AUG 1979
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eti
ELECTRONICS TODAY INTERNATIONAL

MOSFET hi-fi amp – how good

Light pipes replace 'phone cables

'Touch-throw' dice to build

Simple SSB generator project

How to build quad antennas

The face of today's communications equipment—reviews inside

A new dynamic generation of Maxell tapes.

When Maxell announces an improvement in the quality of its tape, you can bet the improvement has to be pretty dynamic. In fact, we think our new generation has even gone beyond our own standards of superior sound reproduction.

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Tape selector position UD-XL I, UD, LN: Normal position (Normal bias/120 μsec. EQ)
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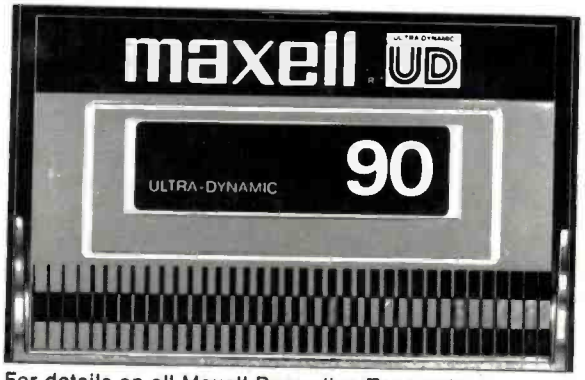

For details on all Maxell Recording Tape write to
Maxell Advisory Service, P.O. Box 307, North Ryde, N.S.W. 2113

Available time length UD-XL I: 60, 90 min./UD-XL II: 60, 90 min.
UD: 60, 90, 120 min./LN: 60, 90, 120 min.

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eti ELECTRONICS TODAY INTERNATIONAL

HOW SOON before videophones are practical? The only thing holding them up, it seems, is the cable required to conduct the signals from subscriber to subscriber. That's where our lead feature comes in. Optical fibre **'light pipes'** will be the common communications cable of the future, replacing today's telephone and coaxial cables. If you'd like to dabble in communications right now, then see what challenge there is in **shortwave DX listening** on page 25, or if you'd like to get into some hard copy, then **Get going on radio teletype** — page 40.

Equipment for the communications hobbyist is getting ever more sophisticated, but that doesn't mean it's not easy to drive. We've reviewed **two transceivers** and a **receiver**, commencing page 74.

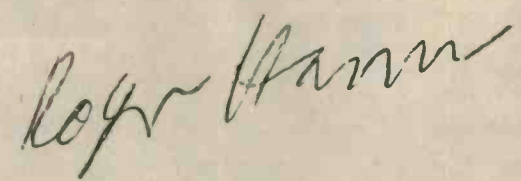
Amongst **five great projects** this month we have an electronic dice, the **Dinkydie!**, and a **Light Wand** that should be popular with campers and motorists.

For the hi-fi buff we have reviewed a stunning new power amp, the **Accuphase E303**, featuring MOSFET devices in the output stage. For more information on MOSFETs we have an article for you on page 120. We also have a review on a valve amplifier. **A valve amplifier!** Don't laugh, turn to page 116 — they still have something to offer.

The Texas Instruments **'University Module'**, TM990/189 is a powerful little 16-bit microcomputer. Silicon Valley kindly supplied one for review and you can read all about it on page 152.

Another solid month's reading — I won't hold you back any longer!

Roger Harrison, Editor



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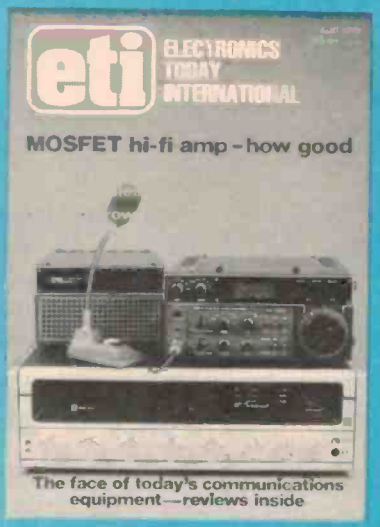

COVER

Modern communications equipment is taking on an increasingly sophisticated appearance as well as incorporating more sophisticated technology. The IC701 (upper) is a high technology amateur transceiver with impressive performance while the DR22 receiver (below) – looking more like a piece of hi-fi gear – features digital frequency selection and state-of-the-art performance. Both items reviewed inside.

Our cover this month is by Ivy Hansen who recently joined us as a technical illustrator.

news

features

projects

sound

general

next month

NAVSTAR

"Our job is to put five bombs in one hole". So says the US Air Force agency in charge of this project – placing a satellite system in orbit to provide super accurate navigation signals for military missiles, air and sea craft.

BIOFEEDBACK – A BRIDGE TO BIONICS

By monitoring the various activities of the body with sensitive electronic equipment, one can learn to control a variety of bodily functions with proven therapeutic effect. Our feature discusses the advances made in biofeedback and its relationship to the rehabilitation of handicapped people and manmade "body parts'.

BUILD AN ELECTROMYOGRAM

Our main construction project next month ties in with our lead feature article. Developed in the ETI laboratory, this device uses readily available components and features performance rivalling commercial units.

NAKAMICHI'S HALF-SPEED CASSETTE DECK

While the rest of the marketplace goes for double-speed facilities in cassette decks, Nakamichi come up with this unit that will play metal tapes and claims a bandwidth to 15 kHz at 24 mm/sec.

THE CALCUMETER 4100

A review of an amazingly versatile and powerful tool. A combination of digital multimeter, calculator and data logger.

THE FOURTH CE SHOW

Report on Australia's biggest annual event for the hi-fi and consumer electronics industry.

