are changed.

Full spare parts and service back-up are readily available from the manufacturer.

For further information contact Daley Electronics Pty Ltd, 84 Keys Rd, Moorabbin, Victoria 3189. Telephone (03) 95 5153.

GENUINE AIRCRAFT CLOCKS
8-DAY EX RAAF
$27.50
P & P A$1.60 B$2.50
C$2.70 D$2.70

GENUINE EX ARMY WRIST WATCHES
Complete with nylon band **$19.50**
Post **$1.10**

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Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line. **$35.00**
(2 TELEPHONE SETS)
$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

TEN CHANNEL VHF TRANSCEIVER
100 to 125 MHz 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. **$33.00**

EX ABC MAGNETIC RECORDING TAPES ¼"
PROFESSIONAL QUALITY

5" x 600	**$1.50**
7" x 1200	**$2.75**
7" x 18 000	**$4.50**

P&P A. $1.10, B. $2.00, C. $2.25, D. $2.25.

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75
Fully synthesised transceiver with am, upper, lower and independent sideband operation. 1KHz steps from 2MHz to 29.999MHz. 1 microvolt sensitivity. 2.5KHz bandwidth ssb, 6KHz bandwidth AM. 1 RW PEP max output. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc. 400Hz supply.
Ideal for amateur use.
PRICE $750

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TRC/75 receiver section of transceiver specification as above.
PRICE $400

TELEPHONE WIRE
1 mile twin (2 miles) genuine ex-Army Don. 8 perfection condition. $35 per drum. $2.00 cartage to rail, freight payable at destination.

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A compact and handy tester for workshop or lab where quick circuit checks are required.
DC Volts 2.5 to 1 000V (20.000 OHMS per volt) AC Volts 10 to 1.000V (10.000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM. Decibels minus 20 DB plus 62 DB complete with instructions only **$23.95** ea, P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$29.50** P.P. $1.05.

SIEMENS Typing Perforator
240 Volt Type with Keyboard **$57.50**

4 DIGIT RELAY COUNTERS
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Carbon Steel. **$3** dozen
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Can also be adapted as a Dumpy Level or as base for a telescope has full 360? 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L. 10" with cross hairs, eyepiece, ½" right angle prism — height 10" — weight 3½kgs. With leather carrying case. Original cost $300. Our Special only **$27.50**.
P&P A. $1.95, B. $4.25, C. $5.90, D. $5.90.

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BRAND NEW

6BM8	$1.80	65N7GT	95c
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832	$5.00	2 x 2	75c
6X4	$1.80		
VR65	75c		

P&P 40c

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(Usual Price **$1750**)
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LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb
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High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.
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SPY TELESCOPES
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8 x 30	$32.50	A	$1.65
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12 x 50	$46.00	D	$3.20
20 x 50	$47.50		

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1½" diam. 4½" F.L. **75c** 2½" diam. 2" F.L. **$1.50** each or **$2.50** per pair. P&P 40c.

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New gunmetal body, Stainless Steel Shaft, Neoprene Impeller. Up to 15ft Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx. size 8" x 5" ⅜" **$30.35**, ½" **$43.30**, ¾" **$47.60**
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Post **$1.10**

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$1.75	**$4.25**
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Suits PRC 25 and dozens of other uses. 15 volts long life only **$1.50 ea**.
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Directional Gyros.
AN5735-1 Air Operated.
Dimensions: 6inx5inx5in.
Weight: 2kg.
$35

Sperry Artificial Horizon.
AN5736-1 Air Operated.
Dimensions: Length 9in;
Diam. 4½in.
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Electric. Type Mk. 12.
24Vdc.
Dimensions: Length 6½in.
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Weight: 1kg.
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WITH HANDSET ANTENNA $25 EA
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Post A. $1.65, B. $2.75, C. $3.20, D. $3.20.

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COLLINS R — 391/URR
Continuous tuning of range 500 Kills — 32MHz in 32 bands. Receive frequency indicated directly on digital counter type readout to within 300Hz. Selectivity adjustable in six steps. From 100Hz to 16KHz bandwidth. Sensitivity 1 microvolt or better 240 VAC operation — 10 inch rack mount — autotone on eight preset channels available complete with instructions and service manual and tested.
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Letters to the editor

Turner distributors

We enclose a copy of a letter the original of which by this time should be in your possession. The particular object in sending the communication is to refute the untrue announcement published in the March 1978 issue of your journal on page 35 which begins "Turner Microphones USA" in connection with a company trading as Audio Telex Communications.

I view of the misleading effect of the subject statement which was not announced by, nor authorized by Turner Microphones, we would expect you to give equal prominence in your journal to the authorised statement sent to you by Turner.

We look forward to your co-operation in this matter.

Alex F. Glancy
Manager, Electronics Division
John Barry Group Artarmon, NSW

It has become apparent to us that there exists confusion in the minds of Australian distributors, dealers, and consumers of microphones and antennas as to the officially designated/authorised distributor of Turner products.

