HOW TO LISTEN TO DX BROADCASTS

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ALL ABOUT 4-CHANNEL DISCS

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Glass sphere held up by light – story
Sony's TC-440 introduces the unique Roto-Bilateral Head

Here is a remarkable machine with unique advantages. With Sony's revolutionary Roto-Bilateral head matching record and playback characteristics in both directions are obtained. There are fewer bias and record level adjustments, less modulation noise assured by the narrow tape loop span of only 80 mm. Conventional 4-track stereo reverse tape recorders have used a pair each of erase, record and reproduction heads, one for tracks 1 and 3 and the other for tracks 2 and 4. This system, however, has the disadvantage of causing each tape direction to have different recording characteristics. On the TC-440 the total head assembly consists of two erase heads, one for each direction of tape travel, and in the centre, a rotary ROTO-BILATERAL HEAD consisted of separate record and playback heads. This head automatically rotates 180 degrees and reverses the record and playback heads when the tape's travelling direction is switched. A mechanical locking device guarantees perfect alignment of the ROTO-BILATERAL HEAD in either position. Plus auto reverse, auto shut-off, sound on sound, echo and many other professional-standard features. About $499.

SPECIFICATIONS

- **System**: 4-track 2-channel stereo/mono recording and playback
- **Power requirements**: AC 100, 110, 120, 127, 220 or 240V (selectable with voltage selector) 50/60Hz (no need to change)
- **Power consumption**: AC 45W
- **Tape speeds**: 71/2, 31/2 and 11/4ips (19.95 and 4.8cm/s)
- **Reel capacity**: 7" (178mm) or smaller
- **Frequency response**:
  - **NORMAL**:
    - at 71/2ips: 20 - 25,000Hz
    - at 31/2ips: 30 - 20,000Hz ±3dB
    - at 11/4ips: 20 - 17,000Hz
    - at 9,000Hz
  - **SPECIAL**:
    - at 71/2ips: 20 - 30,000Hz
    - at 31/2ips: 30 - 25,000Hz ±3dB
    - at 11/4ips: 20 - 23,000Hz
- **Signal-to-noise ratio**: Better than 53dB (NORMAL)
  - Better than 56dB (SPECIAL)
- **Flutter and wow**: Less than 0.06% at 71/4ips
  - Less than 0.1% at 333/4ips
  - Less than 0.2% at 11/4ips
- **Harmonic distortion**: Less than 1% at normal recording level
- **Level indicator**: Separate level meters
- **Recording time**:
  - on 1,800ft tape:
    - Stereo: 6 hours at 11/4ips
    - Mono: 12 hours at 11/4ips
- **Fast forward and rewind time**:
  - 2 min. 50 sec.

For further information please fill in the Reader Information Service coupon in this issue
USEFUL FOR COLOUR TV. The sync and pattern generator described in the article beginning page 32 can also be used for testing and adjusting colour TV convergence.

QUADRAPHONIC SOUND. Four-channel discs are now available on the Australian market. If you feel tempted to go out looking for the hardware which will play these new discs, read the article beginning on page 24 before committing yourself.

INTERESTED IN DX? In this issue we provide the information you need to have to get started in the hobby of DX listening (page 44). A directory of DX receivers is also provided (page 48).

On the cover
Scientists at the Bell Laboratories in the USA have succeeded in supporting a small sphere of glass by a beam of light from a laser. The cover picture shows Dr Arthur Ashkin, one of the Bell scientists who conducted the experiment, adjusting the equipment. See also the story "Laser Light Lifts Glass" on page 31.
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ELECTRONICS Australia, May, 1972
Computers: some rethinking needed

Computer engineers, business automation experts, system analysts and various other people in the EDP industry frequently make the plea that computers are unjustly blamed for errors, misunderstood, and generally unloved by an unappreciative public. No doubt there is a lot of truth in these claims. But it is also true that much of the blame for the somewhat tarnished image of the computer in the eyes of the public can be laid squarely back at the doorstep of its professional guardians and entrepreneurs.

It is easy enough to point out that the average citizen is painfully ignorant of computer system operation. But who is better fitted for the task of educating the public about computers than the computer experts? It is easy enough to show that the vast majority of errors for which the public blame "the computer" are really due to familiar human failings. But whose job is it to analyse the tasks to be done by a computer, plan the systems and write the programs which are intended to perform the tasks properly? Not that of the general public.

It is easy enough to pontificate about the number of firms which have installed computers they did not really need, or have made inadequate use of their computers, or have unhappily replaced effective but slow business systems with fast but badly-designed EDP systems. Who sold the computers to the firms, supposedly advised them regarding their application, and drew fat salaries while planning their wondrous new system?

"Sorry, we can't do that any more; our accounting / payroll / invoicing system has been computerised." How many times have we all heard this statement, or one like it? Even if in some instances it is used to hide the real reason for providing less service, it suggests that in far too many cases the requirements of a system have been watered down to match the inadequacies of its designers. Let's face it, the initial phase in the incorporation of computers into our society has not been a shining success. And the unpalatable fact of the matter is that it is the computer experts who are largely responsible for this situation, not the so-called ignorant masses. The time is more than ripe for those in the computer industry to justify their much-vaulted professional status by taking a long, cold look at their track record to date.

Surely the aim is to design computer systems which perform tasks useful to society, not to bluff society into changing its goals to suit computers.

— Jamieson Rowe
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Compliance: 35 x 10^-4 cms/dyne
Elliptical Stylus Tip: Contact radius: .0003"; lateral radius: .0007";
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ELECTRONICS Australia, May, 1972
All the systems below are available in kit form. The cabinet kits come in either unpolished Queensland Maple veneer or unpolished teak veneer. All kits are complete, and include speakers, crossover networks (where applicable), cabinet kits, grille cloth and innerbond.

NEW MAGNAVOX 8-30 SYSTEM

Featured in "E.A." Jan. 1971. It handles 30 watts RMS, features a NEW HIGH PERFORMANCE 8" SPEAKER, TWO 3" TWEETERS, AND IS AVAILABLE IN CABINET 20-7/8" x 12-7/8" x 8-7/8" (1 cu. ft.) or 23-7/8" x 15-1/2" x 10-7/8" (1.6 cu. ft.). Available in teak or maple veneer.

COMPLETE SYSTEM
Kit of Parts $46.00 (1 cu ft), $58.00 (1.6 cu ft)
Built and Tested $60.00 (1 cu ft), $76.00 (1.6 cu ft)

SEPARATE COMPONENTS
Enclosure kit (1 cu ft) $19.00 (maple), $19.50 (teak)
Enclosure kit (1.6 cu ft) $31.50 (maple), $33.00 (teak)
Built Enclosure (1 cu ft) $32.00 (walnut), $33.50 (teak)
Built Enclosure (1.6 cu ft) $48.00 (walnut), $51.00 (teak)

WHARFEDALE SPEAKER SYSTEM KITS

The Wharfedale Super Linton, Melton and Dovedale 111 are now available as build-yourself kits, featuring INSTROL quality cabinet kits in choice of maple or teak veneer.

The Super Linton kit employs an 8" and 3" speaker, frequency response 40-17,000Hz, cabinet 21" x 11-1/4" x 9-3/4", 15 watts RMS. The Melton kit employs a 12" bass and a tweeter, cabinet 22-1/4" x 13" x 10", 25 watts RMS.

The Dovedale III kit employs a 12" bass, 5" mid-range and 1" tweeter, cabinet 26-1/4" x 15-1/2" x 10" - 35 watts RMS.

COMPLETE SYSTEM
Super Linton kit (Unit 3) $49.00
Melton kit (Unit 4) $93.00
Dovedale 111 kit (Unit 5) $127.00

SEPARATE COMPONENTS
Unit 3 enclosure kit $17.00 (maple), $19.00 (teak)
Unit 4 enclosure kit $25.50 (maple), $27.00 (teak)
Unit 5 enclosure kit $24.00 (maple), $35.00 (teak)

KEF SPEAKER SYSTEMS

CONCERTO -- The KEF Concerto contains B139 bass unit, B110 midrange and T27 tweeter in teak cabinet 29" x 17" x 12". Frequency range 30-30,000Hz. Power handling capacity 25 watts.

CONCORD -- The KEF Concord contains B139 bass unit and T15 tweeter in attractive teak cabinet. Frequency range 30-20,000 Hz. Power handling capacity 25 watts.


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ELECTRONICS Australia, May, 1972
The old adage about "the blind leading the blind" acquires new meaning in this story. It concerns a Canadian electronics engineer, blind himself since early childhood, who has designed and developed numerous aids for blind persons to assist them in daily life and work.

It's been 25 years since James Swail — just graduated from McGill University's Faculty of Science — joined the National Research Council of Canada. His objective: to make a personal contribution in the struggle of blind people to achieve an independent way of life in a sighted world.

In the two decades since Jim Swail went to work with the Instrument Section of NRC's Radio and Electrical Engineering Division, he has produced close to 100 instruments and devices for increasing the mobility and job skills of the sightless.

In the process he has gone a long way to demonstrate, by personal example, how to live and work creatively despite such a handicap. For Jim Swail has been blind since the age of four. His university days were hard ones. He took his notes in Braille and relied on fellow students to read to him.

The tape recorder and many other electronic devices now in use by the blind were non-existent in the early 1940s.

During his first five years with NRC Mr. Swail developed special electronic equipment to help him conduct his own research. There followed a steady and continuing stream of mechanical and electronic devices. Some, like the Braille thermometer for a blind man to measure the melting point of type metal in a print shop, and special meters which enabled a blind radio announcer to be licensed to monitor all the functions of a broadcast station, were designed to help one specific person surmount one specific obstacle. Others have wider application. The most recent is an ultrasonic obstacle detector for the blind.

The ultrasonic detector is Jim Swail's approach to the blind man's problem of how to navigate in restricted areas without the traditional long white cane or the seeing eye dog. There are certain situations where both the cane and the dog become, in Jim's words, "socially unacceptable." Indoors, in a crowded house party setting, for example, the cane tends to trip people and becomes a bit of a nuisance to have around. The same applies to the dog. A similar situation occurs when a blind man navigates between rows of tables in a restaurant. He lives with the fear that his cane, in searching out obstacles, will inadvertently slide under one of the tables and touch another person — to everyone's intense embarrassment.

For such situations, but more generally when a blind person is not called upon to move quickly nor perform actions calling for much care and attention, (i.e. scanning the office or corridor for newly-placed or disarranged articles such as chairs, tables, wastebaskets, etc.), the handheld ultrasonic detector is expected to prove highly useful.

The device, essentially, is a simple radar unit using inexpensive transducers similar to those used in the television industry for remote control of television channel switching. It is packaged in a pocket-sized plastic carrying case with integral handle.

Power for the unit is derived from built-in rechargeable batteries. The device generates 40kHz or 70kHz, transmitted as two-millisecond pulses in a narrow beam at a pulse repetition rate of 10 per second. The receiver unit is turned on immediately after the termination of the pulse. A range switch mounted on the handle selects the length of time the receiver remains on after each pulse.

The ranges have been set at 4ft, 7ft and 15ft and the receiver unit will respond to targets within the selected range. If a reflected pulse is received within the above chosen ranges, a monostable circuit is fired. This in turn drives a solenoid-operated tactile stimulator, a rod which vibrates through a hole in the unit's handle and against the forefinger of the operator. The distance to a target can be estimated by altering the range control until the indication ceases. Target direction is determined by scanning.

The prototype device was field tested for signal interference levels at an Ottawa construction site. It was found that the ultrasonic energy generated by construction equipment such as air-brakes had no jamming effect on the unit's signal.

"We gave it a pretty stiff test, and it performed beautifully, so we are confident it can operate anywhere safely," Mr. Swail says.

The device has its limitations. The beam width (eight degrees) and the pulse rate of 10 per second means that scanning cannot proceed as swiftly as would be desired. Too fast a scan and the object is missed. Certain objects such as corners around doors give disproportionately high ultrasonic reflection, confusing the operator as to target locations. Consequently Mr. Swail

Reprinted from "Science Dimension" of Ottawa, Canada.

A blind programmer can quickly scan a punched card with his special reader.

This machinist's level emits a high-pitched tone unless it is exactly level.

12 ELECTRONICS Australia, May, 1972
the Blind

expects operators will have to undergo a short period of training if a high degree of effectiveness is desired.

Other Swail-engineered instruments include:
- A photoelectric sensor for detecting light sources. One pencil-sized version allows blind personnel to operate telephone switchboards. When a line comes into use a light goes on and the operator can locate the line by scanning with the sensor. Another use includes detecting the presence of print on a page.
- A manually operated reader for IBM punched cards to assist blind persons working as computer operators and in related fields. A carriage is moved across the card and pins are raised when a hole is encountered. Brailled markings indicate the location of the hole.
- Various electronic thermometers equipped with tactile and auditory readouts are used by blind technicians working in commercial photographic darkrooms.
- Several instruments designed to assist the Canadian National Institute for the Blind in its vocational training program.
- The Swail Dot Inverter for production of Braille drawings by hand. In producing a Braille drawing, a pointed instrument is used to produce characters by punching holes through paper. The raised dots forming the characters come out on the underside of the paper meaning that Braille must be produced in reverse. The Swail inverter raises the dots on the upper side, eliminating the reversal process.
- An auditory beacon which emits a beep every 10 seconds, enabling a blind person to place it next to an object he wishes to leave and then later locate.
- A four-section collapsible white cane for the blind. Rigid in use, four feet in length, it can be carried in a blind person's pocket.

A light detector enables the blind operator to locate a flashing light indicating an incoming telephone call.

This tiny electronic "bleeper" makes it easier for the blind to leave and later relocate needed items.

James Swail (right) demonstrates his ultrasonic obstacle detector in an office corridor. A close-up of the detector is shown at the left.
Home Video Replay & Colour TV: Rendezvous by March 1975?

At present most of the colour TV planning by the Australian consumer electronics industry is directed towards the commencement of broadcasting in March, 1975. However it is entirely possible that by this time another important dimension may be added to the colour TV picture: the concept of low cost home video playback.

Not long ago on the French Riviera, more than a thousand hard-headed businessmen from countries all over the world were chasing a dream. The dream that Americans, Britons, Japanese, Dutchmen, Germans, Frenchmen and others were pursuing in Cannes was a very tantalising one for the modern consumer electronics industry: home video players and recorders.

Already introduced in industrial, educational and other institutional markets, video recordings - in the form of cartridges, cassettes and discs - have long been on the horizon as a home entertainment medium but have not quite made it yet.

However those attending the Second International Conference on Video Cassettes, called VIDCA, learned that the long-promised "revolution" of personal television geared to individual tastes may soon be here, according to video trade analyst Leonard Sloane.

"And somewhere between the blue-sky pontificating of the over-optimistic and the wailing of the prophets of gloom lie the realities of the enormous impact that home video recordings could make in the future to those within the electronics and entertainment industries and without," "The New York Times" expert predicts.

The names of those companies involved in this market range from giants on the "Fortune" 500 list to smaller concerns that are both publicly and non-publicly owned. Their total investments are well in the range of hundreds of millions of dollars and a few of them have been working in this field for more than 10 years.

As with so many other technological innovations, there have been three major bottlenecks to progress for home video recording systems — engineering, economics and compatibility. The first has apparently been cleared by at least some of the hardware and software manufacturers, and the second is within reach in the years immediately ahead. But as yet the third is nowhere in sight.

The potential, however, is vast enough to spur on those who might have been otherwise discouraged by the relatively slow progress so far and the frequent failures to meet target dates for reaching the public.

Arthur D. Little, Inc, estimates that the consumer market could reach $200 million within a year, while others envision the worldwide volume for hardware and software each at the level of around $2,000 million by 1980.

Daniel Denham, a division vice-president of the 3M company, says that sales of home video recording machines and equipment have "as high a potential as colour TV."

Last year, 6.1 million colour television sets were sold with a retail value of more than $3,000 million.

Denham's company, of course, has a vested interest in this fledgling market, as do such well-known names as the RCA Corp, Columbia Broadcasting System, Sears Roebuck and Co, Inc, Eastman Kodak Co, Ei Du Pont de Nemours and Co, Columbia Pictures Industries, Inc, and Motorola Systems, Inc. Then there are also Cartridge Television, Inc and the Ampex Corp, and, from abroad, AEG, Telefunken, British Decca, and NV Philips — not to mention Japanese companies like Sony, Matsushita, Toshiba, Hitachi and Shibaden.

Despite all of these names, not a single
video recording unit has been sold yet for the home — unless someone bought an expensive commercial device as a plaything or an executive of a corporation in the industry purchased one wholesale. So the market is starting from scratch and can go nowhere but up.

"The colour video cassette recorder is a new consumer concept that has yet to prove its viability as a consumer product," according to Gerald Citron, manager of the consumer electronics department of the North American Philips Corp.

"In order to become a mass market item, the device will have to retail for no more than $500 to $600 dollars and ideally should retail for between $250 and $400 dollars. Right now, though, there is no device in that moderate price range to whet the appetite of American consumers. As far as the manufacturers are concerned, notes one security analyst who follows the field closely, "it's still a big poker game - with everyone sitting there waiting for something to happen."

There are basically four different technologies presently striving for acceptance in home video recordings. These are magnetic tape, photographic film, discs and holographic tape. Photographic film is further subdivided into normal film taken using a camera, and "EVR" film made using an electron-beam recording system.

Just as manufacturers once battled for dominance in determining the speed of long-playing records and later the system for colour television, producers of hardware are firing their marketing and promotional guns full blast in an effort to win this billion-

A cassette for the Sony "U-Matic" colour videotape system, recently announced.
dollar war. Until one of these systems forgins into the lead, suppliers of software and programming are generally hedging their bets and remaining neutral.

Dr Peter Goldmark, a pioneer in video recordings at CBS and now establishing an organisation at Warner Communications, Inc, says that "asking who can win this battle is like asking who won the San Francisco earthquake."

As far as Australia is concerned, the battle may well be decided before colour TV broadcasting begins in 1975. Apart from creating a new market for home video playback equipment and programs, the development may also provide a worthwhile impetus to the colour TV receiver market. Most of the systems under development are designed to feed into normal receivers, and most are orientated towards colour playback. It is likely that few users will be content to play back their colour cassettes through their existing monochrome receivers.

(Adapted from "Australian Financial Review", by permission.)
Garrard proudly presents the incomparable Zero 100 ... a dramatic new concept in automatic turntables ... a classic in record playing perfection.

The Zero 100 features a unique new pick up arm design that virtually eliminates tracking error; provides manual control or automatic play of up to six records, two speeds (33-1/3 and 45 rpm), freedom from distortion and new life for your records.

Among the twelve new major advances included, are magnetic bias compensation, viscous damped cueing device, variable speed (± 3%) patented Synchro-Lab motor, illuminated stroboscope and magnetic anti-skating control.

This then is part of the Zero 100 story. But while the appearance of a product does not improve performance, it is indicative of the craftsmanship and quality that went into it. The Zero 100, utilising materials such as acrylics, brass, satin finish aluminium, all set off on a sparkling white base plate, is the very personification of quality.

Garrard has pioneered and introduced virtually every significant new feature in record playing units for over 50 years ... this is the cue for '72.

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*International Award (1971) "Maker of the Microphone" (U.S.A.) European Award (1971) "Mercurio d'Oro" (Italy)
LOCAL SEMICONDUCTOR BREAKTHROUGH:

Fairchild scores a win in battle of the big chips

Locally made silicon power transistors like the popular "workhorse" 2N3055 are now available in commercial quantities, as a result of new development at Fairchild's plant in Croydon, Victoria.

by JAMIESON ROWE

Despite its ubiquity in solid state hi-fi amplifiers, power supplies and switching circuits, the silicon bipolar power transistor is not easy to make on a full-scale commercial basis. Like other semiconductor manufacturers, Fairchild Australia has had its share of troubles in producing these devices. But unlike others the company has now announced that they have finally mastered the technology of "big chips", a development which has enabled them to produce the first commercial quantities of locally-made power devices.

Progress has not been easy. As Manufacturing Manager Bernie O'Shannessy says with some feeling, "The so-called 'humble workhorse' 2N3055 may be easy enough to make on a one-off basis in the lab, but to make this type of device in commercial quantities is damned hard. It's taken us just on four years of trials and tribulations in order to iron out the problems, but it's finally paid off."

Some of the problems which had to be solved centred around design of the actual device chip or die. At first Fairchild tried using a scaled-up version of their highly successful small signal planar construction, developed by physicist Jean Hoerni in 1960 at the Mountain View plant. However the planar approach produced a relatively expensive power device, and one whose characteristics were not entirely suitable for many applications. Then they tried a multiple emitter construction, like that used for RF power devices, with resistive nichrome emitter bonding wires to ensure current sharing. The story was still much the same.

A significant step forward came with the change to their "bi-mesar" chip. This is Fairchild's version of the epitaxial collector-epitaxial base power construction. With grown base and collector regions, the bi-mesar chip can be designed for very predictable high current and high voltage performance. And because it involves only one critical masked diffusion process, it lowers the cost of producing devices on the basic silicon wafer. Fewer production steps and higher yields help to at least partly compensate for the reduced number of big chips per wafer, and the relatively high cost of power packages.

But finding the right type of big chip was only part of the story. Putting the chip into its package to produce a reliable high performance end product is not nearly as easy as it might seem. The main problem is to achieve a proper bond between the die itself and the package header. The bond must be secure mechanically, while not subjecting the die to stress. It must also present a low thermal impedance, yet at the same time have just the right thermal expansion characteristics.

After much investigation Fairchild finally adopted a special reflow solder bonding technique which uses a four-zone hydrogen furnace. The composition of the solder is part of the secret, another being the temperature profile of the furnace.

Using these techniques the Croydon plant has been producing commercial quantities of power products for some months, and a thorough testing program has shown that they are consistently meeting all specs.

The fourteen power products currently being made include TO-3 devices such as the popular 2N3055, TO-66 types such as the 2N3054, and smaller TO-5 devices. Both NPN and PNP types are being made, and Fairchild say their technology makes it equally easy to produce either polarity.

Being able to produce silicon power products of this type in Australia on a full-scale commercial basis is a big achievement, and Fairchild is justifiably proud. Of course, having demonstrated the capability of local technology, they can now expect tariff protection. But Marketing Manager Trevor Andrews stresses that this was not their goal: "It would be quite wrong to think that we undertook this development simply in order to obtain tariff protection. It was a purely commercial enterprise. We believe that the market in Australia for silicon power devices, will justify our investment in developing the technology."
How we got live pictures from Peking

Those live TV pictures we watched of President Nixon's China visit should be forgiven for looking a bit tired at times. They had travelled from a mobile earth station in Peking to a satellite 22,300 miles above the Pacific, then down to an earth station in California where they were retransmitted back to the same satellite for relay to Australia. From OTC's earth station at Moree they were distributed to local TV stations by cable and microwave, then transmitted to your television sets.

Considering the length of the journey and the number of relay stations the signals went through, the pictures appeared in fairly good condition.

An indication of the dependability of modern electronic equipment is the fact that a month before the visit, neither the Peking earth station nor the satellite which relayed the pictures had been put in place.

The earth station used in Peking was a mobile system built by the Hughes Aircraft Company for Western Union International. The 50,000 pound station was flown to the People's Republic of China aboard a Super Hercules commercial cargo aircraft which arrived in Peking February 2, just three weeks before the Presidential party. The mobile station, which consists of two 14ft trailers full of electronics and a 24ft diameter dish antenna, was set up in 48 hours and began testing with the new Intelsat IV satellite. The satellite had been launched on January 31.

In addition to its television capacity of one colour channel and nine voice commentaries, the station has 60 two-way telephone channels for other voice, telephoto and teletype reports. The $1.2 million station operated 24 hours a day during Mr. Nixon's stay in China.

The first version of the ground station was developed by Hughes in 1968 and air-shipped to Bogota, Colombia, to transmit color-TV coverage of Pope Paul's visit. Later the same year it was air-lifted to a coastal site near San Jose, California, from where it relayed TV pictures of the Mexico City Olympics to the Far East. Last October the same roving quickie-TV station used in Peking was based in Iran to serve as a WUI communications link during the Shah's celebrations of the 2,500th anniversary of the founding of the Persian Empire.

After its launch at the end of January, Intelsat IV was tested by OTC's Carnarvon tracking station and a similar station in Paumalu, Hawaii. Partly owned by OTC through their membership in Intelsat, the new satellite was the key to getting the Peking pictures live in Australia because the satellite formerly used, Intelsat III, had only one television channel. Intelsat IV can handle up to 12 TV channels simultaneously.

If Intelsat IV had not been in orbit, the single TV channel on Intelsat III would have been insufficient.

QUICKIE TV STATION. Engineers at Hughes Aircraft Co in California examine the mobile earth station their company built for Western Union International. The station was on the air with one colour TV channel and 60 voice channels only 48 hours after its arrival at Peking airport.
been used for the China-US link and a direct rebroadcast to Australia would not have been possible.

One of the pre-visit agreements made between the Chinese and the Americans was that all communications must go directly to the United States. Otherwise Australian TV viewers could have seen their live pictures directly from China via the satellite.

The colour picture of Mrs Nixon which appeared on the cover of the March 13 issue of the magazine "Woman's Day" had an even longer route to travel. It was transmitted in three colour separations from Peking to California, then by land-line to New York where it went into the United Press International picturegramming service which links New York with London, Sydney and Hong Kong. Each colour separation took 15 minutes to arrive on the picturegram machine.

It was the first time a colour picture had been transmitted from China.

Better communication links with China in future are highly probable, as the Chinese have built in Shanghai prior to the American President's visit. The Peking installation, however, has been dismantled and returned to the United States.

Intelsat IV will be used for routine TV and message communications between Australia and the US, Japan, New Zealand and Hong Kong through OTC's earth stations at Moree and Carnarvon.

New diamond heat sinks developed

De Beers' diamond research laboratory in Johannesburg has developed a new method of making diamond heat sinks for microminiature devices. In the new process, high thermal conductivity diamonds from 1 to 2.5mm are rounded in bulk and then slowly graded for size. Previously, diamond heat sinks have been made by slicing stones into slabs, polishing them, then slicing them into squares.

With the new method several hundred diamonds can be processed at the same time prior to metallising and bonding as shown in the illustration. In the next step the diamonds are either hot-pressed into copper or the blocks are drilled to accommodate the diamonds.

The assembly has such high heat dissipation and electrical insulation that several devices can be mounted on a single heat sink. De Beers' new technique shows particular promise for use with IMPATT diodes, not only because of high heat dissipation but because accurate size grading of the diamonds is essential when heat sinks are used in microwave cavities.

Facsimile system transmits on voice line

A facsimile system that reduces the cost of transmitting newspaper and magazine pages to distant printing plants by as much as 90 per cent has been introduced by Litton Industries.

By compressing words and pictures on a printed page into digital pulse groups, the new system allows high-speed transmission of reproduction quality facsimile over low-cost telephone lines.

This new application of digital technology will permit publishers to send facsimiles over privately leased lines at a cost that is much cheaper than similar systems now available. Currently, full-page newspaper and magazine facsimiles are transmitted over expensive wide-band communication channels in order to produce facsimile copies of a quality suitable for use in the printing process.

In conventional facsimile, a newspaper page is scanned, just as a person reads it — left to right, top to bottom. The facsimile scanner picks up individually and sequentially as many as 135 million black print and white space elements for transmission and reproduction at the receiver. This method requires a transmission frequency band of 48kHz, as wide as that needed to carry a block of a dozen voice channels.

Litton's technique, called Data Redundancy Reduction (DRR), transmits digital pulse 'instructions' to the receiving machine for recording the black print and white space elements in proper sequence along the line being printed. A group of as few as seven pulses carries the instruction for more than 100 consecutive black or white space elements, reducing the bandwidth to approximately 3kHz.

Key to the development is a proprietary method for closely matching the transmission speed of the facsimile machine drum which holds the printed page with the highly variable rate at which black and white elements are picked off and coded for transmission. Smoothing this difference in rate makes possible the use of low cost narrow band transmission lines.

Axle load indicator invented in New Zealand

A New Zealand inventor has developed an electronic axle load indication system which shows loading of any number of axles by an indicator in the cab of heavy transport vehicles. A sealed sensing device with no moving parts is mounted on each axle to be monitored; a selector switch within easy reach of the driver permits him to read loading on any axle individually.

The system, known as ALIS (axle load indication system), is now commercially available. For more information write ALIS, PO Box 40.172, Upper Hutt, NZ.
Introducing the little counter that can.

It can become four different systems.
It can go anywhere you do.
It can protect you against obsolescence.
It can make buying and maintaining a counter less expensive than ever before.
Meet the Hewlett-Packard 5300, the snap-together counter that's not much bigger than the palm of your hand. It has six digit accuracy, solid state display and autoranging. It'll make period, frequency, time interval and ratio measurements, operate on its optional snap-on battery pack and drive a printer. Rugged dust-proof aluminium case resists almost any bumps it might get in the field.
Start with the basic mainframe

Then snap on any of the following modules (more on the way) to make just the counter you need, and avoid obsolescence, too:
- 10 MHz frequency module. Model 5301A.
- 50 MHz all-purpose module includes period, time interval. Model 5302A.
- 500 MHz module with both 50Ω and 1 MΩ inputs. Model 5303A.
- 100 ns time interval module with: unique "time holdoff" feature, dc coupling, slope and trigger level controls, and period and frequency measurements to 10 MHz. Model 5304A. All the functions you'd pay at least $1800 for in a universal counter. Battery pack. Works with any of the above for up to 8 hours of cord-free operation. Model 5310A.
The 5300 is one system you have to use to appreciate. If you've ever needed to accurately measure frequency or time interval, you owe it to yourself to call your nearby HP field engineer for further information.
Or write Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.
Telephone: 20 1371.
Lasers make clean-cut hybrid circuits

Three new laser production tools have recently been put on the production line at Motorola Inc. They are being used to trim thick and thin film resistors, active filters and networks in hybrid circuits.

The lasers are computer controlled, with the computer monitoring component values until design parameters are reached, then automatically cycling the laser to the next trim location in the hybrid circuit.

According to Motorola, laser trimming has increased production speed, improved control of resistance changes and resistor size due to the narrow laser beam cut, and improved reliability and stability of hybrids because no abrasives are used to cut the resistor films.

PIP — 60 MINUTES OF TRAINING ON 50 FEET OF FILM. Philips Industries new "programmed individual presentation” (PIP) training system has sound and visual elements of a program contained in separate compact cassettes. The visual component, in a new Super-8mm cassette, lasts as long as the 60 min sound cassette because many pictures are in slow motion and the film is stopped for single frame presentations. Inaudible electronic pulses on the audio cassette tape control the variable-speed projector. PIP is shown in action below.

Preparing for 1984

The new town of Milton Keynes in England is being wired for the sound and video services of the future by the British Post Office. A twin cable system is being brought into each house. One cable is a standard telephone pair; the other is a high performance coaxial cable capable of relaying computer data, meter reading signals and video signals in both directions.

A central relay system will receive TV and radio signals from an aerial. After amplifying, cleaning up and frequency conversion, the signals are reassembled for transmission into the main cable network. Translators fitted in local street cabinets restore the 625-line TV signals for UHF channels and 405-line TV and radio signals for the VHF band. The outputs of these translators, in the frequency range of 50 to 700MHz, are delivered to each home by the twin cable network.

The return path transmissions will use a frequency band from 0 to 80MHz. "Upstream" amplifiers and bypass circuits are used in the main cable network to bring return transmissions to the telephone exchanges, which will contain equipment to receive, redirect and process the signals.

Viewphones can be connected into the system as they become available, and presumably, some form of video monitoring system could also be easily connected.
The level makes a difference.
We recommend 'high-level' recording with our GX machines. There's no high frequency deterioration.

The perfect method to record modern sounds
If you record modern music you may have found that the results often leave something to be desired. Modern music contains a lot more high frequency sound than classical music, and extreme highs deteriorate in high level conventional recording even on low noise tape. So you're forced to compromise: to record at around -10dB and sacrifice your S/N ratio as the lesser of two evils. Our recording system does away with this dilemma. GX machines exhibit 50–20,000Hz response even when the VU indication is around zero. That's the main reason for GX recording's far better signal-to-noise ratio, more dynamic range and wider frequency response.

The difference: new head materials and focused bias field
Our exclusive GX head contains a single crystal ferrite core set in glass. It has greatly improved precision and magnetic conversion efficiency: an ideally focused bias field that minimizes high-frequency loss, eliminates undue equalization and achieves wider dynamic range.

Recording equalizer characteristics

Long-lasting performance
Dust and magnetic particles cannot adhere to the surface of the GX head. You need never worry about recording failure from collected dust. And the head is free from wear. Showroom sound performance is maintained longer than any other head in present existence. A semi-permanent hi-fi recording with surprisingly low noise, low distortion and very wide dynamic range and frequency response.

GX-280D stereo tape deck
One of the most sophisticated models in the GX family. The 3-head, 3-motor deck features a servo-control capstan motor for negligible wow/flutter, 30–24,000Hz (±3dB) response at 7-1/2 ips (30–19,000Hz ±3dB at 3-3/4 ips), switch-over equalizers for standard and low-noise tape, automatic reverse and sound-on-sound functions. There's much more. GX machines are setting higher standards for audiophiles.
Pioneer 10 on trajectory to Jupiter and beyond

With completion of the first midcourse correction, NASA's Pioneer 10 spacecraft is on a trajectory planned to bring it to about 87,000 miles from Jupiter's cloud tops and to arrive over the planet's surface at a point 14° below the equator on December 3, 1973.

The arrival point will allow several looks at Jupiter's Great Red Spot, as the planet rotates once every ten hours, and at various parts of Jupiter's blue and orange belts and zones.

Jupiter is a spectacular planet and is so massive that it is almost a small star. It may have the necessary ingredients to produce life. Its volume is 1,000 times that of Earth, and it has more than twice the mass of all the other planets combined. Striped in glowing yellow-orange and blue-gray, it floats in space like a bright-colored rubber ball.

It broadcasts predictably modulated radio signals of enormous power. Though it has only 1/1000th the mass of the Sun, it may have Sun-like internal processes, apparently radiating about four times as much energy as it receives from solar radiation.

Pioneer 10 is the first spacecraft to be placed on a trajectory to escape from a solar system into interstellar space. It will be the first craft to fly beyond Mars, first to enter the Asteroid Belt and first to fly to Jupiter. If the spacecraft continues to function well, it may be the first to sense the interstellar gas beyond the Sun's atmosphere.

Jupiter is so far away that radio messages moving at the speed of light will take 45 minutes to reach the spacecraft there, with a round trip time of 90 minutes. Its absolute communications limit will be near the orbit of Uranus at about 1.8 billion miles from the Sun. It will reach this point in 7.5 years.

To carry out the mission, the advanced communications technology of NASA's Deep Space Network (DSN) will be strained to the limit. The DSN's 64-meter (210-foot) "big dish" antennas, one of which now hears the Mariner 9 spacecraft in Mars orbit, will have to hear seven times as far as Pioneer approaches Jupiter.

Pioneer's eight-watt signal, transmitted from Jupiter, will reach DSN antennas with a power of 1/100,000,000,000,000 watt. Collected for 19 million years, this energy would light a 7.5-watt Christmas tree bulb for only one-thousandth of a second.

Tidbinbilla Deep Space Communications Complex is providing prime Australian support for the mission. Tidbinbilla's 26-metre (85-foot) antenna is now tracking the spacecraft 12 hours a day, 7 days a week. There will be two breaks of about a month each when Tidbinbilla will assist the Prime Apollo station at Honeysuckle Creek in support of the Apollo 16 and 17 manned missions to the moon.

During these periods the Island Lagoon tracking station near Woomera, SA, will support the Pioneer 10 mission. Island Lagoon is currently supporting the Mariner Mars mission.

It is expected that by mid-1973 the new 64-metre (210-foot) antenna at Tidbinbilla will be in operation and can support Pioneer 10 on the latter half of its flight, as it will then be out of range of the 26m antenna. The smaller antenna can then be used to track Pioneer 11, due to be launched toward Jupiter in March-April 1973.

New phone system tested

Field trials are being carried out in Australia by the Overseas Telecommunications Commission (OTC) of a new signalling (dialling) system designed for future international telephone services.

The new system, called CCITT No. 6, has electronic exchanges controlled by a computer rather than the electro mechanical cross-bar exchanges now in use.

All dialling codes, system service and operational information will be on a special high speed data circuit. The present system makes use of the actual voice circuits for dialling before and after a telephone call. By reserving a special circuit for dialling, all of the available voice circuits could be used to their maximum capacity.

Business briefs...

CONTROL DATA will computerise the TAB in New Zealand. Under the new system, to be initially installed in Auckland, Christchurch and Wellington, both cash and telephone betting will be handled by electronic machines automatically transmitting each bet to a central computer.

AWA recently announced that the Italian Carabinieri (police force) is now its largest customer for VHF/FM test equipment. AWA is presently engaged in a marketing drive in Europe and has appointed Marconi Instruments Ltd as UK distributor for a range of test sets for communications and broadcasting equipment.

PLESSEY has sold an additional 75 ground-to-air transmitters and receivers (T39 / R39 types) to the Department of Civil Aviation. Frequency range is 180MHz to 1360MHz. All circuitry is solid state and includes discrete silicon transistors, high frequency ICs and dual gate MOSFETS.

FERRANTI has received an order from the Australian Department of Supply for two sets of Projectile Velocity Measuring Equipment, a type of doppler radar speed meter. The equipment measures velocity with an accuracy of 1 part in 10,000.

EXPORTERS EXHIBIT AT IEEE SHOW IN NEW YORK. Electrical and electronic exports have doubled in the past three years. Australian companies exhibiting in the IEEE (Institute of Electrical and Electronics Engineers) show in March to help boost export sales were Adcola Products, DC Industries and Plessey Rola from Victoria; Hawke Siddeley Electronics and Plessey Electrical of NSW; and ODL from South Australia.
Magazine articles, the announcement of demonstrations of interest in four-channel tape around the market until mono discs became the poor relations. But technology seldom stands still. During the past decade, while the vast majority of enthusiasts were listening happily to their two-channel stereo systems, a few producers, engineers and manufacturers have been dreaming about additional channels which would allow them to introduce sound sources behind the listening position, as well as in front of it. Why do this?

To the manufacturer quadraphonic sound represented a technical challenge.

To the producer of musical spectacles, it offered the chance of "surround stereo", a listening position, as well as in front of it.

To the purist musician, it offered the chance of "stereo-Four", placing the listener right inside a circle of performers.

To the manufacturer, it held the promise of a whole new market activity, involving more equipment, more amplifiers, more loudspeakers.

It was assumed initially that four-channel sound would have to be recorded and reproduced from tape. Thus the initial engineering effort was aimed at evolving suitable multiple heads and adapting existing stereo tape equipment to record and play four parallel tracks.

And since the tracks could be entirely separate, each as important and distinct as the other, such a concept was commonly described as "discrete" four-channel sound.

As far back as 1961, the Nortronics Company in the USA sought to introduce their "stereo-Four" discrete tape system but that was about as far as it went. Commercially, the message seemed crystal clear: consumers were simply not ready to step directly from two channels on disc to four channels on tape.