Although these articles are in an advanced stage of preparation circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

eti

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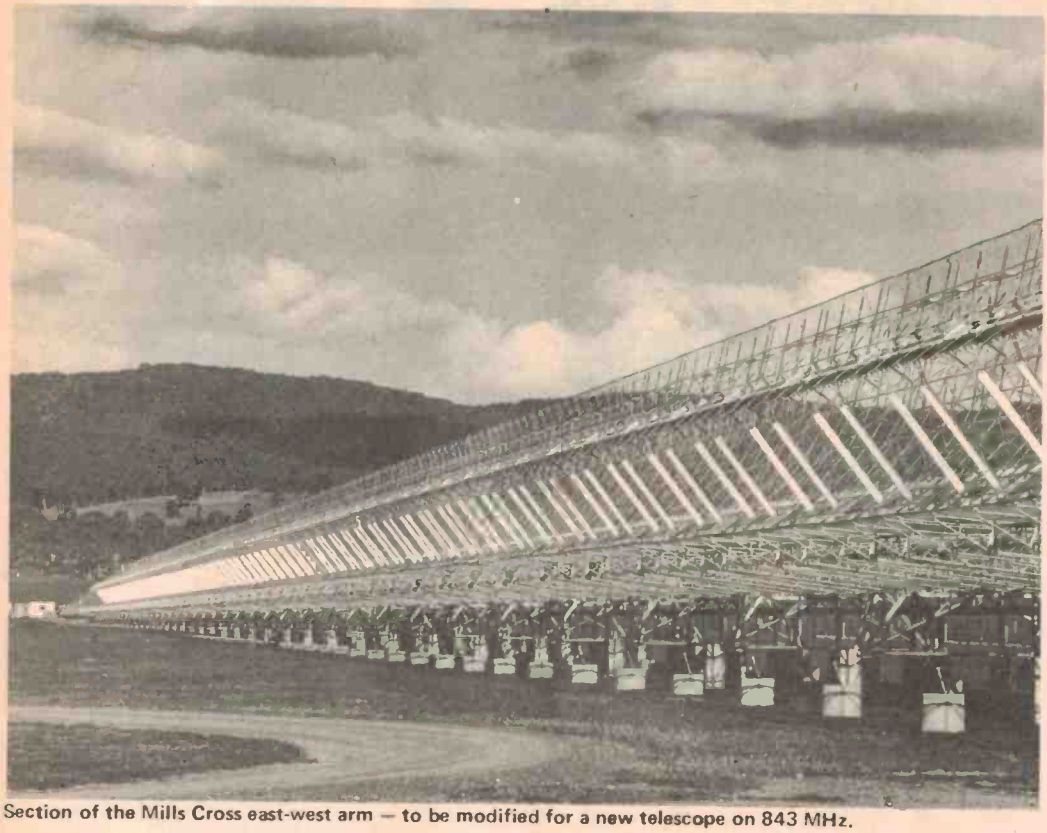

Section of the Mills Cross east-west arm — to be modified for a new telescope on 843 MHz.

New radio telescope to replace Mills Cross

Following a decade of intensive use, Sydney University's Mills Cross radio telescope at Molonglo (near Canberra) is being dismantled.

Constructed in 1962, the Mills Cross was built to explore the whole of the southern sky at several radio frequencies. The programmes originally planned for the Mills Cross have all been completed, along with many others, research efforts resulting in a number of significant achievements over the years.

The original Mills Cross was a 'transit' telescope — objects could only be observed for a very short time every 24 hours as they crossed the meridian. Results of previous observing programmes have all been stored on magnetic tape and will provide a source of scientific data for many years to come.

The new instrument being constructed will use the east-west arm of the old Mills Cross antenna. It will be altered to allow tracking of a fixed point in the sky for 12 hours at a time. The operating frequency is being raised to 843 MHz to provide higher angular resolution.

The effect of the changes will be to add together, over 12 hours, the signals received over a small area of sky producing a radio 'picture' of the area with a sensitivity 100 times better than obtained on a single quick observation with the original instrument.

The new radio telescope will be used particularly in extending knowledge of physical conditions in the Magellanic Clouds, a pair of southern galaxies which are ten times closer than any accessible to northern hemisphere astronomers but still far enough away to require the highest sensitivity for observing all the structures of interest.

New colours to stop forgeries

A method for printing truly dichroic, iridescent colours has been developed by a US scientist.

Marv Oster, the inventor of the system, spent 12 years and US$100 000 of his own money in developing the system.

Companies such as US Bank Note, RCA and MGM are interested in the process, which can be used to render printed matter 'un-copyable'.

As the chemical steps needed are beyond the capabilities of the forger, the inclusion of a stripe of iridescent colour on a banknote — or on a record — would mean that it was very difficult to copy.

Oster first began using the colours in paintings of his. When someone suggested that he get them reproduced by a printer he realised the potential of the process in aiding document security.

The process allows the colours to be applied to almost any surface, from cloth to plastic. Washing causes the colour to disappear — but it returns when the material dries.

Because the colours are dichroic — red and yellow (for example) do not merge into orange, but stay separate — there is no merging of retinal response.

According to Oster, he had to stop producing portraits for this reason — when people saw them they were "rattled quite badly."

Invalid programs may close reactors

The American nuclear watchdog, the NRC, may close more reactors if it finds that piping has been designed by invalid computer programs.

In March, the NRC ordered five plants in the Eastern US to close because it was unhappy about piping design.

At present it is completing a study to determine whether earthquakes could damage existing plant.

The study was initiated after an anonymous phone call to the NRC from someone who claimed that many plants were using a flawed design method.

Meanwhile, electricity services in some US states may reach a dangerously low level if the many reactors serving those areas remain idle.

Australian buoys help weather forecasts

Fifty Australian-built buoys set adrift in the southern oceans over the past six months have benefitted weather forecasting already, according to the Minister for Science and the Environment, Senator Webster.

The buoys transmit measurements on sea surface temperature and air pressure via a satellite system.

"This information was almost unavailable previously from these vast areas and the data now being obtained, particularly on the intensity of low pressure systems, are proving of great value to forecasters," Senator Webster said.

"There have been several instances this year where forecasts have been more accurate as a result of this new information being available," he said.

"In tropical areas, the main benefit has been the more accurate tracking of cyclones."

The buoy system is part of a world-wide meteorological research programme, the 'global weather experiment', where several weather observation systems are used for the first time.