On December 2, 1977, Turner Division of Conrac Corporation entered into an International Distributor Agreement with John Barry Group of Companies located at 105 Reserve Road, Artarmon, NSW 2064, Australia. It is our intent by way of this agreement to establish John Barry Group of Companies as our sole importer for Turner products in return for the services the John Barry Group of Companies is providing the Australian electronics dealer.

As editor of an electronics publication you should be cognizant of the official relationship that exists between John Barry Group of Companies and Turner Division as described above.

We are enthusiastic about our relationship with John Barry Group of Companies and trust that this will clarify the confusion that presently exists.

Michael L. Olinger
Director, International Sales
Ronald B. Taylor
Director Marketing Services
Turner Division, Conrac Corporation
Cedar Rapids, Iowa.

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Books & Literature

Op-amps, without tears

OP-AMPS. Their Principles and Applications by J. Brian Dance. Published by Newnes, London, 1978. Stiff paper covers, 88 pages 215mm x 135mm, illustrated by circuits. Price in Australia $5.50.

I'd better not be critical of the contents of this book, because it follows closely the text of material already published in this magazine as a series of articles by Brian Dance.

Written in a descriptive rather than a mathematical style, it is intended for reading by technicians and enthusiasts alike. The author's stated aim is to help readers use op-amps in typical applications without having to spend too much time working out the basics.

The five chapters cover: Introduction to op-amps — Some basic 741 circuits — Further 741 circuits — Various integrated circuit amplifiers — FET input devices — Audio power circuits — Low noise audio and preamplifiers. At the back of the book is a glossary of terms, an index of devices referred to in the text, and general index.

The material is easy to follow and the book can be commended to anyone who wants to gain greater familiarity with these now ubiquitous devices.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. Tel. (02) 412 3444 (WNW).

Auto audio for all

MASTER IN-CAR ENTERTAINMENT by Vivian Capel. Published 1977 by Newnes/Butterworth, London. Stiff paper covers, 122 pages, 214mm x 135mm, illustrated by pictures and diagrams. Price in Australia $6.00.

At first glance, this book may tend to be discounted as a discourse on the commonplace but then, considering the enormous proliferation of AM and FM radio receivers in cars, along with tape facilities and 1, 2 or 4 loudspeakers, it may be an unfair reaction. After all, there must be a very large number of salesmen, customers and automotive mechanics who could use some additional background information on the subject.

Vivian Capel discusses the car equipment seen in general, and the considerations for mono, stereo and "quadraphonic" systems. He talks about reel tape, cassette and cartridge formats and their relative merits and limitations. This is followed by chapters on car radios, antennas, installation, in-

terference suppression and troubleshooting.

The text is eminently readable and, along with diagrams, pitched at a level which should present no problems to anyone not utterly foreign to technical talk. In short, a potentially useful book for any anyone in the categories mentioned earlier.

Our review copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. Tel. (02) 412 3444. (WNW).

Amateur radio Q&A

RADIO AMATEURS' EXAMINATION QUESTIONS AND ANSWERS, compiled by the RSGB Education Committee. Published by the Radio Society of Great Britain. Soft covers, 106 pages 190mm x 250mm, illustrated with diagrams, loose leaf binding. Price in UK £1.70.

Although intended for aspiring amateurs in the UK, this book, with the exception of one chapter, would be well suited to the Australian student with similar ambitions. The exception is the chapter on regulations, since the UK regulations differ considerably from ours. (For which we should be duly thankful!)

The book is divided into 10 sections, as follows: (1) Licensing Conditions, (2) Transmitter Interference, (3) Elementary Electricity and Magnetism, (4) Elementary Alternating Current Theory, (5) Thermionic Valves and Semiconductors, (6) Radio Receivers, (7) Low Power Transmitters, (8) Propagation, (9) Aerials, (10) Measurements.

Quite apart from the content of each section, the general approach and format is to be particularly commended. The committee has taken a series of questions on each subject, from previous examination papers, and drafted concise (but also usefully instructional) answers to them, at the level they consider the examiner requires.

Thus the book presents the reader with the type of questions he is likely to encounter, typical answers which indicate the level required of him, the time and space which should be devoted to any one question, and a means to check the accuracy of his thinking on the subject.

In addition the book may be regarded as a useful textbook in its own right, and loses nothing from the question and answer format. Even where, as in this country, some questions may not be typical of the local examinations, their instructional value remains.

Local instructional committees could well follow this format in compiling material for the Australian examination scene. Highly recommended.

Our review copy came direct from the publishers, 35 Doughty St, London, WC1N 2AE (PGW).

INFORMATION CENTRE

SPEAKER ENCLOSURES: In your recent designs using Nisco loudspeakers, you appear to have specified enclosures larger than those suggested by the manufacturers. Indeed, their enclosure for their 15-inch woofer is smaller than your 3-75L system using a 12-inch woofer. Would the smaller enclosures cramp the bass response?