What was necessary was a method of impressing four channels on disc — but in such a way as to be compatible with present stereo players. Customers could then be expected to migrate, in their own good time, from two channels to four — just as they had done from mono to stereo.

But how could four sets of information possibly be impressed on a groove which geometrically seemed capable of responding only to two sets of information? It seemed impossible — or at least impractical.

There was also the question of stereo FM broadcasting. Here was another audience locked to two-channel sound. Somehow, another two channels had to be loaded on to the carrier without compromising existing services and equipment. It seemed like a paralled problem: solve one and you have most likely solved the other.

In 1969, Peter Scheiber, an enthusiast-engineer-musician announced that he had devised a method of compressing four sets of audio information into two channels, which could then be recorded in the ordinary stereo FM format.

He claimed that the recording could be played either as a two-channel disc or, with supplementary decoding equipment, as a four-channel source. Moreover, the same encoding and decoding principle would be applicable to twin-track tape and stereo FM broadcasting.

Industry was cautious at first, even dubious, but demonstrations seemed to establish the validity of his claims. But what of the patent situation, rights, royalties and all that? Here was a challenge for the engineers and management of any number of large hi-fi concerns. Laboratories around the world turned their attention to "4-2-4" audio: four channels into two, then back into four.

One by-product of this concentrated effort was a rash of systems aimed at synthesising a four-channel sound from existing two-channel recordings. The method suggested by David Haller was relatively simple (see "Electronics Australia", April 1971). Others, like the Sansui QS-1, were quite complex in their approach ("Electronics Australia", September 1971).

The 2-2-4 approach (two initial signals, two channels, 4 outputs) offered a link between existing program material and 4-channel replay equipment but it was commonly viewed as a short-term expedient. In fact, for reasons which will become apparent later, there is more affinity than might first be expected between these 2-2-4 systems and some of the commercial 4-2-4 approaches which have evolved from Scheiber's proposals.

Scheiber's basic approach to the problem of compressing four signals on to two channels is by the use of a matrix network, which is shown in generalised form in Fig. 1. It is assumed that a complementary matrix will be provided to recover the four signals from the two-channel medium at the point of replay. More of that later, however.

While it was aimed primarily at solving the problems of disc recording, the idea of matrixing is equally applicable to ordinary stereo tape equipment and stereo FM broadcasting. A matrixed signal contains only audio frequencies and only two channels, and it can be copied and transmitted just like any other two-channel stereo. Only in the listening room does it need to be decoded and reproduced as four channels.

It is interesting to note, in passing, that
even a mono input signal via any one channel will tend to place a signal on both Y and Z. A two-channel stereo via any two channels will tend to place two signals each on Y and Z.

Considering the 4-2 (four-to-two) matrix of Fig. 1, four input signals A, B, C & D are fed through amplifiers to the two output channels Y & Z. It is for the designer of the matrix to determine what shall be the relative gain of the respective matrix amplifiers and their phase and frequency characteristics.

The options in designing a matrix are almost endless. If, for example, the amplifiers all had the same gain and phase characteristics, equal proportions of all four input signals would appear on each of the two output lines. This would obviously be a rather pointless result, since the four inputs would simply have been mixed into two indential mono channels!

However, by setting up the amplifiers with different orders of gain, certain of the input signals can be made to dominate one or other of the output channels.

Again, by reversing the output phase of one or more of the amplifiers, certain input signals can appear on the output lines in opposite phase.

In fact, the designer can do virtually anything he sees fit to any of the matrix amplifiers, in terms of gain, phase, frequency response or dynamic characteristics, to obtain what he judges to be the most desirable end result.

Certain requirements have to be observed, however, if that result is to be compatible with present-day two-channel stereo systems, or with older mono players or for mono broadcasting.

If signal A is intended for the left-front loudspeaker, it should clearly dominate, say output channel Z so that it will be reproduced in the left-front loudspeaker of an existing two-channel stereo system.

Similarly, if signal B is intended for the right-front loudspeaker, it should clearly dominate output channel Y.

If too large a sample of input A should appear on output Y, or too much of input B should appear on output Z, the apparent separation in ordinary stereo mode would be prejudiced.

The influence of signals C and D also has to be considered. If C happens to represent the left-rear channel, it might conceivably be allowed to mix with the left-front on line Z, with D going to line Y. Again, too much of C and D on the opposite output lines could upset normal stereo separation.

Here the designer faces a dilemma. He must allow a fairly generous mix of all four signals on the output lines if he is going to achieve his ultimate goal of unscrambling them into four signals. Yet too generous a mix could result in a record with such debased separation in the ordinary stereo mode that it would not be acceptable to customers who have their own ideas as to how a two-channel record should sound.

Hence the idea of playing tricks with the phase of the mixed signals. By putting the 'unwanted' component on the respective channels in reverse phase, the subjective effect may be to increase the apparent separation. The engineer has the option of putting either or both B and D on line Z in opposite phase, setting the level so that the subjective separation in two-channel stereo mode is adequate.

But there is still another important consideration which happens when output lines Y and Z are paralleled as for mono reproduction? Components which are equal and out of phase on the two lines will cancel and virtually disappear. The end result could be that the total output signal is lowered to an unacceptable level by cancellation. Worse still, vital musical information might virtually disappear.

Along with this is the uncomfortable possibility that incomplete cancellation, the result of phase aberration, could leave remnants of the cancelled signals to be interpreted as odd sounds or straight-out distortion.

To sum up what has been said, a recording engineer, in aiming for an ultimate four-channel recording, has to make sure that the matrixing will provide a completely acceptable result, when played in normal stereo and mono mode. If this is not achieved, the recording will lose its appeal for the existing mass player market and for mono broadcasting, defeating the whole concept of compatibility.

These requirements notwithstanding, the ultimate objective is, of course, to produce a two-channel signal which can be decoded into four signals, hopefully equivalent to the original A, B, C & D.

This involves a matrix network as in figure 2, being the converse of Fig. 1. The two input signals are fed into Y and Z and emerge as signals A, B, C & D.

At this point, the reader can be excused for demanding a re-statement and verification. It is one thing to mix signals, but how can they be separated out again if they have not been "tagged" in some way in terms of frequency (as by a carrier system) or time (in terms of time multiplexing)?

In fact, it would be quite a task to analyse the operation of a four-channel matrix in so many words, and without resource to copious and tedious algebra. However, it may be helpful, in resolving the difficulty, to realise that, by proper segregation of wiring, two channels can provide the equivalent of a four-wire AC circuit: four wires into the record head (tape or disc) and four from the replay head.

With four wires available there is no special problem in conveying three separate signals (between D-A, A-B, B-C) as Fig. 3. Most likely, three phases of the ordinary power mains are carried into your home on four wires for independent use. There is certainly nothing new about this and, if the record manufacturers had been content to settle for a tri-phonie system, further difficulties might largely have been avoided.

But they weren't content and, to match the challenge of the tape medium, they insisted on introducing a fourth signal. In terms of a basic four-wire circuit, it in-
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volves introducing a signal between C and D, as in Fig. 4a.

This closes the loop and, fairly obviously, some of the new signal voltage between C and D will be distributed across the other paths D-A, A-B and B-C, in proportions depending on the relative impedance levels.

By exactly the same reasoning the voltage between B and C will distribute around C-D-A and A-B-D. The same will be true of the remaining channels.

Because of this interaction, it will no longer be possible to pick off from A-B a simple signal, as would have been the case for Fig. 3. As indicated in 4b, the signal across A-B must contain a proportion of the signals B-C, C-D and D-A. In turn, the signals across each of these other channels must be similarly "polluted."

It is for this reason that the outputs from the decode matrix are designated as A', B', C', D', the implication is that they may relate to, but will differ from A, B, C & D.

What would seem to emerge from this is that a two-channel (4-wire) system can carry, at most, only three discrete (or separate) signals. The penalty of trying to handle four signals is a high order of cross-talking.

Not satisfied with mere words and generalities. Editor Jim Rowe took it on himself, while this article was being written, actually to work out typical figures, starting with the original Scheiber matrix. Several sheets of paper later, he was convinced the elements of the original signals could, in fact, be recovered from a 4-wire matrix, but only with a significant degree of cross-talk which, in some cases, could be within 30dB of the wanted signal!

How small that figure sounds to enthusiasts who are apt to frown if the cross-talk in a stereo pickup falls below 20dB!

As we have indicated, the encode and decode matrices can be manipulated within wide limits, and the phase of the signals varied to achieve different orders of cross-talk between different channels. However, measures to decrease cross-talk between certain channels are likely to increase it between others.

No one has yet succeeded in developing a 2-4 matrix which is free from this problem, despite impressions to the contrary which might be created by euphemistic articles and advertisements.

Proponents of the matrix system admit to the cross-talk problem but claim that it is not nearly as serious, subjectively, as the figures might suggest. Frontal left-right separation has to be preserved but they claim that a quite small loudness difference between the front and rear channels on the respective sides is adequate.

From this point on, the literature is full of ideas for "processing" the respective signals in order to achieve the most acceptable end-result. Nor is it immediately clear as to how many of these ideas are theoretical proposals and how many are actually incorporated in existing or emerging matrix systems.

One broad approach, which seems to have been dignified by such terms as "logic" and "digital", is virtually an expander system. In-built circuitry senses signals which are unique to particular channels and seeks to emphasise those signals by a dynamic change in gain of the appropriate amplifier path.

Another approach, as already mentioned, is to reverse the phase of certain signals in certain paths, so that they tend to cancel rather than add. By this means, for example, a signal intended for the respective front loudspeakers may be eliminated specifically from the diagonally opposite rear loudspeaker, though it will still be present as cross-talk in the right front and left rear.

Such cross-talk tends to broaden the apparent source for the particular signal, as illustrated in Figure 5. While this may not be important to a listener in a near optimum position, it will lead to problems for listeners elsewhere in the room. As the listener moves towards right-front or left-rear, they will hear more of the intended signal from that particular loudspeaker. The apparent sound source will move towards that loudspeaker and might ultimately be identified with it.

In fact, it is possible to derive a whole series of apparent sound source patterns for typical matrix networks and, in particular, those which satisfy the basic requirements stated earlier for quadrature. Stereo/mono compatibility. For good measure, these can be expanded to take in what is claimed to be a major difference in the ability of listeners to discern sound sources in front of them and behind them.

What emerges from this kind of analysis is that a matrix system can be devised readily enough which will satisfy the basic mono/stereo/quadra requirement for a strong center-front sound image and acceptable left-right frontal spread.

But having satisfied this basic requirement, it is difficult to produce a firm, isolated image from the respective rear loudspeakers and even more difficult to create an even sound spread across the rear wall. There is a strong tendency for sounds intended for the centre rear to be interpreted as coming from centre front.

The technique, which was mentioned earlier, of reversing the phase of some signal components has a complex effect. Electrically, it can produce actual cancellation of signal components to diminish the severity of particularly troublesome crosstalk.

Acoustically, there is the possibility that a deliberate anti-phase component may tend to confirm a listener's judgment that a particular sound is NOT coming from a particular direction. Fairly obviously, this kind of thinking cannot be pushed too far, because phase tends to become random once sounds have been projected into the listening room.

However it is obvious that, having manipulated matrix constants, gain and phase reversals to the limit, some engineers have still not been satisfied with the end result. They have accordingly resorted to other tricks of electronic circuitry. One of these is illustrated in basic form in Fig. 6.

It involves a transistor amplifier operating into a split load such that the signals at collector and emitter are of equal amplitude but opposite phase. The actual output is taken from the junction of an R-C network between the two.

Depending on the choice of constants, the output can be arranged to exhibit a 90-
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degree phase shift at some particular frequency in the audio range. At higher frequencies, the phase will approach that of the collector. At lower frequencies it will approach that of the emitter.

By upending the RC network, the phase would rotate in the opposite manner.

Networks like this may, for example, be introduced into the signal path for the rear loudspeakers if the intention is to blur their sound image and create a more effective feeling of ambience.

But that is not the end.

In Figure 7, an LDR has been introduced so that the phase of the output signal can be subjected to external control. Electronic organ fans will recognise the circuit immediately as the basis of electronic phase modulation, as applied to organs and other such instruments.

With such a circuit, the phase of selected channels can be rotated in response to an external cyclic signal (as per the electronic chorus in an organ) or it can be modulated by a voltage derived from the signal itself.

This statement, along with Figures 6 and 7 take the mystique out of drawings which refer to spiral groove modulation. By shifting the phase of certain drive signals to the cutter by 90 degrees a certain "radial" or "spiral" quality may be given to the groove but that does not obviate the cross-talk problem. In the ultimate, the cutter and the recording stylus know only two vectors and signal current can only be translated into and out of these two vectors. This simply means two channels nothing more and nothing less.

What is apparent from all this is the enormous range of options open to recording engineers, and the opportunities for as many "standards" as there are studios. What chance has the record buyer of identifying the original encode matrix used and selecting the appropriate one for decoding?

In fact it would not seem out of place to ask whether, in certain cases, there is such a thing as "an appropriate one for decoding." From within the industry, critics of the whole approach claim that it is rapidly moving into the area of electronic processing, with the result supposedly justifying the means.

There is talk overseas of switchable replay matrices and claims of universal matrices which give an acceptable result with all present matrixed quadraphonic records. But, right now, the vagueness threatens to be of far greater magnitude than it was twenty years back, in relation to compensation curves.

There is this difference, however: in the matter of compensation curves the enthusiast was matching one curve with another in the reasonable hope of obtaining a fairly accurate end result. With matrixed quadraphonic, the intangibles are far more numerous and the end result can only be a compromise which has all the built-in limitations of having tried to cram in one channel too many.

Subjectively, the end result may be acceptable, even very pleasant, but, at the grass roots, the whole structure of compromise and subjective reaction is at cross purposes with the true aims of high fidelity reproduction.

Maybe it is progress, but in a rather oblique direction!

And here, rather curiously, we find ourselves almost back to something referred to earlier in this article to methods of processing existing stereo recordings to extract and exploit rear ambience and other effects. Basically, these depend on extracting the difference between the left-front and right-front stereo signals and reproducing this difference at the back of the room from out-of-phase loudspeakers.

It can be done quite simply, as per our earlier reference, using a couple of extra loudspeakers. Alternatively, the L and R signals can be fed into a supplementary combining unit, allowing them to be "fiddled" to a greater or lesser extent, using some of the techniques already referred to. This done, they can be passed to a supplementary stereo amplifier driving a pair of loudspeakers at the back of the room.

It may well be that, in may cases, the end result will not be all that different from that obtained using matrix techniques.

Simulated quadraphonic should therefore not be written off as a superseded gimmick. It is a significant and still useful step in the direction of matrixed quadraphonic.

But matrixed quadraphonic is not the (Continued on page 127)
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ELECTRONICS Australia, May, 1972
Laser light lifts glass

In their search for better ways to measure light-scattering losses in optical communications systems, American scientists have caused solid glass particles to rise and float in air, supported by a laser beam. At left, Arthur Ashkin, head of Bell Labs physical optics and research department, watches the levitation experiment.

Using a beam of laser light, Bell Labs Scientists have raised small transparent glass spheres off a glass surface and held them aloft for hours in a stable position.

As announced in our March issue, the experiments which demonstrated optical levitation for the first time were conducted by Arthur Ashkin and Joseph Dziedzic of Bell Labs, Holmdel, N.J.

The new technique is expected to provide simple, precise methods for manipulating small particles without mechanical support. It could be useful in communications research to measure scattering loss caused by particles, either in the atmosphere or in other transmission media. Such measurements may help in developing optical communications systems for the future.

In their experiment, Ashkin and Dziedzic focus a laser beam upward on a tiny glass sphere about 20 microns in diameter (.02mm or about .001in). Radiation pressure from the light not only counteracts gravity and raises the particle, but also traps the sphere in the beam and prevents it from slipping out of the beam sideways. In the experiment, which has been successfully demonstrated in air and in a partial vacuum, they thus generate a stable optical trap for holding particles which they term an "optical bottle."

"Light photons have momentum as well as energy," Dr Ashkin, head of Bell Labs physical optics and research department, says. "When we focus a quarter-watt laser on a small transparent particle, the extremely small force exerted by light is then sufficient to lift the sphere off the surface and suspend it."

The sphere is launched by lifting it off a transparent glass plate with the light beam. Initially, radiation pressure is not sufficient to overcome molecular attraction between the sphere and the glass plate. This attraction, known as Van der Waals force, is about ten-thousand times gravity for a 20-micron sphere. For this experiment, the Van der Waals attraction is broken acoustically by vibrating a ceramic cylinder attached to the plate.

When the attraction is broken, the sphere rises in the light beam and comes to rest where the upward pressure caused by the laser is balanced by the earth's gravity. In this position, it can be held aloft as long as the light is focused on it. By changing the position of the focus, the trapped sphere can be moved up and down or sideways very precisely.

In the experiment, these trapping forces were also studied, using a second laser focused on the particle from the side. As the power of the second laser is increased, the particle is displaced within the first beam until it is finally driven out and falls.

"Any laser will produce the levitation effect," Dr Ashkin says. "However, the particle is preferably transparent. If the beam were focused on objects that absorb light, most would melt. By remaining cool, the transparent sphere allows radiation pressure to be studied, without any disturbing thermal effects."

The laser levitation technique may also be a valuable research technique for suspending particles in optically induced thermonuclear fusion experiments.

When used in an evacuated environment, where damping effects on the particle are negligible, the technique may also have applications in inertial devices such as gyroscopes and accelerometers.
Sync & Pattern Generator for TV

Use it for adjusting colour TV convergence, for interlocking closed-circuit TV cameras, or as master sync and blanking generator for amateur TV

First of two articles by JAMIESON ROWE

A sync pulse generator or SPG is almost essential in closed-circuit TV work whenever two or more cameras are to be used together. Unless the cameras are locked to a single and stable source of sync signals, any attempt to switch from one camera to another will result in annoying picture rolling and/or tearing. Such effects are particularly embarrassing where the cameras are to be used with a videotape recorder or VTR.

When the cameras are locked together by means of an SPG, most of these effects are eliminated, and switching between cameras can be performed with great ease.

The sync pulse generator to be described has been designed to deliver all of the sync and blanking signals necessary to lock a number of CCTV cameras together. It generates pulses which are derived from a quartz crystal master oscillator, and locked accurately in frequency and phase to the Australian standards for 50 fields per second, with a 2:1 interlace. Apart from its use in CCTV work, another application for which the unit would be well suited is as the master sync generator of an amateur television (ATV) station. The regulations covering ATV standards in Australia specify that normal (wideband) television signals radiated in the 420–450M Hz and higher amateur bands must have 625 lines per picture, 25 pictures and 50 fields per second, with a 2:1 interlace. To conform with these requirements, it is really necessary to use a synchronising reference such as the SPG described here.

In addition to providing sync and blanking signals, the unit has also been designed to generate a number of stable video test patterns. These include signals producing horizontal lines, vertical lines, a spaced dot pattern, a vertical white bar, and bars modulated with high frequency square waves. The availability of these signals makes the instrument also suitable for checking, servicing and adjusting TV receivers and monitors, both monochrome and colour.

For example, sweep linearity testing and adjustment are readily carried out using the horizontal and vertical line patterns. Similarly, the vertical white bar is very convenient in testing for low frequency response and smearing, while high frequency response may be checked using the HP modulated bars.

The spaced dot pattern is quite suitable for convergence testing and setting-up on both NTSC and PAL colour receivers and monitors using the RCA shadow-mask tube.

Convergence adjustments on colour receivers and monitors using the Sony Trinitron or similar tubes may be done using the vertical lines pattern.

The unit described in these articles is therefore not simply an SPG for use in multi-camera CCTV systems and ATV stations, but a flexible device which should also find lots of uses in both monochrome and colour TV servicing. It should have considerable appeal for the TV service technician wishing to prepare for the forthcoming commencement of colour transmissions, particularly as its cost will be very much less than that of equivalent commercial units.

The synchronising and blanking pulses generated by the unit are shown in Fig. 1, which also indicates the Australian standards for comparison. It may be seen that for all practical purposes the horizontal sync and blanking pulses conform accurately to the standards. The vertical sync pulse does not conform to the standard, however, being a simplified single pulse rather than the specified “block” synthesised from widened horizontal sync pulses. It is not preceded by pre-equalising pulses, nor followed by post-equalising pulses.

The main effect of this simplified vertical sync pulse is that it virtually obliterates the concomitant horizontal sync pulses, so that the horizontal sweep system of the receiver or monitor receives no synchronising pulses during the 2.5-line vertical sync interval.

While at first sight this may seem likely to have a drastic effect upon picture stability, this does not occur in practice. The vast majority of modern receivers and monitors accept the situation without any obvious weakening of picture stability. In the rare cases where this does occur, usually the only visible effect is a slight horizontal displacement or jitter of the first few lines at the top of the picture.

The six test pattern signals supplied by the instrument in addition to horizontal and vertical sync and blanking: The vertical lines and dot pattern may be used for setting up colour TV convergence, while the other patterns may be used for linearity and frequency response tests.
which will be given next month.

The completed generator, full details of which will be given next month.

Probably the main reason why the simplified vertical sync pulse causes so few problems in practice is that the sync circuitry used in modern receivers and monitors does not really need the pre- and post-equalising pulses to lock reliably, while modern horizontal AFC circuits are capable of recovering sufficiently rapidly after a 2 - line loss of sync to produce no visible embarrassment.

Any disturbance to the horizontal oscillator of the receiver or monitor caused by the loss of horizontal sync pulses during the vertical pulse is generally fully corrected before the start of the first active scanning line of the next field. This is helped by the fact that the "back porch" section of the vertical blanking pulses delivered by the SPG happens to be three lines longer than the maximum specified in the Australian standards — 20 lines instead of 17.

Why are we seeking to justify this simplified vertical sync pulse, and its longer-than-usual blanking pulse? Why doesn't the SPG deliver the standard pulses? The reason is quite simple: cost. To provide a fully synthesised vertical sync block complete with pre- and post-equalising pulses and a standard blanking pulse would involve a considerable increase in circuit complexity, and the cost of the unit would rise significantly. In view of the largely academic advantage which would be gained, the author does not regard this as justified.

It should be remembered that the vast majority of CCTV cameras in use deliver a simplified vertical sync pulse very similar to that produced by this unit. In many cases the sync pulses delivered by such cameras are not even "protected" by properly-shaped and accurately timed blanking pulses, as they are here. Yet the signals delivered by such cameras are still locked quite satisfactorily by most modern receivers and monitors. The operation of the unit will now be described.

In order to produce the horizontal and vertical sync pulses required for a locked 2:1 interface 625-line 50 field television system, one must derive both these trains from a common 31.25kHz source. The horizontal sync pulses are derived from this source by means of a x2 frequency division, while the vertical sync pulses are

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TV sync / pattern generator ... derived by means of a x625 division. Note that the vertical pulses cannot be derived directly from the 15.625kHz horizontal frequency, because this would involve a division by 312½ — rather difficult!

The basic requirement for an SPG, then, is a stable and accurate source of 31.25kHz. Perhaps the most obvious way of providing this would be to use a 31.25kHz quartz crystal in a suitable oscillator circuit. However crystals cut to oscillate at this part of the frequency spectrum tend to be very expensive. From the point of view of cost it is therefore preferable to generate a signal at a suitable multiple of this frequency, and divide down to the required 31.25kHz using low-cost IC dividers.

There tends to be a broad trough in the cost of quartz crystals in the vicinity of 2 - 5MHz, so that in general it is desirable to pick a crystal frequency in this area. One possibility which suggests itself is to use a 2MHz crystal, with a string of 6 simple binary x2 dividers using flip-flops. This will give 31.25kHz very simply, as this frequency is equal to 2MHz divided by 64.

While this method is probably the cheapest way of producing a crystal-derived 31.25kHz signal, it suffers from a disadvantage as far as an SPG design is concerned. Thus is that the intermediate signals available on the frequency divider chain do not lend themselves to convenient synthesis of the horizontal sync and blanking pulse waveforms.

The crystal frequency actually used in our generator is 3.125MHz. As this is simply 100 times the desired 31.25kHz, the divider system used is thus two low-cost decade stages. While these stages involve two more divider flip-flops than would be required for the simple 2MHz / x64 divider method, the advantage is that certain intermediate frequency signals lend themselves to easy synthesis of the horizontal sync and blanking pulses.

As mentioned earlier, the basic horizontal pulse repetition frequency is derived from the 31.25kHz signal by a x2 frequency division, while the vertical frequency is derived by a x625 division. The latter division ratio is provided by four x5 dividers in cascade. The basic sync divider system of the SPG thus as shown in Fig 2.

Like the x10 divider stages used in the initial part of the chain, the x5 stages used to derive the vertical frequency use a very economical logic configuration. Thus the complete x625 vertical divider chain uses only 12 flip-flops.

Of course the derivation of the horizontal and vertical scanning frequencies is only part of the story, because it is then necessary to synthesise the corresponding sync and blanking pulse waveforms. These must not only have an acceptable shape, but must also be in the correct phase relationships to each other.

The basic method used in the SPG to synthesise the horizontal sync and blanking pulses is shown in Fig 3. The blanking pulse is produced by using the basic 15.625kHz signal to gate a train of 12.8us-long pulses available at the output of the second x10 divider stage. The blanking pulses are then used to gate a train of 512us-long pulses produced by a simple logic circuit from two signals taken also from the second x10
1 Sus.

1 Sus.

3.125kHz

2.5kHz

2.5kHz

NOTE SIMPLIFIED VERTICAL
SYNC PULSE FORMAT.
NO EQUALISING PULSES.

SOLID SYNC PULSE WHICH
OBLITERATES HORIZ. SYNC
PULSE FOR 25Hz.

HORIZ. BLANKING AND SYNC. PULSES PRODUCED
BY THE UNIT

Fig. 1

SYNC AND BLANKING PULSES PRODUCED
BY THE UNIT

HORIZ. BLANKING AND SYNC. PULSES
SYNTHESISED共同

Fig. 2

BASIC SYNC DIVIDER SYSTEM

Fig. 3

SYNTHESIS OF HORIZ. BLANKING AND SYNC. PULSES

divider stage, together with the 312.5kHz
signal at the input of this stage. Both the
sync and blanking pulses are fed through
inverting buffer amplifiers after being syn-
thetised, to provide a low impedance
source.

As before the blanking pulses are then
used to generate the sync pulse
synthesis. In this case the pulses are generated by
the SPG are produced by the
the SPG are produced by the
Fig. 4. Here the 50Hz pulses from the
end of the x625 divider chain are used to
gate a train of pulses picked off from the
last x5 divider section, and the resultant
pulses are then used to gate a train of pulses
of 25-line duration to produce the vertical
blanking pulses.

As before the blanking pulses are then
used to perform gating for the sync pulse
synthesis. In this case the pulses are generated by
the SPG are produced by the
the SPG are produced by the
end of the x625 divider chain are used to
gate a train of pulses picked off from the
last x5 divider section, and the resultant
pulses are then used to gate a train of pulses
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last x5 divider section, and the resultant
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of 25-line duration to produce the vertical
blanking pulses.
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MP60 four speed heavy balanced die cast turntable with viscous cue (single play) $120.00 + cartridge.

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610 heavy balanced diecast turntable auto/manual turntable viscous cue $125.00 + cartridge.

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Synchronous 4 pole motor to suit either 100-125 or 200-250 volt 50 cycles mains supply.
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Rumble — better than -35dB.
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New Zealand C.P.O. Box 2030 Auckland
For all three of the remaining test patterns a vertical bar signal is derived from the 15.625kHz horizontal timing signal and another signal taken from the output of the second x10 divider stage, using a simple logic circuit. The bar signal is selected by S1a, and is used alone (by earthing the rotor of Sib) when the white bar pattern is required. To effectively modulate the bar for the other two patterns, Sib is used to select either a 1.562MHz or a 3.125MHz signal derived from the first x10 divider stage.

The composite blanking signal is used to gate the signals selected by S1a and Sib in order to ensure that the pulses which form the test pattern logic signal Tp occur only during the "active" portions of each scanning line and field interval.

The actual test pattern video signal is produced by the four-transistor discrete circuit section shown in Fig. 6. Basically this circuit consists of the PNP transistor T4 connected as an inverted emitter-follower, with its base fed by a resistive voltage divider connected across the 4V supply lines. The top part of the divider is the 560 ohm resistor; superficially the lower part is the 470 ohm resistor, but in fact this is shunted by the switching transistors T1, T2 and T3, the last with a 100 ohm resistor in series. The video signal is generated by the switching action of these transistors as they change the effective resistance in the lower part of the voltage divider.

Transistors T1 and T2 are fed with inverted vertical and horizontal sync pulses, so that they saturate during the sync intervals. During the sync intervals one or the other of the transistors therefore effectively shorts the 470 ohm divider resistor at the base of T4, reducing the base voltage to almost zero. During the sync pulse intervals the output from the emitter of T4 is therefore very low — approximately 0.6V.

Between sync pulses, T1 and T2 are normally cut off, so that if it were not for T3 the voltage at the base of T4 would rise to approximately half the supply voltage. However, the test pattern logic signal Tp keeps T3 saturated for at least the duration of the composite blanking pulses, and this means that the 100 ohm resistor in series with T3 is effectively connected in parallel with the 470 ohm divider resistor.

This means that at least during the blanking intervals the voltage in the base of T4 can only rise to about +0.5V. While T3 is driven into conduction by the Tp signal, then, T4 delivers the "setup level" of the video level, at about 1.1V.

The "white" level of the video signal is produced whenever the Tp logic signal removes the forward bias on transistor T3. With T1, T2 and T3 all cut off, the voltage on the base of T4 thus rises to approximately half the supply voltage, so that T4 delivers a white level output of approximately 2.1V.

(Continued on page 129)
Two new instruments from ADVANCE which offer:

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**OUTSTANDING FEATURES**
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The ADVANCE OS1000 is a portable, dual trace oscilloscope, combining small size and light weight with a specification providing the ability to make precise waveform measurements. Wide time base ranges and comprehensive trigger control combined with broad bandwidth and calibrated deflection factor make this instrument suitable for many general purpose and laboratory and TV applications. Use of solid state circuitry throughout makes the OS1000 particularly suitable for servicing or laboratory use. Full specifications available on request.

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The DMM2 Digital Multimeter provides in 17 ranges a clear digital reading of AC or DC voltage, AC and DC current and resistance. Push button selection of functions and ranges. The display has a maximum reading of 1999 with automatically positioned decimal point. Overrange and reverse polarity indications are provided. The DMM2 weighs only 3 1/2 lb and can be operated from AC supply, external 12V DC, or an optional rechargeable battery pack. Design ensures maximum stability for all measurements, ease of operation allowing use by non-technical operators and high reliability with all counting and storage functions performed by an LSI package (Large Scale Integrated Circuit). Full specifications available on request.

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**JACOBY MITCHELL**

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ELECTRONICS Australia. May. 1972
TAKE 20 COMPONENTS...

A group of simple transistor projects, each using less than 20 low-cost components.

by JULIAN ANDERSON

A Mini Metronome

Here is a really simple project — a unit that simulates beautifully the sound of a time bomb ticking away! For those more attracted to gentler pastimes it may also serve as a metronome, that is it gives a loud click at regular intervals, the actual interval being varied by a potentiometer in the circuit. It’s very simplicity also makes it highly suitable for use as an audio warning device, inserting the alarm switch in the supply line.

The actual working of the circuit is fairly simple; on applying a voltage across R1, VR1, C1 and the loudspeaker, the capacitor C1 charges up till a point is reached when TR1 switches on, this in turn switches TR2 to a conducting state — meaning that a voltage is applied across the loudspeaker causing it to "plop".

The base current of TR1 neutralises the charge on C1 and soon the voltage on the base reaches the stage where the transistor is turned off; thus the cycle starts all over again. The rate at which C1 charges depends upon VR1 and thus by altering this the interval between each cycle can be varied.

The actual transistors used are unimportant, I have tried a large variety and all have worked successfully. One of the transistors is a PNP, the other NPN. The germanium one is similar to the OC71, OC44 etc, and the silicon one is like the BC108, BC109, 2N2926 etc.

The components are mounted on a small piece of Veroboard. One end is drilled to take the potentiometer (¼ in spindles are virtually standard) and the other components are mounted and soldered at the other end. The project is so simple that very little can go wrong and immediately you switch on regular "plops" will be heard. By altering VR1 a wide range of intervals should be covered but if you want slower ones — that is with several seconds’ interval, increase the value of C1. If you want faster ones lower its value.

The circuit described is certainly the cheapest method of getting a sound from a loudspeaker and it makes an ideal warning device. The plops themselves are loud and the unit could be used as a burglar alarm by arranging the supply voltage to be switched on when a window is opened etc. Even if the plopping isn’t heard by anyone you can bet it’ll get your unwelcome visitor worried.

The time intervals are regular and the unit will serve well for its intended use as a metronome providing the beat for music lessons etc.

Metronome Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>22k, 10% 1/4W</td>
</tr>
<tr>
<td>C1</td>
<td>30uf 12V</td>
</tr>
<tr>
<td>VR1</td>
<td>250k lin pot</td>
</tr>
<tr>
<td>TR1</td>
<td>2N2926, see text</td>
</tr>
<tr>
<td>TR2</td>
<td>OC81, see text</td>
</tr>
<tr>
<td>Loudspeaker</td>
<td>any 3-ohm or 8-ohm type</td>
</tr>
<tr>
<td>Veroboard</td>
<td>1¼ x 1¼in, 0.15in matrix</td>
</tr>
<tr>
<td>9V battery</td>
<td></td>
</tr>
</tbody>
</table>

A One-Transistor Radio

Ever since I first started playing about with transistors, I wanted to build a one-transistor radio, operating a loudspeaker without an external aerial. This was not possible in those early days as there were no transistors on the market with sufficient gain. A few months ago I had a crack at this again using the very high gain silicon transistors now available quite cheaply. The result is published here.

I don’t want to mislead anyone, the volume is low but it is sufficient for a child’s or bedside radio.

With the prices of nearly all components falling — and transistors falling most rapidly, many readers will think that it would be cheaper and easier to use two transistors and do away with some of the other parts. They are perfectly correct, but until there are laws forbidding slavery in transistors there is a lot of satisfaction in getting the last ounce of work out of them.

The signal is picked up on the aerial winding L1 on the ferrite rod and tuned by VC1. L2 transforms the signal and feeds it to the base of the transistor, C1 acting as a DC blocking capacitor. The amplified RF signal appears at the collector and finding its path blocked by the inductance of T1, passes through C2. Now C2 and L3 are chosen so that they form a tuned circuit, which is slightly damped by the other parts of the circuit, and it encourages the RF through it. The diode D1 detects this signal and after being smoothed by C2 passes to the base of TR1.

The amplified AF signal appears at the collector and T1 acts as the load, transforms it and feeds it to the speaker. C2 is too low in value to pass much AF but any that does is taken straight to the earthy side of the circuit by L3. R1 provides the bias for the transistor and will vary with the one chosen; it is best found by experiment but will probably lie between 47k and 1M.

Almost any broadcast-band ferrite rod aerial may be used but the larger the better. If you want to wind your own, the aerial winding should consist of about 70 turns and the secondary, wound either beside or on top, of about 7 turns. Any transistor output transformer will suffice for T1, most of these are centre tapped but this should be ignored. L3 is the primary of an IF transformer; take off the can protecting this and cut off the small capacitor if one is fitted; in this case the centre tap and secondary are ignored.

The larger the loudspeaker the better and although sufficient volume is obtained with a 2in speaker, the larger ones are far better. A volume control, if needed, is best fitted across the secondary of the output transformer; a 10-ohm pot should do. If this were fitted into any other part of the circuit it would affect the working conditions.

Care must be taken in the layout. Owing...
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- QS/3. Multiple Guitars of Les Thatcher
- QS/4. Today's Hits by Jack Dorsey

AUDIO SPECTRUM ON...

ASTOR
to the very high gain it is easy for the circuit to break into oscillation and L3 must be kept well away from L1. Similarly L2 and the collector of Tr1 must be away from the aerial coil. This explains VC2; regeneration can be applied by feeding a tiny part of the signal back to the aerial coil, but the value of such a capacitor will be in the order of 0.5pF and its value is critical. It is best to keep the two apart as much as possible and then with a wire fixed to Tr1 collector to lay this near the winding. If the radio fails to oscillate reverse the connections of L2. If Veroboard is used even the capacitance between the strips may send it into uncontrolled oscillation.

After switching on, adjust the core in L3 for best results over the section of the band you will normally be using.

The current consumption is between 4mA and 15mA and a battery should last a fair while under these conditions.

### Parts for One-Transistor Radio

- R1 — see text
- C1 0.04uF
- C2 100pF
- VC1 250pF variable
- VC2 — see text
- Tr1 2N2926 or similar
- D1 OA70, OA79, OA81 etc
- Tr1 Transistor output transformer
- L3 IF transformer
- Ferrite rod with MW winding
- 9V battery
- Loudspeaker
- Paxolin board

---

### Simple Intercom

There are on the market several types of intercom, and there is no doubt that many readers could find a use for one, but doubt whether the expenditure would be justified. The unit described here is a relatively low-cost project. It can easily be used as a baby alarm — it is certainly sensitive enough merely by switching one of the units on permanently.

Most of the commercially available units are arranged so that first a signal button is pressed and the unit is then switched on and the volume level set. Also nearly all of them can be used for “spying”, that is, switching on by the master activates the slave microphone so that the master can eavesdrop.

The unit described here is not fitted with a buzzer as calling over the unit is usually enough to draw the attention of the distant party. It cannot be used for eavesdropping (an undesirable, “Big Brother” type feature) and thus its installation can cause no offence. Since no volume control is fitted (this is really unnecessary for this type of equipment) only one switch is operated by either end to activate the unit.

The basis of the intercom is a simple amplifier which boosts the “microphone” output to feed a speaker. To make the project simpler and cheaper we use balanced armature earpieces which, by being switched, serve both functions as microphone and loudspeaker. These balanced armature earpieces are really marvellous pieces of design. They are extremely sensitive, have a perfect impedance for transformerless transistor work and are very cheap. Some are still available from various sources, but this will not help those who can’t obtain them. Eight-ohm loudspeakers can be used in their place, even if a little more expensive.

The amplifier is slightly unusual and is a very simple Lo-Fi (I imagine that’s the
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- 5mV to 20V/CM.
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ELECTRONICS Australia, May, 1972
opposite of hi-fi) sensitive AF amplifier. It uses a PNP and an NPN transistor and is RC coupled. The switching is straight-forward; two batteries are used, one each in the master and slave sections. This is done purely to enable a three-wire rather than a four-wire connector to be used. 

In the normal position (as shown in the circuit diagram) no current is drawn and the switch on the master is set to receive calls from the slave. The only thing the slave has to do is apply battery voltage to the master by making SW2.

When the master makes a call the output from the amplifier is fed to the slave loudspeaker, its own loudspeaker is switched to the output of the amplifier. The master unit will, of course, override the slave.

Both the sections are built on Paxolin boards about 4 x 6 in and all the components, including the battery, are mounted on this; the layout is by no means critical and the drawing is self-explanatory.