A group of 300 buoys are to be set adrift in the southern hemisphere oceans. Australia's involvement in the project cost $350000. Senator Webster said US scientists were impressed with the benefits and were examining the feasability of a similar buoy system for the northern hemisphere.

Briefs

The Arab Organisation for Industrialisation, created four years ago to develop a pan-Arabic electronic manufacturing industry, was dissolved on July 1st because of Egypt's peace with Israel.

Specialising in electronic educational products for children seems a timely venture with calculators appearing in primary schools and computers in secondary schools. Manpower Support Services of Sydney has opened a retail store called 'Microware' to sell Texas Instruments learning aids and programming tools, Commodore PETs and related educational software. Seems the technological revolution has spread to the ground floor . . .

TDK have developed a ferrite roofing tile which absorbs TV signals — with a view to reducing 'ghosting' in high-rise areas.

Blue LEDs may result from research being done by Siemens. The devices would use silicon carbide and are predicted to have a forward voltage drop of 4 V at 50 mA.

Lloyds bends to bugger

Charles "Chris" Christopher — known previously for his 'bugging' of the Chemical Bank — has managed to sell Lloyds of London a deal which could mean the largest loss in their 291-year history.

The idea was very simple. He persuaded Lloyds, one of the world's largest insurance companies, to provide insurance to computer leasing firms which would cover him in the event of their leases being cancelled due to new and better equipment appearing on the market.

On the strength of this cover, Christopher persuaded banks and other financial institutions to lend his firm hundreds of millions of dollars, which he used to buy computer equipment.

He then leased the machines and waited.

If the users wanted to cancel their contracts between the fourth and seventh year, Lloyds would make good the losses.

As of January this year, about US $1000 million of these policies had been taken out — then IBM came out with their 4300 series — faster, more powerful and cheaper than anything on the market.

Meanwhile, the banks who had loaned money to Christopher were asking for repayment.

Under Lloyd's policy, if a company with a seven-year lease cancelled for any reason after only three or four years, they would pay any balance owed to the bank. As security, they had the re-leasing rights of the computers.

Lloyds under-writers fear that the losses over the next few years could run to US $500 million.

Electronics tests flying skills

An assembly of electronic instruments is being used by a West Australian researcher to examine the abilities of pilots controlling supersonic jets.

Keith Pearson, doing post graduate research in 'Human Factors' at the West Australian Institute of Technology says, "We're hoping to predict the flying skills of student pilots and compare them with the subjective assessment of the instructors, and objective psychological and aptitude tests taken early in the selection procedure."

"We are not reproducing flying conditions. It's what we like to call parallel processing."

The equipment is to be installed at RAAF headquarters at Pearce in Canberra. The Government has provided clearance for a project which Keith Pearson hopes will eventually lead to the development of a technique for selecting the most suitable applicants for pilot training.

The equipment used in the research project was predominently from Australian manufacturer BWD Electronics. Two function generators, a sine/square generator, a 'Wavemaker' and two BWD 603A 'Mini-Labs' were used to generate a spot on a video screen that moves in a complex manner which the subject attempts to control.

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It's been a long time coming, but the wait was well worthwhile!

Covers just about all the topics of interest to Australian amateurs or aspiring amateurs. What it is, the different types, how to get into it, licensing requirements, getting started in radio, the different bands, antennas, operating procedures, solving interference problems, amateur clubs, references, etc, etc etc . . .

Newcomer or old hand, you'll find the Dick Smith Australian Amateur Radio Handbook a valuable addition to your amateur radio library. Cat B-2320 $6.95

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All other items in this kit normal stock lines

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Battery operated, size 81x117x179mm.

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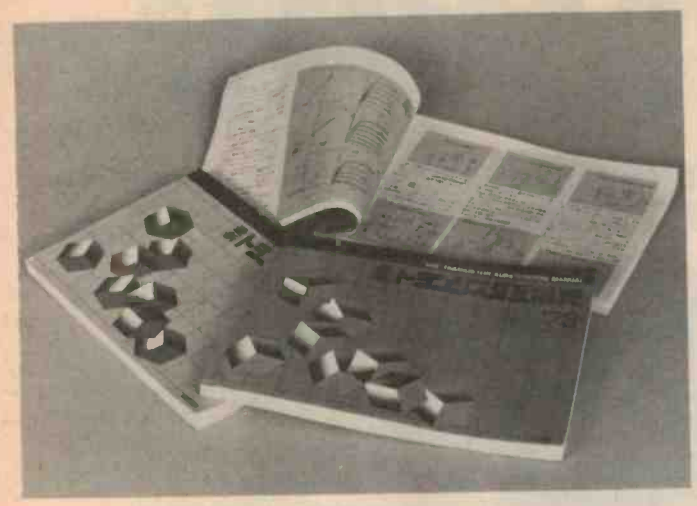

Jacoby take over Radiometer Electronics

The Jacoby Mitchell Company has taken over representation of Radiometer Electronics Audio and RF Measuring Instruments from Foss Electric (Aust.) Pty Ltd.

Foss Electric's Managing Director, Mr Jim Kelly, stated that Foss are traditionally in the medical, dairy and food industries.

He further stated that Jacoby Mitchell are better suited to handle the expanding range of the Audio and RF products of Radiometer Electronics as they already cover the market with other products and have the service back-up facilities.

Foss Electric, a 40 percent subsidiary of Radiometer Electronics, will continue to market the clinical and analytical products of that Company.

The changeover is effective immediately and enquiries can now be addressed directly to Jacoby Mitchell's Sydney, Melbourne, Adelaide and Brisbane offices.

Hatched, matched, despatched

Brief news on new components, new outlets, mergers and closures.

Hatched

A & R Soanar have opened a new Branch Office in Perth at 611 Hay Street, Jolimont W.A. 6014 (09) 381-9522. State manager is Barry Slocum and the branch will market the Arlec and Soanar range of products.

Dick Smith's ninth store to open in his Australia-wide 'chain' is located in Canberra at 96-98 Gladstone Street, Fyshwick (062) 80-4944.