● When a bass driver is housed in an enclosure, the natural cone resonance is pushed upwards and, with it, the bass roll-off frequency of the system. Having in mind that we are talking in the context of sealed enclosures, the options are: (a) to specify a smaller, therefore more compact, enclosure and sacrifice some bass response or (b) to specify a larger enclosure and gain an extension down around the 40-50Hz region. This was the thinking behind the 3-75L. We would not expect a conventional 15-inch woofer to give its full potential bass response if housed in a 70-odd litre enclosure. Something in the region of 100 to 120 litres would be more appropriate — and more bulky!

VHF AERIAL: Re the 146MHz ground plane aerial in the April 1978 issue. Does the 16 B&S, added for impedance correction, give directional characteristics to the antenna and, if so, to what degree. (B. W., Port Lincoln, SA.)

● None of the tests we conducted indication that the aerial favoured one direction over another. In fact, this is exactly what we would expect since the theory behind the experiment is that of the folded dipole, and its effect on impedance. There has never been any suggestion that the folded dipole exhibits any directivity compared with the simple dipole it replaces.

COMPUTER CLUBS: While reading an advertisement in one of your issues for 1974, I found a reference to an Australian Micro Computer Club, with the suggestion that people write to you for further information. Is the club concerned still in existence? I am in the RAAF and doing a Radio Apprenticeship course which includes digital equipment. A number of us have microcomputer equipment, such as the Signetics 2650, Motorola 6800 and the Mini Scamp. We would like to contact others with similar interests, with the idea of finding out more about connecting peripheral devices. (G. I., Alphington, Vic.)

● The club referred to became the Microcomputer Enthusiasts Group and is still going strongly to the best of our knowledge. However more convenient to you may be the Microcomputer Club of Melbourne. For details regarding both clubs, refer to the list on page 69 of the June issue this year.

MICROCOMPUTERS: I would like to learn something about computers and I was thinking about getting the 2650 system described in your May 1978 issue. However I don't think I will because wherever I look I come up against an impenetrable wall of unintelligible jargon. I have looked in half a dozen books, pamphlets and introductions to various systems, "structured so that the user not familiar with computers can learn to generate code with a minimum of effort . . ." but have found without exception a mass of unintelligible jargon. Is there any book which has a list of codes together with their binary equivalents and an explanation in readable English of what they are supposed to do? If so I would be very grateful if you could let me know. (R. H., Alphington, Vic.)

● We agree that there do not seem to be any easily read up-to-date books on machine language programming, which make no assumptions regarding the background knowledge of the reader. Most people have had to plough their way through many different books and articles, to gain even a modest understanding. And whether it would be a proposition for anyone to write such a book now is perhaps in doubt, as machine language may not be in wide use for much longer. Incidentally, there is no standardised machine instruction code used by all of the various microprocessors; virtually all of them use different codes.

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

SYNC-A-SLIDE (October, 1976, File No. 2/MS/40): The circuit should show a 4.7k resistor from the positive rail to pin 8 of the NE567. Without this resistor the system will activate continuously. The 6.2V zener diode in the parts list should be 7.5V to agree with the circuit.

LOW COST VIDEO DISPLAY UNIT (February 1978, File No 2/CC/23): In the circuit diagram on page 63, R9 and R6 should be interchanged, along with C11 and C8. The parts list and overlay diagram on page 65 are correct. Note also that the polarity of C19 is incorrectly marked on the overlay diagram.

Trigger unit-cont'd.

as it should from switch-on, so there was no need to work through the trouble-shooting section of the manual. However I found it necessary to read through the operating guide chapters carefully, to make sure I was "driving" it correctly.

As with the basic 100A analyser, I tried out the combination on a small microcomputer based on the Signetics 2650. The additional facilities provided by the model 10 quickly became apparent, and there seems no doubt that the 100A/10 combination makes a very powerful instrument for analysing the operation of microprocessor based systems.

Further information on both the model 100A logic analyser and the model 10 trigger expander are available from the Australian agents for Paratronics, Kenelex Australia Pty Ltd. In Victoria the address is 142 Highbury Road, Burwood, 3125, and in NSW it is 14 Valetta Building, Campbell Street, Artarmon 2064.

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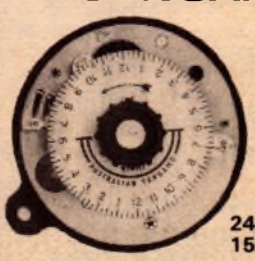

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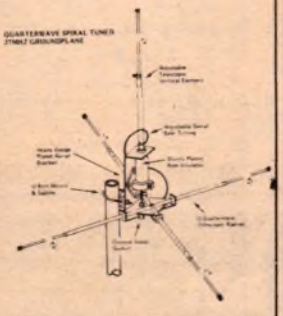

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