Although it may be better if press button switches were used, these are not readily available and are rather dear compared with the rotary switches used here. Also, using rotary switches enables either of these units to be switched on permanently for use as a baby alarm.

**Magic Candle**

Part of the fun of electronics is in being able to "amaze and mystify" members of the family and friends with little tricks. Those unfamiliar with the mysteries of electronics invariably assume that anyone who has tackled even the simplest crystal set is a true genius and, even when they see how few parts are employed, refuse to believe that "that's all there is to it". When they can't see the components that make an item tick they are even more impressed let alone disillusioned, let us allow the uninitiated to marvel at our unquestionable brilliance!

This project is purely for fun; to my knowledge it has no practical use whatsoever but it should amuse and it is relatively inexpensive. Using the constructional layout shown none of the component leads need be cut short and this will allow the components to be employed later for some more practical purpose.

The title of magic candle is self-explanatory: the wick and flame are replaced by a small light bulb, when a lighted match or cigarette lighter is moved near it the bulb lights up and remains alight until "snuffed" by turning it off.

The circuit of the magic candle (above). The components are mounted inside a cardboard tube (right), painted to look like a candle.

Apart from the battery, only four components are used: a light dependent resistor (LDR), a silicon-controlled rectifier (SCR), a potentiometer (VR1) and the bulb itself.

At normal light levels the resistance of the LDR will be several hundred ohms (though this varies enormously with the specimen and the actual light level) and with VR1 at maximum setting there will not be sufficient current flowing in the gate circuit to trigger the SCR. However, if VR1 is reduced in value and the light level on the LDR increases there will be an increase in current, the SCR will turn on and apply the battery voltage across the bulb. For an SCR to fire it is necessary that the LDR's resistance is less than about 100 ohms. The circuit to trigger the SCR is shown in the diagram.

VR1 acts as the sensitivity control; when it is set to minimum resistance and with a sensitive LDR, even quite low light levels will trigger the circuit. At maximum resistance the bulb will probably not light at all.

Ideally one would use both a battery and a bulb of the same voltage but SCRs don't seem to work well at voltages much below 9V and 9V bulbs with low current consumption are not widely available. If one can be obtained (note that the current should be no higher than 60mA) the circuit is exactly as shown. However 6V, 40mA bulbs are available and cheap but to avoid blowing it a 68-ohm resistor should be wired in series with the bulb at the point marked (though this varies enormously with the specimen and the actual light level) and with VR1 at maximum setting there will not be sufficient current flowing in the gate circuit to trigger the SCR. However, if VR1 is reduced in value and the light level on the LDR increases there will be an increase in current, the SCR will turn on and apply the battery voltage across the bulb.

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The practice of DX (long distance) listening to radio broadcasts is a highly organised hobby in which most radio stations co-operate. Here we explain how to get started in DX, how to report to stations and the rewards to be expected.

The fascinating DX hobby

by HARRY TYRER

The hobby of DXing has its origins in the early days of broadcasting, but in those days only a few broadcasting organisations transmitted material on short wave for overseas reception. Nowadays, the situation is quite different.

For various reasons nearly every country of any size in the world operates short wave radio services, intended for reception outside its national boundaries. The broadcasting bodies of these countries actively encourage overseas listeners to send in reports of reception conditions in their particular areas. This has the twofold purpose of estimating the penetration of their program material and of establishing the quality of reception in various parts of the world. They request their overseas listeners to send reports of reception, and in return they send a confirmation of reception in the form of a letter or “QSL card”, sometimes accompanied by pennants, calendars, diaries and other mementos.

This practice of listening to overseas stations on short wave and obtaining confirmation of reception has developed into a hobby with world-wide following. The extent of the hobby may be judged by the existence of DX clubs, specialist magazines in some countries, and in our own magazine a monthly feature entitled “Listening Around The World.”

In view of the close connection between DX reception and ionospheric conditions, many DXers have acquired a secondary interest in the study of the ionosphere which can be every bit as absorbing as the main hobby. Some DX clubs obtain information on the sunspot activity for the benefit of their members.

The range of frequencies available to long range broadcasters is limited by two factors, known respectively as the maximum usable frequency (MUF) which determines the upper limit and the absorption limiting frequency (ALF), which fixes the lowest usable frequency for short wave broadcasting. Both these factors vary according to ionospheric conditions — for example, in periods of high sunspot activity, the MUF goes higher — but in general the changes in the ALF are not significant enough to warrant special attention on the part of international broadcasters. However, station engineers pay close attention to variations in the MUF, and as the maximum occurs in the 11-year sunspot cycles, many stations move up into the higher frequencies which become available for use at this time, since these frequencies are relatively uncluttered and propagation close to the MUF is more efficient.

At one time, the choice of frequencies by international broadcasters tended to be haphazard, with several stations broadcasting on the same or overlapping frequencies, causing mutual interference to the disadvantage of all concerned. In more recent years, there has been widespread acceptance of a plan drawn up by the International Radio Frequency Board (IRFB) of the International Telecommunication Union (ITU). This requires every short wave station of signatory countries to register in advance with the IRFB its planned transmission schedule and frequencies to be employed. The IRFB then points out any instances where interference is likely to be experienced, and suggests alternative arrangements which offer minimum inconvenience to all parties. Four times a year there is a major reshuffle of frequency allocation to allow the best use of available frequencies according to seasonal conditions in the different parts of the world. The changes come into effect on the first Sundays of March, May, September and November. Interference on short waves is now very much less than formerly.

While most DXers carry out the major part of their listening on short wave, many find pleasure in DX reception of stations operating in the broadcast bands on medium wave. The range of frequencies in the broadcast band cover 530KHz to 1600KHz. On these frequencies, reception over long distances is possible only when the transmission path is in darkness, after the D and E layers of the ionosphere have virtually disappeared. Reception is still possible when either the transmitting or receiving end of the transmission path is in the half light of dawn or dusk.

Signals across the Tasman are the easiest to receive by DXers in Australia and New Zealand, being at good level from dusk to station close down. After 1400, Asian signals are still quite strong.

A selection from the thousands of verification cards received from every continent by our short-wave correspondent Arthur Cushen. TOP OF FACING PAGE: Arthur Cushen at his listening post. In the past 35 years he has verified 2000 medium-wave stations and some 3800 short-wave stations from 228 countries.
are present, being best received in the winter months and at the equinoctial periods of March and September. European signals are also best received during the equinoctial periods, the most favourable time being our dawn. Our DX correspondent Art Cushen has confirmed reception of 1900 stations operating in the broadcast band, of which 1100 stations are in North America alone, and 110 stations in Europe.

In this part of the world, the best reception period for signals from North and South America are from 0700 to 0900GMT and 1100 to 1400GMT. American stations usually begin operating at 0400 local time, which is 1100GMT in the Eastern States, 1200GMT in the Central States, 1300GMT in the Mountains and 1400GMT on the Pacific Coast. Stations in Hawaii begin at 1600GMT.

The unpredictable nature of reception on medium wave is one of the fascinations of this aspect of the DX hobby. One may spend many hours listening to faint signals, subject to fading and severe interference, then unaccountably stations come flooding in at good signal level.

Since medium-wave signals are not intended to be received over long distances, there is a special interest in logging these signals, and reports of reception are specially appreciated by the stations concerned.

The question is sometimes posed, especially by younger readers, "How do I get started in DXing?" One of the principal attractions of DXing is that it requires no technical knowledge, no special licence, and the equipment can be very simple — in the very simplest case, only an ordinary domestic receiver with a short wave band is sufficient to make a start. As interest develops, a better receiver designed specifically for short-wave will probably be sought by the keen enthusiast. In the practice of this hobby, the DXer will in the course of time acquire some knowledge of some of the technicalities involved. He should certainly seek to understand the meaning of such terms as kilohertz (KHz) and megahertz (MHz), Greenwich Mean Time (GMT), ionosphere, sunspot activity, and fading.

While listening sessions can be nothing more than random dial-turning, the dedicated DXer will want to work to a method. As with most other hobbies, more pleasure can be extracted by working systematically. The following hints have been provided by our DX correspondent, Arthur Cushen, author of our monthly feature "Listening Around the World," who extending from 50 to 90 miles; the F1 layer, which begins slightly above the E layer and extends to about 150 miles; and the F2 layer, the upper limit of which varies from around 200 miles to 300 miles, according to season.

All the layers of the ionosphere go through a daily cycle. Reaching maximum intensity around noon (the different layers reach their maximum ionisation at slightly different times) but whereas the D and E layers virtually disappear during the hours of darkness, because of recombinination of the electrons, the F layers persist from sunset to dawn. Were it not for this fact, radio communication except over line-of-sight paths with any region in darkness would be impossible.

The amount of radiation received by the ionosphere from the sun varies continually, as the result of various natural phenomena, such as the elliptical orbit of the earth around the sun, which results in the earth being about three million miles nearer to the sun during our summer: the rotation of the earth on its axis, which results in the daily cycle of change already described, irregular events, such as solar eclipses; and the 11-year sunspot cycle.

The changes in the number of sunspots has a dramatic effect on the ionosphere. Current theories suggest that the disturbances on the surface of the sun which give rise to sunspots cause the formation of ions on a massive scale, and that vast numbers of liberated electrons shoot across space to bombard our ionosphere. The resulting formation of ionised particles in the upper ionosphere makes it possible to obtain better reflection of radio waves at higher frequencies than normal. For this reason, international short wave broadcasters make much greater use of the higher frequencies in the 13 and 16 metre bands during periods of high sunspot count.

On the other hand, during sunspot minimum periods, the short wave frequencies in the lower 31, 41 and 49 metres bands become greatly over-crowded as short wave broadcasters all over the world are forced to abandon the higher frequencies.

In long-range radio communication, the radio waves travel around the world in a series of skips, reflecting successively from the ionosphere and the surface of the earth. Were it not for the ability of the ionosphere to act as a reflector in this way, the radio waves which impinge on it would simply travel out into space, and radio communication around the earth would be impossible without the aid of man-made reflectors.

As a radio wave skips back and forth between the ionosphere and the earth it becomes attenuated (weakened) in the process. Signals reflected by the lower D and E layers quickly become attenuated to the point where they cannot be received beyond a limited service area. The higher frequencies used by short wave broadcasters can penetrate the D and E layers and reflect from the F layer, but they become attenuated in the process. For this reason, signals travelling via the "path of darkness" are received at better signal level, since the D and E layers do not exist on the night side of the earth.
DSR-1: Specifications

Frequency Range: 10 kHz to 30.0 MHz.
Modes of Operation: USB, LSB, CW, RTTY, AM, SSB.

Frequency Readout: Complete to 100 Hz on six NIXIE tubes.

Frequency Selectivity: 0.001 MHz continuously variable.

Frequency Stability: Drift does not exceed 150 Hz in any 15 minute period with a temperature change of 7°C per hour over a range of 0 to 40°C.

Sensitivity: Less than 0.5 microvolt for 10 dB SINAD at 2.4 kHz SSB mode. Less than 1.0 microvolt for 10 dB SINAD at 6 KHz AM mode.

Image Rejection: Greater than 70dB relative to 1 microvolt.

Blocking: Greater than 100 dB relative to 1 microvolt.

Cross Modulation: Greater than 90 dB relative to 1 microvolt.

Intermodulation: Greater than 80 dB relative to 1 microvolt.

Opposite Sidelobe Suppression: Greater than 60 dB at 500 Hz into the opposite sideband.

I.F. Bandwidth Selectivity:

<table>
<thead>
<tr>
<th>Bandwidth</th>
<th>Selectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 kHz</td>
<td>60 dB</td>
</tr>
<tr>
<td>1.2 kHz</td>
<td>40 dB</td>
</tr>
<tr>
<td>2.4 kHz</td>
<td>30 dB</td>
</tr>
<tr>
<td>4.8 kHz</td>
<td>15 dB</td>
</tr>
<tr>
<td>6.0 kHz</td>
<td>10 dB</td>
</tr>
<tr>
<td>7.2 kHz</td>
<td>0.0 dB</td>
</tr>
</tbody>
</table>

Optional filters available for other bandwidths.

I.F. Outputs: 50 millivolts into 50 ohms at 1st I.F., 0.55 MHz and 2nd I.F., 50 kHz.

Automatic Gain Control: Audio Output rises less than 3 dB for 1 microvolt to 100 millivolts. Attack time: 500 microseconds. Release time: 750 milliseconds (1st I.F.)

Antenna Input: 10k ohms to 500 kHz, 1000 ohms. 50KHz to 50KHz 50 ohms.

Audio Output: 3 watts at 5% maximum distortion into 3.2 ohm load. 1 volt into 600 ohm output line. 3.2 ohm unbalanced.

Audio Hold and Noise Greater than 40 dB below rated output.

BFO Derived from standard clock or variable over a ± 3 kHz range from front panel.

Power Requirements: 115 ± 10°c single phase 50.60 Hz 15 watts. 12 or 24 VDC supply optional.

Dimensions: 5.25 in. H x 19 in. W x 15 1/2 in. D. (13.3 cm H x 48 cm W x 38 cm D)

Weight: 21 lbs. (9.5kg)

SPR-4: Specifications

Frequency Coverage: Can be programmed with accessory crystals for 23 ranges (each tuning a 500 kHz band) from 5 to 20 MHz plus 150 to 500 kHz. Crystals supplied with the receiver allow coverage on these ranges: 150, 500 kHz, 2.5 kHz, 10 kHz, 1 MHz, 10 MHz, 60 GHz MHz, 9.51 to 10 MHz, 11.5 to 12 MHz, 15 to 15.5 MHz, 17.5 to 18 MHz, 21 to 22 MHz.

Modes of Operation: AM, CW, SSB (upper and lower sideband) selection.

Selectivity: AM: 4 kHz at 6 dB, 10 kHz at 60 dB, 55 dB; 2.4 kHz at 6 dB, 7.2 kHz at 60 dB 6 dB, 2.7 kHz at 60 dB.

Intermediate Frequencies: 1st I.F. 5.5 kHz four pole crystal lattice filter, 2nd I.F. 50 kHz four pole Hi-Q Ferrite LC filter.

Frequency Stability: At room temperature, drift for all causes (including ±10°C change in supply voltage) is less than ±100 Hz.

Sensitivity: 55B and CW: 0.25 microvolt gives 10 dB SINAD at 2.4 kHz SSB mode. Less than 1.0 microvolt for 10 dB SINAD at 5 kHz CW mode.

Automatic Volume Control: AVC is used on AM, CW, and SSB. Time constants are selected for optimum effectiveness on each mode. Audio output is held constant to 6 dB over a 100 dB range of input signals.

Input Impedance: 50 ohms approximately (higher impedance for 150 kHz to 1500 kHz)

Output Power: 3 watts into 400 ohm load (less into higher impedance loads).

Power Consumption: 18 watts on 120 VAC or 12 watts on 12 VDC. 12 watts in SSB mode with dial lights turned off.

Calibration: Dial is accurate to within 0.1 kHz when calibrated at nearest 100 kHz calibration point.

Hum and Noise: More than 60 dB below rated output.

Size and Weight: 5½" H x 10¼" W x 12½" D. Weight: 18 pounds.

R-4B: Specifications

FREQUENCY COVERAGE: 3.5-4.0 MHz, 7.0-7.5 MHz, 14.0-14.5 MHz, 21.0-21.5 MHz, and 28.5-29.0 MHz with crystals supplied.

Ten accessory crystal sockets are provided for coverage on these ranges: 150, 500 kHz, 5 kHz, 10 kHz, 1 MHz, 10 MHz, 60 GHz MHz, 9.51 to 10 MHz, 11.5 to 12 MHz, 15 to 15.5 MHz, 17.5 to 18 MHz, 21 to 22 MHz.

Modes of Operation: AM, CW, SSB (upper and lower sideband) selection.

Selectivity: AM: 4 kHz at 6 dB, 10 kHz at 60 dB, 55 dB; 2.4 kHz at 6 dB, 7.2 kHz at 60 dB 6 dB, 2.7 kHz at 60 dB.

Intermediate Frequencies: 1st I.F. 5.5 kHz four pole crystal lattice filter, 2nd I.F. 50 kHz four pole Hi-Q Ferrite LC filter.

Frequency Stability: At room temperature, drift for all causes (including ±10°C change in supply voltage) is less than ±100 Hz.

Sensitivity: 55B and CW: 0.25 microvolt gives 10 dB SINAD at 2.4 kHz SSB mode. Less than 1.0 microvolt for 10 dB SINAD at 5 kHz CW mode.

Automatic Volume Control: AVC is used on AM, CW, and SSB. Time constants are selected for optimum effectiveness on each mode. Audio output is held constant to 6 dB over a 100 dB range of input signals.

Input Impedance: 50 ohms approximately (higher impedance for 150 kHz to 1500 kHz)

Output Power: 3 watts into 400 ohm load (less into higher impedance loads).

Power Consumption: 18 watts on 120 VAC or 12 watts on 12 VDC. 12 watts in SSB mode with dial lights turned off.

Calibration: Dial is accurate to within 0.1 kHz when calibrated at nearest 100 kHz calibration point.

Hum and Noise: More than 60 dB below rated output.

Size and Weight: 5½" H x 10¼" W x 12½" D. Weight: 18 pounds.

ELMEASCO INSTRUMENTS PTY LTD

PO BOX 334, Brookvale, NSW 2100. Phone 92 7944.

Melbourne Phone 26 1352. Adelaide Phone 64 3796. Brisbane Phone 71 3366.

46 ELECTRONICS Australia, May, 1972
THE SINPO CODE

<table>
<thead>
<tr>
<th>S (Signal)</th>
<th>I (Interference)</th>
<th>N (Noise)</th>
<th>P (Propagation disturbance)</th>
<th>O (Overall merit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 excellent</td>
<td>5 nil</td>
<td>5 nil</td>
<td>5 excellent</td>
<td>5 excellent</td>
</tr>
<tr>
<td>4 good</td>
<td>4 slight</td>
<td>4 slight</td>
<td>4 good</td>
<td>4 good</td>
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<tr>
<td>3 fair</td>
<td>3 moderate</td>
<td>3 moderate</td>
<td>3 fair</td>
<td>3 fair</td>
</tr>
<tr>
<td>2 poor</td>
<td>2 severe</td>
<td>2 severe</td>
<td>2 poor</td>
<td>2 poor</td>
</tr>
<tr>
<td>1 barely audible</td>
<td>1 extreme</td>
<td>1 extreme</td>
<td>1 barely audible</td>
<td>1 barely audible</td>
</tr>
</tbody>
</table>

Information about interference is valuable to stations to enable them to choose the most suitable frequency for broadcasting to certain areas. Listeners can therefore assist in ensuring that the best signal is transmitted to their areas by co-operating with stations in this matter.

DX clubs are operating in Australia and New Zealand, and interested readers should get in touch with the following:
- Australian Radio DX Club, PO Box 227, Box Hill, Victoria, Australia.
- New Zealand Radio DX League, 212 Earn Street, Invercargill.

Most DX clubs have special printed forms for the use of their members which contain all the information necessary to suit the short-wave radio reception. In those cases where limited outdoor space prevents the erection of an outdoor aerial, many DXers are using loop aerials.

One of the advantages of DXing is that a hobby of this sort can be conducted on the scale which suits the individual. Some people are content to limit their activities to simply listening on short wave. Others regularly send reception reports. What is necessary is to keep in touch with worldwide DX developments by reading the magazines which cater for DX activities.

Before sending reception reports, the beginner should at least understand the information required by the DX clubs and to avoid ambiguity when expressing time is based on the 24-hour clock, with the reference point taken as the Royal Observatory at Greenwich, London. Mean Time (GMT). This international way of expressing time is based on the 24-hour clock, with the reference point taken as the Royal Observatory at Greenwich, London.

The beginner is advised to locate only those stations broadcasting English language programs to begin with (or programs in his native tongue, if this is not English). When a station has been properly tuned, note its frequency on the tuning dial. Since tuning dials are seldom 100 per cent accurate, try to stay tuned until a station announcement, when station identification and call sign will be given. A list of stations with call signs and frequencies is a useful thing to have at hand, since these usually give information on the location of the transmitter, power and station address.

The "World Radio and TV Handbook" is the best-known publication containing this information. It is published annually, and is available through technical book sellers. Although such a book can never be completely up to date it does contain a great deal of useful information for the DXer.

To avoid ambiguity when expressing time, it is universal practice in short-wave broadcasting to give all times in Greenwich Mean Time (GMT). This international way of expressing time is based on the 24-hour clock, with the reference point taken as the Royal Observatory at Greenwich, London.

When tuning a receiver, make sure that you give your full name and address, the date and time of reception (international stations refer to this to be shown in GMT), the frequency of the transmission, and detailed conditions, using the SINPO code. A panel giving details of the SINPO code is published elsewhere in this article.

It is also necessary to provide details of your receiver, and the type of aerial used. If possible, give some comparison with signals from other stations broadcasting to your area.

A DXer should have a clear idea of the inter-relationships which give rise to fading. The difficulty for short-wave listeners is to determine the extent of fading. Some sets have a "magic eye" tuning indicator which allows the degree of fading to be estimated, but a far better device is an "S-meter" (signal strength meter) which is commonly incorporated in receivers designed specifically for short wave.

Since the terms "frequency" and "wavelength" continue to be used more or less indiscriminately, it is desirable that the DXer should have a clear idea of the inter-relationships between the two.

Briefly, the frequency at which a transmitter operates and the wavelength of the signals produced are interdependent, and are related by the following formula:

\[ L = \frac{V}{F} \]

where L is the wavelength in metres; V is the velocity of the radio waves (usually taken as 3 x 10^8 metres a second); and F is the frequency in Hz.

Thus, we find that Radio Singapore operates on a frequency of 6000KHz (6.000,000Hz) so the wavelength is 3 x 10^8 m, or 300 metres.

In the early days of broadcasting, it was not uncommon to say that a station was working on a wavelength of so many metres, but this practice is now largely obsolete and the operating frequency is used instead.
The information provided in the following list is published as a general guide to performance and is not intended for direct comparison. Readers are advised to check the manufacturers' literature for more detailed specifications of any receivers which interest them. Receivers marked with an asterisk (*) are available in rack-mounted versions for professional use. Prices indicated are recommended maximum retail selling prices and may or may not include sales tax.

**PHILIPS 90 RL 297**
- Circuitry: 7 transistors.
- Power: 6V internal batteries.
- Coverage: 525-1605kHz and 2.2-23MHz in 2 bands.
- Modes: AM.
- Features: Provision for external power supply. In-built telescopic aerial.
- Price: $59.

**PHILIPS 22 RL 497**
- Circuitry: 7 transistors.
- Power: 9V internal batteries.
- Coverage: 525kHz to 22MHz (less 3.9-4.6MHz) in 4 bands.
- Modes: AM.
- Features: Connection for AC mains supply unit. In-built ferrite rod and frame aerials. Electrical fine tuning on higher 2 bands.
- Price: $132.

**PHILIPS 22RR 415**
- Circuitry: 15 transistors.
- Power: AC mains or 6V internal batteries.
- Coverage: 525-1605kHz, 2.1-6.6MHz, 7-18MHz.
- Modes: AM.
- Features: Provision for external power supply recorder. In-built cassette recorder (4.75cm, 5, 2 tracks). Ferrite rod and telescopic aerials.
- Price: $139.

**LAFAYETTE "Guardian 6000"**
- Circuitry: Not quoted.
- Power: AC mains or internal batteries.
- Coverage: 160-390kHz, 540-1600kHz, 1.6-4.6MHz plus 3 VHF FM bands.
- Modes: Not quoted.
- Features: Not quoted.
- Price: $179.50.
- Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

**LAFAYETTE "Guardian 7000"**
- Circuitry: Not quoted.
- Power: AC mains or internal batteries.
- Coverage: 540-1600kHz, 4.0-12.0MHz plus 3 VHF FM and 1 UHF FM bands.
- Modes: Not quoted.
- Features: Not quoted.
- Price: $189.50.
- Distributor: Lafayette Electronics, 94 High Street, St Kilda, Vic 3182.

**TRIO 9R59DS**
- Circuitry: 6 valves.
- Power: AC mains.
- Coverage: 550kHz to 30MHz in 4 bands.
- Modes: AM, CW and SSB.
- Price: $191.
- Distributor: Weston Electronics Pty Ltd, 376 Eastern Valley Way, Roseville, NSW 2069.

**EICO DX 718 "Space Ranger"**
- Circuitry: 9 transistors, inc FET front end.
- Power: AC mains (105-125V) or 12V battery.
- Coverage: 535kHz to 30MHz in 4 bands.
- Modes: AM, CW and SSB.
- Price: $189 plus sales tax.
- Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

**LAFAYETTE HA-800B**
- Circuitry: Not quoted.
- Power: AC mains or 12V battery.
- Coverage: 6 amateur bands in range 3.5 to 18MHz.


SONY CRF-160 Circuitry: 22 transistors, inc 2 FETs. Power: AC mains or 9V internal batteries. 12V DC optional. Coverage: 150-400kHz, 530-1605kHz, 10 SW bands in range 1.6-26.1MHz inc all popular DX frequencies, and 1 VHF FM band. Modes: AM and FM. Features: Double superhet all SW bands above 4.7MHz. Telescopic antenna (1.2m) for SW. Price: $386.50. Distributor: Jacoby Kemphorne Pty Ltd, 469 Kent Street, Sydney, 2000.

VERSATILITY Copes with all soldering jobs—from miniature components to large solder lugs. Can even be operated from a 6 volt car battery.

CONTROL Temperature control at your finger tips. Heat only when, where and as much as needed.

CONVENIENCE Ideal for those almost inaccessible spots. No burning of adjacent insulation.

SAFETY Low voltage operation.

LESS MAINTENANCE Longer tip life. NO expensive heating elements to replace. Maintenance without special tools. Spare tips and elements readily available from your Scope Distributor.

SPEED ONLY 5 to 6 seconds’ initial heating up time from cold, then practically instantaneous.

MINI WEIGHT Scope De Luxe weighs only 3½ ozs. complete. Mini-scope 1¾.

SCOPE MEANS A LIFETIME OF SATISFACTION Please post free SCOPE literature.

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ADDRESS ____________________________________
CITY _________________________________________
POSTCODE ___________________________________

ELECTRONICS Australia, May, 1972 49
Measuring is fast and accurate with
KEWSNAP
VOLT AMMETERS

Body turns 180° & sets in at five different positions

KEWSNAP 5 has jaw opening of 1½" with thumb-operated range selection. Range selected is automatically identified through a viewing window. Four models are available.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>AMMETER RANGES</th>
<th>VOLTAGE RANGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-5 &amp; 0-25A</td>
<td>0-150V</td>
</tr>
<tr>
<td>B</td>
<td>0-10 &amp; 0-50A</td>
<td>0-300V</td>
</tr>
<tr>
<td>C</td>
<td>0-30 &amp; 0-150A</td>
<td>0-600V</td>
</tr>
<tr>
<td>D</td>
<td>0-60 &amp; 0-300A</td>
<td></td>
</tr>
</tbody>
</table>

Other models available—

<table>
<thead>
<tr>
<th>MODEL</th>
<th>CURRENT</th>
<th>VOLTAGE</th>
<th>RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0-10 &amp; 0-50A</td>
<td>0-150/300/600V</td>
<td>0-300 OHMS</td>
</tr>
<tr>
<td></td>
<td>0-30 &amp; 0-150A</td>
<td>0-150/300/600V</td>
<td>0-300 OHMS</td>
</tr>
<tr>
<td>8</td>
<td>0-300A</td>
<td>0-150/300/600V</td>
<td>0-300 OHMS</td>
</tr>
<tr>
<td>9</td>
<td>0-900A</td>
<td>0-150/300/600V</td>
<td>0-300 OHMS</td>
</tr>
</tbody>
</table>

DRAKE SW-4A
Circuitry: 6 valves, 7 transistors.
Power: AC mains.
Coverage: 150-500kHz plus 10 500kHz bands between 0.5 and 25MHz.
Price: $390 plus sales tax
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

DRAKE SPR-4
Circuitry: Transistor, inc FET front end.
Power: AC Mains (120V) or 12V battery.
Coverage: 150 to 500kHz plus nine 500kHz bands between 0.5 and 30MHz.
Modes: AM, CW and SSB.
Price: $520 plus sales tax
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

DRAKE R-4B
Circuitry: 10 valves, 10 transistors, 2 ICs.
Power: AC mains.
Coverage: 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5 and 28.5 to 29.0MHz plus any 10 500kHz ranges between 1.5 and 30MHz.
Modes: AM, CW, SSB and FSK.
Features: Crystal oscillator and permeability tuned VFO. Crystal lattice filter. 25kHz calibrator.
Price: $615 plus sales tax.
Distributor: Elmeasco Instruments Pty Ltd, PO Box 334, Brookvale, NSW 2100.

SONY CRF-230B
Circuitry: 48 transistors, inc 3 FETs
Power: AC mains or 9V internal batteries. 12V DC optional.
Coverage: 150-400kHz, 530-1605kHz, 19 SW bands in the range 1.6-29.8MHz inc all popular DX frequencies. and 2 VHF FM bands.
Modes: AM, CW and FM.

Distributed by:
JACOBY MITCHELL

ELECTRONICS Australia, May, 1972
**LABTRONICS 21B**
Circuitry: 20 transistors.  
Power: AC mains or 12V battery.  
Coverage: Up to nine channels in 3 to 30MHz range.  
Modes: AM and CW.  
Price: Not quoted.  
Distributor: Jacoby Kemphorne Pty Ltd, 469 Kent Street, Sydney, 2000.

**EDDYSTONE 21B**
Price: $1157.  
Features: Double superhet all SW bands.  
Coverage: 120kHz to 30MHz in 9 bands.  
Modes: AM and CW.  
Price: Not quoted.  
Distributor: Laboratory Electronics, 96 Osborne Road, Mitchelton, Qld 4053.

**EDDYSTONE 1830**
Circuitry: Transistors, inc FET. MOSFET front end.  
Power: AC mains or 12V battery.  
Coverage: 120kHz to 30MHz in 9 bands.  
Modes: CW, AM and SSB.  
Features: Double conversion above 1.5MHz. Incremental IF tuning. Selectivity adjustable to mode. Crystal filter for narrow-band CW reception. Noise limiter. 100kHz IF output.  
Price: $1898.09 inc sales tax.  
Distributor: R.H. Cunningham Pty Ltd, 608 Collins St, Melbourne, Vic 3000.

**RACAL RA.171.**
Circuitry: 23 valves.  
Power: AC mains.  
Coverage: 500kHz to 30MHz continuous.  
Modes: AM and CW.  
Features: Wadley loop drift-cancelling system. Electronic bandswitching. Triple frequency conversion. 100kHz crystal calibrator. 100kHz IF output.  
Price: Not quoted.  
Distributor: Racial Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

**RACAL RA.1217.**
Circuitry: Transistor.  
Power: AC mains or 21-27V DC (positive earth).  
Coverage: 200kHz to 30MHz continuous.  
Modes: AM, CW and SSB.  
Features: Wadley loop drift-cancelling system. Electronic bandswitching. Triple frequency conversion. 100kHz crystal calibrator. IF output at 100kHz or 455kHz. In-line digital frequency display.  
Price: Not quoted.  
Distributor: Racial Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW 2113.

**RACAL RA.1220.**
Circuitry: All solid-state inc ICs.  
Power: AC mains.  
Coverage: 1 to 30MHz continuous.  
Modes: AM, CW and SSB.  
Features: Wadley drift-cancelling system. Electronic digital display to 1Hz. Electronic bandswitching. Five IF selectivity positions.  
Price: Not quoted.  
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Microwaves for the radio amateur — I

The microwave region of the electromagnetic spectrum still offers almost boundless opportunities for the amateur radio enthusiast to contribute to the state of the art. This is the first of a series of articles written in an attempt to stimulate more interest on the microwave amateur bands.

As so often happens in radio communications, the disadvantages of one part of the spectrum can become advantages at another. In this country, the geographical disadvantage of having the capital cities separated by hundreds of miles, which certainly limits activity on 144 and 432 MHz, becomes a decided advantage on the microwave bands. This is because a high proportion of the interested amateurs will all live within the three or four small areas associated with these capital cities. Even more fortuitous is the fact that practically all these capital cities have reasonable (20-60 miles) line of sight paths available to the amateur. The reverse of these two factors is generally true in both the UK and USA.

Most of the bands listed have been available since soon after the war. Activity has ebbed and flowed over the years and varies from highly organised mountain top expeditions in the USA to the pairs of single operator portable station activity which is the main subject of the article.

The complexity and availability of equipment has also varied greatly over the years as will be seen by a study of various articles on the subject. The writer feels that the acceptance of solid state techniques by the average amateur now so greatly reduces the problems associated with portable operation that there should be an upsurge in activity such as there has never been before.

The old perennial about there being no surplus equipment available or other parties interested, which is the amateur’s usual excuse for non use of these particular allocations, is just not valid. The writer has purchased over the last three or four years, some excellent pieces of microwave test equipment and components, at costs comparable or even less than those prevailing in the UK before he emigrated here in 1965.

At least one technique, the polaplexer, developed by the amateurs in the USA in their 3300 MHz experiments, has been used commercially in the now widely used microwave surveying equipment. Home made equipment does work satisfactorily and, although, as with all aspects of amateur work, life is made much easier with the help of a bit of test equipment. Contrary to popular belief, a knowledge of advanced mathematics and physics and the ability to solve Maxwell’s equations is not a necessity!

Microwaves is a very practical subject. It is unique in that the wavelengths involved are of the same order as the dimensions of the gear itself and this makes life easy in many ways. It is hoped that this article will provide the basic knowledge which will open the door to this most interesting aspect of amateur radio communication.

The remainder of this introductory chapter will be used to give the reader a resume of amateur activity on the various microwave bands. The bands will be treated in order, starting from that with the lowest frequency.

1215-1300 MHz

Almost universally, operation on this band is by crystal controlled transmitters and receivers, usually trebling from 432 MHz. Transmitters are either varactor treblers or 2C39 type treblers and straight amplifiers. Receivers are usually single or balanced crystal mixers, fed by a harmonically derived and filtered local oscillator. Operation is usually relay controlled simplex, but often with manual changeover, and a very convenient IF frequency can be 52 or 144 MHz.

Circuitry for the treblers and straight amplifiers can be made up conveniently from half-wave trough lines. Usually antenna are small and not very effective parabolas, corner reflectors, or even Yagi arrays. The August 1971 issue of the RSGB magazine "Radio Communication" gives details of a modern design for a 23cm Yagi; the writer’s experience with a previous RSGB design (an 8 over 8 skeleton slot) was not very good. The 23cm band is really outside the scope of this series of articles, as conventional VHF/UHF techniques are mainly used.

2300-2450 MHz

Operation here is often by crystal controlled transmitters and receivers using similar techniques, but with more multipliers than 1215 MHz equipment. Such operation has tended to become standardised on 2304 MHz, the sixteenth harmonic of 144 MHz. Most amateur operators continue to use valves, and a number of surplus types, used in trow lines, or cylindrical cavities are suitable (DET22, DET29, 416B, 2C39A, etc) for the final stages of transmitters. Harmonic mixing in single crystal mixers, followed by a low noise IF pre-amplifier, and again, a 52 or 144 MHz IF are the vogue for receiving. The smaller parabolas become more effective at this frequency and are the type of antennas used almost universally.

A number of UK amateurs have solved the multiplier chain problem in the receiver by using a self excited BFY90 transistor cavity oscillator on 2280 MHz (with an IF of 24 MHz) and injecting a marker signal of 2304 MHz at —40dBm derived from two 2N706’s at 36 MHz crystal oscillator, and x4 multiplier, feeding a x16 multiplier using an AA2112 diode in a home made cavity. Apparently the stability is good enough for use of the quite narrow band Heathkit Mohican as a tunable IF. This arrangement results in simplicity and lower power consumption.

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Another UK group are using self excited pulsed 2C43 triodes in order to achieve high peak powers, and have succeeded in contacts in the region of 100 miles.

At present, therefore, this band really forms the crossroads between the world of conventional valves and transistors and their associated circuitry and that of the true microwave bands, where up to the present, the reflex klystron has been almost universally used.

This is the first of the microwave bands where full duplex operation usually takes place, and thus some form of standardisation of equipment is essential. The technique is as shown in figure 1, it is equally applicable to any of the bands under consideration but most used from 3300 MHz upward.

Station 1 has its transmitter operating on frequency 1. In practice this is usually provided by a small reflex klystron generating between 10 mW and 100 mW of power. A few milliwatts of this power is sampled in the coupling element and passed to a crystal mixer to act as the receiver local oscillator power. Here it combines with the received signal from Station 2, which has a similar transmitter whose frequency differs by the intermediate frequency (typically 30 MHz) from the frequency of the Station 1 transmitter. A similar IF frequency is also derived in Station 2. This arrangement, of course, necessitates that the two stations use the same IF frequency.

The advantages of this system are numerous and include:
1. Only one klystron is required per station.
2. No transmit/receive switching is necessary.
3. Tuning and antenna aligning can be done easily since a sidetone is produced from one's own modulator or tone whenever the carrier from the remote station is being received.

Practical arrangements using this technique vary with the band. In the 3300 MHz band, a system known as 'polaplexing' has been widely used. In this system the two antennas of figure 1 are replaced by a single one, and the transmitted and received signals are arranged to be polarised at 90° with respect to one another and, therefore, electrically almost independent of each other. This constitutes the coupling element, of which the crystal mixer is an integral part, and as a result, the mechanics of the system are quite simple. Most of the 3300 MHz systems in use in the USA use this system and the polaplexer is often fabricated from soft drink cans. (Details in QST, June '63.)

Another view of the prototype 10,000 MHz system used by VK5CU, this time showing the parabolic aerial and feed system.

The table at right shows the various amateur microwave bands, together with the terminology used to describe them, and an indication of the activity to date.

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<td>21000-22000</td>
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<td>1.3cm</td>
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† An unofficial, but generally accepted terminology relating to amateur microwave allocations.

Note that the UK and USA allocations are basically the same as the Australian ones.

Although the only set of 5650 MHz equipment produced by the writer used rectangular waveguide, it is now felt that this should be superseded by the polaplexing technique, as practically no test equipment, or for that matter, basic hardware, seems to have appeared on the surplus market. Nevertheless both the rectangular waveguide techniques as described in the 10,000 MHz sections, following, and the polaplexing techniques of 3300 MHz are equally applicable. It is interesting to note here that basic coaxial techniques, hardly ever used by amateurs to date could well be investigated further for both 5650 and 3300 MHz.

This is the band among those under review which has probably attracted most interest by the amateur fraternity, particularly in the UK where activity has been excellent of late. The main reasons for this interest are:
(a) A large amount of surplus equipment from the widely used and adjacent frequency range of 8000-9750 MHz has been available, including a number of types of klystrons suitable for operation (after a simple modification) in the amateur allocation.
(b) This part of the spectrum became very

Fig. 1: The basic arrangement used for amateur microwave communications. Each transmitter also acts as the local oscillator for its receiver.