Zipping back to Perth, Dick Smith's presence in that city is located at 414 William Street (09) 328-6944.

Matched

The components side of R.H. Cunningham's business — representing Bulgin, Eddystone and Stetna, amongst others — will be taken over by RIFA, well-known for their capacitor lines. R.H. Cunningham will concentrate on professional sound equipment, chief amongst their range being Sennheiser headphones and microphones.

Despatched

Well, not quite despatched — more like mentioned in despatches — is Dick Smith's Hong Kong store. It's been advertised for sale.

Don't say Dicky's had a disaster! — Nope. Quite the opposite, according to product manager Gary Johnston. D.S. established a buying and sales office in Hong Kong including a retail store there to help pay the rent. The latter's success is holding back progress of the buying and sales office as it takes so much of manager, Bob Johnson's time.

The 'resistor-starved' marketplace can now have large quantities of carbon film and wirewound resistors despatched to it ex-stock, according to A & R Soanar, now that import licensing restrictions on fixed resistors have been lifted. Metal film and flameproof resistors are also available. Chew hard you starving people out there.

Semiconductor manuals

Five new Japanese semiconductor manuals, released in June, will be available in Australia this month.

Suitable for servicemen working on equipment of Asian origin, such as CB radios, cassettes or hi-fi equipment, the five manuals cover FETs, diodes, linear ICs and transistors — one being a transistor substitution manual.

Although listings are predominantly in Japanese, the English 'subtitles' are sufficient to enable one to get by. The transistor substitution manual covers Sanyo, Sony, Toshiba, NEC, Hitachi, Fujitsu, Matsushita and Mitsubishi types.

The transistor and FET manuals include data tables and package outlines. The first covers 2SA, 2SB, 2SC and the 2SD series while the latter covers the 2SJ series from 2SJ18 to 2SJ50, the 2SK series from 2SK11 to 2SK192 and a number of GaAS types. Also included in the FET manual are the dual-gate MOS types from 3SK14 to 3SK77.

All the manuals are priced at $9.95 each. They are obtainable from Semiconductor Imports, P.O. Box 43 Croydon 2132. Pack and post charges are $2.00 on any order.

The manuals may also be obtained through Pre-Pak Electronics who are acting as sales agents.

Switchmode transformer design

A design manual for three basic switched-mode power transformers — push-pull, forward or flyback — is now available from Philips Electronic Components and Materials.

Each transformer design has a separate set of nomograms. Instructions and a typical example are given for each nomogram.

The nomograms use EC cores, specifically designed for switched-mode power supplies, and conventional P-series pot-cores. The 31 nomograms and 61 pages of "how-to" information are printed on durable paper stock and bound in loose-leaf binders. They are available only from Philips Electronic Components & Materials, 67 Mars Road, Lane Cove. The single copy price is $19.95.

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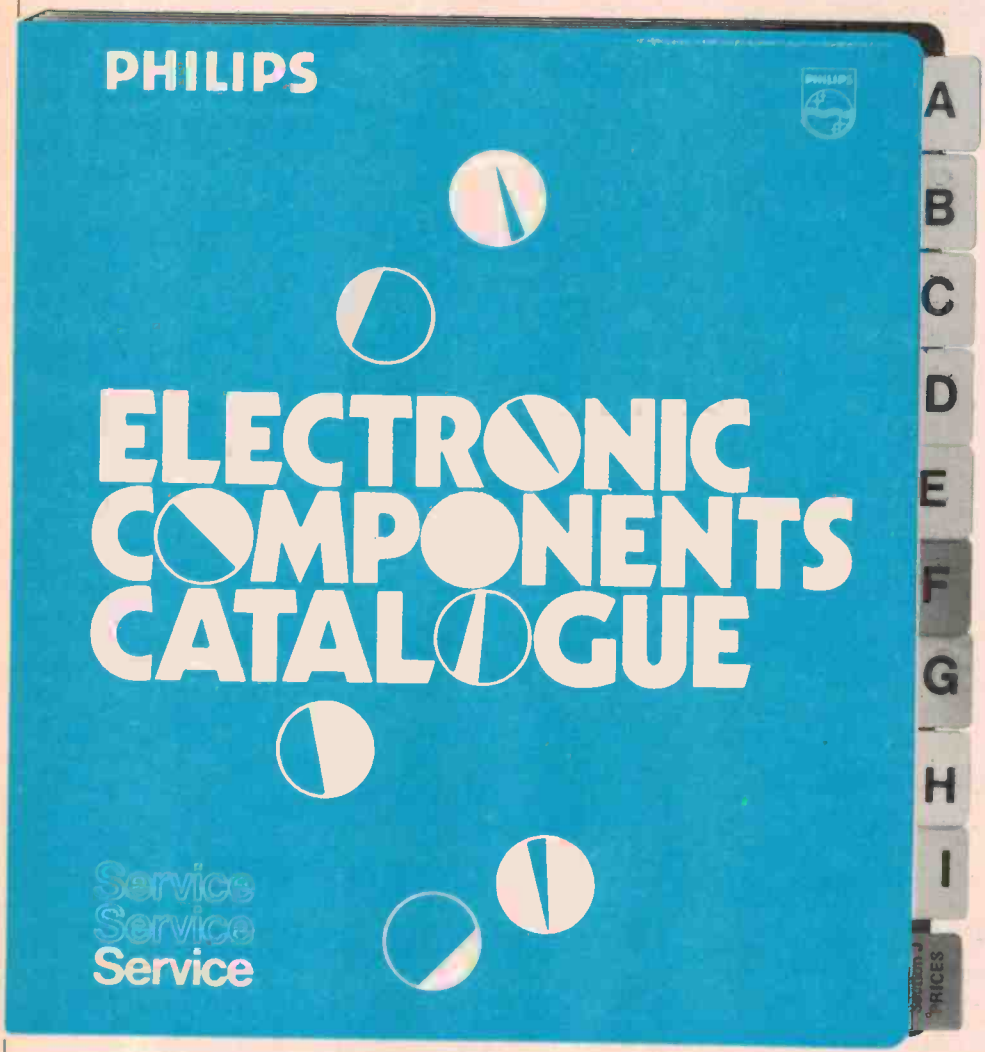