Electronics Australia, May, 1972
Opposition mounts protest campaign against new Fairchild weapon in the IC War

A.P.P. Fri.: Increased tension and concern are reported from all opposition following Fairchild's successful introduction of the μA776 Multipurpose Programmable Operational Amplifier.

Latest reports indicate down to ±1.2V. The growing support among the μA776 has all the features enemy to have the μA776 of an earlier Fairchild totally banned. The enemy is particularly worried by the extreme versatility of the μA776, because users will be able to programme their own particular requirements.

Further concern mounted when more was learned about the precise features of the μA776 op amp. With the addition of a simple external resistor, a user can select his own slew rate, frequency response, input bias current, and a power supply range μA776.

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familiar to amateurs connected with radar while in the services and it has been used almost exclusively for teaching microwave techniques at all levels.

(c) The size of the wave guide used is very convenient (as opposed to the very much larger and heavier sizes for use at 3300 MHz—a subject dealt with later in this discussion). Although surplus waveguide is the most convenient to work with, home-made waveguide tubing and components are reasonably easily made and work quite satisfactorily at this frequency.

(d) It offers a challenge to operate on as high a frequency as possible, and this frequency is probably the practical limit for the majority of amateurs.

(e) The antenna problem is not difficult, as home-made horn antennas with gains approaching those of small parabolas are easy to make and have known and repeatable characteristics.

The general modes of operation at 10,000 MHz are as previously described, with the addition of a few more which become practical because of the component availability and size. Three of these use a single antenna, but use different methods of obtaining the local oscillator and IF signals as shown in figures 2a, 2c, and 2d.

Probably the most efficient system the writer has used is shown in figure 2(d) and this and the circulator coupled system of 2(c) are the two in current use at VK5CU and described in detail in the later articles of this series.

ABOUT THE AUTHOR

Des Clift has been active on the microwave amateur bands for many years. In England he operated with the call sign GB5AK, until migrating to Australia in 1965. Until recently he was living in Hope Valley, S.A., where on 30th December 1971 in conjunction with Barry Walls VE5CMW he set a new 10,000MHz Australian record of 61 miles.

Although one or two UK amateurs have used the polaplexer principle at 10,000 MHz, and in fact it is used commercially at an even higher frequency, the writer prefers to keep to rectangular waveguide at this frequency because all of the associated equipment and test equipment is also in rectangular waveguides. Thus, there are less measurement and conversion (from polaplexer to test equipment) problems. Furthermore, the mechanical tolerances and complexity of the 10,000 MHz polaplexer do approach the limit of the average amateur facilities.

21,000-22,000 MHz

As with 5650 MHz the surplus market has yielded practically nothing for this band. Coupled with this is the fact that the mechanical engineering involved in the fabrication of components at this frequency is really outside the amateur field. What few reports of activity there have been over the years seem to have been concerned with amateurs professionally engaged in microwaves or microwave test equipment, who have had access to and borrowed commercial gear for the event.

All the techniques referred to for use at 10,000 MHz also tend to apply here. Klystrons do generally require higher voltages, which constitutes a problem for portable operation, and the generation of an appreciable amount of power at this frequency by the amateur using solid state devices is still, it is felt, quite a few years away. But, since the spirit of these articles is to solicit and encourage activity in all the amateur microwave bands, let us hope that some enthusiast in Australia will surmount all the problems and have a contact on 21,000 MHz.

(To be continued.)

---

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**ELECTRONICS Australia, May 1972**
The Australian-designed T-VASIS aircraft landing aid, which was recently adopted as a world standard by the International Civil Aviation Organisation, has been further honoured by the award of the Prince Philip Prize for Australian design.

Two visual approach aids have so far received ICAO endorsement. The first was a British system called red-white VASIS, the second was the Australian system, for which T-VASIS is the internationally accepted abbreviation.

The abbreviation stems from the T-shaped patterns of light seen by a pilot approaching a runway. If his approach is too high, he will see the lights as an inverted "T"; if too low, he will see a normal "T". When his approach path is optimum, he will see merely a horizontal row of lights.

A system to provide this information has to operate in a variety of situations under changing ambient conditions, by day or night, and it has to be visible at four miles from the runway "threshold" (the line marking the beginning of the effective operational surface, before which the aircraft should not land).

The Department of Civil Aviation and the Aeronautical Research Laboratories of the Department of Supply began a long-term research study in the late 1950s, aimed at meeting these requirements with a high degree of accuracy. Several systems were subjected to evaluation and comparison. The result was T-VASIS. This system was developed from a concept originated by DCA and rigorously tested until it met all the requirements.

The system consists of two sets of light units, 10 on each side of the runway. Each set of 10 has a line of four light units (the "wing bar") at right angles to the centre line of the runway. The remaining six bisect the wing bar at right angles, three on each side of it. The pattern thus produced is in the form of a right-angled cross.

According to his height, the pilot of an approaching aircraft will see:

1. a single horizontal line of lights, indicating that his approach path and height are right
2. an inverted "T", indicating that he is too high
3. an upright "T", indicating that he is too low.

The lights forming the upright "T" also have red filters and blades arranged so that a pilot approaching in a gross undershoot condition will see a red upright "T". (See figure 1.)

The lights are positioned alongside the runway at a point where the flight path of an approaching aircraft at a height of 50ft above the runway threshold and descend-
international landing aid

ing at a rate of 1 in 19, would, if produced in a straight line, intersect the runway. (See figure 2.)

As will be seen from figure 1, the pilot is provided with an indication of the amount of undershoot or overshoot by the number of lights he can see forming the tail of the upright or inverted "T". For a slight degree of undershoot or overshoot, he will see only one light in the tail. Three lights in the tail indicate a considerable overshoot or undershoot. As previously mentioned, gross undershoot is indicated by a red upright "T".

The system is sufficiently accurate to allow the safe operation of all present airline aircraft irrespective of size.

In the normal approach the system will guide the pilot's eye over the threshold at a height of about 50ft, thereby allowing adequate clearance of the aircraft wheels. With larger aircraft, particularly those referred to as long bodied aircraft such as the Boeing 747, it is necessary for a pilot to fly higher than a normal slope. With this system it is considered quite satisfactory that the pilot fly the slope with between one and two lights indication of "fly down". This will result in the height of the pilot's eye at the threshold being increased to a height of approximately 70ft, which provides adequate clearance between the aircraft wheels and the threshold.

It was the ability of the T-VASIS to provide suitable guidance for the Boeing 747 that helped persuade ICAO to adopt the system as an alternative world standard.

The T-VASIS light units are located well clear of the runway, the leg units of the T being 175ft from the centreline, with the nearest wing bar light unit normally 60ft from the runway edge.

To provide the required four mile range in Australian conditions it has been ascertained that a light intensity of 100,000 candela is required. This is obtained from a group of four sealed beam lamps situated on the rear of the light unit.

In order to cover the full range of ambient lighting conditions two sets of lamps, one for daylight and one for night use, together with different current levels, provide a six stage intensity system.

T-VASIS has been used at major Australian and NZ airports for a number of years. Since 1964, there have been 94 systems installed in the two countries.

The adoption of T-VASIS by ICAO is seen as an important step in world aviation safety. Anticipating the future use of the system on overseas airports, overseas companies are currently negotiating with DCA for licences to manufacture the equipment in their own countries.

DCA personnel check the accuracy of alignment of a T-VASIS light unit at Melbourne airport with a special 6ft long spirit level.

ELECTRONICS Australia, May, 1972
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Building your own colour TV receiver

Announcement of the starting date for colour television in Australia has triggered a number of inquiries from readers along the lines: "Are we going to be able to build our own colour television receivers — and save money? Are you going to run a constructional series? Why not start now so that the set will be finished and paid for by March 1975?"

To answer these questions, it is necessary to repeat in part what was said a few months back, but let's do it anyway.

Building your own receiver was all the rage around 1957-1960, following the introduction of television into Australia. Would-be constructors were motivated by the desire to learn something about television in a practical way and also by the then valid assumption that they would save money in the process.

No less important was the fact that, about the same time, a number of component manufacturers saw their chance to make some "gravy" by supplying the home constructor market, along with the many small manufacturers who seemed suddenly to materialise.

As a result, it was possible to buy from regular parts suppliers packaged and prealigned IF strips, matching and prealigned tuners, complete deflection kits, pre-chassis tube hardware and all the other necessary bits and pieces, even down to matching sets of knobs.

No less important, it was possible to put the components together, literally on the kitchen table, to switch on, make a few adjustments and settle down with a finished set — without having gone within miles of an alignment set-up.

This facility came as a pleasant surprise after years of speculation as to whether home-constructed TV sets would ever be a proposition. I know, because I was involved in the speculation and I personally built that first 17-inch TV set in my own home situation.

But, unfortunately, what was a proposition in 1957 has ceased to be so in 1972.

The novelty of building one's own TV receiver has faded and the incentive of lower cost has been eroded or eliminated by competition between the major receiver manufacturers.

Small-time receiver manufacturers, whose needs more or less paralleled those of the home-builder, have long since disappeared from the scene.

As a result, firms manufacturing or importing for the particular market have either folded or turned their attentions elsewhere.

Consequently, anyone who might wish to build their own television receiver today (even monochrome) would have to collect parts held mainly as replacements for commercial receivers. They would have to contrive a circuit around whatever parts they managed to acquire, assemble their own IF channels, confirm the design, test and align using whatever test gear they could get their hands on.

Undoubtedly there must still be some activity along these lines — but not much. From all evidence, home constructors of TV receivers are very, very few and far between. There is virtually no demand and, equally, no systematic supply of components.

So to the question of colour sets.

Undoubtedly a certain number of engineers and technicians from receiver factories, TV stations and other such places will already have been collecting sample and oddment components that might one day become part of a complete colour receiver.

However, it is one thing for an individual to build a colour receiver against a background of expertise and a lab full of equipment. It is quite another to attempt the same job on a kitchen table, without such a background and using parts bought over the counter.

Right now in Australia — for all practical purposes — it couldn't be done. The parts are simply not there to be bought and the circuits are not there to be followed.

But what say we were to take a senior member of our staff off all other work for six to twelve months and put his time to the design and presentation of a complete colour receiver.

Would the parts position automatically be resolved?

Would manufacturers commit themselves to the production of the components and modules that constructors would ultimately require?

Would importers undertake to provide a continuing supply of those components which might not be available from local sources?

The answers would almost certainly be in the negative unless the firms concerned felt they could see a substantially re-invested in home television construction and a parallel demand from a whole new crop of small-time colour TV set manufacturers.

So we face the old chicken-and-egg dilemma, with a twist:

What's the use of a design without the components?

What's the use of components without a design?

What's the use of either — or both — if the market isn't big enough to justify the investment?

Do you feel sure that the demand would be there? You may be absolutely right.

The real question is whether there are manufacturers or importers out there who share that opinion strongly enough to back a marketing venture.

It happened that way in 1957. There are, as yet, no significant portsents relative to 1975.

Over this whole situation hangs another problem which must surely haunt anyone who addresses themselves to the design of a colour television receiver, whether for home construction or commercial release. I refer to the television industry's induction into the era of solid-state.

Up till a few years ago, a new model TV set could be approached basically as a variation on a theme. Most of the circuitry could be bought from someone having a ready-made model. Here and there a new valve would replace an older and less efficient type. The deflection and power supply configuration would be altered to suit, but the design problems were fairly well understood and fay well under control.

After all, the industry had been making and using valves and the allied technology for fifty years and a few new type numbers really didn't change the situation.

But a few years ago, semiconductors literally forced themselves into the sights of TV set designers and the process of changing over to solid-state circuitry began. For the most part, it has been a fairly gradual operation, marked by quite a few hybrid receivers built around a mixture of valves, transistors and integrated circuits. Each new model has represented a further step towards completely solid-state design.

Unfortunately, the path has not been a smooth one. Introduce the subject in a service situation and one is almost certain to be regaled with stories of well-known brand name receivers which suffer from recurrent and unforeseen failures of this transistor or that transistor — for reasons that are by no means apparent.

There are stories of modifications to certain models, which have rendered the original circuit entirely meaningless and which have long since outstripped the modification.

A classic story concerns a receiver which "blows" line output transistors unless the waveforms are adjusted precisely to specification, under working conditions. The trouble is that it is likely to blow the replacement transistor before the technician has had time to optimise the waveform! (See "Serviceman" elsewhere.)

Even applying a discount to the grousches of the servicing industry, it is impossible to
Work of art 6166A

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escape the conviction that the electronics industry still has some lessons to learn about solid state as applied to monochrome television receivers. And if this is true of monochrome, it will apply even more to colour with its greater complexity and more critical circuitry.

It is a pretty safe bet that Australian colour TV receivers will be all solid-state.

Nor is technology going to stand still during the next two or three years. It is virtually certain that more and more sections of colour receivers will be compressed into integrated circuit blocks. Inductors will tend to give place to resonant filters and perhaps obviate some of the present uncertainties of circuit alignment.

Picture tubes and deflection circuitry will come into a lot of attention. To date, the shadow-mask tube has been the major display device but the Sony Trinitron has the potential to cause an upset in more ways than one.

In short, Australian receiver (and component) manufacturers are going to have to cope with a large plateful of problems within the next twelve or eighteen months:

- Sort out the lingering problems with solid-state technology;
- Expand the technology to take in the greater complexities of colour receivers;
- Evaluate new components and techniques as they are announced;
- Anticipate as far as possible what components will be obtained locally and what will be imported;
- Freeze their initial designs in time for production and release ahead of C-Day — but not so soon that it will be obsolete before the colour service begins.

As we have said, the position may change closer to C-Day; it is difficult to say. Manufacturers may come to light with pre-adjusted modules suitable for home assembly, or modules that don’t need adjusting. Deflection components, along with recommended circuitry may become available, as they did in 1957. Constructors may opt for colour tubes less large, less massive and less daunting in their price than those required for full-size consoles.

The price level may appeal — or it may not.

It is one thing to tackle a project costing a few dollars or even a hundred dollars. If it doesn’t work out as well as it should, there will be a certain amount of disappointment and possibly a certain amount of recrimination at domestic level. But what about many hundreds of dollars worth of colour TV parts that fail to produce the anticipated picture? It wouldn’t be funny!

Many hundreds of dollars?

The March 1972 issue of “QC” magazine featured and reviewed the Model GR-371 MX colour television receiver kit marketed in the USA by Heath, under the title Heathkit. Wilfred M. Scherer, Technical Director of the magazine is unimpressed in his praise of the project. It apparently went together without any problems, involving in the region of 40 to 60 hours work, depending on the intensity of the effort put into it. He does warn that mounting the picture tube and installation in the cabinet is a two-man job, because of the weight of the units involved.

The price of the 25-inch receiver? US$579.95, for the chassis and picture tube plus US$114.75 for the cabinet, making a grand total of US$714.90.

This is a big, luxury receiver, to be sure.

For a 23-inch receiver (chassis only) the price mentioned by Scherer is US$399.95, and $249.95 for a 14-inch style.

These, of course, are American prices, reflecting the relatively modest price levels of electronic components in that country and the buying resources of a very large specialist company. Comparable kits of components, purchased ad hoc over the counter, would be for American standards and for the NTSC system of colour presentation.

Whether it would be worthwhile to develop a kit for Australian standards would be up to the companies concerned to say.

One other point would be worth making: The 25-inch receiver constructed by Wilfred Scherer for QC magazine involved five separate manuals for the construction and adjustment of the chassis, one of them being 160 pages. A sixth manual covers fitting to the cabinet.

One must certainly take one’s hat off to the characteristic thoroughness of the Heathkit presentation — but by the same token the space required can only dismay the editor of an ordinary journal, who can personally want to build your own colour receiver? Are you concerned about costs relative to commercial receivers? How would you cope with the “it doesn’t work” risk?
Service — A Cinderella Industry?

I have two stories this month, neither of which is very flattering to the set manufacturer. More important, I am rapidly being forced to the conclusion that the serviceman, who has never been given much of a break, is being considered less and less in the march of progress. See what you think.

The first story concerns an 11in solid state portable TV set, of local manufacture, which was suffering from weak sound. Taken at face value, that description should not strike fear into the heart of the average serviceman. One would expect that, if he was worth his salt, he should be able to knock a couple of such jobs over before breakfast.

Well, in a manner of speaking! At least, that’s what I thought until I struck this job. And it is not simply this individual case that is worrying me, but the implications in regard to the whole servicing scene. I think you will appreciate why when I have finished the story.

A preliminary check indicated that the audio system was functioning normally and, since the picture appeared to be normal, it appeared that the fault was somewhere between the video detector, where the sound IF was picked off, and the ratio detector output.

This part of the set — the sound IF, limiter, ratio detector — is built around an IC, an IF transformer, a ratio detector transformer, and a few minor components. A voltage check around this section suggested that all was well with the associated components. Voltage was being applied to, or was appearing on, all the right pins, transformer windings were intact, and so on. It seemed almost certain that the trouble was in the IC itself.

So far, all appeared to be plain sailing. All I had to do was obtain a replacement IC and fit it. The number was clearly marked on both the unit itself and the manufacturer's circuit diagram. I contacted one of my usual suppliers and was assured that he could supply it ex-stock. So far, so good.

But I was curious to learn more about the IC. What it consisted of, its ratings, etc. But I was curious to learn more about the usual suppliers and was assured that he could supply it. I decided to take matters into my own hands.

As can be appreciated, all this took a considerable time. Working on the assumption that the IC was a good one, I had to assume that one of the other components was faulty. But when I could find nothing wrong I found myself going over the associated components a few times.

So I went over everything again, pulled out all the stops and tested each component. This made it difficult to positively identify the problem, until I hit on the idea of identifying the common pin, connecting to the case, by means of an ohmmeter. Using this as a reference, I simply wired it in the same manner as the original.

A word of warning here though. If you should find yourself in a similar predicament, be careful how you use the ohmmeter. Certain ranges of certain types of ohmmeters could create dangerous voltages or current conditions inside the IC if one happened to test other than the case lead. It is impossible to lay down hard and fast rules, but most servicemen would be aware of the currents and voltages involved in their own instruments.

But to get on with the story. I fitted the new IC and switched on hopefully. No joy. The sound section was completely dead. Had I overlooked some subtle fault in one of the associated components? I went over everything again. All voltages checked out OK and I made a thorough check of the transformers, capacitors, resistors etc, but could find nothing wrong.

As can be appreciated, all this took a considerable time. Working on the assumption that the IC was a good one, I had to assume that one of the other components was faulty. But when I could find nothing wrong I found myself going over the same components several times, convinced that there was a fault, and that I just couldn’t see it.

Finally I gave up. New IC or not I concluded it too must be faulty. After all, brand new devices can be faulty. So I obtained a second IC from the same supplier. Results were almost exactly the same, except that there was now very weak, very distorted sound.

This time I nearly went up the wall. The idea of two brand new faulty ICs in a row was so preposterous that I was forced to dismiss it as wishful thinking. There just had to be some other explanation.

So I went over everything again, pulled out all the stops and tested each component by every possible means at my disposal. Again I came to a blank wall. It couldn’t be the IC yet, by my book it wasn’t any of the other components either.

At the point of desperation I clutched at the only straw I could see. In spite of the long odds, it just had to be the IC. I would try a third one, if only because it was cheaper than sitting there going over the same ground umpteen times. I made one other decision. If it was the IC then I had bought two faulty ones in a row. Did this dealer have a faulty batch? I decided to buy the next one somewhere else.

As it turned out, the only somewhere else I could find was the maker of the set. When this one was delivered I noticed a curious thing: the indexing spigot on this one was in its correct position between the pins, as was the original.

When I fitted this one the set first try, and performed perfectly when the transformers were peaked. A victory? Perhaps, but a dreadful hollow one.

In fact, the whole incident leaves a very nasty taste in the mouth and prompts a number of very pertinent questions.

First, from a purely technical point of view, what was wrong with the ICs whereby they were able to establish the correct DC voltages in all parts of the circuit, yet were unable to process the signal? Were they actually faulty or were they not the same device at all, but a similar one, incorrectly marked, which just happened to produce the correct DC voltages?

More importantly from a business point of view — who pays for the six or seven hours wasted on the job? The customer certainly won’t, nor will the IC manufacturer. Which leaves only yours truly, who would be forced under no circumstances to say that I didn’t make any money on that job; in fact I lost substantially.

Again, who takes the blame for the length of time it took to fix a relatively simple fault? (The whole exercise was, of necessity, spread over many days) Again, the answer is yours truly, unless I am lucky enough to be able to convince the customer otherwise.

Finally, what can the average serviceman do to guard against such a situation? The answer, I’m afraid, is very little. Whereas valves and transistors can be replaced independently, with simple testers, there appears to be little likelihood that an equivalent device for ICs will ever be a practical proposition. The highly complex nature of these devices, plus the fact that they can be obtained in an infinite variety, rules out any chance of a simple IC tester.

This puts the serviceman completely at the mercy of the IC manufacturer and leaves him wide open to the very situation which I experienced.

Which brings me to the whole point of this story. The serviceman has always been something of a Cinderella in the radio and TV industry, with one ugly sister in the form of the manufacturers, who have generally been given scant consideration to the problems of servicing their own products. The other ugly sister is in the form of the general public who complain bitterly when this very lack of consideration rebounds in the form of difficult service jobs and high charges.

For a while, not so long ago, it looked as though our fairy godmother was about to burst upon the scene. We were regaled with stories of completely new construction methods, including the modular concept, which would reduce servicing to a mere routine operation. So far I have seen little of this in practice, and what I have seen has
not impressed me — to put it mildly!

To date, the change-over to solid state techniques, particularly in regard to TV, has done little to improve the serviceman's lot, and a great deal to impair it. And the situation does not appear to be improving.

Don't misunderstand me — I am not suggesting that we should not have the kind of overall progress which solid state techniques can offer. That would be foolish and completely unrealistic. Nor am I so unrealistic as to expect that every new technique and device will be perfect from the word go.

What I am saying is that too many mistakes which are born in the laboratories and production lines finish up being left on the serviceman's doorstep. Personally, I feel that it is time those who create the electronic monsters should be prepared to accept some responsibility for their after-care.

To emphasise my point, here is another story. It is about this same model set, though not the same actual unit. The set as I received it had a blown out power transistor in the line output stage. In addition, there was a rather vague history of the same thing having happened on a previous occasion, and having been repaired by another serviceman.

Having confirmed that the transistor was, in fact, blown, I checked all likely associated components to satisfy myself that none of these was responsible. Finding nothing wrong, I fitted a new transistor, whereupon the stage came to life. Conscious of the previous failure I went over the circuit with a CR0 and meters, in a further effort to find anything which might contribute to such a failure. As far as I could see, there was nothing abnormal anywhere.

Yet I had hardly finished the tests when the transistor packed it in. Convinced that there was some subtle fault which I had not found, I went over the set again, with more detailed reference to the circuit. This time I realised that the two did not agree.

The upshot of this was that I rang the maker's service department and asked about modifications in general and in particular about any concerned with protecting the line output transistor. No one seemed to know much about this particular problem, but they admitted that there had been a number of changes to this part of the set, and promised to forward a list of the modifications.

When these subsequently arrived I was rather shocked at the number of changes involved. It was pretty obvious that the design boys had had a lot of "second thoughts" about this and other parts of the circuit.

But I was even more shocked to realise that, even with all these changes to the circuit, the set would still not agree with it. I rang the service department again; could someone please explain what was going on? The best reply I could get was to the effect that, yes, they thought there had been some changes of this nature, but they weren't too sure exactly what they were or why they had been made. I gave up in disgust.

It was only by sheer chance that I finally discovered the vital piece of information concerning the safety of the output transistor.

The power transistor I had blown up was the last one in stock. Supplies around the

(Continued on page 126)
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- **Ω**: 0~5 k, 0~500 k (max. 500 kΩ)
- **dB**: -20~+36
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- **μF**: 0.0001~0.6  use ext.
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- **Ω**: 0~10 k, 0~1 M (max. 1 MΩ)
- **dB**: -20~+62
- **μF**: 0.0001~0.6  use ext.
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- **ACV**: 2.5, 10, 50, 250, 1 k (8 kΩ/V)
- **DCA**: 50 μ, 5 m, 50 m, 250 m (500 mV)
- **Ω**: RX1, RX10, RX100, RX1 k
- **dB**: -20~+62
- **μF**: 0.0001~0.6  use ext.
- **H**: 10~1000, 0~1 k (max. 5 MΩ)
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- **DCA**: 0.5 m, 25 m, 500 m, 1 k (500 mV)
- **Ω**: 0~10 k, 0~1 M (max. 1 MΩ)
- **dB**: -20~+36
- **μF**: 0.0001~0.6  use ext.
- **H**: 10~1000, 0~1 k (max. 1 MΩ)
- **Accuracy**: DC ±3%, AC ±4%
- **Battery**: 1.5 V (UM-3) x 2

Dimensions: 132 x 95 x 46 mm, 465 gr

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- Collapsible stand fitted on the back.
- Meter movement protection.

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- **ACV**: 10, 50, 250, 500, 1 k (5 kΩ/V)
- **DCA**: 0.1 m, 2.5 m, 25 m, 500 m, 1 k (250 mV)
- **Ω**: RX1, RX10, RX100, RX1 k (max. 10 MΩ)
- **dB**: -20~+62
- **μF**: 0.0001~0.6  use ext.
- **H**: 10~1000, 0~1 k (max. 5 MΩ)
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**A Simple FET Dipper**

Most solid-state dippers use a diode to rectify the RF energy present at the collector or drain terminal of the oscillator. The rectified RF is used to drive a DC amplifier and the amplifier operates a meter. This technique is fine provided the dipper is not coupled too tightly to the circuit under test, a condition which can cause the RF voltage to fall below the conduction point of the diode — approximately 0.4 volt for a germanium diode, and 0.6 volt for a silicon diode. When the diode no longer conducts, the meter indication falls to zero, thereby preventing one from obtaining a reading.

The circuit shown was tried and the performance was good. There are no dead spots in the tuning range and a pronounced dip in meter reading can be obtained without experiencing "dropout". Changes in drain current are observed on a sample RF to provide an indication on the source-gate junction rectifies the RF voltage to approximately 0.4 volt for a germanium diode, and 0.6 volt for a silicon diode, when the conduction point falls to zero, thereby preventing one from obtaining a reading.

**Terminating Coaxial Cables**

It is often a difficult job to produce neat, strong connections with coaxial cable, and the inner wires seem to break off with annoying frequency. A method of termination used in industry, but which may not be known to hobbyists, helps prevent this sort of failure.

1. With a sharp knife, cut around the outer insulation about an inch from the end, and remove it from the cable. Take care not to score or nick the copper braid.
2. With a spike or small screwdriver tease out the braid strands and twist them together to form a "tail" leaving the inner insulation revealed.
3. Strip off about 1/4 in. of inner insulation. One way of doing this without fear of damaging the inner strands of the wire is to run the tip of a hot soldering iron round the insulation — a rather smelly but effective method!
4. Fold the inner strands back along the insulation. The cable end should now be as in Fig. (a).
5. Take a length of tinned copper wire (20 or 22SWG.) and wrap it tightly round the strands and insulation, leaving a piece projecting to provide the inner connections.
6. With a clean hot iron run solder round the tinned copper wire and inner strands.
7. Leave to cool, after which it will be found that the tinned copper wire has been soldered on to the inner strands and has also melted into the inner polythene insulation.
8. For additional protection a rubber sleeve can, if desired, be put over the inner connections to prevent any danger of the braid connection short-circuiting against it.

(from "Radio-Constructor")

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A Two-Way Mobile Tuning Aid

It is not certain just how widely this little unit is known, but I have found it invaluable for tuning up two-way mobile receivers after the front end has been modified from the original frequency. The original idea was extracted from an American magazine about nine years ago by Bill, VK2BMX. The circuit specifies a type 2N3964 transistor and a 2.5mH RF choke. I am successfully using a BF115 transistor and a smaller value of RF choke which I salvaged from a scrapped TV receiver. (By Ken Hargreaves, VK2ZIL, in VHF & TV Group “Newsletter”, WIA, New South Wales Division.)

Editorial note: Our Assistant Editor, Philip Watson, has made up one of these units for his own use and a detailed drawing is shown herewith. It is built into a “Strepsils” tin which measures $\frac{3}{4}$in x 2$\frac{3}{4}$in x 7in and includes a battery, switch, crystal socket and miniature coax socket to take an aerial. The aerial consists of a 7in length of stiff hookup wire soldered to a miniature coax plug.

This unit has been used to tune up modified two-way mobile receivers for both the 52 and 144MHz bands, using the crystal from the companion transmitter. It is also invaluable for tracking down interference on an FM receiver, such that the required signal level can be provided in the receiver, while steps are being taken to trace and remedy the interference.

The required signal strength for adjustment and alignment purposes may be obtained by the simple expedient of varying the distance between the receiver and the oscillator. It was observed that with the lid on the oscillator case and without the aerial, a signal could not be detected beyond a few inches from the receiver aerial input.

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More Complex Receivers

Limitations of simple receivers — the RF amplifier stage, its operation and use — neutralisation — gain control of TRF receivers — the superheterodyne principle, its operation and advantages — autodyne converters — transistor receivers — more elaborate receivers.

While a beginner may concentrate initially on building small regenerative radio receivers of the type discussed in the last chapter, he must inevitably wonder about the design of larger receivers. In this chapter, we explain the basic idea behind two well-known types of receiver, the "TRF" and the "superheterodyne."

In an explanation of reasonable length, it is not possible to discuss individual circuits in detail — the how and why of every resistor and capacitor. The reader will have achieved something, however, if he can understand the general idea behind these circuits, particularly the superheterodyne.

Having grasped the basic idea, it should be possible to enlarge upon it later by studying the circuit and design information on actual receivers.

The TRF and, later, the modern superheterodyne receiver, came as a natural development from the desire to produce receivers which were more sensitive, more selective and more suitable for use by non-technical members of an ordinary household than regenerative receivers.

The story of the development of these types of receiver is really a continuation of the story told in chapter 11 about small receivers, and it must inevitably read like a piece of radio history.

As we pointed out in the last chapter, a receiver having a regenerative detector followed by two audio stages is capable of receiving a great many stations, both on the broadcast and short-wave bands.

By using a power transistor or valve in the final stage, such a set can operate a loudspeaker at good volume on the stronger stations and, in the early days of radio broadcasting, many domestic receivers were of this general type.

For domestic use, however, such receivers have certain basic limitations.

In the first place, performance depends very largely on proper use of the reaction (regeneration) control. If it is too far advanced, the set oscillates, producing whistles in its own loudspeaker and in neighbouring receivers tuned to the same station. If the reaction control is not sufficiently advanced, perhaps to limit volume, selectivity is likely to suffer to the point where two or more signals are heard together.

While this is no special problem to anyone who understands what the controls are for and how they are supposed to be adjusted, it did prove an embarrassment in the early days for non-technical members of the household. Some less critical arrangement was obviously desirable for general use.

Another difficulty which was experienced with early simple regenerative sets lay in the fact that there was a practical limit to the amount of amplification one could provide following a detector. Thus, while one or two audio stages could be used to usefully increase gain and even selectivity (the latter by roundabout means), anything more than this tended to lead to difficulty.

Slight vibration in the detector valve, causing slight changes in plate current, could be amplified by subsequent stages to produce what are known as microphonic effects. Tapping the valve, or even normal vibration, would produce thumps and ringing noises from the loudspeaker.

Then again, noise due to electron flow in the detector itself could be amplified to the point where it produced a continuous background hiss. And in mains-operated receivers, very slight 50Hz or 100Hz voltages, coupled into the detector circuit, could be amplified by subsequent stages to produce what are known as "motor-boating" effects. These are noise due to electron flow in the detector valve, causing slight changes in plate current, which could be fed back as a spurious signal to the plate of the detector. If regenerative, this feedback was able to cause an effect called motor-boat. It is connected directly to the grid of the valve, without any capacitor or resistor, because the valve is intended to operate as an amplifier rather than as a detector. For the same reason the valve is provided with grid-cathode bias — here by means of a bypassed cathode resistor — to ensure operation as a class-A amplifier.

The RF amplifier stage, its operation and use. Amplifier signal output current from the plate circuit flows through the primary winding of a second coil assembly, and is coupled into a tuned secondary winding, the two windings forming what is commonly referred to as an "RF coil" or RF transformer.

The secondary windings of both the input and output tuned circuits, with their associated capacitors, must be capable of tuning over the entire broadcast band. To receive any given station, both tuned circuits should be set to the frequency of that station.

Under these conditions, the signal from the desired station is selected and passed to the RF amplifier grid, in preference to other signals which may be present. It is amplified by the RF amplifier valve and passed through the second tuned circuit, which also favours the desired signal and tends to reject signals on other frequencies.

In other words, the use of a tuned RF amplifier grid, in preference to other signals which may be present. It is amplified by the RF amplifier valve and passed through the second tuned circuit, which also favours the desired signal and tends to reject signals on other frequencies.

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stage not only provides amplification, but also increases selectivity. This was — and is — a most important point.

Since an RF amplifier stage feeds into a circuit tuned to the signal frequency, this is the only frequency which it can amplify properly. Because there is no load resistor in the plate or collector circuit and no audio transformer, this circuit cannot significantly pass on signals within the audio range. Therefore, it is not nearly as susceptible as an audio stage to hum, hiss, microphony or motor-boating. This, too, is important.

Many early receivers used one triode RF amplifier stage, a regenerative detector and two audio stages. They were the first "TRF" receivers, the letters indicating the use of a tuned radio frequency amplifier stage.

Such receivers were generally better than earlier types without the RF stage. They had better gain and also set the stage for a lesser extent on critical setting of the reaction control. And because there was an amplifier stage between the detector and the aerial, the reaction setting was not affected so much by the type of aerial in use.

For all that, the basic problem remained that there was still a reaction control to set, and attempts were made to produce receivers with two RF amplifier stages ahead of the detector, but with no reaction.

Here designers came up against the full measure of a problem which was mentioned in chapter 6. They found that, because plate and grid in a triode were side by side, there was considerable capacitance between them and energy was being fed back from plate to grid as a result.

In detector or audio service it did not matter greatly, but in RF stages, with both grid and plate circuits tuned to the one frequency, the feedback tended to cause oscillation. One low-gain triode RF stage was practicable (even if barely so), but two such stages were almost unmanageable.

A temporary answer to the problem was found in the so-called "Neutrodyne" principle, which enjoyed some popularity in the late 1930s. The primary winding of the RF coil was centre-tapped so that a signal voltage appeared at the lower end similar to but out-of-phase with the signal voltage at the plate end. Small variable capacitors was connected from the lower end of the primary to grid and adjusted to have the same value as the grid-plate capacitance of the value.

Being connected in this fashion, this so-called neutralising capacitor fed back to the grid a signal equal to and out-of-phase with that fed back from the plate, so that the two cancelled out. As a result, the tendency to oscillation was overcome and two triode RF amplifier stages became practical.

The early "Neutrodyne" receivers were, therefore, a special type of TRF receiver, employing the principle of neutralisation. In point of fact, neutralised TRF receivers did not enjoy a lengthy period of popularity because valve designers came to light with the screen-grid principle. Applied in RF stages and pentode valves, it almost eliminated grid-plate capacitance, and therefore, eliminated the major source of instability in RF stages.

It was not possible to achieve high figures of stage gain, and, further, to use two high-gain stages in sequence. Nor was there any great trouble with instability. By shielding the valves and coils and adopting a layout which kept input and output leads reasonably apart, such a set could remain completely stable, even under full gain conditions.

With such gain available and the selectivity afforded by three tuned circuits, reaction became unnecessary, and the reaction control therefore largely disappeared from sets of the day.

By carefully matching tuning coils and adding small variable trimmer capacitors across each tuned circuit, designers were able to gang together the three tuning capacitors and operate them from a single tuning dial. Thus, these domestic receivers became really simple to operate for the first time — one dial to select the station and one knob to control the volume.

TRF receivers reached their heyday about 1930 and their general design followed the pattern shown in the block schematic diagram of figure 2.

As a result, they began to look for other basic methods of receiver design and the one which seemed to hold the greatest promise was the superheterodyne principle.

As the name suggests the superheterodyne receiver utilises a method of heterodyning or beating two signals together. Let's explain this.

It has been found that when two signals are fed into a non-linear circuit, they combine to produce signal voltages at frequencies additional to and distinct from either of the original input frequencies. Further, that these new frequencies are equal to the sum and the difference of the original frequencies.

Consider, for example, two frequencies which we shall designate as f1 and f2. If fed into a non-linear amplifying stage, it would be possible to detect output voltages, as expected, having the original frequencies f1 and f2. But, in addition, we would find that output voltages were present at frequencies equal to f1 plus f2, and f1 minus f2 (assuming f1 to be the higher numerical value).

This was the key to the superheterodyne principle. By tuning a circuit to, say, f1 plus f2, and then converting the output voltage to audio frequency we could reproduce the signal originally fed into the receiver.

This was the essence of the superheterodyne receiver.

The incoming signal was fed by the aerial coil to the first RF amplifier stage, then passed to the second RF amplifier stage and thence to the detector.

This was followed by a single audio stage, but, using a sensitive pentode valve, which gave high amplification as well as ample power output to operate a loudspeaker.

Power to operate all these stages came, in mains receivers, anyway, from a power supply rectified to the same chassis. This included a power transformer, a rectifier, a filter choke of some description and two or more filter capacitors. (More will be said about the operation of this section of the circuit in a later chapter.)

The volume control in such receivers usually took the form of a potentiometer connected at one end to the two RF amplifier cathodes, and at the other to the aerial terminal. The adjustable tapping between aerial and earth was too high to make any real difference to its efficiency. Adjusting the control the other way applied high bias to the RF amplifier cathode and reduced the terminal gain. At the same time it shunted the aerial to ground and therefore reduced the signal input.

It might be thought that the evolution of the TRF receiver would have largely halted receiver development in that it provided good gain and selectivity with plenty of acoustic output and simplicity of operation. But it didn't.

About the same time, many new stations were coming on the air, crowding the broadcast band and ever increasing the demand for selectivity. The limitations of the simple TRF soon became apparent, particularly for the more difficult reception areas.

To add yet another RF stage or yet another tuning circuit gave only limited improvement at the cost of much greater complexity and with the attendant risk of instability. What was more there didn't seem to be any obvious way of making tuned circuits much more efficient. To resort again to reaction as an aid to selectivity was unthinkable to a commercial designer.

As a result, they began to look for other basic methods of receiver design and the one which seemed to hold the greatest promise was the superheterodyne principle.

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signal voltages at, say, 2,000 and 1,500 kilohertz into a non-linear stage. Both original signal frequencies would be present in the output, plus additional frequencies of 3,500 kHz (2,000 plus 1,500) and 500 (2,000 minus 1,500).

In actual fact, there may be other frequency components in the output, due to the presence or generation of harmonics, but we can afford to neglect these as being incidental to the main effect.

As we already know, stations on the broadcast band transmit on allotted frequencies, between the limits of 550 and 1600 kHz. To tune and amplify them on a TRF receiver involves the use of a ganged capacitor tuning two or three matched coils.

There are difficulties in the way of tuning more than about three coils in this way, so that the performance of a TRF receiver is largely limited by the selectivity and gain which can be achieved with three variable tuned circuits.

But in the superheterodyne, the designers utilise the heterodyne principle to change the frequency of any and every desired incoming signal to a new, pre-arranged and fixed frequency. This is passed to and amplified in a section of the receiver, which can employ any desired number of fixed tuned circuits.

The new frequency is usually lower than the signal frequency but still well above the audio spectrum, which is perhaps the reason why it is commonly referred to as the "Intermediate" frequency — usually shortened to "IF".

The particular intermediate frequency is selected by the designer to suit his requirements. If high gain and extreme selectivity is the object, he may choose an intermediate frequency of about 200 kHz. But, with such a low frequency, great care has to be exercised to avoid receiving the same signal at two points on the dial — called "two-spotting" — owing to unwanted heterodyne effects.

An intermediate frequency of more like 2,000 kHz minimises double-spotting, but requires greater attention to the design of the tuned circuits, if gain and selectivity are not to be sacrificed.

A compromise figure, which is widely employed in this country, is an intermediate frequency of 455kHz or thereabouts.

Assume that a desired signal is on 1,000 kHz. The first obvious requirement then, is for the tuned aerial input circuit to be resonated to this figure. This is accomplished by tuning the aerial input coil with a variable capacitor, exactly as in an ordinary TRF receiver.

The desired 1,000 kHz signal is then fed into the "mixer" or "frequency changer." In the output, remember one desires a frequency equal to the selected intermediate frequency, which one may assume to be 455kHz.

Essential for the frequency change is an oscillator, which delivers a locally generated signal voltage to the mixer stage. To obtain the desired result, the oscillator would be tuned to 1,455 kHz coming signal frequency by just 455 kHz.

It could alternatively be tuned to (1000-455) or 545 kHz, but the higher oscillator frequency is normally used.

At the output of the mixer stage, one would expect frequency components of 1,000, 1,455, 2,455 and 455 kHz. But the mixer invariably feeds directly into a tuned circuit, which would be resonated permanently at 455 kHz. This one frequency is, therefore, selected and passed on, while the first three mentioned above, together with all other incidental harmonic frequencies, are suppressed.

If the desired signal were on 1,020 kHz, then it would be necessary to increase the local oscillator frequency by another 20 kHz to ensure that the IF output remained at 455 kHz.

Thus, in a simple superhet, there are two variable tuned circuits. One gives initial selection at the signal frequency, and the other adjusts the local oscillator frequency to a figure which differs from the signal frequency by the selected intermediate frequency.

In the earliest "superhets" the aerial and oscillator circuits were controlled by separate capacitors and tuning dials. But, in all modern sets, the coils are accurately adjusted and the oscillator tuned circuit arranged so that it maintains the required frequency difference automatically. This is called "tracking."

In most modern receivers this is arranged by means of a so-called "padderless gang". A two-gang variable capacitor in which one of the sections has smaller and specially-shaped plates. An alternative technique, and that generally used for short-wave receivers, is to use a conventional tuning capacitor with a so-called "padder" capacitor connected in series with the section used to tune the oscillator. The padder may be made variable to ensure that the oscillator frequency may be adjusted for optimum tracking.

The intermediate frequency generated from the received RF carrier retains the original modulation, so that it can be amplified and passed on to the detector in the usual way.

It is here that the advantage of the superheterodyne principle becomes evident. Since each selected signal is automatically transformed to a constant frequency (which we have assumed to be 455kHz), the IF amplifier channel may be provided with any desired number of circuits, permanently tuned to the selected intermediate frequency.

Coupling coils between valves may have both primary and secondary tuned, instead of the secondaries only, as in ordinary TRF practice. No variable tuning gang is necessary for this purpose, and the coils may be designed for compactness and efficiency, and thoroughly shielded for stability.

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mica trimmers, adjusted with a screwdriver. Alternative and common practice nowadays is to have a fixed mica or ceramic tuning capacitor and to vary the inductance of the coil by a small adjustable iron core.

Most ordinary superhets employ one stage of IF amplification, involving two IF transformers. Larger sets may use two IF amplifier valves or transistors with three IF transformers.

These tuned circuits in the IF channel are fully effective in discriminating against unwanted signals.

For example, the desired signal may be on 1,000 kHz with an adjacent and interfering signal of 1,010. The single tuned circuit ahead of the mixer valve could not discriminate effectively against a signal only 10 kHz removed from the desired one, so that a substantial 1,010 kHz signal may reach the input of the mixer valve.

In the output of the latter, there would, therefore, be the desired heterodyne frequency of 455 kHz, plus another heterodyne produced by the unwanted carrier at 445 kHz. But, with four or more circuits to negotiate, all tuned to 455 kHz the signal on 445 kHz would have little chance of reaching the detector at troublesome level.

Thus, even though the average domestic superhet uses only a two-gang tuning capacitor, there are generally something like four or five tuned circuits to discriminate against unwanted signals — as against two tuned circuits provided by a two-gang capacitor in the TRF arrangement.

Another reason for improved selectivity in the superhet is the basic fact that the frequency is changed to a lower value. As shown in the example above, the difference in frequency between the wanted and unwanted station — 10 kHz in this case — is retained when the frequency is changed. However, relative to 455 kHz, 10 kHz is a greater change, in terms of percentage, than the same change relative to 1000 kHz.

Thus, assuming tuned circuits of equivalent "Q", the one at 455 kHz will be better able to reject the unwanted signal than the one at 1000 kHz. It will also be understood why some circuits use even lower frequencies, 175 kHz and even 50 kHz being employed where very high selectivity is required.

The output from the IF amplifier stage ultimately feeds into a detector, which may be any one of several varieties. The output and power supply arrangements are exactly as for a TRF receiver.

Figure 3 shows the sequence of stages in a typical superhet in block schematic form. The aerial input signal is fed to the detector, where the audio component is extracted. This is amplified in the audio stage and applied to the loudspeaker.

At first, the functions of mixer and oscillator were entirely separate, as indicated.

The mixer was normally operated under very high bias conditions, as employed for a detector. Hence, the mixer valve in these early superhets was commonly referred to as the "first detector." The normal detector for demodulation naturally gained the title of "second detector."

In the inevitable trend to simplification, it was found possible to obviate the separate oscillator valve, and the first detector was made simultaneously to fulfil the function of oscillator by connecting it to the oscillator tuned circuit.

This arrangement, employing generally the 57 or 6C6 pentode, was widely used around 1932. Known as the "autodyne" circuit, it proved quite efficient and adequate until the demand for dual-wave sets emphasised its non-suitability for such receivers.

Ultimately, the trend to superhet circuits, the popularity of dual-wave receivers and adoption of automatic volume control, led to the evolution of special valves for use as frequency changes. These varied a good deal in structure from one type to the next, but normally had a triode oscillator and a screen-grid mixer section within the one envelope.

With the advent of transistors, the autodyne principle has been revived with the first transistor acting as both local oscillator and mixer.

In fact a modern "pocket portable" transistor radio illustrates very well how the superhet has been developed and simplified. Typical receivers of this type use only six transistors: one as an autodyne mixer, one as an IF amplifier, and the remaining four in the audio amplifier. The "second detector" function is generally performed by a germanium diode.

Receivers intended for specialised communications work invariably use the superhet principle, because of the high gain and selectivity which it offers. In high gain of these receivers more than one intermediate frequency is used, with a number of mixers used to change the frequency of the signals from one to the other. Thus one can have a "double-conversion" receiver, a "triple-conversion" receiver, and so on. Many such receivers use special filter units in their IF amplifiers, to achieve either very sharp selectivity response or a carefully adjusted wider response. There are a variety of such filter units available with names such as "crystal filter", "mechanical filter", and "ceramic band-pass filter".

The provision of these and other facilities at the fixed intermediate frequency is something which could not reasonably be duplicated in any TRF design.

At the same time, most high performance superhet receivers do use at least one RF amplifier stage ahead of the frequency changer. An RF stage ahead of a superhet circuit makes a minor contribution to gain and selectivity and also helps exclude from
An Electroscope
by Ross Tester

Most science students will be familiar with the electroscope — a device using very thin metal foil to detect the presence of static electricity. Here is a modern version — using solid state techniques and a moving coil meter.

We described a conventional electroscope in February, 1970 (File No. 8/C15). Copies of this article are available for those who may not have the issue. As well as describing how to construct the device, the article lists a number of experiments which can be conducted. This article would make good background reading for those who wish to construct this version of the electroscope.

Our new electroscope is quite a jump from the simple concept of the original electroscope which, incidentally, was among the first primitive measuring devices with which the pioneers laid the foundations for our present electronic technology. This latest version uses one of the most recently developed solid state devices — the FET — in a simple bridge circuit to produce an extremely sensitive device.

The bridge circuit may be a new concept to many readers, but is a most important circuit configuration. Furthermore, it is not particularly difficult to understand. It has many uses, ranging from direct measurement of resistance, capacitance etc. to industrial control circuits. In our present circuit we make use of its balanced condition to balance out, or cancel, a heavy standing current, which would normally overload our sensitive indicating meter.

To understand this better let us look at a basic bridge circuit. As shown in the diagram, it consists of four resistors, Ra, Rb, Rc, and Rd. In bridge terminology, Ra and Rb form one “arm” of the bridge. Rc and Rd form a second “arm”.

If a voltage is applied between points X and Y current will flow through two paths, through Ra and Rb, and through Rc and Rd. The amount of current flowing in each arm will depend on the values of the resistors. Let us take an example.

Suppose that Ra is 20 ohms, Rb is 100 ohms, Rc is 100 ohms and Rd is 20 ohms. Note that the ratio between Ra and Rb is the same as the ratio between Rd and Rc. While these ratios are equal the bridge is said to be balanced. The two arms need not have the same values of resistance, provided the ratios are equal. For example, Ra and Rb could be 2 ohms and 10 ohms, or 40 ohms and 200 ohms, just so long as the ratio (fire to one in this case) is the same.

If we assume a specific value of voltage applied between points X and Y we can work out the current in each arm, using Ohm’s law. Suppose we connect a 12V battery between X and Y.

The total resistance of the right arm (Ra, Rb) is 120 ohms. Ohm’s law says that the current flowing through a resistor is equal to the voltage applied to the resistor, divided by its resistance. (I=V/R) From this we find that 0.1A flows through each arm.

Now take a look at the circuit of our electroscope. Notice the similarity? In place of Ra and Rb we have a 2K resistor, and in place of Rd we have the source/drain path of the FET. The meter and battery connections are as before.

From what we have already explained it should not be too hard to visualise this circuit in a balanced condition. When the FET is in its “quiescent” state (no voltage between gate and source) its resistance is quite stable. When we adjust the tap on the pot so that the upper and lower halves of this arm have the same ratio as the 22K resistor and the source/drain resistance of the FET, the bridge is balanced and the meter reads zero.

Because of the balanced condition we can use the most sensitive indicating meter we
like, regardless of the current required by the FET. For example, we could use a 50uA meter, even though the current through the FET is more likely to be around 15mA. A meter of this sensitivity will detect an extremely small change in the bridge. Because the change is likely to be an ammeter reading, the needle will wave hard FSD (full scale deflection), we suggest you use a lower sensitivity meter — around 1mA.

Now, how does the electrostatic charge upset the balance of the bridge? Whenever an ammeter is read, there will be an electric field associated with the charge. This field radiates from the body, getting progressively weaker as it moves further away.

If a capacitor is placed in this field, the capacitor will become charged. It will lose the charge as soon as it is removed from the field.

Our static electricity detector is virtually a capacitor. On one side we have the detection rod, on the other the wiring of the bridge. And between these two “plates” we have the gate and source electrodes of the FET.

Now bring a charged mass into close proximity to the rod. As the capacitor is now charged, there will be a potential difference between its two plates, and between the gate and source. This changes the resistance of the FET, upsetting the balance of the bridge, and deflects the meter.

If we were to actually touch the rod with some charged objects, it is possible that a large current might flow into the gate. This current could, conceivably, be large enough to damage or destroy the junction of the FET by overheating it. For this reason, we have taken the precaution of covering the rod with PVC tubing, to prevent accidental touching.

In the interests of economy, we are not suggesting you buy a meter just for this project. Rather, we hope that by now most, if not all, of the readers of the Elementary Electronics section will have obtained a multimeter. If you have not, now is a very good time to buy one. There is one time when you can put the “uA” and “mA” ranges of your meter to work.

Most modern multimeters are of the conductor (one of the forms of carbon) the perspex melted, firmly fixing the probe in place. We then cut off the excess protruding from it to the gate.

To finish off the rod, we slid a length of drinking straw will do. We finally worked out that the author’s comment was correct. We added a piece of plastic rod rubbed on cloth.

As with a conventional electroscope, the weather has a marked effect on sensitivity. If it is a humid or rainy day, the readings will be less than those made in the same way on a dry, hot day. This is because the charge is able to leak away through the air, due to the amount of water vapour in it.

One fine, warm day, we turned the detector on, and found that nothing would induce the pointer to move from the stop at the bottom end of the scale. So we reversed the meter connections, and found that the pointer now pressed hard on the other stop.

Turning the pot through its full range had no effect — it was not until the meter was put on the 50mA range that the pointer dropped a little.

We made simple wire holders for the battery, by drilling four holes alongside it and then tightening some thin wire around it with a pair of fine pliers. Note that you will need a battery connector if you use the same battery we did.

We made a few experiments with our detector to determine how sensitive it was, and were mildly surprised. A plastic bag, waved around from across the other side of our laboratory, caused a large deflection on the meter. If we moved any closer, we had to use a higher scale on the meter to stop it banging hard against the restraint at the end of the scale.

A comb, brushed through one’s hair a few times will cause a full scale deflection, as will a piece of plastic rod rubbed on cloth.

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Improved Brake Light

Since presenting the Brake Light Warning System on these pages in the March issue, we have had the opportunity to consider it in relation to a wider range of vehicles. As a result, we have evolved a circuit which permits the handbrake warning light to double as a stop light indicator without the
A Remotely Controlled Variable Resistor

There are many situations in which a remotely controlled variable resistor would be extremely useful. A typical one would be where it was desired to control an audio signal from a remote point, but where it is impractical to bring the actual audio circuit to the control point. Many similar applications will suggest themselves.

Such a device is relatively easy to make and, as described, has the marked advantage that the variable resistor is completely isolated, electrically, from the control circuit. The heart of the device is a light dependant resistor (LDR), which is optically coupled to a small filament type lamp. By varying the brilliance of the lamp, using a variable resistor in series with it, the resistance of the LDR can be varied from a few hundred ohms to several megohms.

A typical LDR is the ORP12 (or ORP15) while the lamp can be one of the several dial lamps available, according to the supply voltage and the brightness range required. A good all round choice would be the popular 6.3V, 250mA type. This lamp can be effectively controlled by a 50 ohm wire wound variable resistor, which should have a dissipation rating of two watts over the whole element.

A practical form of such a device is shown in the accompanying photograph. Basis for the assembly is a 7 pin shielded valve socket. The socket prevents a convenient mounting for the LDR, the lamp is mounted in the end of the shield, and the complete assembly is virtually light tight.

The pin spacing of the LDR is similar to that between any two diametrically opposed socket pins. The LDR pins are too thin to fit the socket but, if bent double, they can be forced into a new socket. Fit an old valve and rock it around a little to open the pins slightly. The lamp may be held in the end of the shield by simply pushing it into a suitable size grommet already fitted, the leads being soldered directly to the lamp.

Ideally, the lamp should operate from DC, since there is then no possibility that the LDR will be modulated at 100Hz, as will be the case if the lamp is operated from the 50Hz mains. On the other hand, the system is surprisingly tolerant to AC. This is partly due to the thermal lag of the lamp filament, and partly due to the relatively slow response of the LDR. However, this response time varies with the light level involved.

If the control function does not involve signal circuits, there may be no objection to the use of AC. Where signal circuits are involved, the level will probably determine whether AC can or cannot be used. As an example, the idea has been successfully used as a variable contrast control between a video detector and video amplifier, without any AC modulation being obvious. On the other hand, very low signal levels would make a DC supply essential.

Brake Light — Cont.

need for the isolating diode. This makes the system just about as cheap and simple as one can imagine, yet retains the professional appearance of the car dashboard.

The accompanying circuit shows how it is done. While car electrical systems may vary in minor details, it should be possible to adapt it to most models. Basically, the red connections are separated completely from the energising coil and simply connected in parallel with the handbrake switch. The coil is connected in series with the stop light circuit as before.

Some stop light circuits are activated only when the ignition switch is on, others will function at all times, regardless of switch settings. With the circuit as shown, unwanted voltages cannot be applied to the ignition or other circuits regardless of the switching arrangement used.

The actual method of connection to the handbrake switch will vary according to the car. In cars having handbrakes mounted under the dashboard, access to the switch is usually simple. Those having floor mounted levers often have the switch under the floor, in which case it may be easier to pick up the circuits somewhere else. For example, using the accompanying circuit as a guide, one connection could be to the appropriate side of the warning light, and the other to the chassis.

Finally, the installation illustrated in the March issue has already justified itself. A few weeks after it was fitted it indicated a fault, which turned out to be a burnt out globe in one stop light.
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Bohm's Salome: "rare delicacy"

STRAUSS (Richard) — Salome. Complete Opera. Richard Cassilly (Herod); Mignon Dunn (Herodias); Gwyneth Jones (Salome); Dietrich Fischer-Dieskau (Jochanaan); Wieslaw Ochman (Narroboth) and others with the Hamburg State Opera Orchestra conducted by Karl Bohm. DGG Stereo 2707 052. Two Discs.

Bohm's reading of this opera is often one of rare delicacy which lends irresistible charm to many of the more lyrical passages. Even in the finest bars you realise that you are to hear an entirely different interpretation from Solti's fine Decca set. The innumerable references to Salome by the soldiers, Salome's entrance — a little unsteady at first but gaining confidence as she gets into the skin of the part — and the musings of Narraboth all enchant the ear. Later, however, where the music becomes much more forceful as the drama develops, Bohm seems altogether too gentle. Salome becomes almost coquettish when she refuses to dance for Herod, hinting at none of the obsequiousness that fills her mind.

In the Dance of the Seven Veils the orchestra playing is very restrained at first, gracefully sinuous rather than explicitly erotic. It is an unusual performance that grows on one with repetition, certainly the most refined I have ever heard. But if you're looking for the punch you have in the Solti set you will be disappointed. Yet Bohm's whole reading is valid when it makes you into suspending critical faculties. Your attention remains riveted even when your mind dictates disapproval. But one detail did really let me down. After the terrific build-up of the final scene, the final heavy chords in C Minor have a strangely dead, dry sound, quite unlike the peremptory conclusion Strauss imagined and Solti realised where the ancient world is cut off by the fall of the curtain and one returns, in one giant step, emotionally exhausted, to the 20th century.

Enjoyed Richard Cassilly's performance as Herod, no weakling slobbering inanely but a strong man drunk on alcohol and lust. The complex music of the quarrelling Jews is brought off with skilful clarity, and all the minor parts, especially Mignon Dunn's vicious Herodias crowing in triumph, are splendidly played. But whatever your opinion of Bohm's interpretation of the opera the sheer vitality of Strauss' score compels your involvement. He bludgeons you into suspending critical faculties. Your mind dictates disapproval. But one detail did really let me down. After the terrific build-up of the final scene, the final heavy chords in C Minor have a strangely dead, dry sound, quite unlike the peremptory conclusion Strauss imagined and Solti realised where the ancient world is cut off by the fall of the curtain and one returns, in one giant step, emotionally exhausted, to the 20th century.

Mozart — The Marriage of Figaro. Complete opera. Ingvar Wixell (Count Almaviva); Jessye Norman (Countess Almaviva); Mirella Freni (Susanna); Vladimir Ganzarioli (Figaro); Yvonne Minton (Cherubino); Maria Casula (Marcellina); Clifford Grant (Bartolo); Robert Tear (Basilio) and others with the BBC Symphony Orchestra and Chorus conducted by Colin Davis. Philips Stereo 6717 011. Four Discs.

Colin Davis' views on Figaro are unusual but indisputably valid. Whether or not you enjoy his performance will depend to a large extent on your open-mindedness. But the set under review, in terms of tempos, ensemble, soloists, and orchestra will be found hard to match. The chief difference between Davis' reading and that of most other conductors is that Davis, while never overlooking any opportunity to bring out every aspect of the comedy, also stresses the serious import of a play that is supposed to have had a considerable influence — among, of course, many others — in sparking off the French Revolution. The places where he introduces these profoundly perceptive moments amidst all the surface frivolity are too numerous to mention in the space I have here. But again I hasten to add that he never sermonises. It is all done with quite magical deftness, and without impeding the natural, sparkling flow of Mozart's inspired music. Having pointed this out, all too briefly, alas, I can go on to say that vocally the set is unsurpassed in its precision and expression. You will hear no wobbly voices. On the contrary, voices focused on an unwavering accuracy of pitch and production. The whole cast is so impressive that it is difficult to select any members for special mention, though the performance remains the most vividly in the memory are Ganzarioli's Figaro and Jessye Norman's Countess.

There is, too, Ingvar Wixell's aristocratic but not over-sweet Count, Yvonne Minton's youthful but assured Cherubino and Mirella Freni's beautifully sung Susanna, whose occasional seriousness in no way inhibits her general sense of coquettishness. A deliciously fragile-toned but clear harspsichord supplies the continuo and the sensitively controlled stereo separation aids vastly in the identification of the various characters during complex ensemble scenes. The orchestra provides constant joy in its precise pointing, exhilarating rhythms and the subtlety of its unfurling nuancing.

You may be surprised to hear the famous aria 'Dove sono' sung after the Sextet, but there is nowadays a considerable body of opinion to support this transposition. You may also notice that Davis, in his treatment, is much more of a moderniser, making it quite purely conversational and which should make its point to the audience. On the vexed question of appoggiaturas Davis follows a middle line, avoiding cut-off effects and using them elsewhere. I could go on for pages lauding the freshness and beauty of this memorable set which I think, should interest all Mozart lovers, even those who already own a favourite performance previously recorded. I can only urge you to acquire it and enjoy it yourselves.


Generally speaking the late Charles Munch was not one of my favourite conductors. I remember him when he visited Australia with the Boston Symphony some years ago driving them like a drill sergeant through a program which included Berioz Symphonie Fantastique. In the middle tiers I heard him conduct, in Paris, a French orchestra in a tribute to Debussy and was again disappointed. But in the Honegger recorded here, one of the last recordings he made, his handling of different moods and textures is altogether. The symphony was written in Paris the year after the fall of that city during the last war and opens in a mood of unrelieved despair. It was composed after I had heard him conduct, in Paris, a French orchestra in a tribute to Debussy and was again disappointed. But in the Honegger recorded here, one of the last recordings he made, his handling of different moods and textures is altogether...
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lament, seeking relief but never finding it. It is soul lacerating music and the Orchestre de Paris has never played better. The Finale is more hopeful even if that hope is never quite realised. Rather, distraction is sought in physical activity. A trumpet is added towards the end to support one of the many polyphonic lines in the strings and, when it plays, hope really seems within reach of fulfillment. And the year was still 1941. This string symphony is a most eloquent work, most eloquently played.

The Messiaen work features the same orchestra but this time under the baton of Serge Baudo, in my opinion the best French-born conductor working in France today. I found one curious fact in Messiaen’s sleeve notes. He states that “the scoring intends it for vast spaces.” Yet its first performance was given in 1965 at the Sainte-Chapelle in Paris and there is nothing vast about this small Gothic gem situated on the Ile de la Cite. However, listening to it as presented on this massively vivid recording one can appreciate what the composer had in mind.

It is in five sections, each inspired by a Biblical text. The first is taken from the 130th psalm — “Out of the depths I have cried to thee, O Lord,” — a truly agonised cry for Divine mercy. The second section; “Christ being raised from the dead” (Romans 6, verse 9) is in a mood of contrasting serenity and peace featuring mostly unaccompanied woodwind solos. Later comes a characteristic interlude with a background of tuned percussion, then a return to the woodwind solos, this time lightly accompanied. In this movement much dramatic use is made of silence.

Section 3 “The Hour is coming when the dead shall hear the voice of the Son of God” (John 5:25) offers some more characteristic Messiaen sound — that of bird song. The whole is so highly coloured in its opposing solemn statements that a description would take many pages. The fourth movement, “They shall be raised in glory” (1 Corinthians, 15:43) is introduced with the menace of gongs strokes against the jubilation of a lark’s song that reminded me of the Flecker poem, “Penebris Interluculentem.” The finale, a song of praise by the Saints “And I heard the voice of a great multitude” (Revelation 19:6) features prominently the always sinister tritone at the beginning, then goes into rapturous praise that carries one with it to intoxicating heights, believer and sceptic alike.

I should like to point out that if you know your way around Messiaen’s music — and perhaps even if you don’t — you won’t find any great problems of appreciation of this music even at first hearing. The whole production is a very moving disc of music superbly played and recorded. But a word of warning — it is intended only for the serious.

SCRIABIN — Le Poeme de l’Extase.
TCHAIKOVSKY — Romeo and Juliet.

In the wrong hands, which allow the composer to seemingly hypnotise himself by contemplating his chromatic harmonisations — wistful mystic chords, theosophy and other quaint conceits — Scriabin’s Poeme of Ecstasy can wander about pointlessly. The music rises and falls, gathers tenebromence and fades way without orgasmic release. Repetition
follows repetition, each usually a little louder than the last, straining ever upwards — to nowhere. Abbado, however, stiffens the skeletal foundation more than I could have imagined possible but without impairing the sweet chromaticism of its fleshings. There is no flabbiness. He is never afraid to let his trombones crackle. His trumpets proclaim their unsatisfied yearning. The engineering is superior to that of any other recording of the work I have heard, and the Boston plays the music superbly. Abbado achieves scarcely bearable tension throughout and if it all dribbles away to nought that is the fault of the composer and not the fine orchestra. Even when the work reaches its final destiny, firmly anchored in the harbour of C Major, it could easily start all over again with the same effect of incompletion. In the meantime you have heard some beautiful, hazy musical thoughts — despite the assertive brass — and some thoroughly enjoyable playing.

The Tchaikovsky piece has nothing in common with the Scriabin except in its Russian nationality. Tchaikovsky always knew where he was heading and Abbado sees his final destination clearly from the first bars. He gives the work an impressively grave introduction of rare dignity. His touch of Slavic melancholy is in no way out of place. Later in the intro he develops intensity — just before the allegro — and perhaps just a hint of fervour. But once embarked on the fast section he pushes it along with great energy. Still you can have some lovely legato playing of the great love theme — surely one of the most beautiful melodies ever written — which transforms the theme into one long cantilena. Then comes vivid conflict with even the frequent use of crashing cymbals skilfully avoiding vulgarity.

Abbado’s is a beautifully balanced account of the work, recorded with sumptuous sound. The quality of the Boston strings is quite wonderful. I know of no better current recording.

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John Ireland (1879-1962) was an English petit maitre of considerable skill and good taste once famous among those only mildly interested in his other music by his setting of John Masefield’s poem, “Sea Fever.” The bulk of Ireland’s music was unfaithfully pleasant if seldom memorable, like most of the other music written by the more timid of the English composers working during the 1920s and 30s. His orchestral pieces show a nice sense of colourful scoring of the more conventional kind.

The city of London has inspired many British composers — the two most notable to come to mind are Elgar (Cockaigne) and Vaughan-Williams (A London Symphony). Ireland’s London Overture follows much
The do-it-yourself amplifier for non-technical people who hate soldering irons.

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along the lines of the Elgar piece though without that composer's vigorous invention. It does, however, in its modest way, capture the spirit of the old city, the background of a people who, when they indulge in pageantry, are without peers.

The Epic March has all you'd expect in a piece commisioned for patriotic purposes during the last war. Its best feature is a nice "open air" section in E flat.

In The Holy Boy for string orchestra Ireland is occasionally reminiscent of his Sea Fever. It is a Christmas carol of the Nativity and has been popular in England since its composition for piano solo in 1913. The string version was arranged by the composer in 1941.

The Concertino Pastorale for Strings is in three movements. The first, an Elocue, reflects the tension of 1939 pre-war England, beginning with a tense introduction then passing into a rather non-committal statement of pastoral ruminations that fragment at the end.

The second disc opens with the Prelude, The Feast of Biter, inspired, by the evidence of the prehistoric past still to be found in the Channel Islands. Mai-Dun was also inspired by prehistoric ruins, this time Maiden Castle near Dorchester. It aims to evoke the anxiety of this people in their struggle to repel invaders back in the days of Roman Britain and displays considerable orchestral and harmonic resources.

Legend for Piano and Orchestra again goes back to prehistoric Britain for inspiration, a mediaeval leper colony, and a curious vision that Ireland had of ghostly children dancing, all set out with great skill and refinement. The sensitively played piano part is by Eric Parkin.

The overture Satyricon is based on the famous novel by the ancient Roman Petronius. It has a lovely clarinet solo in the middle section but elsewhere shows only little of the rumbustious spirit of the elegant Roman's naughty literary achievement. The London Philharmonic under Sir Adrian Boult plays the whole program affectionately and the sound on both discs is better than fair.

Only very rarely indeed does she project either vocally or dramatically the formidable nature of the queen she is playing. Her voice lacks color and dramatic intensity and to compensate for the absence of the latter she over-indulges in such substitutes as "dramatic" parlando - a sudden descent from song to speech quite alien to Donizetti's style. I find it difficult to understand just how a conductor, with Mackerras' respect for integrity could have approved such lapses. And I find it still more surprising that a musician with such an interest in authenticity could have stated that later changes to the original orchestration "must be minimal."

However having got my most serious disappointments off my chest I must reiterate my enjoyment of an opera that was well worth reviving. As soon as one has surmounted the handicap of Miss Sills' lack of identification with her role and her trivialisation of much of Donizetti's ornamemtation, which is nearly always far removed from the trivial and often very subtle, you will find much to enjoy in the score. Both Ilosfalvy (Essex) and Glossop (Nottingham) are always commendable if seldom exciting. On the other hand Beverly Wolf (Sara) though occasionally a trifle insusirence produces a mezzo-soprano voice of a quality that promises great things for her future recordings. Mackerras is, as always, impressive in his conducting. The orchestra's attack is crisp, its rhythms vital and the nuances sensitive. Indeed it is he who makes the most valuable contribution to the whole production.
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92 ELECTRONICS Australia. May, 1972
THE BEST OF FRANK BOGGS. Stereo, Word WST-8548-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Frank Boggs, one of the best-known artists on the USA "Word" label, has a magnificent bass-baritone voice, strongly masculine yet as smooth and true as they come. Most of the numbers on the album have a full but restrained orchestral backing but, for a variety, a couple are backed only by his own solo piano.

The tracks: Come Thou Fount — Does Jesus Care? — Yes, God Is Real — The Old Rugged Cross — Fill My Cup, Lord — The Saviour Is Waiting — His Eye Is On The Sparrow — Sweet Little Jesus Boy — Every Time I Feel The Spirit — What A Friend We Have In Jesus — Amazing Grace — I Never Have In Jesus — Amazing Grace — I Never

The album is titled "The Best of Frank Boggs" and there's not the slightest reason to question it. Very well recorded, it's the most enjoyable Gospel vocal album that I've heard in many a long day. Strongly recommended. (W.N.W.)

MARTHA. Martha Nixon with orchestra and chorus directed by George Coward. Stereo, J&M Productions BRC-817. (From A.A.V.R., 87a Mullens St, Balmain 2014.)

I well remember the occasion when Martha Chastain (I'm not sure of the spelling) arrived in Australia, the youthful protege of the evangelistic team of Neil and Pat Macaulay. Now very much a part of the local scene, the wife of evangelist Les Nixon, Martha is well known to Australian audiences from her television appearances. Reviewing this, her latest album, Sydney broadcaster Ross Saunders suggests that Martha sounds a little hurried, a little tired and, along with some of the arrangements, a trifle old-fashioned.

Judged by the pop scene standards there may be some justification for these remarks but are these the right criteria? If I'm any judge, Martha Nixon and arranger George Coward have ended up with a sound which will have wide appeal, modern enough to retain the interest of a fair slice of the 'teen audience, yet smooth enough and round enough to be accepted by the older generation as well.

The tracks: Come Alive — What Grace Is This — The Lord Is My Shepherd — I Looked For Love — We Never Wonder Who — He Never Changes — My All — All My Life — He'll Be A Friend To Me — Who Can We Turn To? — He Touched Me — When You're Young.

The quality is technically good and I think that most Gospel orientated listeners will like the new album. Good family listening. (W.N.W.)

SONGS FOR SUNDAY. Jimmy Durante, with orchestra and chorus conducted by Ralph Carmichael. Stereo, Light. LS-5515-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

There has only ever been one, unmistakable Jimmy Durante, who hasn't seen him in films, heard him on air, watched him on television? Well here he is on record, singing hymns, and in his own inimitable style. He's no songbird! Perhaps he's not known in church circles but, for a variety, a couple are provided here by Ralph Carmichael.

The tracks: Down By The Riverside — Precious Lord — He Touch Me In — In The Garden — Somebody's Keeping Score — Amen — Beyond The Sunset — Peace In The Valley — His Eye Is On The Sparrow — One Of These Days.

Whether or not you'll enjoy this record is very much an individual matter: it's bright and, meditative in others but always sincere. Listen to "He Touch Me" and "Amen," then make up your own mind. (W.N.W.)

The Comprehensive Folk. Stereo, Parker Records PR-002. (From Parker Recordings, 9 Carmel Place, Winston Hills, NSW 2153. Price $1.50 plus 50c packaging and postage.)

The Comprehensive Folk — Bronwyn Field, Ross Davey and David Carr — were formed as a group in 1968 from the Methodist church at East Denistone, Sydney. Using 6- and 12-string guitars, double bass and a tambourine, their repertoire includes quite a few of their own compositions.

Since 1968 they have featured in Gospel coffee shops all over Sydney, on Channel 9 TV "New Faces Auditions," on 2CH "Gospel Sound Spectacular" and in the NSW "New Faces" competition. Circumstances forced the dispersion of the group just after this recording was made early this year.

There are 12 tracks on the two sides: A Meeting Here Tonight — Gonna Show I'm Happy — When The Stars Begin To Fall — Tell The Whole World Our Song — I Think, I Feel — All My Trials — Sing A Happy Song — Questions And An Answer — When I Survey — Let Us Break Bread Together — That Extra Mile — This Little Light Of Mine.

The Comprehensive Folk have the happy kind of sound that has won them acceptance in the circles in which they have moved and this limited issue album, in its plain white jacket, will provide a link to those who have enjoyed their appearances. However, their performance lacks the variety and the ultimate polish necessary for a successful LP and I doubt that this one will have too much appeal outside the coffee shop audience. (W.N.W.)

REVIEWS OF OTHER RECORDINGS

VARIETY FARE

The quality is okay technically and I think that most Gospel orientated listeners will like the new album. Good family listening. (W.N.W.)

An unusual record, this. From the notes, it would appear to have coalesced around teenage soprano, Elizabeth Ryan, who entered show business through a successful appearance in television's "New Faces". Around her entrepreneur David McIlwraith formed his singers and, for the music, chose several themes from Robert King Crawford's as yet unpublished musical drama based on the life of the Virgin Mary. To these themes Crawford added lyrics and arrangements based on melodies from the classics.

It is these latter which really dominate the album and, ironically, it is the male voices which are most notable both for their quality and their diction.

Here are the track titles with their basis, where applicable: The New Lord's Prayer (Crawford) — He Sees (Smetana) — Wondrous Road (Greensleeves) — Who? (Crawford) — Love Is The Song (Tchaikovsky, Symphony 5) — At The Close Of The Day (Brahm's Lullaby) — Hail Mary (Crawford) — Summer Air (Chopin) — Hymn To Relativity (Tchaikovsky, Swan Lake) — The Veil (Borodin, Polovtsian Dances) — How Many Wonders (Tchaikovsky, Pathetique) — The New Wedding Song (Tchaikovsky, Piano Concerto 1).

If words to the classics affronts, you won't want the album. If the idea appeals, you'll like it. Run Wills, A&R Manager for Australia, is banking on a good reception for this disc. He bought world rights for RCA when he heard the tapes of the recording session in the GTV9 television studios, Melbourne. Technically, the quality is good. (W.N.W.)

** ** **

HE SEES. The David McIlwraith Singers. Stereo, RCA Victor SL-101947.

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.) and Gil Wahquist (G.W.).

The Comprehensive Folk have the happy kind of sound that has won them acceptance in the circles in which they have moved and this limited issue album, in its plain white jacket, will provide a link to those who have enjoyed their appearances. However, their performance lacks the variety and the ultimate polish necessary for a successful LP and I doubt that this one will have too much appeal outside the coffee shop audience. (W.N.W.)

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**Instrumental, Vocal and Humour . . .**

**DIE KLUGE (The Wise Woman) — Carl Orff. Lucia Popp, soprano; Kurt Bohm, bass-baritone; Max Lorenz, bass; Carl Orff Riverdance Orchestra conducted by Kurt Eichhorn. Produced by Carl Orff. World Record Club stereo S-S0667. Two disc boxed set with German-English libretto.**

This musical folk tale for stage performance, based on a story by Grimm, is very much like the other Carl Orff work "Der Mond" (The Moon) which World Record Club issued a few years ago. Presumably those who know "The Moon" will want this work also. To my mind, "The Moon" is odourless, highly resistant to attack by bacteria or fungus and is vermin repellent; "INNERBOND" is odorless, highly resistant to attack by bacteria or fungus and is vermin repellent; "INNERBOND" at 160 oz. sq. yd. has a density of 1" and at this density is recommended as a packing in speaker enclosures for sound absorption.

**STOCKISTS:**

**SHE PETERSON:** Arrow Electronics Pty. Ltd., 342 Kent St., Bankstown; Philip Electronics, Pty. Ltd., 375 Clarence St., Sydney; Martin de Launay Pty. Ltd., King St., Sydney; Arrow Electronics Pty. Ltd., 342 Kent St.; Robinsons Pty. Ltd., 245 Parramatta Rd., Haberfield; BACQUIER & CO., 1300 Turbot St., Sydney; LEICHEARDT; Sammon Electronics, 172 Carlingford Rd., Epping.

**NSW 2040.**

**BACH FESTIVAL OF HITS. Various artists. DGG (Phonogram Recordings) stereo 2538 118.**

DGG has entered the "Classics for Your Christmas Tree" album, which features "The Greatest Hits" of Bach, with a CD that includes the complete "Weihnachtsoratorium" (The Christmas Oratorio), conducted by Richard Bonynge. The recording is a superb achievement, with a cast that includes semi-reliably presented by the vocalists, and the whole performance was produced by Carl Orff in person. This is a new recording, dating from 1970, and the sound is excellent, with no noticeable distortion and good stereo spread. (H.A.T.)