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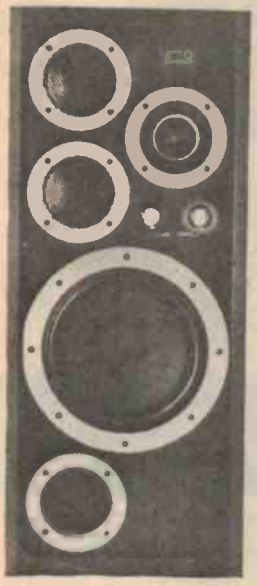

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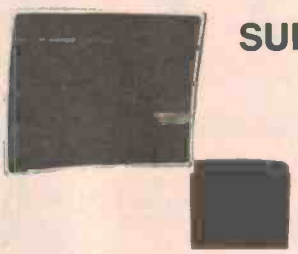

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Phil Cohen

BORN IN Glasgow in 1956 and has never been quite the same since his parents moved to one of the 'slightly better' areas of the city (where the neighbours used to attack each other with broken *vin ordinaire* bottles). At five, he was forcibly sent to the local primary school.

His favourite subject was lunch — it wasn't until he reached the age of twelve that he discovered that this was not, in fact, part of the curriculum. Attending Williamwood Junior High School , which was co-educational (Protestants *and* Catholics), he quickly learned one of the most important lessons of his school career — that lunch was not on the curriculum. The school motto was Nasalus Pristinus Et Nils Strifus — "Keep your nose clean and don't get into trouble".

From Williamwood High he went to Eastwood Senior High School (Glasgow, not Sydney) (motto: Floreat Laborae — either "Those who labour shall flourish" or "Anyone who works is a pansy"; depending on your point of view). There he joined the school drama group. And, by virtue of the fact that the girls in the group outnumbered the boys by about ten to one, was thrust upon the stage in the first production. This was rather a disappointment as all he wanted to do was operate the stage lights.

At Eastwood he discovered the Radio Room. This was a fun place since it was always the warmest room in the school. In Glasgow, that's quite a fun thing!

Eventually, he decided on a university course. As chemistry was the only subject he could stay awake for — the class had to sit on high lab stools and falling asleep meant a rude awakening on the floor — and having done little engineering, he decided on Chemical Engineering.

At Strathclyde University Phil discovered three pastimes which have fascinated him ever since — beer, pinball and computing. Having been convinced by the Chemical Engineering department not to take up beer drinking full time, he settled down to the four-year course finally graduating with an Honours BSc in Chemical Engineering, with Special Honours in Advanced Synergistic Beer Drinking.

After graduating, he went to a place about thirty miles — sorry, forty-eight kilometres — north of London, called Welwyn Garden City to work for ICI as a Chemical Engineer. Finding that Welwyn G.C. was rather a dull place, he moved another sixteen kilometres further north to Stevenage; dull, but the beer was better. After working for ICI for about five months, he realised that he could predict with a fair degree of accuracy what he would be working on in 1987. Rather shocked by the prospect of being able to write his entire autobiography at the age of twenty-two, he spotted (luckily) an advert in ETI UK for a Technical Journalist. This had been placed as a cunning ruse to get one for ETI Oz, as we seem to be rather short of them here.

While waiting for permission to join a convict ship, he was trained by ETI UK in Technical Journalism — most of which he was familiar with, having been an avid beer drinker for some time. Finally, in December 1978, he was shipped here by air. Going from British winter to the Australian summer was a bit of a shock — countered by attending Synergistic beer drinking . . . every week.

Phil is currently working on a project which should result in a computer-controlled pinball machine that delivers a pint of 'old' as a prize.

Star sign: Aquarius (what could be more appropriate . . .)

Likes: Beer, pinball, ALGOL 68R (a programming language) and equipment with plenty of flashing lights.

Dislikes: Ozzie sunshine, tea-totallers (not misspelt) and people who will only use brown sugar.

Quote: "Sliced bread is the greatest thing since beer". ●

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Optical fibre 'light pipes' will replace existing cables for telecommunications

Brian Dance

This technology will gradually replace conventional cable systems in telecommunications over the next decade or two. Apart from providing huge increases in traffic capacity, it paves the way for electronic mail facilities and perhaps videophone communications for business and domestic use.

The conventional telephone service provides two way audio communications over the limited frequency band of about 300 Hz to 3.4 kHz. There is a considerable demand for video telephone-like links which not only allow people at distant places to see one another as they talk, but enables pictures, charts, graphs, etc to be transmitted between two places.

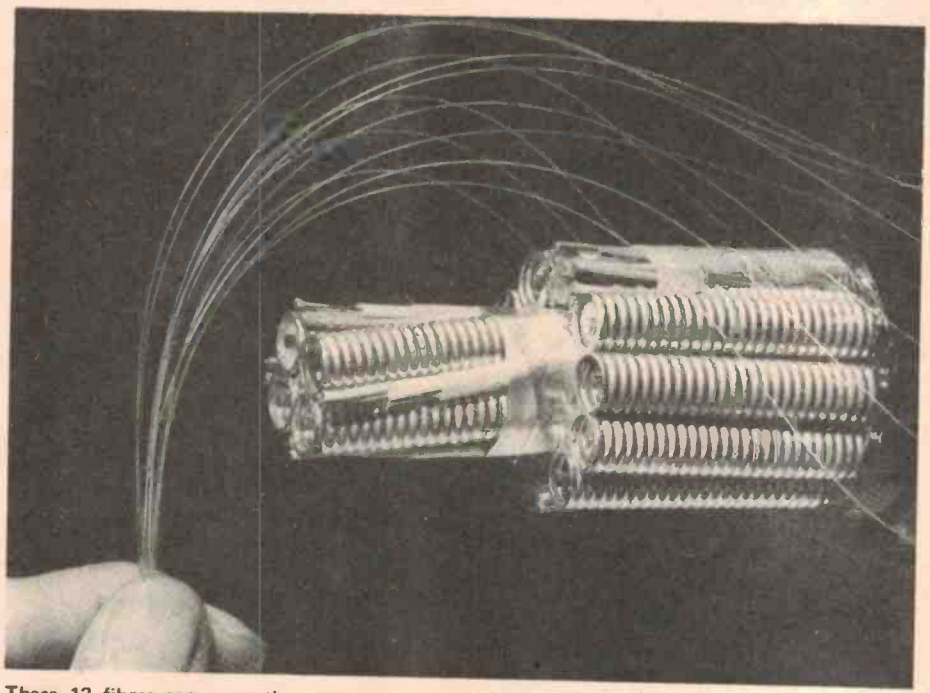
Video signals require bandwidths around a thousand times that of audio signals, so conventional telephone wires are quite unsuitable for carrying such signals.