**DON GIOVANNI — HIGHLIGHTS (Mozart). Joan Sutherland, Pilar Lorengar, Marilyn Horne, Gabriel Bacquier and others, with the English Chamber Orchestra, conducted by Richard Bonynge. Decca (EMI) stereo SET 496.**

I have kept this recording for some time before reviewing it, to see if the generally unfavourable impression I gained of it at first hearing would modify. Unfortunately, this is not the case, and I cannot but feel that the set from which this selection has been taken is a far from satisfactory account of "Don Giovanni". The singing is competent, as one would expect of the strong. The orchestra provides excellent support to the vocalists, and the whole performance was produced by Carl Orff in person. In the female roles, Pilar Lorengar provides the only satisfying performance. Not only is her voice beautifully controlled, but her characterisation of the role of the near hysterical Elvira is quite convincing. On the other hand, Marilyn Horne is far from convincing as Zerlina; her strong voice inclines me to believe that she is quite capable of handling the hanky panky of the Don. Joan Sutherland is below her best — her singing lacks sparkle, and her diction is even worse than usual. On the other side, Bacquier makes a splendid Giovanni, suitably seductive or menacing, as the occasion demands. None of the other parts is particularly outstanding, although in the scene where the Don is dragged down to Hell, the Comedianto of Clifford Grant commands the attention. The English Chamber Orchestra under Richard Bonynge provide an elegant accompaniment, but it is too lightweight for my taste. The recording quality is fine. (H.A.T.)

**STRAUSS FESTIVAL OF HITS. The Berlin Philarmonic Orchestra conducted by Herbert von Karajan. DGG (Phonogram Recordings) stereo 2538 147.**

There is surely no need to dwell long on this recording, which is an eminently fine combination as the Berlin Philharmonic and von Karajan can be relied upon to present a performance well above average — which they do. Just
look at the titles, and if these appeal, buy with confidence: Blue Danube Waltz — Radetsky March — Annen Polka — Delirium Waltz — Vienna Blood Waltz — Pizzicato Polka — Emperor Waltz — Hunting Polka. Those who know their Strauss family will realise that all items are not from the pen of the younger Johann Strauss — his father Johann senior, and his brother Josef, are also represented. Nevertheless, all fine music, splendidly played and beautifully recorded. The recording is notable for the wide dynamic range, and is otherwise of the usual DGG excellence. (H.A.T.)

J. S. BACH TRANSCRIPTION FOR ORCHESTRA. The Pro Arte Orchestra of Munich conducted by Kurt Redel, with Helmut Rose, harpsichord. World Record Club stereo S/5089.

Arguments have always raged about the musical validity of transcriptions, particularly when the works involved are by composers of the stature of Bach. The antitranscription faction is not likely to be converted by anything I may say here, but if you are not biased, this disc is well worth a trial. The pieces have been arranged with a great deal of skill and understanding by Kurt Redel, and are given polished performances by the Munich Pro Arte. The major work is the great Passacaglia and Fugue in C minor, a masterpiece of imposing dimensions, which sounds quite marvellous in this arrangement. The old orchestral warhorse, Toccata and Fugue in D minor is also included, and I was surprised to find how much pleasure I derived from listening to it — it is a long time since an orchestral transcription of this has held my attention.


The recording, originally by Erato, Paris, is of excellent quality, the string tone being exceptionally good. (H.A.T.)

THE GUITARS OF SERGIO AND EDUARD ABREU. Decca Ace of Diamonds (EMI) stereo SDDA 219.

The two young Brazilian brothers featured here will be visiting Australia soon, which is why this disc has been reissued on the budget price Ace of Diamonds label. When the disc was first released in 1969, they were only 21 and 20 years old respectively, yet they demonstrate a mastery of their instruments and a degree of maturity and sensitivity in their playing which is little short of astonishing. Their duet playing is particularly impressive, demonstrating immaculate timing and complete understanding between the pair. There are five duets and seven solos in the recital.

The program is an interesting one, with the whole of the first side taken up by works of the 16th and 17th centuries, while side two has all 20th century music. Side 1: Sir John Langton's Pavan (Downland) — Fugue (Frescobaldi) — Preludio and Corrente (Vivaldi) — Sonata in D, L.104 (Scarlatti) — Lute Suite No 3, S.995 (Bach). Side 2: Preludio No 1 and Estudio No 1 (Villa Lobos) — Estudio sin Luz (Segovia) —

This month, a brief and important message for Sydney audio fans.

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The Decca London (Mk 5) Story

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When the ffss system was first invented the signal was generated at the stylus itself and any hum present in the vicinity of the pick-up was "read" as a genuine signal since it could not differentiate between this and the magnetic field created by the stylus movement. The advantage of direct coupling between stylus and search coil was obvious but in the interests of obtaining the best signal from the record, hum produced by turntable motors, mains leads, switches and transformers had to be tackled if progress was to be achieved in sound reproduction. In the following ten years people were satisfied with reproduction from moving magnet or induced magnet systems, although losses occur in the interpretation of the signal, sometimes known as cantilever haze, cantilever translation losses and so on.

With the improved quality obtained by the DECCA "POSITIVE SCANNING" system, the consumer became aware he must accept a degree of hum or select a turntable motor which did not generate an external magnetic field.

In the meantime DECCA continued on the seemingly impossible task of producing a hum free pick-up still having the "POSITIVE SCANNING" system.

The major breakthrough has come with the production of a new magnetic material. Although very small yet extremely powerful, with the tight magnetic circuit a significant reduction in hum has been achieved, and the cartridge mass is reduced from 14 grams to less than 4 grams. The external magnetic field which made the previous ffss cartridges unacceptable with steel turntables is now virtually removed. One final bonus is an increase in output which gives 1.5mV/± db/sec, some 50% increase on the average top quality magnetics now available.

While this work was going on another line of research has been pursued in conjunction with a leading British university specialising in metallurgy. Decca laboratories in experiments with something like 2,000 samples tested and analysed, evolved a new method of tempering the cantilever using liquid nitrogen — "super cooled" at minus 196°C.

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OVERTURE SPECTACULAR. The Royal Liverpool Philharmonic Orchestra conducted by Charles Groves. Columbia stereo SOEX 9678.

Anyone beginning a collection of classical music should have at least one record of popular overtures. The brilliant overtures featured on this disc certainly make a good start. They are played by a very professional orchestra — the Royal Liverpool Philharmonic conducted by Decca Groves. The sound quality is uniformly good and the spread is wide. At the economy price of the Columbia Series 275, the disc is a bargain.

Six overtures are presented: Light Cavalry, Von Suppe, Nabucco by Verdi, Zampa by Verdi, Ruy Blas by Mendelssohn, Mignon by Thomas, Donna Diana by Reznicek. (L.D.S.)

GIPSY FLAMENCO. Carlos Montoya, guitar, with supporting artists. Probe (EMI) stereo SPSS 8988.

Any disc by the brilliant flamenco guitarist Carlos Montoya is always welcome, but doubly so when it offers 16 tracks for a mere $2.75. Most of the tracks are the familiar guitar solos with which Montoya has entertained the world for many years — with titles such as Bolero, Gota Guia, Alegrias and Fandango — but some variety is given to this program by supporting artists. For those familiar with flamenco terms, these contributions are cantar, tanguillo and zapateado, in jaleo style — in other words, there is plenty of vocalising, hand clapping, and foot stamping. Montoya is, as usual, magnificent, and the variety of sounds he can produce with his instrument always amazes me. Sound and stereo spread are both of good standard. At the low price, the disc carries a strong recommendation. (H.A.T.)


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At $2.75, this latest release in the "World Wide" series will be keenly sought by those with a liking for the French chanson, as exemplified by the many fine artists presenting this kind of material in the 1940s and 1950s. If you have any knowledge of the subject at all, you will need no more than a list of the titles and names to realise the value of this collection: Pigalle (George Ulmer), Chopin Chopant (Pierre Dudon) — La Fournier (Juliette Greco) — El Jete T'Aime (Les Peters Sisters) — Je-Te-Le-Le (Maria Candido) — Le Petit Cordonnier (Vivette Giraud) — La Rue S'Allume (Michele Arnaud) — Me-Que, Me-Que (Gilbert Becaud) — Mon Pot (Jacques Verrieres) — Sous le Ciel de Paris (Juliette Greco) — Et Je Me-Que (Tino Rossi) — Tout Ca Parquet au Bois D'Chaville (Jacques Pills) — L'Amour (Arnaud) — Madame (Claude Robin) — Une Boucle (B. Arnaud) — Une Boucle (Edith Piaf) — Mes Jeunes Annees (Charles Trenet) — J'Attendrai (Tino Rossi) — Zampa by Verdi — El Puerto from "Iberia" (Albeniz). For those with a liking for classical guitar recitals, recommended. The recorded sound is very realistic. (H.A.T.)

ELECTRONICS Australia, May, 1972
This is a really splendid selection, executed with all the elegance of style and sophistication one associates with French artists of the stature of those presented here. Many of the recordings have been remastered from 78 rpm originals, but this has been done expertly, so that although there is rather more background noise than with modern recordings, the sound is generally very good, allowing excellent comprehension of the lyrics — of course, this is helped by the diction of the artists, which is extremely clear. Some of the tracks plainly originate from LP masters, and you will have no difficulty identifying these. Naturally, the stereo is simulated, but it is quite unimportant in discs of this kind, where the spotlight is on a single performer. (H.A.T.)

** ** **

**MANCINI CONCERT.** Henry Mancini and his concert orchestra. RCA Victor stereo LSP-4542.

The cover notes of this album state that no other previous album has demonstrated the remarkable versatility so positively as this one. I would not agree. It is remarkable that a composer of popular film themes could produce such a dull and uninspiring performance.

There are four medleys, entitled: Portrait of Simon and Garfunkel — March with Mancini — Jesus Christ, Superstar — Big Band Montage. The Overture from "Tommy" completes the disc. The overture is passable and the "big band montage" gives an authentic recreation of the bands of the 40s and 50s. Apart from this, there is little to commend it musically. Sound quality is good. (L.D.S.)

** ** **

**GREAT MOTION PICTURE THEMES.** Various conductors and orchestras. His Master's Voice stereo SXL 7541.

EMI certainly have best-seller material on their hands with this disc. All the themes are extracted from the classics and they are played by top-flight orchestras and conductors. Side one begins with the opening theme from the film "2001 — A Space Odyssey" and it is hard to think of a more impressive short piece of music than the beginning of the Strauss tone poem, "Also Sprach Zarathustra". This is played by the Philharmonia Orchestra conducted by Lorin Maazel.

Following the above piece is the theme from "Death in Venice" which is from Mahler's 5th Symphony, played here by the New Philharmonia Orchestra under Sir John Barbirolli. Completing side one is the theme from "The Mephisto Waltz" which, appropriately enough, is Liszt's Mephisto Waltz No 1, played as a piano solo by John Browning.

Side 2 begins with the theme from "Elvira Madigan", which is the slow movement from Mozart's Piano Concerto No 21 in C, played here by Daniel Barenboim on piano, while also conducting the English Chamber Orchestra. This music admirably reflects the nostalgic beauty of the film, and many people will buy the disc for this piece alone.

Centre piece on Side 2 is the theme from "The Music Lovers" and regardless of how one might have been affected by the film, the Finale of Tchaikovsky's "Pathetique" Symphony merits its place on this disc as a very good. The disciplined singing of the choir is just what we have come to expect from this group of specialists, and the sound is clean with good dynamic range and stereo spread. (H.A.T.)

*** *** *

GET HAPPY. Lyn Larsen at the Senate Theatre Organ. Detroit. Stereo, Concept CRS-3102. (From 6 Carrington St, North Balwyn, 3104. Also from Winton Music Centre, 41 Edward St, Summer Hill, 2130.)

A letter to hand from Australian organist Tony Fenelon advises that this recording was made by the engineer of the Detroit Theatre Organ Club, involving what he considers to be one of the finest Wurlitzers in the USA — an instrument boasting 4 manuals and 8 ranks. For those interested in technical detail, the specifications are listed on the jacket.

After his recitals in this country and his earlier releases, the young American organist Lyn Larsen will need no introduction to Australian popular organ enthusiasts. He is in fine form as he plays some "Get Happy" themes, interspersed with items in more serious vein: Get Happy — Soon It's Gonna Rain — 42nd Street Overture — Only A Rose — March of the Siamese Children — The Last Spring (Grieg) — Married I Can Always Get — Lullaby (Rosemary's Baby) — Fantasie Impromptu (Chopin).

If you want to sample his sheer skill at the console listen to that last track. And, incidentally, it's a fine example of popular organ recording as you're likely to hear anywhere — clean, well balanced and well

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spread between the stereo channels. A "must" for organ enthusiasts. The price, by the way, is $5.95, plus 35c postage and package, plus exchange. (W.N.W.)


Buyers of previous "Music of the Mountains" discs need have no hesitation in buying this budget priced reissue, which has been popular since its first release some years ago. Manuel (or Geoff Love, to give him his real name) uses a large orchestra with emphasis on "singing strings". The recording quality is not entirely faultless, and there is an edginess on the string tone, but this is quite mild, and can be overlooked — particularly as the disc costs only $2.75. Stereo spread is good.


I was interested to see that EMI are now issuing the "World Wide" series in the budget price $2.75 range, instead of the $5.75 range as previously. At this price, the series becomes a very attractive proposition, as the sound quality, performance and recording has been consistently good. This second disc to feature the music of Spain is no exception. It takes in a rather wider range than the first disc, as it includes not only night club music, but flamenco and light music also. This still leaves serious gaps — why no zarzuela and bullring music, for example, but within its limitations it provides enjoyable listening. Well known numbers included are: Cuando Sale de Cuba — La Banda — Cu-Cu-Rru-Cu Paloma — Spanish Eyes. The remaining 10 titles are unlikely to be widely known. (H.A.T.)


Vols 1 and 2 with the same title as this disc have been extremely popular for a long time. Volumes have been released of more than 10 years in the case of Vol. 1. Vol. 3 is very much like the others — orchestra with large string section playing arrangements of popular Spanish tunes, some up tempo and with rhythm backing. The titles in this case are: Ritual Fire Dance — Andalucia (Granados). Selection from "La Boda de Luis Alonso" — Novillerio — Ante el Escorial — Los Gatitantes — Fiesta Flamenco — Cordoba (Albeniz). All very tuneful, very Spanish and very enjoyable.

The disc was played on a normal stereo system, but the observant reader will have noted the reference to four-channel sound. This disc is in fact one of the first four to be issued by Astor for use with the Electro-Voice four-channel sound system. Although the hardware is very scarce at the moment, this is not important, since the discs are fully compatible with normal stereo equipment. If four-channel becomes the established thing in the future, owners of these discs will have a head start with their collections. On the other hand, if four-channel does not get off the ground, you haven't lost anything — particularly as these discs are being issued right from the start at the low price of $3.99 each. The sound is quite good, with just a slight edge of distortion on peaks. There is no room for any more detailed discussion here, but see the article on four-channel sound elsewhere in this issue. (H.A.T.)

TODAY'S HITS. 101 Strings. Stereo 4 compatible four-channel, Audio Spectrum QN 1.

Here's another of the four-channel discs just released in Australia, using the Electro-Voice matrix system, of the general type discussed elsewhere in this issue.

I played it, as most will for the time being, on a normal two-channel stereo system, listening for any hint of abnormality. It's a very "busy" recording with a lot of musicians seemingly crowded on to the front sound stage — possibly the result of not using four channels. Otherwise the spread is normal enough, though with no hint of extending beyond the loudspeakers. In terms of general quality, the balance is normal and the sound well up to medium standards.

Under the baton of Jack Dorsey, the selections should please: Theme From "Love Story" — El Condor Pasa — Hain Drops Keep Falling On My Head — Eidelweiss — It's All Happy — Mozart Symphony in G-Minor — Close To You — Bridge Over Troubled Water — I'll Never Fall In Love Again — Everybody's Talking. At $3.99 the disc is good value for normal stereo reproduction. If you happen to equip later with four-channel, you'll be that much ahead. (W.N.W.)

LAST OF OLD ENGLAND. James Last, with orchestra and chorus. Polydor stereo 2271, 164.

With his usual flair for the original, James Last has collected here a bunch of traditional English airs and ballads, and arranged them as medleys in dance tempos. The usual skilful Last arrangements and polished playing of the band are supplemented on this occasion by a female choir. Presumably because their knowledge of the English language is not too good, the choir are not called upon to sing the words of the songs, and they just hum and "ah" their way through the melodies. It's all very entertaining, and should be fine for dancing too. The titles, all very well known, include such popular tunes as Sweet Lass of Richmond Hill — Rule Britannia — Beguine Dull Care — The Vicar of Bray — Polly Oliver — Cherry Ripe. It is probably superfluous to say that the quality of the Polydor recording is first class. (H.A.T.)


There are two reasons for people buying this disc: the still considerable popularity of the now-defunct group and the recent tour of Judith Durham who was the driving force (vocal) behind the group. Whatever the reason, the disc is a good one at the WHC price of $3.39. Recording quality and stereo spread are good throughout.


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(L.D.S.)

* * *

THE FIRST MEN ON THE GOON. The Goon Show. Parlophone (EMI) mono PMCO 7132.

The reason for the title of this disc is not at all clear, as those taking part are not all regular Goon Show participants, and Michael Bentine, who was one of the originals, is not in the two shows presented. However, Goon Show addicts, of which there are still a great number, will welcome the chance of adding these to their collection. Side 1 has "Foiled by President Fred", concerning some improbable happenings in a South American Republic, where Neddy Seagoon goes to collect a gas bill for four shillings and ninepence, required to keep the South Balham Gasworks solvent; and Side 2 is a Goon Show Christmas special, "Robin Hood and His Merry Men", where the regulars are joined by Valentine Dyall (Sheriff of Nottingham) and Denis Price (Prince John).

The inspired idocy is right up to normal Goon Show standards, and is sure to keep those infected with Goonitis happy for weeks ahead. The mono only sound is adequate, although as usual much of the ad libbing is lost in background noises and audience noise. (H.A.T.)

Jazz and Rock . . . . .

Bob Dylan's Greatest Hits Volume 2. CBS stereo (S2BP 220085).

Of 22 songs spread over two LPs there are only five songs which Dylan hasn't sung before. Of course there are plenty of people who don't own everything. The album appears to have been inspired by the bootleg recordings and "current" performances by Dylan. These records appeared in great numbers in the past two years. Some of the performances, rushed and not really typical, legitimate the undercover performances which we have heard. There's "Watching the River Flow" recorded with Leon Russell and "When I Paint My Masterpiece" which The Band recorded on their last disc.

One of the surprises is "Tomorrow's Such a Long Time" recorded at a 1963 Carnegie Hall concert. Back in those far off days the music had a direct quality and a command of the situation which Dylan doesn't seem to have today. A Dylan performance these days involves a number of other musicians and to some extent a dissipation of those earlier forces.

The sound quality over the album varies with the venue. (G.W.)

* * *

THE CONCERT FOR BANGLA DESH. Apple stereo (STCX 3385).

Bob Dylan was the central performer in this outstanding concert organised last year by George Harrison to aid children in the Pakistan conflict. The usual concert recording is something which the record buyer has learned to live with. Poor balance and poor sound quality are endured for the sake of an exciting performance. Luckily, Harrison is a perfectionist who has insisted on good quality right through. Not only are the performances good, but the sound is there to match.

There are three LPs with performances selected from two concerts, boxed with a large colour book. The price ($17) compares favourably with what you would pay for three separate albums and no book.

From a musical point of view the concert was the first jam between Dylan and the Beatles. Dylan, Leon Russell, Ringo Starr and George Harrison formed an exciting quartet which performed "Hard Rain", "Blowing in the Wind", "My Tambourine Man" and other Dylan numbers.

Dylan's voice isn't as raspy as it used to be, Billy Preston and members of Badfinger were along. Ravi Shankar plays for one side with top sarod player Ali Akbar Khan. The whole set is undeniably the best concert recording to come from a rock or folk festival. (G.W.)

SHANANA. Kama Sutra stereo 2319 007.

The revival of early sixties rock and roll got underway when this group appeared at the Woodstock rock festival a couple of years ago. Groups in Australia like "Daddy Cool" followed the Shanana example. The music has a great verve, is rhythmical and bombards the ears with two-beat music, "Yakety Yak", "Jailhouse Rock" and "Great Balls of Fire" feature on the first side, recorded at a live concert.

Shanana show great spirit on this side. Unfortunately on the second side, a studio performance, they try to take on a ballad style and become just another band with not much to say.

* * *

WEIRD SCENES INSIDE THE GOLD MINE. The Doors. Elektra stereo (8E-6001).

Jim Morrison was one of the few poets of pop to ever get anywhere in the rock scene. He had been popular for five years before his death last year, a strange, tortured figure whose intense songs seemed unsuited to the pop scene yet made it anyway. This was the beginning of dark music, songs preoccupied with misery and darkness.

The little darlings of pop had their Greek tragedy after all in the music of Jim Morrison, his organ player Ray Manzarek and guitarist Robbie Kreiger.

These two LPs go back to the first single, "Break on Through", and include two of the big performances by The Doors, "The End" and "The Music's Over". Recording quality is good. (G.W.)

* * *


Van Morrison is the most impressive of the current composer-performers. He writes his own material, plays acoustic guitar, and sings very well indeed. The title song is superbly sung by Morrison who shows a sense of structure, building performances around a tuneful theme and a simple, uncomplicated lyric.

"Start a New Life", "You're My Woman" and "Old Old Woodstock" are a bridge between country music and rock and roll. The recording quality and stereo is first class. (G.W.)

* * *

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ELECTRONICS Australia, May, 1972

103
Harman Kardon CAD-5 Cassette Deck

The Harman Kardon CAD-5 is a high quality stereo cassette deck incorporating the Dolby "B" system of noise reduction. It is suitable for both conventional and chromium dioxide tapes. Our sample was submitted for review by Recorded Music Salon of Melbourne.

As with the Harman Kardon 330 Stereo amplifier reviewed in last column in February of this year, the CAD-5 cassette deck is manufactured in Japan. It is very compact and is probably one of the smallest cassette stereo decks on the market. Dimensions are 12 1/4(w) x 9 1/2(d) x 3 1/4(h) inches or 314 x 242 x 79mm. Weight is 10 pounds (4.5 Kg).

There are four holes to provide screwdriver access to potentiometer adjustments for correct adjustment of record and playback levels. The playback levels are potentiometer adjustments for correct adjustment of chromium dioxide tapes.

Provided to adjust the bias level to suit conventional of 950mV at 0 VU. The other two pairs are low and high sockets. One pair is for replay and has an output level and is quite accurate.

It is necessary to obtain a Dolby level setting tape. The record levels are set with the aid of a test tone which is provided by a "hold-on" push button on the rear panel. The cassette is dropped on the loading platform and then pressed into place by hand or using the smoked clicker. The cassette is ejected by pushing the stop button. The interior of the CAD-5 is very tightly packed with circuitry. The power transformer is mounted in the dust cover be normally closed but under normal conditions we found cassette cover opened.

The Harman Kardon CAD-5 cassette deck with cassette cover opened.

The CAD-5 operates very quietly and the only time one is aware that it is running is during rewind or fast forward. No electrical noise, such as motor noise or clicks, is fed through to the following amplifier. The push buttons were stiff to operate, especially the play button.

Listening tests confirm the advantages of the Dolby system. We recorded some discs on Chromium dioxide tapes and found the results very good. It is possible to distinguish the difference between the recorded tape and the original disc, but this will depend on the acuity of the listener's ears. The differences are a slight increase in hiss and slight degradation in the high frequency response. Most people will regard the results as very good.

We made a number of record-to-playback frequency response tests using various types of tape, both chromium dioxide and conventional low noise. Chromium dioxide tapes easily exceed the performance of conventional tapes. At signal levels of -10 VU or below the response is within +3dB from 40Hz to 13kHz. With conventional low noise tapes, the best we could achieve was +3dB from 40Hz to 7kHz.

With Dolby operation, signal to noise ratio with respect to VU is better than -50dB which is ap-proaching the best performance of domestic open reel recorders. Crosstalk with respect to 0 VU ranges from -30dB at 10kHz to -60dB at 10kHz. Harmonic distortion at 0 VU was 1.0% as specified and at lower signal levels, ie., -10VU, it was less than 1%. These figures clearly demonstrate just how good Dolbyised machines can be.

These advantages come at a price. At $599 the Harman Kardon CAD-5 must be considered expensive, especially since it is made in Japan. But no doubt those who buy it will be completely satisfied. Harman Kardon equipment is available from retail outlets throughout Australia. All enquiries should be directed to Recorded Music Salon, 11 Collins Street, Melbourne, Victoria, 3000. (1.D.S.).

Dana Electronic Counter

Dana Laboratories have released a new range of electronic counters designated the 8000B series. They have frequency measurement capability up to 550MHz. Australian distributors are Jacoby, Mitchell & Co Pty Ltd.

Each counter provides four measurement modes: frequency, period, multiple period average and totalise. Four additional modes are available on some models: an extended frequency range to 550MHz, time interval, average time interval and frequency ratio. A temperature-compensated crystal oscillator (TXCO) is used as the reference to eliminate long warm-up delays and to obtain optimum accuracy. A higher stability TXCO and a range of oven-controlled oscillators are available as options.

Input sensitivity is normally 50mV up to 550MHz. An optional amplifier increases this to 1mV with automatic triggering. This high sensitivity allows frequency measurements of signals having up to 99% amplitude modulation.

Further information can be obtained from the Australian distributors for Dana equipment, Jacoby Mitchell & Co Pty Ltd, P.O. Box 2009, North Parramatta, NSW 2151.

Dana electronic counters have frequency measurement capability up to 550MHz.
Sansui SD-5000 Tape Deck

Sansui Electric Co Ltd recently announced the release of the new SD-5000 three-motor, four-head tape deck. It has been designed with special emphasis on tonal quality, tape protection and operating convenience. It is distributed in Australia by Simon Gray Pty Ltd.

Apart from the features mentioned above, Sansui engineers have given special attention to mechanical ruggedness of the recorder. A case in point is aluminium die-cast base for the tape transport which because of advances in die-casting and new materials, is exceptionally rigid. Much attention has also been paid to ease of service and little dismantling is necessary to obtain access to major sections.

Features of the tape transport system include relay-actuated, interlocked controls incorporating an electronic delay to eliminate tape snatch, twin 6-pole induction motors for reel drive and a hysteresis-synchronous 4-8 pole motor for capstan drive.

The recording and playback heads are exceptionally large to ensure large signal-handling capability and a smooth extended bass response. Similarly, the equalisation preamplifiers have excellent signal handling capability and a high level of negative feedback to minimise distortion.

Mixing facilities are provided for microphone and line inputs. Control features include automatic reverse, remote control, echo recording, pause control and cue button.

Australian made semiconductors from ITT

Standard Telephones and Cables Pty Ltd now have available a new ITT range of Australian made semiconductors. Included in the range are 3-amp rectifier diodes, triacs, silicon controlled-rectifiers, unijunction transistors and a bidirectional trigger diode (diac).

The 3-amp rectifier diodes are IN4719 to IN4725 (axial lead) and IN4097 to IN4093 (single-ended mounting). Peak repetitive reverse voltage ratings are 50, 100, 200, 400, 600, 800 and 1000 volts DC. Reverse current at rated reverse voltage is a maximum of 0.5mA at 25°C ambient. Non-repetitive peak surge current is 300 amps for cycle time of 500μs. Operating case temperature ranges from -55°C to 175°C.

Triacs are available with three current ratings: 1, 6 and 10 amps RMS. The 1-amp type is the TC101. This is a metal TO-8 encapsulation and a repetitive peak off-state voltage rating of 400 volts, making it suitable for low power 240V AC operation. The 6 and 10 amp types are the TC1102 and TC1103, respectively. These have TO-6 encapulation and are also suitable for 240V AC operation. They are direct replacements for the superseded TC60DR(T) and AC160DR(T) triacs.

The silicon controlled-rectifiers are available in two current ratings: 1.6 and 10 amps RMS. Average current ratings are reduced, depending on the conduction angle. The 1.6 amp range is designated TS1201 to TS1220 and has metal TO-5 encapsulation. Repetitive peak off-state voltage ratings are 50, 100, 200, 400 and 500 volts.

The 10-amp SCR's are designated TS1216 to TS1220 and have TO-66 encapsulation. Repetitive peak off-state voltage ratings are the same as for the 1.6 amp range. Non-repetitive surge current rating for the 10-amp units is 80 amps for 10 milliseconds. Maximum operating junction temperature for all the SCR's is 100°C.

Triggering circuits for the triacs and SCRs may be designed around the bidirectional diode V403 or the unijunction transistors 2N2446 and 2N2647 which are now manufactured locally by ITT so that continuity of supply is assured.

Further information on the complete ITT range of Australian-made semiconductors may be obtained from Standard Telephones and Cables Pty Ltd, Moorabbin Avenue, Melbourne, Victoria 3188 or their interstate distributors.

SONAB DEMONSTRATION

Sonab of Sweden Pty Ltd is offering appointed Sonab dealers the services of a trained demonstrator to promote the range of Sonab loudspeakers and equipment. All information can be obtained by contacting Sonab at 092 1286 or 092 4554.
Peak integrated circuit stereo amplifier

Peak amplifiers have been on the Australian market for many years and are probably well-known to most enthusiasts. One of the latest models is the Peak TRM-50 which has rated power output of 18 watts per channel. Apart from the four output transistors, all circuitry uses integrated circuits.

Overall dimensions of the Peak TRM-50 are 12½ x 10d x 4½ inches or 318 x 254 x 107mm including knobs and rubber feet. It has a vinyl-covered steel top cover and oiled walnut end covers. The extruded aluminium front panel is finished in matt black and natural aluminium and is rather “busy” with six knobs and four lever switches.

From the left, the knobs are loudspeaker selector, bass and treble controls, balance, volume and input selector. The loudspeaker selector gives a choice of one or both of either two loudspeaker systems or they may both be switched off. The bass control knob pushes-in to switch in a rumble filter and similarly, the treble control knob pushes-in to operate a high filter which is erroneously labelled a “scratch” filter.

From left, the lever switches provide the following functions: Stereo mono selector, Tape monitor, Loudness and Power. The stereo headphone socket and pilot light complete the list of front panel features.

The rear panel has several interesting features, such as the three red push-buttons for the re-settable circuit breakers. These act to protect the amplifier in the case of an unacceptable load, such as a short-circuit or in the case of an internal component breakdown. Each circuit breaker is in series with the transformer primary. The other two are in series with the positive DC supply line to each power amplifier.

Spring-loaded terminals are provided for two sets of loudspeakers. Two 2pin mains outlets are provided, one switched, one unswitched. Four pairs of phono sockets are provided, for magnetic cartridge, one switched, one unswitched. Four pairs of phono loudspeakers. Two 2-pin mains outlets are provided. DI’s supply line to each power amplifier.

There are two printed boards inside the amplifier, one large and one small. The small board measures about 7 x 2 inches and accommodates the tone control and filter circuitry. It is mounted upside down and the potentiometers are soldered directly to it. This is a common feature these days but it does tend to make servicing in this section a little difficult.

The large board accommodates the circuitry for both power amplifiers, together with the magnetic equalisation preamplifier. The four output transistors, which have a metal TO-96 encapsulation, are mounted together with their U-shaped heatsinks directly on the board. Apart from the output transistors, there are no discrete transistors in the unit. Instead, there are six IC’s, one in each power amplifier, one in each channel of the magnetic cartridge preamplifier and one in each channel of the tone control circuitry.

To keep wires carrying low-level signals as short as possible, the input selector switch is mounted at the rear of the amplifier, adjacent to the input sockets. A long shaft runs from it to the input selector knob in the front panel.

A generously sized power transformer, two silicon diodes and a 10000μF capacitor make up the power supply. Further resistors and electrolytic capacitors provide decoupled supply rails for the low-level sections of the amplifier.

The amplifier output configuration is the familiar quasi-complementary mode and output signal coupling is via 1000μF 35V electrolytic capacitors, one per channel. The output terminals are insulated from the amplifier ground via a 0.01μF capacitor, and a diode. If an isolated load such as a turntable is connected, a capacitor can be used between the output terminal and the ground wire. This is via a 1000μF electrolytic capacitor, which is provided for this purpose.

The overload capability of the magnetic input is rather poor. Power output into 8 ohm loads is 10.5 watts for one channel, or 10 watts per channel with both channels driven. At this power level, harmonic distortion was 0.3% Power output into 4 ohm loads is 18 watts with 15 watts per channel driven and 25 watts per channel with both driven. Harmonic distortion was 0.5%, into 4 ohm loads, continuous power output is 21 watts with both channels driven, and 15 watts per channel with both.

Separation between channels with respect to 15 watts into 8 ohms was -42dB at 1kHz and -55dB at 10kHz. These figures are very good. Frequency response at a level of -3dB points at 20Hz and 20kHz is 1kHz and treble boost and cut is ±12dB or ±15dB at 1kHz and ±12dB or ±15dB at 20kHz. These figures are very good. Frequency response is +1dB at 20Hz and ±12dB or ±15dB at 20kHz. These figures are very good. Frequency response is +1dB at 20Hz and ±12dB or ±15dB at 20kHz. These figures are very good.

The cross-over network is via UMW: 15VW electrolytic capacitors, one per channel and filter circuitry. It is mounted upside down and the potentiometers are soldered directly to it. This is a common feature these days but it does tend to make servicing in this section a little difficult.

The large board accommodates the circuitry for both power amplifiers, together with the magnetic equalisation preamplifier. The four output transistors, which have a metal TO-96 encapsulation, are mounted together with their U-shaped heatsinks directly on the board. Apart from the output transistors, there are no discrete transistors in the unit. Instead, there are six IC’s, one in each power amplifier, one in each channel of the magnetic cartridge preamplifier and one in each channel of the tone control circuitry.

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The overload capability of the magnetic input is rather poor. Power output into 8 ohm loads is 10.5 watts for one channel, or 10 watts per channel with both channels driven. At this power level, harmonic distortion was 0.3% Power output into 4 ohm loads is 18 watts with 15 watts per channel driven and 25 watts per channel with both driven. Harmonic distortion was 0.5%, into 4 ohm loads, continuous power output is 21 watts with both channels driven, and 15 watts per channel with both.

Separation between channels with respect to 15 watts into 8 ohms was -42dB at 1kHz and -55dB at 10kHz. These figures are very good. Frequency response at a level of -3dB points at 20Hz and 20kHz is 1kHz and treble boost and cut is ±12dB or ±15dB at 1kHz and ±12dB or ±15dB at 20kHz. These figures are very good. Frequency response is +1dB at 20Hz and ±12dB or ±15dB at 20kHz. These figures are very good. Frequency response is +1dB at 20Hz and ±12dB or ±15dB at 20kHz. These figures are very good.
Jabel Mains Interference Filter

Watkin Wynne Pty Ltd announce the release of the Jabel F500 radio interference filter for mains operated domestic appliances. It contains an iron-cored inductor and a delta-configuration of 600 volt capacitors.

The unit has a current rating of 2 amps, making it suitable for electronic organs and other appliances with low power consumption up to 50 watts. Depending on how the interference is radiated, the filter can effect a major improvement to radio reception and sound reproduction.

Trade price of the F500 is $8.00 plus tax, for small numbers. The unit is available from trade outlets or

Hewlett-Packard Microwave Transistors

A range of low-noise microwave transistors is now available from Hewlett-Packard at prices less than half those previously applying. Designated the HP 21A series, they have "worst case" noise figures of 4.5dB at 4GHz and 3dB at 2GHz.

The new HP21A series exhibit exactly the same smooth matching characteristics as the current HP21 series. In fact, the only difference is that the HP21A series have arsenic emitters.

Data sheets are available giving thorough specifications, including k-parameter information and source-matching impedance at the low noise biasing levels (Volts, mA).

The transistors come in 200-mil, 260-mil and 130-mil four-lead common-emitter strip-line packages. Differed at the same time are transistors with 0.5dB higher noise figures.

Further information can be obtained from Hewlett-Packard Australia Pty Ltd, 22-28 Weir Street, Glen Iris, Vic 3147 or 61 Alexander Street, Crows Nest, NSW 2065.

Test Equipment from Schlumberger

Schlumberger Instrumentation Australia Pty Ltd have recently released three new instruments, the FB 2003 / 0 Digital Counter, the TH5611 Multiplexer / A-D Converter and OCT 461 transistorised Oscilloscope.

The Schlumberger SIS Digital Counter FB2003-0, with a bandwidth of 0-60MHz, measures frequency, periods, multiple periods, positive or negative pulse duration, duration of a short circuit and time intervals with a stability of 2 parts in 100 million. High reliability is achieved with TTL integrated circuits and the 6 digit display is enhanced by the use of non-blanking indicator tubes.

Various add-on modules are available to increase the flexibility of the counter: a 1MHz divider, a 50MHz divider, a voltage to frequency converter and a drift expander.

The TH5611 Multiplexer and Analog-to-Digital Converter multiplexes and samples up to 64 inputs. The sample rate, number of channels, etc., can be selected manually by front panel controls or can be selected automatically by a central processor or remote control device. The 5611 can be integrated into an automatic data processing system.

Up to eight plug-in cards can be included in the multiplexer and each can include up to 8 FET analog switches. The multiplexed output is routed via an amplifier for impedance and level adaption. The conversion time for 11 bits is less than 50ns, regardless of the selected sample rate. The output of the analog to binary converter is transferred to two buffers: one for the series output and one for the parallel output.

The OCT 461 transistored oscilloscope weighs 13 pounds 4kg and is designed to operate from AC or DC power sources. An accessory battery pack gives up to eight hours use. Bandwidth of the OCT 461 is DC to 10MHz at 1mV cm sensitivity. Comprehensive time-base facilities include TV line and field synchronisation, X expansion and automatic stability control.

Screen size is 54mm x 68mm and overall dimensions are 12 x 12 x 4 inches 305 x 305 x 114mm. For further information, contact Schlumberger Instrumentation Australia Pty Ltd, P.O. Box 138, Keilor, Victoria, 3031.

TRADE RELEASES — in brief

SIEMENS INDUSTRIES LTD, 544 Church Street, Richmond, Vic 3121. Linear ICs, types TAA 981 and 991, TBA 120 and 140. The TAA 981 and 991 are combined AM/FM IF amplifiers for use in radio receivers. The 991 has an AGC output, otherwise the two types are identical. The IF amplifier circuit consists of two stages directly coupled by an emitter follower. The operating points are stabilised by feedback. FM limiting is at an input voltage of 20uV, the AM suppression factor is 50dB, and the supply current drain is 6mA. The TBA 120 and 140 are FM IF amplifiers primarily for use as TV sound or FM broadcast IF amplifiers. They operate to 40MHz and can be used as limiting amplifiers, controlled demodulators and modulators. Limiting begins at 70uV and AM suppression is better than 60dB at 1mV.
ALL CARTRIDGES ARE DIFFERENT.
EMPIRE CARTRIDGES ARE MORE DIFFERENT THAN OTHERS.

They are undisputably the best in the world. If you know how moving magnetic cartridges are made, you can see right away just how different an Empire variable reluctance cartridge is. With the others, the magnet is washed directly to the stylus — so that all extra weight rests on your record.

With Empire's construction, (unique of its type), the stylus floats free of the magnets. So naturally, it imposes much less weight on the record surface.