One can use coaxial cable or microwave links for carrying video signals, but at the present time there is very great interest in the use of optical fibres for telecommunications.

Basically, a semiconductor laser or an emitting diode is used to transmit infra-red radiation, modulated with the signal, into one end of an optical fibre. A silicon photodiode at the remote end transforms the modulation back into an electrical signal.

Even when vision signals are not required, the wide bandwidth which can be made available through the use of optical fibre links between major telephone exchanges offers a very attractive way of carrying large numbers of simultaneous telephone calls – apart from high speed data transmission, computing using a visual display unit as a terminal, etc.

Experiments are being carried out in many countries on the use of small diameter optical fibres as part of the telephone system. The role of telecommunications is almost certain to expand considerably in the coming years particularly in such fields as that of money transfer and optical fibre links may well provide much of the required traffic carrying capacity.



These 12 fibres can carry the same amount of information as the digital coaxial cable in the background.

It seems certain that digital telephone techniques will gradually take over from the current analogue systems providing a further increase in traffic capacity. In addition, cable television systems may well bring video and audio signals into many individual homes by means of optical fibres.

Optical fibres

The optical fibres used for telecommunications must have a relatively low loss or an excessive number of repeaters will be required at points along the line. Typical optical fibres currently available have a loss around a few dB per km. In order to minimise losses, the materials used in the manufacture of the glass for such optical fibres must be of the highest purity. Inhomogeneities in the glass must also be minimised, since they will increase the light losses.

Cables with a loss as low as 3 dB/km are commercially available for use at a wavelength in the near infra-red (about 820 nm) at which gallium arsenide semiconductor injection lasers emit. Losses are limited to no more than 1.5 to 2 dB/km at 820 nm wavelength, by Rayleigh scattering. As this scattering is inversely proportional to the fourth power of the wavelength, the use of

visible light at the blue end of the spectrum would lead to excessive losses.

It seems likely that the 1200 to 1400 nm region will be eventually used, but work on these wavelength is currently in the research stage. Losses as low as 0.5 dB/km have been reported using such wavelengths.

Commercially available optical fibres have losses which are low enough to enable the repeaters to be spaced at intervals of about 10 km along major telephone links operating at data rates of 140 Mbits/s. When ultra-low loss cables are available it seems likely that they will be especially useful for submarine and long distance trunk cables in which repeater spacings over 50 km may eventually be possible.

Losses can also be increased in an optical fibre link by the presence of a fairly large number of small-radius bends. This problem of 'microbending' is one of the most difficult which the fibre optic designer has to face, although a coating of a material such as polyvinyl chloride (PVC) can greatly reduce the problem.

Graded fibres

In principle, a fibre optic cable can consist of a length of small diameter glass surrounded by a material of lower refractive index, such as air. Rays which enter the glass at a relatively small angle to the fibre axis will undergo total internal reflection each time they strike the boundary and will thus be propagated along the length of the fibre by a series of reflections.

Unfortunately, various rays have different path lengths in such a uniform glass fibre and take different times to pass through its length. If a narrow pulse of radiation enters the fibre, it will be 'spread' in time when it emerges from the far end.

Graded fibres, in which the refractive index decreases parabolically with the radial distance from the axis, offer a solution to this problem. Light travelling in the part of the glass near to the core has a lower velocity than that near the outside so that rays which travel a shorter distance travel more slowly. Thus, the use of graded fibres results in all rays taking about the same time to traverse the length of the fibre so that there is much less spreading and distortion of pulses. A ray which enters the fibre within the acceptance angle is repeatedly guided towards the centre of the fibre. Time spreads of less than 1 ns/km can be obtained using a first class graded fibre.

The production of a graded fibre is no easy matter, since one must make a fibre whose refractive index at any radius n(r) is given by the equation

$$n(r) = n_0 (1 - K r^2/r_1^2)$$

where n_0 is the refractive index on the fibre axis, K is a constant and r_1 is the radius of the core.

Further, it is important to have the fibre available in fairly long lengths since each junction introduces an additional loss of the order of 0.3 dB. Fibres are generally manufactured in 1 km lengths, but the Nippon Telegraph and Telephone Company have drawn fibres up to 14 km long.

Fibres may be manufactured by the use of a double crucible made of pure platinum. The glass forming the centre of the fibre is fed into the centre crucible; it may consist of an alkali-germanosilicate glass with a high sodium ion content and hence a high refractive index. A somewhat similar glass, which has a high potassium ion content and a lower refractive index, is fed into the outer crucible. The glass fibre is drawn from concentric points at the base of the crucibles and the exchange of sodium and potassium ions in this region at the base of the crucibles produces the required graded refractive index profile.

It is understandable that there are variations in the quality of fibres produced by such a difficult manufacturing technique. Small variations in the way the refractive index changes as one moves from the axis of the fibre to the periphery produce quite large changes in performance. Although an optimum bandwidth of about 10 GHz is theoretically possible for a 1 km length, fibre used in trials by the British Post Office ranged from 260 MHz up to 1600 MHz bandwidth for 1 km lengths owing to problems of obtaining the correct graded index profile (*P.O. Electrical Engineers' Journal, Vol. 71, page 244, January 1979*).