Less record wear
Empire's lightweight tracking ability means less wear on the stylus and less wear on your records. Some experts claim that an Empire cartridge can give as much as 50 times the number of plays you'd get from an ordinary cartridge without any measurable record wear! "A real hi-fi masterpiece. A remarkable cartridge unlikely to wear out discs any more rapidly than a feather held tightly against the spinning groove." Hi-Fi Sound on the 999 VE.

We refer to the most Authoritative Products reviewed in "Electronics Australia" March, 1972. Pages 100 and 106, as quoted below.

Empire 1000ZE / X Magnetic Cartridge

Over the past few years manufacturers' top-of-the-line pickup cartridges have become increasingly expensive but at the same time their performance has been much improved. The 1000ZE / X is the top of the Empire line and few cartridges can compare with it.

As with most things, high fidelity equipment conforms to the law of diminishing returns — "the more you pay, the more subtle the improvement becomes". But the Empire 1000ZE / X seems to be the exception that proves the rule. It is audibly better than the other cartridges in the Empire range, and most of those of other manufacturers.

The 1000ZE / X has a moulded plastic body and a removable stylus assembly which incorporates a flip-down stylus guard. Finish is black and gold. Mu-metal shielding and num-bucking connection of the four internal coils result in a cartridge with very low residual noise output. Cartridge weight is 7 grams.

ARMSTRONG 526

"Best buys of the day"

AMPLIFIER: Power Output: 25 watts R.M.S. each channel into 8 ohms. Frequency Response: +20 to -2.5 db at 20 to 20,000 Hz. Total Harmonic Distortion: Less than 0.5% for power levels up to 25 watts throughout the audio range. Crosstalk: Better than -80 db. Hum and Noise: Better than -70 db on tape playback. -60 db on radio and -55 db on pickup. FM TUNER: Coverage: 86-108 MHz. AM TUNER: Coverage: Medium and Long wavebands. IF Bandwidth: 4kHz at 6dB down.

Era

The World's Best Turntable Which Tracks At 1/10th Of A Gramme

- The Era arm outperforms even the most recent cartridges: it can track at 1/10th of a gram.
- By principle its pivot eliminates all fractions. The pivot is in fact the intersection of the counter-balanced spring blades. They form two Xs which do not touch each other.
- The tracking weight is applied directly to the pivot by changing the angles of the blades; in this way the inertia of the arm is not increased with the tracking force as in all other arms. The pick-ups sound better.
- The arm itself is made of a light alloy H beam which eliminates the resonant frequencies of tubes.
- 33.45 rpm stop between speeds.
- Hydraulic arm lift.
- Total wow and flutter 0.04%.
- Slide in feel for all pick-ups.
- 12 pounds.
- 50 to 60 cycles.
- Power requirements 1.5 watts.
- 22 cm arm.
- The motor of the ERA turntable rotates so regularly that it does not need a heavy platter. It is belt driven to avoid flat spots.
- The ERA motor is synchronous. Its speed is rigorously stable because it is keyed to the frequency of the AC current.
- The oversized ERA motor allows fast starts. Its work load is well within its possibilities since it could drive a 30 pound weight.
- As in all professional turntables the drive is through a belt. It is made of a special neoprene and ground to its specifications within 0.002 of an inch. The simplicity of this one step drive eliminates wow and flutter.

Superb performance
The lightweight Empire cartridge picks up the recorded sound from the grooves with amazing accuracy. Distortion is minimal (one reviewer could measure no distortion at all levels on the 1000ZE / X and 999VE / X). Separation is razor sharp. (Audio Magazine said "Outstanding square waves. Tops in separation") And frequency response is outstanding. (4-40,000Hz on the 1000ZE / X).

Empire cartridges are different
And all the better for it.

Sole Agents for Australia

RECORDED MUSIC SALON
(C. Pinczewski)

11 Collins Street, MELBOURNE, VIC 3000. Tel. 63-6257

Electronics Australia, May, 1972
When the Plastiform magnetic tape viewer is placed on recording tape, the magnetic field pattern forms a clear image.

AUSTRALIAN VIDEO ENGINEERING. 7 The recent, Annandale, NSW 2038. Agent for JTC (Japan) Video tape recorder, model TVR 45C. This unit uses standard 1/2 inch tapes and has been designed for interchange of tapes with other EIAJ machines. - EIAJ is the new Japanese standard format. The recorder features push-button operation, full remote control possible, tape speed of 6-1/2ips for 71 minutes recording.

Also agent for Dynasciences Corp, USA, Editor-programmer. Claimed to be compatible with most VTR equipment, this unit provides a means of performing tape-to-tape assembly and insert editing with 1/4 inch helical scan units to 2in quadruplex machines.

HARAL ELECTRONICS PTY LTD, 47 Telawera Road, North Ryde, NSW 2113. HF SSB Transceiver, model RCA 260. Provides six optionally 12 MHz stability crystal controlled channels which may be located anywhere in the range 2-10 MHz. Using silicon solid-state circuitry including ICs throughout, the transmitter has a PEP output of 25W. It is able to operate into any load from a short circuit to an open circuit without damage. It operates from a 12V DC source of either polarity, and an optional external AC supply is available.

FAIRCHILD AUSTRALIA PTY LTD, PO Box 151, Chatswood, NSW 2067. Agent for Fairchild Instruments Ltd, UK RF millivoltmeters. This is a general purpose recorder. To examine the pattern of recorded sound and to synchronise the audio track on a side() reproduce problems in malfunctioning systems. It can also be used to help determine record or reproduce problems in malfunctioning systems. It can be used to synchronise the audio track on a side. Designed to provide a simple, low-cost method of interfacing DTI, TTL data terminal and communications equipment. The 9616 is implemented by an AND- OR- Invert function instead of the positive NAND function used in other drivers. It also features internal slew rate control which eliminates the need for an external capacitor for each driver. The 9617 has 3 to 2k input resistance and protection to 25V. It offers control of slew rate, output operation and produces small individual response control to allow increased AC noise immunity.

EMI AUSTRALIAN LTD, 101 Castlecrag Road, Sydney 2067. Agent for EMI Electronics, UK. Photomultiplier tube. Type 9558F. This is for use in colour flying and film scanning applications where, relatively high light levels are involved. Intended for use in the blue and green channels, the 9558F extends the EMI range of tubes with S20 photocathodes. The S20 photocathode has intrinsic properties which help reduce picture breakup distortion by improving linearity and reduce skew over a wide range of light levels.

TORN ELECTRICAL INDUSTRIES (AUS) PTY LTD, 1111 Hambledon Road, West Hindenburg, Vic 3163. Agent for Goodman's loudspeakers Ltd, UK. Bidirectional sound source. The design and arrangement of drive units in this loudspeaker system provide directio
dional sound sources as distinct from the uni
directional or omnidirectional behaviour of some domestic series sets. Nine matched drive units (one bass unit, two mid-range units, two high frequency drive units in twelve unit loudspeaker box) are arranged in the union of the two cabinets comprising the system. The units are integrated by a crossover network of three-way components.

Small case loudspeakers are used throughout to prevent undue breakup distortion. The frequency range is 21 to 22KHz. The nominal power output is 9W sensitive in a 4W, and impedance is 8 ohms. The speakers measure 30 x 14 x 12 inches and weigh 41bs.

H.M. RADIO SALES
Makers of Radio and Radio Furniture for 40 Years.

105 CATHERINE STREET
LEICHHARDT, SYDNEY
Telephone: 56 5580

POWER MODULES

- Single and Dual Outputs
- Output Voltages to 50 Volts
- Output Current to 2.0 Amps
- Line and Load Regulation - Less than 0.01%
- Short Circuit proof

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Melbourne 729 3170; Brisbane
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MAY SPEAKER SPECIALS

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<tr>
<th>MAGNAVOX B 30 30 watts</th>
<th>$58.50</th>
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<tr>
<td>Cabinet Kit and Speakers</td>
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PLAYER PLATFORMS 64 50 Tinted covers $6.30
PACKAGES 5 per order. Freight on delivery.

See Stereo Catalogue 4th Edition
Equipment, Cables, Player Guide and Am. Filter Snap Shot.

H.B. RADIO SALES
TRANSISTOR STEREO AMPLIFIERS WITH IN-BUILT AM TUNER
ULTIMATE IN DESIGN — LONG DEPENDABILITY
 USING ALL SILICON TRANSISTORS 40 WATTS — RMS

SPECIFICATIONS:
20 watts per channel RMS.
Total output 40 watts RMS.
FREQUENCY RESPONSE:
From 20 to 20,000Hz ± 0.1dB.
HARMONIC DISTORTION:
Less than 1 per cent of rated output.
HUM AND NOISE:
AUX 70dB, Mag 50dB.
INPUT SENSITIVITY:
Mag 4mV, Aux 200mV.
SPEAKER IMPEDANCE:
8 ohms.
EQUILISED:
Mag RIAA.
TONE CONTROLS:
Bass, Treble.
LOUDNESS CONTROL:
50Hz 10dB.
SCRATCH FILTER:
(2nd filter) at 10kHz 9dB.
RUMBLE FILTER:
(1st filter) at 50Hz 6dB.
PROVISION FOR HEADPHONES:
With headphone/speaker switch on front panel.
DIMENSIONS:
16" x 512 x 11" deep.
TUNER:
This unit can be supplied with either valve or transistor tuner with a coverage of 530 to 1600KHz. Calibrated dial available for all states.
THE CIRCUIT incorporates regulated power supply with transistor switching protection for output transistors. 26 silicon transistors plus 5 diodes are used.

NEW 6 WATT STEREO AMPLIFIER WITH A.M. TUNER

SPECIFICATIONS:
DISTORTION:
Less than 0.5 per cent THD at 1KHz, less than 0.5 per cent at 100mW at 1KHz.
SIGNAL TO NOISE RATIO:
62dB with respect to 3 watts into 8ohms.
FREQUENCY RESPONSE:
Within 2dB from 20Hz to 100KHz.
TONE CONTROLS:
Bass control 15dB boost or cut at 50Hz, treble control 14dB boost or cut at 10KHz.
INPUT SENSITIVITY:
250mV for all inputs, tape, aux. or phono.
SHORT CIRCUIT PROTECTION.

THE NEW MAGNAVOX 8-30 SPEAKER SYSTEM
Complete System (1.6 cubic ft.) in Walnut or Teak Veneer, Oiled Finish.
Speaker Kit (less cabinets) COMPRISING 1-8/30 Speaker, 2-3TC Tweeters, 2-4mfd Condenser, Innerbond and Speaker Silk Available in 8 or 15 ohms. Postage $1.50 extra. $29.50.
variable from 10us to 103s, and total delay span from 50dB range: ±1.5dB in the 80 to 120dB range. A front production line. It generates power levels between DC to 500kHz with incremental delay variable from 10us to 103s, and total delay span from 50dB range: ±1.5dB in the 80 to 120dB range. A front production line.

HEWLETT-PACKARD AUST PTY LTD, 22-26 Weir Street, Glen Iris, Vic 3146. Signal generators, models TFN 1024 and TF 200.

RF power levels between DC to 2.5MHz. Models CNTR 1024 and CTR 200A are HF computes 200 points over a frequency range from 10-16 points are also available as an option. Model CTR 200A has been specially designed for the repair of transistor radios for many years.

AMPHENOL TYREE PTY LTD, 10-16 Charles Street, Redfern, NSW 2016, is a newly formed company which was previously established under licence, the complete Amphenol line of electrical and electronic components, including connectors, potentiometers, switches, keypads, and relays. The company is 60% Australian-owned with the balance held by Bunker Ramo Corp. USA, its largest operating group. CEMA (Distributor) Pty Ltd has been appointed national distributor for Amphenol connectors throughout Australia. The telephone number of Amphenol Tyree Pty Ltd is (Sydney) 699 2292.

FAIRCHILD AUSTRALIA PTY LTD has moved its South Australian office to North Terrace House, Hackney, SA 5086. The telephone number is (Adelaide) 63 1453.

AUSTRALIAN GENERAL ELECTRIC PTY LTD has moved to 86-90 Bay Street, Ultimo, NSW 2007. The telephone number is (Sydney) 321 0771.

PLESSEY DUCON PTY LTD, Battery Systems Division, PO Box 2, Villawood, NSW 2163, will market Eagle-picher professional battery systems in Australia, New Zealand and throughout the Pacific and Far East regions. This follows an agreement with the Electronics Division of Eagle-Picher Inc, USA. Types covered by the agreement include: magnesium perchlorate, metal air, nickel zinc, organic electrolyte, silver cadmium, and all types of silver zinc, thermal, and water activated high-performance battery systems. A contract has been awarded by the Australian Defence Department for Supply under which Plessey Ducon and Eagle-Picher will jointly undertake a feasibility study concerned with the production of silver-zinc batteries for defence applications.

McMURDO (AUSTRALIA) PTY LTD, PO Box 531, Clayton, Vic 3168. Agent for Birch-Stolec, UK. Sub-miniature thumbwheel switches. Only 0.312in wide, the miniature switch is available with 10-way, decimal, or binary (1248 and 1242 codes) readouts. The switch maps into a panel cutout from the front which obviates the need for external switches, components, including capacitors, resistors, potentiometers, diodes, varactors, RF / IF amplifiers, receivers, stripline components, modules, attenuators, Packages, silicon controlled rectifiers, communication transistors.

PETER G. BROUGHTON has moved to 99 Sussex Street, near King Street, Sydney, 2000. The telephone number is 29 3965. Mr. Broughton has specialized in the repair of transistor radios for many years.

Frequency stability is ±0.03ppm in over a ten-hour period after a one-hour warm-up. Typically, it recovers specified accuracy within ten following a frequency change of ±3% after 30m warm-up, and residual FM is less than 0.5ppm Internal 400Hz and 1kHz oscillators are available for AM or FM, and external modulation can be used.

McMURDO (AUSTRALIA) PTY LTD, PO Box 531, Clayton, Vic 3168. Agent for Birch-Stolec, UK. Sub-miniature thumbwheel switches. Only 0.312in wide, the switches are available with 10-way, decimal, or binary (1248 and 1242 codes) readouts. The switch maps into a panel cutout from the front which obviates the need for external switches, components, including capacitors, resistors, potentiometers, diodes, varactors, RF / IF amplifiers, receivers, stripline components, modules, attenuators, Packages, silicon controlled rectifiers, communication transistors.

PHILIPS INDUSTRIES LTD has announced that the marketing of Pye Unicorn instruments will be transferred to Philips Australasia Pty Ltd, a subsidiary of Electronic Industries Ltd, to the Scientific and Industrial Equipment Division of Philips. The change will take place from July 1, 1972. Pye Unicorn instruments include equipment for gas and liquid chromatography; atomic absorption; ultraviolet, infrared and visible light spectrophotometry, and automatic wet chemistry analysis.

MALLORY BATTERIES (A"SIA) PTY LTD, 3 Chivers Road, Thornleigh, NSW 2120. Blank cassette tapes. Four blank cassette tapes have been introduced, intended for the audiophile, office dictating, youth, and broad consumer market. For the audiophile; Professional Duratape is a new "coated energized" tape capable of studio-quality recording and sound reproduction. The other tapes are: Executive for office dictating machines; Flip-tape, moderately priced for the youth market; and Duratape for the broad consumer market. The latter has a built-in head cleaner that automatically cleans cassette recorders before recording or playback.

R. H. CUNNINGHAM PTY LTD has moved its head office to One Dryburgh and Victoria Streets, North Melbourne, Vic 3061. The telephone number is 528 9003.

AMALGAMATED WIRELESS (A"SIA) LTD has opened a new Queensland office at 73 Jane Street, West End Brisbane, Qld 4101.

PETER G. BROUGHTON has moved to 99 Sussex Street, near King Street, Sydney, 2000. The telephone number is 29 3965. Mr. Broughton has specialized in the repair of transistor radios for many years.

AMPHENOL TYREE PTY LTD, 10-16 Charles Street, Redfern, NSW 2016, is a newly formed company which was previously established under licence, the complete Amphenol line of electrical and electronic components, including connectors, potentiometers, switches, keypads, and relays. The company is 60% Australian-owned with the balance held by Bunker Ramo Corp. USA, its largest operating group. CEMA (Distributor) Pty Ltd has been appointed national distributor for Amphenol connectors throughout Australia. The telephone number of Amphenol Tyree Pty Ltd is (Sydney) 699 2292.

FAIRCHILD AUSTRALIA PTY LTD has moved its South Australian office to North Terrace House, Hackney, SA 5086. The telephone number is (Adelaide) 63 1453.

AUSTRALIAN GENERAL ELECTRIC PTY LTD has moved to 86-90 Bay Street, Ultimo, NSW 2007. The telephone number is (Sydney) 321 0771.

PLESSEY DUCON PTY LTD, Battery Systems Division, PO Box 2, Villawood, NSW 2163, will market Eagle-picher professional battery systems in Australia, New Zealand and throughout the Pacific and Far East regions. This follows an agreement with the Electronics Division of Eagle-Picher Inc, USA. Types covered by the agreement include: magnesium perchlorate, metal air, nickel zinc, organic electrolyte, silver cadmium, and all types of silver zinc, thermal, and water activated high-performance battery systems. A contract has been awarded by the Australian Defence Department for Supply under which Plessey Ducon and Eagle-Picher will jointly undertake a feasibility study concerned with the production of silver-zinc batteries for defence applications.

Electronic exports has changed its address to 94 Eltham Street, Melbourne. The postal address is GPO Box 5402CC, Melbourne, 3001, and the telephone number is 30 4326. The company is interested in expanding its markets in the Pacific area, including Papua New Guinea, and is seeking further agencies. A new company, Modern Electronics, has been formed at the same address to sell to Australian clients, and also seeks agencies.

McMURDO (AUSTRALIA) PTY LTD, PO Box 531, Clayton, Vic 3168, has advised that the death occurred on February 20, 1972, of Mr Norman W. Swann, the founder and chairman of the company. Mr Swann also founded the Swann Electric Co in New Zealand.

Mr N. W. Swann Mr L. F. White

AUSTRALIAN TELECOMMUNICATIONS DEVELOPMENT ASSOCIATION has appointed Mr L. F. White, MSc, FAIM, as its new chairman. He is managing director of Metal Manufacturing Ltd, and has been a member and councilor of the association for many years.

A & R -SONAR ELECTRONICS GROUP (NSW) Pty Ltd has moved to larger premises at 4 Civic Street, Army Barracks, Sydney 2000. The telephone numbers are (Sydney) 78 0211-2-3.

ELECTRONICS Australia, May, 1972

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Short Wave Band: DX-ing in Practice

The chapters on transmission are, in fact concerned not with short-wave transmitters but rather with inhomogeneous propagation. There are three eternal prediction tables in the fourth chapter: these give the optimum working frequencies for working between 13 areas throughout the world and for high, medium and low sunspot counts. A design for a SW converter, with constructional hints, is given in the chapter on communications receivers. The ninth chapter discusses the international agreements governing the allocation of frequencies and tabulates the frequencies allocated to the various services, including broadcasting. This is a valuable introduction to the subject for anyone interested in starting in DXing with a tape recorder.

The review copy was supplied by Philips Industries Ltd, Sydney. Copies may be obtained from the Elcoma Division of Philips Industries in all states.

The chapters on transmission are, in fact concerned not with short-wave stations and their associated transmitters and associated equipment. And although there is no real substitute for the practical experience gained by actually adjusting a colour receiver or monitor, much useful background knowledge can be gained from suitable books. These volumes by well-known British technical writer Gordon King are well worth consideration by the technician with an interest in this field. Although they are written specifically for the service technician working in the UK, they provide much information which would be equally suitable for Australian conditions. This is especially true of Colour Television Servicing, the last of the three, which refers less to specific British equipment, and partly because the British colour TV standards are very close to those which will be used here.

As its title suggests, Television Servicing Handbook is the more basic volume. Its contents and their presentation are shown fairly well by the chapter headings: 1 — Introduction; 2 — No Sound, Vision or Raster; 3 — No Raster, Normal Sound; 4 — No Sound or Vision; 5 — No Vision, Sound and Raster Normal; 6 — Fault Tracing in the Sound Channel; 7 — Servicing the Timebases; 8 — Synchronising Faults; 9 — Vision AGC Systems; 10 — Picture Tube Faults; 11 — Receiver Alignment; 12 — Miscellaneous Faults; 13 — Colour Television; 14 — U.S. Government Printing Office. Washington, D.C. 20402. (Order by Catalog No. C13.6111.) Price 35 cents. It would be advisable to include an extra remittance to cover postage. (I.L.P.)

Television Servicing


With colour TV now definitely on the horizon for Australia, no doubt many service technicians will be giving serious thought to acquiring the knowledge necessary to adjust and repair colour equipment. And although there is no real substitute for the practical experience gained by actually adjusting a colour receiver or monitor, much useful background knowledge can be gained from suitable books.

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Television in the UHF Bands; 15 – Dual Standard and 625-line only Receivers; 16 – Transistor Television Receivers.

Colour Television Servicing is really a complementary volume to the other, starting up where its companion leaves off. The chapters are headed: 1 – Introduction; 2 – The Science of Colours; 3 – The Shadowmask Picture Tube; 5 – An Overall View of the Colour System; 6 – Purity and Convergence; 7 – Timebases, EHT and Power Supplies; 8 – Luminance, Colour Difference Amplifiers and Grey-Scale Tracking; 9 – Vision, Chroma, Reference Generator and Sound Stages; 10 – Encoding and Decoding; 11 – Test Instruments and Signals; 12 – Locating the Fault Area; 13 – Servicing Procedures; 14 – Coding and Decoding; 15 – Faulty Picture Tube Fault Area; 16 – Tuning/Alignment; 16 – Faulty Picture Tube Symptoms.

Both books are written in clear language and should be easily understood by most servicemen and interested amateurs. They would appear to give reasonably good coverage of the subjects concerned, although both are a little less practical in orientation than I would have liked. The more basic book could well give a more thorough treatment of solid-state circuitry, particularly with respect to ICs. I think it would also benefit considerably by the addition of a chapter dealing with general practical techniques such as the use of tools and test instruments, isolating faults, and detection of intermittents.

Colour Television Servicing is somewhat more satisfying than its companion, but even here it would have been nice to see a chapter or section dealing with colour tubes other than the RCA shadow-mask type. But these are perhaps rather academic criticisms. Both books are well written and certainly deserve consideration by the technician intending to prepare himself for ‘C-day’. The review copy came from Butworth and Co (Aust) Ltd, but copies should be available at all major bookstores.

(J. R.)

LITERATURE — in brief

VARISOPE. Vol 2. No 1, 1972. Published by the Electronic Tube and Device Group, Varian Pty Ltd, 42 Christie Street, St. Leonards, NSW 2065. Contents: The microwave tube industry; Microwave filters from Varian. Five watt, 50-60 GHz extended interaction klystrons. More from the Varian range of CRT circuitry, particularly with respect to ICs. I think it would also benefit considerably by the addition of a chapter dealing with general practical techniques such as the use of tools and test instruments, isolating faults, and detection of intermittents.

Colour Television Servicing is somewhat more satisfying than its companion, but even here it would have been nice to see a chapter or section dealing with colour tubes other than the RCA shadow-mask type. But these are perhaps rather academic criticisms. Both books are well written and certainly deserve consideration by the technician intending to prepare himself for ‘C-day’. The review copy came from Butworth and Co (Aust) Ltd, but copies should be available at all major bookstores.

(V.R.)

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114 ELECTRONICS Australia, May, 1972
New Structure for the IARU

What is the future role of the International Amateur Radio Union in maintaining the present status of amateur radio, or strengthening its image in the eyes of officialdom and the general public?

This question has been asked by many amateurs who are seriously concerned with the future of amateur radio. A step that appears to be in the right direction was taken at the recent American Radio Relays League Board meeting.

Mention has been from time to time in these notes of the IARU. In recent months the efforts of the IARU team at the 1971 International Telecommunication Union conference were reported. These indicated the importance of the IARU towards making amateur frequency allocations and the recognition of the Amateur Satellite Service.

While the vast majority of amateurs may not appreciate the importance of the IARU, the part the IARU should play has been the concern of a number of Australians for several years. Even in 1959 when briefing the late John Moyle, VK2UJ, as the W1A observer to the 1959 ITU conference, Council instructed John to discuss with other amateur representatives ways of invigorating the work of the IARU for the advancement of amateur radio.

The International Amateur Radio Union was founded in 1925 and in 1928 was reconstituted to become a liaison body of national amateur radio societies throughout the world. With this change the constitution was amended to provide that one national society act as the headquarters society in each continent. In the past a number of societies have held similar positions in the IARU. The ARRL was chosen as the headquarters society. Since then its presidents have automatically become president of the IARU and its work carried out by the ARRL secretarial staff.

In 1950 the Region 1 Division was formed, sponsored by the RSGB, to provide representation of the European and African societies. This was followed by the Region II Division to represent the Americas, and, in 1968, the Region III Division, sponsored by the W1A, to represent societies in Asia and Oceania. All this greatly increased the work load on the IARU officers.

The IARU constitution does not require member societies to present finances. It is presented to contribute financially. The organisation has always been financed from ARRL funds. It should be pointed out, however, that the ARRL is the only society in the IARU capable of meeting the expenses affecting divisional activities.

The present set-up has been the subject of some discussion, particularly among European societies, some consider that the officers should be dissociated from the administrative duties of the headquarters society. Others favour a body separate from any national society, while some suggest that it should represent the three regional organisations which, in turn, represent the national societies in their region.

From the report published in "QST" March 1972, it is apparent that the future role of the IARU as the international representative of amateurs has been considered very closely body ARRL circles.

At the ARRL Board meeting in January, where officer elections were on the agenda, there was considerable discussion about the growing demands on the personal time of the individual holding the joint office of IARU ARRL president, and what might be done to ease the burden — yet still protect and advance the best interests of the society.

President Bob Dennison, WODX expressed the view that the dual role elections were on the agenda. In addition, there was considerable discussion about the growing demands on the personal time of the individual holding the joint office of IARU ARRL president, and what might be done to ease the burden — yet still protect and advance the best interests of the society.

Following the incorporation of the federal body of the Wireless Institute of Australia in January 1972, the March issue of the magazine "Amateur Radio" was the first to be published under the direct control of the Federal Executive. The magazine for many years has been published by the ARRL for WIA. The change brings the magazine under the control of the Federal Council which represents all institute divisions. Divisions and divisions in this context refer to the sub-divisions of the WIA. It is hoped that the IARU will be able to use this structure as the basis for the future joining of the WIA with the IARU under those provisions if that was a suitable solution. The Board of Directors was much impressed with this philosophy and later elected him as vice-president of ARRL.

Harry J Dannels, W5TU, was chosen as the new ARRL president. He promptly stated to the Board his belief that the offices of president of both organisations are each so important and so demanding of time and energy that they should be held by separate individuals. He therefore chose not to accept the parallel IARU office, and immediately nominated Bob Dennison, WODX for the post of IARU president — a motion which was unanimously adopted.

This does not entirely firm up the matter, the real decision must come from the 56 member societies of IARU — a voting procedure now under way. We feel reasonably certain, however, that foreign society will quickly appreciate the problem, from their own participation in IARU activities, and we hope for their approval of the proposed solution. The real decision will be made by the Board, and that Board, in numbers and effectiveness is the best argument for support of the Board of the future role of the IARU will be to assist national amateur radio societies to provide a uniform approach to their national administration, but it is not the U.S. and the IARU has only observer status and no voting privileges. This places the IARU in the position of being dependent on voluntary influence for the implementation of international regulations. Therefore it would appear that a future role of the IARU will be to assist national amateur radio societies to provide a uniform approach to their national administration, but it is not the U.S. and the IARU has only observer status and no voting privileges. This places the IARU in the position of being dependent on voluntary influence for the implementation of international regulations.

By the same token it will be the responsibility of national societies to actively support the IARU by keeping their members acquainted with international events which have an effect on amateur radio.

ARRL NEWS

As indicated elsewhere, the ARRL elected Harry J. Dannals as their new president at the Board of Directors meeting on January 20-21 1972. The proceedings of the meeting recorded in the March 1972 "QST" provided interesting reading and give an insight into the size and strength of the ARRL.

A motion adopted at the meeting was the decision to permit licensed amateur service to provide a new candidate for re-election as ARRL president. At the same time he called attention to a section of the IARU constitution which provides that a national officer of the member society chosen as IARU headquarters has the option of declining to serve in a similar capacity for the IARU. The ARRL president said that another society is obligated to nominate another qualified and responsible official of its society for the post. Bob indicated he would be willing to stand as candidate for the presidency of the IARU under these provisions if that were a suitable solution. The Board of Directors was much impressed with this philosophy and later elected him as vice-president of ARRL.

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The Annual General Meeting of the NSW Division. WIA held at WIA Centre, 14 Atkinson Street, Uringa, New South Wales on Saturday February 26, 1972. Business included the presentation and acceptance of reports from the president and treasurer. Chairman of the Board, the annual meeting of which were received and accepted. The report expressed appreciation of the work done for the NSW Division by members of council and various committees. In addition a resolution was carried proposing that the president be made a life member and being completed the president indicated that he would be re-elected, on completion of business, until a date to be set.

Only seven nominations for council were received and as this number did not exceed the number required no ballot was necessary. The nominees were — Mike Farell, VK2AM; Bill Lewis, VK2BY; Tony Mulchay, VK2ACV; Chris Jones, VK2DDU; Graham Wilson, VK2SUJ; Ian Mackenzie, VK2ZIM and Ian Binnie, VK2ZIU. At a brief meeting of the new council, held later that evening, Bob Dannals was chosen as president for a second term.

It was announced that a "Womans Trophy" would be awarded to a NSW Division member for the best article in the magazine "Amateur Radio" which was awarded to Dr. Bob Black, VK2ACV.

In accordance with a notice of motion given by the council at a previous meeting and unanimously adopted by members of council at this council meeting. Honorary Life Membership of the Institute was bestowed on two members. "For services given to the Institute in Australia and amateur radio". Several members when speaking in support of the motion, spoke very highly of the two members. The motions were carried.

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correspondence course supervisor since 1962. During which time he had re-written and brought up to date the class and course notes. In addition he had organised the printing and collating of the notes into book form at a considerable saving to the institute.

While more than 160 students had completed the lecture classes up to the present, it was not possible to accurately assess the number throughout Australia and overseas. In such a course, students need to attend lectures and practical classes each week. However, occasional students could attend only from time to time.

In addition to his work associated with amateur radio and the WIA Cee Cee has for more than 35 years served the community in the field of radio communication by training professional radio operators and technicians at the Marconi School of Wireless.

Highlights recounted of the service given by Pierce Healy were -

- 1955-1956 Chairman VHF Group
- 1956-1957 Vice-chairman VHF Group
- 1957-1958 Chairman VHF & TV Group
- 1958-1960 President NSW Division WIA
- 1961-1971 Federal Councillor NSW Division WIA
- 1971-1972 Councillor NSW Division WIA

During the period 1955-1972 had been -

Chairman of the "Ad Hoc" committee which reviewed the constitution of the NSW Division WIA.

Member of the Divisional Constitutional Committee dealing with the new WIA Federal constitution - 1966-1969.

Chairman of the organising committee for the IARU Region III Inaugural Congress held in Sydney 1968.

Member of the Novice Licensing Investigation Committee 1970-1972.

Representative of the NSW Division at 12 federal conventions, travelling to all States in the Commonwealth.

Closely associated with the YRCS since its inception.

Closely associated with the Australis OSCAR V satellite project group.

The initiator of federal policy motions that committed the WIA to adopt the YRCS as an institute activity on an Australia wide basis, also, to support the Australis satellite project group and to initiate the formation of the Region III Association.

Both members expressed their deep appreciation of the honour bestowed on them and their willingness to continue to work for the benefit of the WIA and amateur radio.

Life membership certificates and distinctive membership badges were presented to them to mark the occasion.

VHF & TV Group

The VHF & TV Group, NSW Division, publishes a monthly newsletter giving information on local activities, plus items of interest gleaned from various sources. Technical articles of interest to the VHF experimenter are also included.

The March 1972 issue contained some interesting data on "Transponder, VHF TV Transmission." Perhaps the IFS (Ionospheric Prediction Service) warning system.

Under the revised VHF & TV Group constitution the election of the management committee will be by ballot from nominations received 21 days prior to the annual meeting and not from nominations called for at the meeting as has been the practice in the past. The annual meeting for 1972 was set down for Friday 4th April 9th.

Copies of the VHF & TV Group Newsletter may be obtained by writing for details to the Secretary VHF & TV Group, 14 Atchison Street, Crows Nest, NSW 2065.

Meetings are held on the first Friday of each month at Wireless Institute Centre, 14 Atchison Street, Crows Nest, commencing at 8.00 pm. Visitors are welcome.

VICTORIA

Geelong Amateur Radio - TV Club

The Geelong Ham Fest organised by the Geelong Radio and TV Club will be held on the weekend 12th-14th May 1972. An interesting program has been drawn up and visitors are always welcome.

Club members who participated in the John Moyle Memorial National Field Day on 12th and 13th February 1972 voted the project an outstanding success. Stations were operated in the 3.5MHz, 7.0MHz, 14.0MHz, 21.0MHz, 28.0MHz and 144.0MHz bands. Despite the collapse of a tent and the loss of a log sheet during a high wind, the group finished with a creditable score of 3,338 points.

Details of the club's activities may be obtained from the Secretary, Gleeling Amateur Radio - TV Club, PO Box 520 Geelong, Victoria 3220.

Amateur Satellites

Information from several unofficial sources indicates that the launch of the Australian AO-C satellite will be delayed until mid-1973, not 1972 as originally planned. In its place, AO-C will be launched in July 1972. This will use the 432MHz and 2.4GHz transponders and the Australian 144MHz 432MHz and the German 232MHz 144MHz as up and down link frequencies.

The reason for the change is believed to be due partly to a reduction in weight allowable on the NASA launch vehicle. The AMSAT repeater system is a multiple linear system accepting signals on the up link between 145.9MHz and 432MHz and retransmitting them between 29.5GHz and 28.5GHz.

A beacon on 28.45MHz and a Morse telemetry system will also be aboard AO-C. There will also be a command system to control the various satellite systems. SSB or CW is recommended as the mode for best results.

In the editorial of the NSW VHF & TV Group Newsletter, for March Mike Farrell, VK2AM comments as follows:

"Fortunately the problem arising from the satellite repeater clash in frequency will not be as acute as with the PEP and RO. The AMSAT transponder is 100KHz wide, centred on 145.9MHz and should enable a local SSB station to work through the translator and still be 50KHz away from the channel 4 output frequency."

"The use of SSB or CW adjacent to Channel 4 will not unduly affect Channel 4 reception with a modern FM receiver, but problems may arise with older, broad IF type units. I hope that repeater users in this country do not indulge in anti-social behaviour when they experience interference from AO-C operators. The user will have to bear in mind that the fault lies in his ancient type unit and that the AO-C operator can just as easily tune-out the local repeater during satellite passes. This can only result in ill feeling and chaos, so persons who are likely to find themselves in this situation should strive for understanding (technically) for the advent of AO-C immediately."

Amateur Television

Two items of interest relating to amateur TV were gleaned from the "Victorian VHFER", the publication of the VHF Group, Victorian Section WIA.

First was that Mac McKibbin, VK3YEO, of East Doncaster, Melbourne, received slow scan TV pictures from John Van Staveren, VK7JV in Launceston on Tuesday 8th February 1972. This was no doubt the first interstate SSTV DX on the 144MHz band. Unfortunately John had not finished his monitor and could not receive pictures from Mac and so make it a two-way contact.

Second, ATV was given a big boost with the reception in Melbourne of pictures from Winston Nichols, VK7BMD, at Penguin, Tasmania. Winston's ATV signals were received by W. Biggs, VK3ZBZ at Chadstone. Peter Wollendon, VK3ZPA in Sunbury and J. Brown, VK3YV at Essendon. Peter VK3ZPA received noise free pictures and could read valve markings when Winston turned his camera on his 432MHz transmitter. This would certainly be the longest one way ATV contact in Australia, about 240 miles. The previous record for a two-way was 120 miles, established in South Australia. Peter VK3ZPA is set up to transmit ATV but a two-way contact could not be achieved as Winston, VK7EM had not completed a converter.

The "Victorian VHFER" is edited by Bob Halligan, VK3AOT and gives a wealth of information on various VHF topics.

In the March 1972 issue the following VHF UHF contacts were recorded -

- 144MHz:
  - 7th February VK6KVE beacon heard in Geelong
  - 8th February VK5SKZ Adelaide to VK8BE Albany
  - 9th February VK6KVE beacon heard in Melbourne
  - 13th February VK8KUR Tamarama and VK8YCD P3 to VK9VP PI ACT
  - 2nd February VK3KCG KC to VK5YD Adelaide
  - 25th February VK7EM Penguin Tasmania to VK5ZTH Mt Gambia
  - 432MHz:
    - February VK5SKZ Adelaide on CW heard by VK6BE Albany
    - 24th, 25th and 26th February several contacts between Melbourne and northern Tasmania with a maximum distance of 1200km.
    - 28th February VK5ZKH KC to VK5ZAH Launce- castle a distance of 274 miles.
WIA YOUTH RADIO SCHEME

The Federal Supervisor of the WIA Youth Radio Club Scheme, Reverend Bob Guthberlet, has requested the NYS Division to be born for the YRCS in May 1972. Plans will be formulated for future growth as well as a degree of standardisation in various aspects of the scheme.

South Australia

A review of the YRCS activity in South Australia during 1971 shows that the number of certificates gained by members of registered clubs were:

- Elementary Certificate - 30
- Junior Certificate - 1

There were 154 club members in South Australia. A total of eleven clubs were registered. Those gaining points for the IREEX Pennant Award were:

- School Clubs: Naracoorte High School 215 points
- Non School Clubs: Port Pirie Youth Radio Club 400 points
  - Elizabeth Youth Radio Club
  - Woomera Youth Radio Club

With the YRCS, the School Clubs have received an address list of the other clubs giving times of meetings, club call sign, if any, and the approximate number of members. Clubs are able to arrange adjacent visits to a radio or TV station and plan an interclub visit. Such activities have been successful in the past.

The following members of the Prince Alfred College Radio Club have gained their YRCS certificates:

- Honours Pass - Anthony Morcombe

The Radio Club have gained their YRCS Elementary Certificate examinations during 1971 was Jeffrey Hunt of Elizabeth Youth Radio Club.

So far, eight clubs have registered in 1972. Enquiries have been received from a number of secondary schools and colleges and it is expected that registrations will be increased. All clubs who register with the YRCS receive an address list of the other clubs giving times of meetings, club call sign, if any, and the approximate number of members.

The following members of the Porto Augusta Youth Radio Club have been successful at YRCS examinations during 1971 was Geoffrey Taylor.

Several clubs have registered in 1972. Enquiries have been received from a number of secondary schools and colleges and it is expected that registrations will be increased. All clubs who register with the YRCS receive an address list of the other clubs giving times of meetings, club call sign, if any, and the approximate number of members. Clubs are able to arrange adjacent visits to a radio or TV station and plan an interclub visit.

Wile the following members of the Port Augusta Youth Radio Club have been successful at YRCS examinations during 1971 was Geoffrey Taylor.

The following members of the Porto Augusta Youth Radio Club have been successful at YRCS examinations during 1971 was Geoffrey Taylor.

Westakes Radio Club

The annual general meeting of the Westakes Radio Club was held on Wednesday evening 23rd February 1972. Rev. Watson, president of the Maitland Radio Club, chaired the meeting. The following officers were elected for the coming year:

- President: Keith Howard VK2AKX
- Vice-President: D. Cross
- Secretary: Keith Howard VK2AKX
- Treasurer: Max McLechnan
- Store Manager: Ray McCook
- Canteen Manager: Daryl Boyce
- Canteen Officer: Herb Herivel VK2ZVF
- Grounds Officer: John Swanson
- Other officers are:
  - Secretary-Treasurer: Mrs. J. Watson
  - Publicity: K. Watson and A. Watson

The club's exhibit at the Maitland Show was an outstanding success.

Grounds Officer: J. Whitehead, Assistant K. Dobbs
Examinations Officer: C. G. Cooke
Canteen Manager: Miss W. Eunick
Canteen Officers: P. Ellicient, A. Killkelly
Librarian: L. Morris
QLD Officer: W. Plant
Publicity: K. Watson and A. Watson.

The club's exhibit at the Maitland Show was an outstanding success.

A panel of eleven judges awarded the 2HD shield to

2 HD

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal.

For further information write to:

THE COURSE SUPERVISOR, W.I.A.
14 ATCHISON STREET,
CROWS NEST. N.S.W. 2065

IONOSPHERIC PREDICTIONS FOR MAY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the four most popular amateur bands over a number of interstate and international circuits. Block bands indicate periods when circuit is open.

7MHz EAST

<table>
<thead>
<tr>
<th>15</th>
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28MHz EAST

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SO YOU WANT TO BE A RADIO AMATEUR?

ELECTRONICS Australia, May, 1972
Kaise

VOLT-OHM-MILLIAMMETER

HIGH SENSITIVITY
100,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS:
- DC Volts: 0.6, 3, 12, 40, 300, 1200, 3000
- AC Volts: 6, 30, 120, 600, 1200, 3000
- DC Current: 40uA, 60uA, 2mA, 20mA, 200mA, 2A
- AC Current: 2000uA, 2mA, 20mA, 200mA, 2A
- Resistance: 100K, 200K, 1M, 10M, 100M
- Accuracy: DC plus minus 3%, AC plus minus 5%

Overload Protected by dual silicon diodes
Double jewelled plunger plus minus 2pc. Meter
Polarity changeover switch.
Plus minus 1pc. temperature stabilised film resistors.

Price $34.75

Austin 136 Victoria Rd., Marrickville NSW 2204

PANEL METERS

EDGE

Clear Plastic Flush Mounting 1 3/4", 3", 3 1/4", 4". Full range available. From 50uA
10A DC, 15V DC, 500V DC, 300V AC, Vu and dB. Also Edge Meters, Vu - Stereo Balance. Send for price list. SAE.

Price $31.95

CABLE

Soldering Iron

200H 20K. OPV


Price $18.50

20K OHMS PER VOLT DC


Price $14.60

SOLDERING IRON


$7.25

MICROPHONE STANDS

Floor Model, fit adjustable with heavyweight cast iron base.

$11.75

TABLE MODEL: $2.50 Flexible Goose Necks
Fin: $2.75 18in. $4.35 12in. $3.50 24in. $5.00

$11.95

AMPLIFIERS

PUBLIC ADDRESS RANGE 240V-AC

Amplifiers, public address, 240 volt AC. Two Hi-Imp inputs with independent volume controls for mixing either microphones or P.B. Bass/ treble tone controls. Available with multi-tapped voice coil matchings (2, 3, 5, 10 ohms). Over multi-tapped line matchings (4, 6, 250, 500 ohms). On ordering please indicate impedance matching required. 15 watts RMS. V-C matchings - $49.50 15 watts RMS. Line Matchings - $53.50 30 watts RMS. Line - $99.50

Price $89.50

60 watt $115.00

CURLED CABLE

Extrudes up to 20ft. Standard 6.3mm phone plug each end.

$3.50 Pack & post

DYNAMIC MICROPHONES

Model 10A. Cardioid Unidirect.
Imp. 30K. Sens. 50K. 60dB

Price $18.75

Model 105. Cardioid Unidirect.
Imp. 30K. Sens. 60K. 60dB

Price $32.50

Model III. Omni-direction.
Imp. 50K. Sens. 57dB

Price $9.75

Reverberation Units

Deluxe model. Frees response 60-5500 Hz. Decay time at 200 Hz 2 seconds. Dimensions 12x8x6 in. $19.95

Cable

Twin Speaker Flex. Per 100 yd. $11.75 Single 8Scyd. Twin 25cyd.

$11.75

New Step Down Transformers

240V AC / 110V AC 250 watts

$12.50

P & P $1.50

Crystal Filter

FM 95kHz suitable SSB

$18.50
50 Watt Solid State Guitar Amplifier

50 watts RMS. Solid-state guitar amplifier. RM1125 S 4 inputs, 2 channel with separate volume, bass and treble controls; speed and intensity controls for vibrato. Remote foot switch with plug and lead. Black vinyl carry cabinet. Kit of parts $98.00

Fully constructed and ready for operation on 240VAC $114.00

Auto-Rhythm Unit

Very latest model with cancel controls, 240 volt operation, high and low impedance output. 28" x 3½" x 10½", weight 13 pounds. 16 rhythms: Rhumba, beguine, cha cha, mambo, samba, bass nova, rock'n roll, slow rock, western, waltz, swing, jazz, shuffle, fox trot, and march.

Also, instrument sounds: cymbal, trumpet, snare, rimshot, clave, bongos, hi-conga, lo-conga, bass.

Controls: tempo, volume, stop, start, sustain, cancel for three instruments. Complete with remote foot switch, audio cable and instruction book. $179.00

Hi-Fi Stereo Headphones

Freq. 20-12,000 Hz. Imp. 3 ohms

Complete with lead and standard stereo phone plug.

$5.25

Pack and Post 35c

Magnetic Cartridge

Response 15 Hz - 25,000 Hz

Diamond Stylus

Tracking weight 1.2 grams

$9.60

Pack and Post 1.50

Stereo Record Changers

C129 — C141 — C142 — C142A3

240V AC powered. 8 watts RMS per channel inputs for magnetic, ceramic, and crystal cartridge, also recorder and radio tuner. Hi-Fi frequency response: speaker matching 8½ ohms. Site 10½ in. x 3½ in. Attractive slided top cabinet.

$54.00

Stereo Record Player

B.S.R. Stereo Record Player


$62.50

Pack and Post 1.50

Changer and Player Platforms

Teak. Cut out to suit C109 MA65, MA70, MA75... mounded fitted perspex cover.

12½ in. x 13½ in. x 4 in.

$9.00

Pack and Post 1.50

Top Quality Aust. Made Speakers

12in. Woofer 30 watts RMS

$24.25

12in. Woofer 15 watts RMS

$12.00

12in. Twin cone 15 watts RMS

$19.00

Rola 50 Watts RMS

Model 12350 12inch

24½ in. 11KHz 8 or 16 ohms $25.00

12½ x 13 inch Hi-Fi extended frequency $42.00

Electronics Australia, May, 1972 119
LISTENING AROUND THE WORLD
by Arthur Cushen, MBE

Good reporting leads to improved reception

Short-wave listeners can assist in improving reception by keeping stations informed on frequency changes and interference which affects their transmission.

Four times a year the international short-wave stations make their major frequency changes, on the first Sunday in March, May, September and November.

Four additional minor changes are also to be made.

Four times a year (in March, June, September and December) the International Telecommunication Union (ITU) submits their programmes and broadcasting schedules to a central office of the ITU in Geneva, Switzerland, others do not.

In Geneva, ITU and IFRB (International Radio Frequency Bureau) sort out the schedules well before they are due to come into operation.

The material submitted to Geneva by broadcasters covers the four periods of transmission each year, two of which are for two months, the other two for four months.

The two-month periods are at the time when the sun crosses the equator and unstable conditions prevail; the four-month periods cover summer and winter, when the seasonal conditions are relatively constant.

If there were ample room for short-wave stations in the bands and mutual interference was rare, no additional changes would be necessary during these periods because each station is allowed to work two frequencies originating from the early days of short-wave broadcasting, for each period, in order to cope with ionospheric irregularities. However, if interference from another station is suffered, minor changes have to be taken.

Firstly, the effect of the interference has to be estimated or measured; secondly the search for a new channel with better reception possibilities in the target area has to be conducted. This is often a difficult matter, as in most cases the transmitting station is unable to judge the band conditions in another part of the world.

Here is where the help of well-equipped listeners and monitors comes in.

Then a decision has to be made, whether to move to another part of the band, or to stay put. During the periods between seasonal changes, stations prefer not to move about too much because moves to unused frequencies can be confusing to listeners. Moreover some stations may have a long standing use of certain frequencies originating from the early days of short-wave broadcasting, when there was ample room on the bands and co-ordination and planning were not necessary. It may be possible to persuade interfering stations to move, but in practice it is the weaker station which usually does so. Then the IFRB has to be notified of the change so it can be included in the frequency schedule.

It can be therefore seen that the short-wave listener can play a vital part in improving reception for the better enjoyment of listening as a whole. In our own case we continue to keep up with constant changes, recording, details and reports on interference problems around the world, and we report on these regularly.

In our monitoring work we have supplied information to the BBC since 1942 by cable and airmail reports, to the CBC since 1945 and to the Voice of America, all on a weekly basis. In Austria, Holland, South Africa, Sweden, Vatican and other stations receive reports of monitoring over a monthly period.

TESTS FROM BONAIRE
Radio Nederland relay station on Bonaire has been using 9715 and 11730KHz for its services to Australia and New Zealand. Both channels are on the air 0600-0700 when 9715KHz has Dutch and 11730KHz has English, and again 0800-0900, when 9715 has English and 11730 has Dutch.

In recent months, 11785 has been used for the 0900-1030 Dutch transmission, but this was not a success because of the crowded nature of this part of the band.

Radio Nederland recently conducted tests with 9770KHz in an attempt to find an alternative channel for this transmission. The frequency of 11730KHz was also tried, but did not provide satisfactory reception in Austria because of adjacent channel interference. Radio Nederland decided to use 9770KHz for the 0900-1030 Dutch transmission to Australia.

FINLAND USING 13M
Finland is testing in the 13-metre band with a 1kW transmitter. These tests are being carried out in addition to their normal short-wave service.

The transmission is to the following schedule:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-0900</td>
<td>21650</td>
</tr>
<tr>
<td>0900-1200</td>
<td>21650</td>
</tr>
<tr>
<td>1200-1500</td>
<td>21650</td>
</tr>
<tr>
<td>1500-1800</td>
<td>21650</td>
</tr>
<tr>
<td>1800-2100</td>
<td>21650</td>
</tr>
</tbody>
</table>

RADIO OMDURMAN
A verification letter received by Chris Davies of Featherston, NZ, lists the frequencies and power of Radio Omdurman as well as its present schedule:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200-1315</td>
<td>21500</td>
</tr>
<tr>
<td>1315-1430</td>
<td>21500</td>
</tr>
</tbody>
</table>

The station also has the use of the following alternative frequencies:

- 572 kHz
- 15170 kHz

Broadcasts in Arabic are 0400-0600 and 1100-2200 on 960, 764, 948, 6150, 7200, 9505, and 11135KHz. A special program to Southern Sudan broadcast 1800-1900GMT on 948 and 11135KHz includes programs in Arabic and English.

NEPAL VERIFIES
Radio Nepal at Kathmandu has confirmed our reception on 500KH for an airmail letter and card. The station was heard on a Saturday at 1400GMT, but it was a weak signal. The full test schedule is as follows:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0200-0500</td>
<td>9425</td>
</tr>
<tr>
<td>0500-0800</td>
<td>9425</td>
</tr>
<tr>
<td>0800-1100</td>
<td>9425</td>
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<tr>
<td>1100-1400</td>
<td>9425</td>
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<tr>
<td>1400-1700</td>
<td>9425</td>
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<tr>
<td>1700-2000</td>
<td>9425</td>
</tr>
<tr>
<td>2000-2300</td>
<td>9425</td>
</tr>
</tbody>
</table>

AFRTS SCHEDULE
The American Armed Forces Radio and Television Service which originates radio programs from studios in Washington and broadcasts them over the transmission facilities of the Voice of America, well received in the Pacific. The programs include news on the hour and half hour, as well as interesting discussion and music features. The AFRTS schedule is as follows:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700-1000</td>
<td>17450</td>
</tr>
<tr>
<td>1000-1300</td>
<td>17450</td>
</tr>
<tr>
<td>1300-1600</td>
<td>17450</td>
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<tr>
<td>1600-1900</td>
<td>17450</td>
</tr>
<tr>
<td>1900-2200</td>
<td>17450</td>
</tr>
<tr>
<td>2200-2500</td>
<td>17450</td>
</tr>
</tbody>
</table>

BANGladesh SCHEDULE
Additional information on Radio Bangladesh has come from Alok Das Gupta of Calcutta, India, who gives the schedule as follows:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0300-0500</td>
<td>4875</td>
</tr>
<tr>
<td>0500-0700</td>
<td>7065</td>
</tr>
<tr>
<td>0700-1000</td>
<td>4875</td>
</tr>
<tr>
<td>1000-1300</td>
<td>5985</td>
</tr>
<tr>
<td>1300-1500</td>
<td>9855</td>
</tr>
<tr>
<td>1500-1700</td>
<td>9855</td>
</tr>
</tbody>
</table>

NEW SERVICES FROM DEHLL
All India Radio at Delhi introduced a program in Russian, and has also extended its French broadcasts in its overseas services. An item in Swedem Calling DXers suggests the suitability of 9770KHz on 7110 and 9613KHz, with news at 1630GMT. All India Radio also broadcasts in French to South Asia 1115-1130GMT on 17700 and 21660KHz and to Europe 1845-1930 on 9065 and 9121KHz.

VOICE OF HOPE TESTS
The Voice of Hope has advised that tests are being carried out on 9650KHz over the facilities of Trans World Radio at Sines in Portugal. This frequency is in use on Sunday from 0645GMT. Reception has been best on Sunday at 0800GMT with a program in English. The full test schedule is as follows:

<table>
<thead>
<tr>
<th>Time (GMT)</th>
<th>Frequency (KHz)</th>
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<tbody>
<tr>
<td>0645-0900</td>
<td>9650</td>
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<tr>
<td>0900-1130</td>
<td>9650</td>
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<tr>
<td>1130-1300</td>
<td>9650</td>
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<td>1300-1530</td>
<td>9650</td>
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<td>1530-1700</td>
<td>9650</td>
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<td>1700-1830</td>
<td>9650</td>
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<tr>
<td>1830-2000</td>
<td>9650</td>
</tr>
<tr>
<td>2000-2230</td>
<td>9650</td>
</tr>
<tr>
<td>2230-2400</td>
<td>9650</td>
</tr>
</tbody>
</table>

BROADCAST Band News

JAPAN: Several Japanese stations which carry commercial programs have increased power. The latest of these is JORF at Kyoto on 1149KHz, which now has 20KW. Others are JOKR, 908KHz, Tokyo; JOQR, 1130kHz, Toyko; JOLF, 1249KHz, Tokyo (all 100KW). Stations using 30KW are JORF, 1200KHz, Sapporo; JORF, 1408KHz, Sapporo; JOAF, 1008KHz, Nagoya; JORF, 1320KHz, Nara; JORF, 1310KHz, Osaka; JOQR, 1210KHz, Osaka; JOUF, 1310KHz, Osaka; JORF, 1428KHz, Tokyo, has increased power to 30KW, and JORF, 1615KHz, has also increased to 30KW.

FRANCE: According to "World Bulletin", the transmitter at Saintesat on 1277KHz increased power from 30KW to 308KW.

ISRAEL: "Sweden Calling DXers" says that Radio Estel is a new station operating at Elat in the south of Israel. Radio Estel is the only private station in Israel, and broadcasts popular music and underground music 24 hours a day on medium wave 1732KHz.

BAGhlan: A report from Alok Das Gupta, Calcutta, informs us that all transmitters of Radio Bangladesh at Khulna are now back on the air. The station was destroyed in the December flooding. The last transmitter to become operational is in 13000KHz and operates with 1KW 0300-0500 and 1100-1800GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. All times are GMT. Add 8 hours for WAST, 10 hours for EAST, and 12 hours for NZ.

120 ELECTRONICS Australia, May, 1972
NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-60 $29.00 Packing & Postage $1.00

50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25mA, 75mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: -10 to +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

MODEL RH-100 $39.75. Postage $1.00

100,000 Ohms per Volt DC, 10,000 Ohms per Volt AC
- Overload protected by dual silicon diodes
- Double-jewelled ± 2 per cent meter
- ± 1 per cent temperature-stabilised film resistors
- Polarity changeover switch
- Mirror scale
- Instructions for operation with circuit diagram.

Specifications:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000 / V).
AC Volts: 6, 30, 120, 300, 1200 (10,000 / V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps.
AC Current 12 amp.
Resistance: 20K, 200K, 2M, 20M.
Decibels: -20 to +17, 31, 43, 51, 63.
Accuracy: DC ±3 per cent.
AC ±4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, “Eveready” 915.

“HOMER” 2 station intercom
$12.75 complete
Post & packing 75c

“HANDYMAN” RH150 $11.50
CHECKED PACKED & POSTED $12.00

Pocket-size 3½” x 4½” x 1¼”.
Instruction sheet and circuit.

Specifications:
DC Volts: 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: ± 1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: -20dB, +62dB, 0.7KHz.
Capacitance: 0.001, 0.1, 0.025, 25uF.

MODEL RH-20 $15.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 1mA, 10mA, 25mA, 250mA.
Resistance: 20K, 200K, 2M, 20M.
Decibels: -10, +22 (at AC / 10V) + 20, +36 (at AC / 50V). Upper frequency limit uKHz.
Batteries: Two 1.5V dry cells.
With overload protection $18.00.

MODEL RH-80 $20.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: -10dB +62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, “Eveready” 915.

- Overload protected by dual silicon diodes
- Double-jewelled ± 2 per cent meter
- ± 1 per cent temperature-stabilised film resistors
- Mirror scale.

STYLUS PRESSURE GAUGE, Balance type NW-501
$1.50 Posted

RADIO HOUSE PTY. LTD.
306-308 PITT STREET 61-3832 26-2817
760 GEORGE STREET SYDNEY. 211-0171

ELECTRONICS Australia, May, 1972 121
60 WATT GUITAR AMP: I recently constructed the Playmaster 1160-watt Guitar Amplifier and find that a loss of volume is incurred as the vibtric depth control is advanced, and that the volume level also doubles as the bass control is advanced. If I built a second 60-watt amplifier, would there be some way in which I could connect the two together in order to make a 120 watt system? I am also very interested in echo effects. Do you have any material available on this? (I.D., Bellfield, NSW.)

The vibtric section of the 60 watt guitar amplifier uses a bridge circuit, one arm of which is an LDR illuminated by a neon lamp. Loss of volume will be due to the use of a high limit. Published reprints by the neon, this is apparently exhibiting a static resistance of less than 10K, the value on the opposite side of the bridge, thus upsetting its balance. To overcome the problem disconnect one lead of the LDR and temporarily connect to it. Disable oscillation of the vibtric oscillator, and increase the value of the cathode resistor of the oscillator valve to a value which will cure most projects. Price: $1 for 50c. Reconnect the LDR into circuit. An open circuit capacitor or unsoldered connection may be the cause of the problem. By the way, is there any material available around this section of the circuit. A second 60 watt amplifier may be connected to the existing amplifier jack after the bass and treble controls. Your duplicate amplifier should only require the essential stages of the original circuit up to just after the bass and treble controls. The amplifier should feed its own separate speaker systems, properly phased for best acoustic efficiency. Articles on the subject of reverberation were published in the Dec 1962 and the Feb 1963 issue questions. Material not on file can normally be supplied in photostat form at 50c per issue. We recommend submitting an open cheque. (I.D., Bellfield, NSW.)

LIGHTING: I have been intending to write for some time about the excellent article on Psychedelic Lighting in the February issue jogged my memory. I made a music unit from an English publication a few years ago, but thought my display might be in-terested in this. For a while, I had spheres in my living room, with six colour BC globes in each, two for each channel. As well as the music unit, I have constructed the EA light dimmer, which I use for controlling the main (white) light in the room, and so help to make the display less tiring. By the way, is there anything on the drawing board for a ring modulator for electronic music? (V.S., Higgins ACT.)

Thank you for your comments on the article, and also on your display. Other readers also might prefer the idea of increasing the ambient light level, which we agree would enable you to "live with" the special effects very successful. Cephaline is not very suitable for lighting. A self extinguishing acetate called "Cinomatic" is manufactured in about 25 shades for this purpose. It is available from Strand Electric or its representatives. I hope this information will improve the already fine article. (B.D. Edgehill, Balmain.)

Thank you for the information on the motor and film. However, the author seems to be comparing the "E-mail" motor with the "Emball" motor. Oven rotisseries are invariably horizontal, so the motor would probably not be equipped with bearings capable of operating under some modes envisaged in the article. However, for colourwheels (operated at or near horizontal) they should be satisfactory. The author was aware of the "Cinomatic" film, but did not mention it for a number of reasons. Among these were the price - it is not cheap - and the fact that it must be bought in full sheets - more than the average user requires. However, for those who would buy it, they now have the information necessary. Thank you for the comments on the article.

GRID DIP OSCILLATOR: I am attempting to build a 3-valve meterless grid dip oscillator. I have no coil details, so I intend to work them out using a coil inductance formula. Could you please supply me with a suitable coil inductance formula? Also, have you ever published detailed of a television receiver or oscilloscope? (G.G., Gunnedah, NSW.)

We have an article on the subject of grid dip oscillators, but did not mention it for a number of reasons. Among these were the price - it is not cheap - and the fact that it must be bought in full sheets - more than the average user requires. However, for those who would buy it, they now have the information necessary. Thank you for the comments on the article.

ANSWERS TO CORRESPONDENTS

"ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project notes, metal work dyelines, photographics, printed wiring and other field material to do with constructive projects and (2) A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below.

PROJECT REPRINTS: These cost 50c per project. Prior to December 1959, circuits and diagrams only are available. From December 1959 onwards, complete articles are available. No material can be supplied, additional to that already published, which can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 50c per page.

SUBSCRIPTIONS, BINDERS, HANDBOOKS etc: These are handled by separate departments. For fastest service, send separate orders to the departments concerned.

PHOTOGRAPHS, METAL WORK DRAWINGS: Original photographs are available at a cost of $1 per group. Price: $1 These show dimensions and positions of holes and cut-outs, but give no wiring details.

PRINTED WIRING PATTERNS: We can supply negative transparencies, actual size. Price: 50c. We do NOT deal in manufactured boards. These are available from advertisers.

BACK NUMBERS: These are available for reprints. On issues up to six months, face value. Seven months to 12 months, face value plus 5c. Thirteen months or older, face value plus 10c. Postage and packing, 10c per issue extra. Please indicate if a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-central equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not market in electronic components. Prices, specifications etc should be sought from appropriate advertisers or agents.

REMITTANCES: These must be negotiable in Australia. Where the exact charge may be in doubt, we recommend submitting an open cheque, endorsed "pay to" or otherwise suitable limitation.

POSTAGE & PACKING: All charges shown include postage and packing.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 2728, GPO Sydney, NSW. 2001.
The late Ray Allsop

Raymond Collam Allsop, one of the best known radio pioneers in Australia, died suddenly on March 19 at the age of 75.

Ray Allsop played a vital part in many aspects of the fledgling radio industry in Australia and his name is encountered again and again in literature covering the period from the early twenties to the present day.

A great deal could be said about the late Ray Allsop but, to one who knew him well, three impressions are uppermost.

One was his involvement in the early days of sound motion pictures and his courage in promoting locally-made projectors against the products of industry giants.

Who, among his many colleagues, can forget his demonstration of compatible stereo sound reproduction literally decades before it was taken seriously by the film industry.

My second impression of Ray Allsop was his dedication to the cause of frequency modulated sound broadcasting. A personal friend of FM pioneer the late Major Armstrong Ray lost an opportunity to represent the cause of FM broadcasting in high places, in technical literature and in the press.

He leaves it to others to carry on a campaign which has yet to be won.

Finally, I must mention Ray Allsop's keen sense of history. More than any of his contemporaries, he seemed to have been prescient and unselfish in all the matters which have been published in these pages. He would offer names, occasions, dates and actual quotes that would enlighten - but disturb - a less systematic mind.

As always, it seems lamentable that, with the passing of such a pioneer, another link with history has been broken, another window overlooking the past has been shuttered.

How strange it is that we tend not to worry too much about history till the people have gone and then only just in the dustcuts remnants.
SOUND PROJECTORS
Cinevox Projects and Harman and Heath 10mm in good working order. 240v operated. Complete with speaker and amplifier. $155.00.

CIRCULAR SLIDE RULE
3½” in diameter. Will do the same work as the conventional slide rule. Instruction book included.

P.M.G. TYPE TELEPHONES
Standard type desk top magneto bell calling device. Range 30 miles. Uses standard battery receiver and telephone. Any number can be connected together on single line.

BATTERY CHARGERS
240 volt AC input. Each battery charger will charge either 6 or 12 volt batteries.

MINIATURE ELECTRIC M Otors
1” to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only 65c. each or 10 for $4. (Post 12c.)

TRANSCEIVER
(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38 MHz. R.F. Crystal locked. Transmitter and receiver using frequency synthesiser in 100KHz step 10 channel per set with tripods, microphone, and headphones. 45c. 30c. cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER
(2-way radio) 62 set, 12 volt, operation. Ideal Hams, etc. 1.6 to 10 MHz. Crystal controlled.

HEADDRESS
Low Impedance low current volume control fittted with rubber muffler to reduce external noise, suited for use on hallways, etc. only 8c. 30c. cartage to rail. Freight payable at nearest attended railway station.

LAVOIE HETERODYNE FREQUENCY METERS
10 100MHz. L.A 829G.

ADLER FREQUENCY METER
100KHz-200MHz. $175.

4 DIGIT RELAY COUNTERS
50 volt DC, suit slot car, race car, etc. $1.25 each. Post 10c.

NIBBLING TOOL
Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7 ½ inch.

VALVES
BRAND NEW IN CARTONS

NIFE CELLS
1.2 Volt, fully charged. 4in x 3in x 1in AH.

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Q5 190-550 K/ CS. $22.50
6 TO 9 K/ CS. $15.00

P.M.G. TYPE KEY Switches.
45c. each. Post 24c.

FIELD STRENGTH METERS
100.165 MHz. $25.00

RADAR TRANSCEIVER
X BAND WITH KLYSTRON ETC.

TELESCOPES
30 x 30 Power Coated Lens. Brand New.

CHASSIS PUNCH SET
FIVE SIZES: ⅛ inch, ⅛ inch, 1 inch, and ⅛ x ⅛ inches. With taper reamer.

RADAR TRANSCEIVER
X BAND WITH KLYSTON ETC.

TELESCOPES
30 x 30 with Tripod.

SPECIAL OFFER
NC101 200 Ohm - 1000 Ohm. Coils. $1.25 each. Post 24c.

TOGGLE SWITCHES
Brand new, 3 amp, 240 volt S.P. D.C. each or 10 for $3. Add postage.

CONDENSER LENS
1½ inch diam. 1½ FL. 50c each. Postage 24c.

MINE DETECTORS
Ex A.M.F. with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station. $29.00

ALTEC STUDIO MICROPHONES
619B Western Electric, 1000 grade. Original cost $225. Ideal Broadcast Studio, music recording, Church and play recording, etc. Fraction of original cost. Special offer - 10 per cent.

SPECIAL PURCHASE TOP GRADE RECORDING TAPES
Brand new, from well-known maker. Sorry, we cannot divulge brand name. 7” x 2400’ Mylar in plain carton. Only $3.50 ea. Post 35c.

SOLENOIDS
Plunger Type 12v 300MA. Suit electric camera control, miniature trains, radio, etc. 4017. $3.00. Post 24c. 200 MA 24 volt, 1½ in push movement. Post 24c.

CONDENSER LENS
2½” in DIAM. 2½ FL. $1.50 each. Or $2.50 per pair. Post 24c.

FIELD STRENGTH METERS
164 MHz. $12.50

TEN CHANNELS VHF TRANSCEIVER
Types TR 1515 165 125 MHz and TR 1935 125 150 MHz. 28 volt DC operated AM simplex, lock both TX and RX on same channel complete with generator. $23.00.

RECORDING TAPES
TOP QUALITY, NEW.

CASSETTE TAPE
C60 $1.15; C90 CK1 $1.75; CK10 $2.25.

DUMPLY LEVELS
Made by Lighthouse, excellent condition with triod. $77.50

BYER 77 Mk 1
Rack Mounting Tape Recorder ex A.D.C. 7½” x 1½ lbs. Full track tested $156.

Microphone. Professional S.T.C. Type.

Marcon Video Oscillator Type TF885A 0.12 MHz $75.

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UHF 140-300 MHz. $45.00

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with Lightwave Tubes. Can be converted to 1000 MHz. $175.

RECEIVERS ARC 49
100.165 MHz. $25.00

Deitch Bros.
70 Oxford Street, Sydney 2010

SORRY NO COD.
have constructed a few of them using different types of transistors. I also have found that the "Edison" inter¬
terference is difficult to block for restoring telephone signals. Do you have any circuits for mat¬
tching low impedance devices to high impedance amplifiers? If so, I would like to find those for home¬made amplifiers measuring voltages and currents. I have enclosed a small amplifier circuit for a square wave output.

Articles describing mechanical vibrator designs were published in the October and November 1970 issues. Copies of the essential diagrams are available through the information Service for $0.50 each in the United States. Missed the article, it is virtually impossible to provide chords on an organ of this type. To do this would require a separate oscillator for each note — a prohibitively expensive undertaking. I do not recommend you extend the range by adding more resistors — the transistor may not oscillate reliably much beyond the range given.

NEW DESIGNS WANTED: I have been reading "Electronics Australia" for over ten years and have enjoyed building some of your circuits. As the year is now 1972, I would like to ask if it is possible to publish new designs for an RF signal generator and a more specific, as far as your requirements. Output power measurements are essential, as amplifiers cannot be made by reading DC voltages and currents directly, but would involve an audio generator, load resistances, and AC voltages, and an oscilloscope to monitor the waveform.

OHGAN: First of all I must congratulate you on the home study courses which have been following carefully. I am considering building your beginner's organ which appeared in the February 1972 issue I would like to be able to exchange by adding further resistors, and also provide chords. Would you give me further resistor values? (M.C., Darwin, N.T.)

2 Thank you for your comments on the Home Study Course. Regarding the organ, as we stated in the article, it is virtually impossible to provide chords on an organ of this type. To do this would require a separate oscillator for a given note — a prohibitively costly undertaking. We do not recommend you extend the range by adding more resistors — the transistor may not oscillate reliably much beyond the range given.

 Robots: I was wondering if you can help me. I have built a robot (just a statue at present) and I would like a remote control system ("Electronics Australia") for over ten years and have enjoyed building some of your circuits. As the year is now 1972, I would like to ask if it is possible to publish new designs for an RF signal generator and a more specific, as far as your requirements. Output power measurements are essential, as amplifiers cannot be made by reading DC voltages and currents directly, but would involve an audio generator, load resistances, and AC voltages, and an oscilloscope to monitor the waveform.

ew DESIGNS WANTED: I have been reading "Electronics Australia" for over ten years and have enjoyed building some of your circuits. As the year is now 1972, I would like to ask if it is possible to publish new designs for an RF signal generator and a more specific design. The idea of a solid-state CRO is one which we have considered. However, over and above this, we are looking for ideas for new designs for an RI, signal generator, and a CRO. We welcome suggestions from our readers for new ideas. We do not have the space of print the full list of colours you provided, but no doubt interested readers will be able to obtain the full list of colours from the makers, and will be able to select those which best suit their requirements. We certainly hope that our article may point out the dangers of ultra violet light to those who are possibly not aware of the dangers associated with its indiscriminate use.
KIT-SETS AUST.

MUSICALS 2

$49.75  
(POST 1$1.00)

New, updated lights display as per Dec. 71 E.A. Complete kit to last item - all top grade parts as per the parts list.

TRANSISTOR TESTER

See E.A. Aug. 71. 
TESTS FETS, diodes, and transformers. Very handy. Our kit complete including Battery $14.50 Post 75c.

RESISTOR PACK

Pack 56: Contains 3 resistors of the 57 standard values between 10 ohms and 1 meg. totaling 171. All new, carbon film, 5 P.C. Types. Value, for the hobbyist/service man.

CAPACITOR PACK

Pack 93: Contains 3 top grade "Greencaps" of the 45 values between 2PF and 0.47 uF, a total of 135 (2PF - 20 PF 100V Ceramics). Polyester caps 100V.

GOOD VALUE at $8.30.

UTILITY AMPLIFIER

$27.50

Post 81

A very practical unit, this Amp has low distortion, high gain and a power of 1.8W. See March 72 E.A.

C.D.I. KIT

$21.50

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Described Aug. 70 E.A. Will improve fuel consumption, starting and overall performance of any 12V car. Either neg or pos. earth. Kit complete in every detail in a diecast box. Transformer has secondary pre-wound at no extra cost.

SPEED CONTROL KIT

$13.50

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Will vary speed of electric drills, electric saws, food mixers etc. Suitable to 750 W Motor. Gives a wide range of speeds while still maintaining good torque. See May 71 E.A. Kit complete as per article.

MIC PRE-AMP KIT

$3.30

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New design as featured E.A. March 72, 2 Transistors. This unit has adjustable bass response. Also ideal for Guitar Amps, P.A., Tape Recorders etc. Complete kit now available.

PLAYMASTER 132

$146.00

Regd. Post $2.00

15W per channel, this Amp Tuner is excellent value. Unit has professional specifications. See June 71 E.A.

KITSET POLICY

Like all our Kits, we take much pride in presenting the PM132 as a first grade quality Kitset. Remember, all parts used are new and guaranteed from well known manufacturers that you know and trust. Our kits are packed to the parts list in E.A. We can guarantee that our kits will match the specifications as listed in E.A. You can buy with confidence.

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New Fairchild Transistors. Fully guaranteed. Stock up now on these USEFUL devices at best prices for new Transistors. Packs of 10 of either BC107, BC108 and BC109. $3.60 per Pack.

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Over 70 pages packed with information and prices on parts, kits and Hi-Fi gear. Fully illustrated, this catalogue is a must for all hobbyists and Hi-Fi enthusiasts. It includes guaranteed, those USEFUL devices at best prices for new Transistors. Packs of 10 of either 8C107, BC108 and BC109. $3.60 per Pack.

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been publicised or, at any rate, made available to bona fide servicemen who request it?

Small wonder if servicemen are rapidly coming to the conclusion that some manufacturers couldn’t care less about service and the servicing section of the industry.

And I’m one of them!

4 Channel Disc from p29

ultimate. It has definite limitations and relies significantly on simulation.

What of the future?

Well, matrixed quadraphonic may meet industry and user needs for the foreseeable future. It certainly has a lot going for it:

1. The kind of decoding equipment which is fully compatible with present-day players.
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ACOS REPLACEMENT LONG LIFE CARTRIDGES

Acos 90 Series — a family of pick-up cartridges covering all the main types needed today, each fitted with Diamond Stylus at no extra cost.

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Mix 43-3

A Rochelle Salt (crystal) microphone insert in a die-cast case with expanded aluminium grille.

Dimensions 43.6mm diameter 8.77mm deep

Output at 1KHz 52dB ref. 1V/dyne/cm

Response 30.7kHz

Capacitance 800 picofarads

Ideal Load 5 megohms

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TECHNICAL DATA SHEETS SENT FREE ON REQUEST

Solo Australian Agents
AMPLION (A’ASIA) PTY. LTD.
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A TRANSISTOR PREAMP FOR MAGNETIC PICKUP OR TAPE HEAD

Using 2 transistors per channel, as featured in "Electronics Australia" (Sept. 1971). Complete kit includes transistors, PC board, resistors, capacitors.

Circuit and full details supplied.

Kit (not incl. box) $7.90
240V Power Supply $4.50
Metal box $2.00 extra.

State if required for pickup or tape head.

NEW LOW COST STEREO SYSTEM

AS FEATURED IN JAN. ELECTRONICS AUSTRALIA

Complete kit of parts including "Garrard" record player with auto stop and crystal pick-up. Magnavox 8WR or 6WR wide range twin coned speakers. (Cabinets not supplied). Amplifier only, less speakers and player.

$69.50 Post and packing $2.50 extra.

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Pack of 100 new polyester capacitors .001 to .01 in 160, 250 and 400 volts working. $3.50 Plus 50c Post and Packing

BROADCAST TUNER KIT

$22.50

Post 75c.

Complete kit of parts including dial mechanism and zener diode for this I.C. tuner as featured in Feb. 71 E.A.

NATIONAL RADIO SUPPLIES

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ELECTRONICS Australia, May, 1972 127
FOR SALE

WE SELL construction plans. TELEVISION, 3 D converter, 253 camera, IISS, tape recorder, VTR, colour converter, HOBBYIST. Electron microscope, baud music systems. Contact your local dealer. Morse code to typewriter copier, transcribed tape. TELEVON. Answering machine, pushbutton dialer, photophone, autoscaler, telephone extension in your automobile. Legal connector. SECURITY: Microphone jammer, voice scrambler, microphotography. Plans $5.00. air shipped from our USA research labs. COURSES: Telephone engineering $29.00. security electronics $27.00. investigative electronics $22.50. Super hobby catalogue air mailed $1.00. Payment accepted in dollars (Australian, New Zealand or US). Don Britton Enterprises, Suite 201, 11 East 57th Street, New York, NY 10022.

REAL TEXT END
AUSTRALIAN Tape Recording Society offers tape repairs to receivers, transmitters, and other equipment. Thus corresponds to the standard video format required by CCTV monitors and applications to the sales engineer. For further details of this position, telephone Mrs. [Missing information]. An attractive commencing salary will be negotiated plus vehicle allowance. AGE: 25-45 years. Tertiary training in high level electronic circuitry together with the ability to confer with personnel such as Sales Engineers. QUALIFICATIONS: Previous sales experience in related fields will be an advantage. Required to liaise with existing clients and make new contacts, and must have a valid driver’s license. Compensation to be discussed so far, the SPG is also arranged to trigger input of a CRO, it becomes possible to obtain convenient and reliable locking of the CRO whenever examining any video signal, composite or otherwise, which is locked to the SPG. This obviates many of the annoying problems often encountered when attempting to examine video signals with a CRO, and removes any need to use special sync separators, clamps, etc. Needless to say, because the CRO is synchronised to the leading edges of the blanking pulses, this makes it possible to examine the leading edges of the sync pulses in a video signal even when the CRO has no built-in delay line. The actual circuit of the SPG will be given and discussed in the second of these articles, which will also describe its construction.
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