Fibres are commercially available with bandwidths guaranteed to be no less than 400 MHz/km, but the production of fibres with a minimum bandwidth of 1 GHz/km is expected in the not too distant future.

Other types of fibre have also been considered. One such is fused silica, manufactured in relatively short lengths by a gas plasma process. Another type of fibre is known as the 'monomode' type, since it is of very small diameter, 3 μm, (comparable to the wavelength of the radiation used) and this prevents pulse distortion by confining the track of the beam to the line of the fibre; however, such fibres of uniform refractive index are difficult to handle and join effectively because of their small diameter.

A typical graded optical fibre has a diameter of about 0.1 mm. The complete cable is of considerably larger cross section than this because it must contain a metal strengthening material so that the glass fibre itself is not strained as the cable is pulled through ducts.

Dr Ken White of the British Post Office Research Station making optical measurements on a length of optic fibre. (Picture courtesy of the BPO).

An optical fibre cable weighs about 50 kg per km and is thus much lighter and of smaller dimensions than a conventional cable of a similar traffic carrying capacity. In addition, fibre optic cables are not susceptible to electromagnetic interference.

Even the optical fibres already in use in field trials require a repeater spacing of only some six to 10 km, nearly ten times less than that of conventional telephone cables. There is no cross-talk between adjacent optical fibres.

One of the major problems in the use of optical fibre telecommunications is that of joining successive lengths of the fibre. Special techniques must be used or the signal loss at each joint becomes unacceptably large. The two fibres must be accurately aligned, since alignment errors of even a few microns can cause losses of a fraction of a dB, these losses adding up at successive joints. Special tools have been developed for the cutting of the fibre ends perpendicular to the length of the fibre, for cleaning the ends (sometimes in an ultrasonic bath) and for joining the ends after accurate alignment by means of a material such as a transparent epoxy compound of a refractive index close to that of the fibre core.

Radiation emitters

The only sources of radiation which can be considered for fibre optic tele-▶

communications at the present time are light emitting diodes and injection laser diodes; other sources such as incandescent lamps and gas discharge tubes are far too large and are not bright enough to enable their radiation to be injected into a very fine optical fibre at a sufficiently great intensity. Neodymium solid-state lasers have been considered in the past, but cannot be modulated directly at frequencies above about 1 MHz.

Light and infra-red emitting diodes can easily be modulated by switching the current on and off. They have been used in a field trial by the British Post Office at data rates of 8 Mbits/s, but are unsuitable for high data rates. The spectrum of the radiation from a gallium arsenide emitting diode is relatively wide (up to 50 nm at about 820 nm) and, even in a graded optical fibre, the transmission times for various wavelengths are sufficiently different for an appreciable amount of pulse broadening to occur. In addition, it is much easier to couple the required power (about 1 mW in a typical system) from a semiconductor laser diode into a narrow optical fibre than it is to couple the radiation emitted by a gallium arsenide non-lasing diode efficiently into a similar fibre.

The radiation from a gallium arsenide laser diode has a spectral width of only about 2 nm, so the time spreading of a pulse is of the order of 0.1 ns per km as opposed to 2.5 ns per km when a non-lasing diode is employed.

A gallium arsenide laser diode about the size of a grain of sand has dimensions comparable to that of an optical fibre; in addition, it can easily be modulated and provides relatively high efficiency.

Unfortunately, there is a delay of the order of 10 ns before radiation is emitted after the application of a current pulse and this time is unacceptably long for data rates of the order of 140 Mbits/s. A bias current is therefore passed through the laser diode at all times so that the lasing action can commence very rapidly once the current passing exceeds that required for laser action.

Receivers

The radiation emerging from the receiving end of the optical fibre is focused by a coupling lens onto an avalanche photodiode which can provide a high quantum efficiency at the high pulse frequencies used for high data rates. A bias of the order of 200V is applied across the photodiode junction, but the current is small. The output signal from the photodiode is fed to a very low noise amplifier. Automatic gain control is incorporated. The avalanche photodiode provides low-noise multiplication in much the same way as low-noise multiplication occurs in a photomultiplier tube.

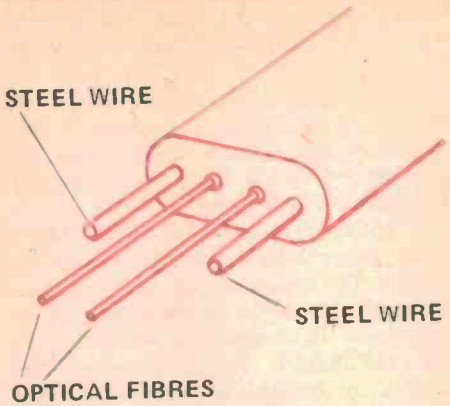


Fig. 1. The optical fibre cable used in the British Post Office field trial.

Fast gallium arsenide emitters and matched photodiodes are now manufactured with integral fibre optic cables so as to minimise losses of the modulated beam.

Early results

England:

Two major field trials of optical fibre systems have been carried out in England. One of these trials has been entirely the work of the British Post Office, whilst the other has been the work of Standard Telephones and Cables Ltd.

In 1977 the British Post Office installed an optical fibre system between their research centre at Martlesham Heath and the telephone exchange at Ipswich, a distance of some 12 km. Only one repeater station was required at the Kesgrave exchange near the centre of this link, 200 MHz/km cable being used. This was a low speed (8.5 Mbits/s) feasibility study using a non-lasing diode.

A shorter link of some 6 km using 400 MHz/km cable was installed between the same research centre and the

Left: Installing optical fibre in telephone cable ducts for a trial in England. (Picture courtesy of the BPO).
Below: One of the regenerative receivers used in the Frankfurt region.

Kesgrave exchange for 140 Mbits/s trials. All of the optical fibres were installed in existing telephone ducts enabling direct-dialled calls to be made from certain telephones at the research centre to most places in Britain using the optical links.

The cable employed is shown in Figure 1. It contains two parallel steel wires to take the tension, embedded in flat polythene with holes for the optical fibres. The fibres have a 62.5 μm core diameter and a numerical aperture of about 0.15 and are of the graded refractive index type. The cables were installed in sections, each of which had a length of between 592 m and 914 m.

In the case of the 140 Mbits/s cable, data and clock inputs at 139.264 Mbits/s are fed to an encoder and, after processing, used for the direct drive of a semiconductor laser. There is a coupling loss of about 0.5 dB at each end of the cable. The maximum power at the input end is about 850 μW and in the digital '0' condition about 70 μW. Thus, the mean input power is about 460 μW, whilst the output at the receiving end of the fibre is about 1.4 μW. The transmission capacity has been estimated at not less than 300 Mbits/s, and the time dispersion 2.5 ns over the 5.75 km length. Calculations indicate that an optical fibre link could be made at a cost of some 33% less than that of an equivalent coaxial system.

This system was the first in Europe to enable people to make telephone calls over optical fibre links using strands of glass no thicker than a human hair. The fibres used could, in principle, carry up to 2000 simultaneous telephone calls. A group of ten such fibres in a cable 6.3 mm in diameter could carry 20 000 calls, whereas the corresponding trunk coaxial cable for the same traffic would be about 38 mm in diameter.

Standard Telephones and Cables have also installed an experimental fibre optic telephone link for a 140 Mbits/s data rate. It runs between Hitchin and Stevenage, a 9 km link north of London. This two-way link uses laser beams to carry up to 1920 telephone conversations (or a mixture of telephone, television and data traffic) using a 7 mm diameter cable. It is claimed that this is the first high capacity repeatered link in the world to be installed in typical field conditions. The cables are installed in Post Office telephone ducts. Pulse Code Modulation is employed. The repeaters are placed at 3 km intervals; they not only boost the signal amplitude, but also sharpen the individual pulses to their original form.

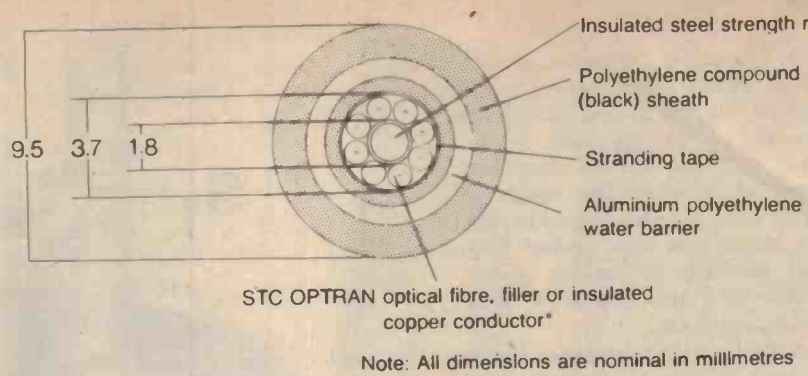
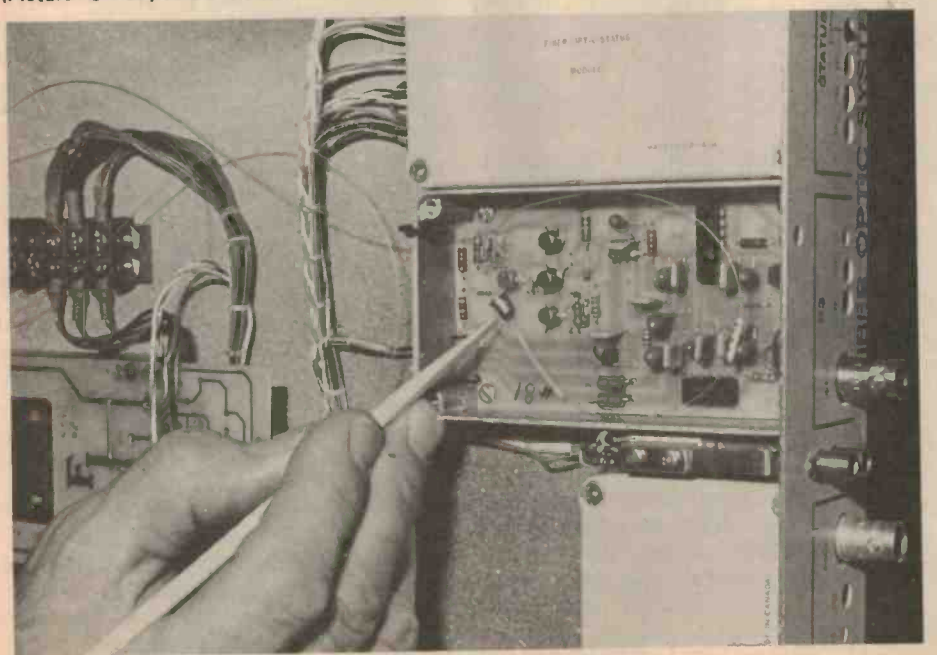


Fig. 2. A cable manufactured by STC, containing optical fibres, conductors, etc.

The STC optical cable consists of eight cores (comprising two working fibres, a spare fibre, a plastic filler and four metallic conductors) which are grouped around a central steel strength member and the whole is completely sheathed in polythene (Figure 2). The four metal conductors carry power to the repeater units and provide the order wire facilities for the maintenance staff. Although the link remains the property of STC, it is part of the public telephone system; in addition, the British Broadcasting Corporation has used this link for colour television test transmissions.

Another manufacturer, Telephone Cables, has installed a 6 km trial link for Post Office tests, but it is intended that it will later carry normal telephone traffic. This manufacturer has also supplied a 7 km optical link to London transport for telephone communications over an 8 Mbits/s bandwidth between two underground stations.

Close-up view of an optical receiver inside one of the fibre optics terminals at a switching centre. (Picture courtesy Bell Canada).



Germany:

On 16 March 1978 Siemens handed over their 4.3 km optical fibre test link in Berlin to the Deutsche Bundespost. After this had operated successfully for almost a year, the Deutsche Bundespost commissioned an optical fibre link between the Frankfurt/Ginnheim and Oberursel exchanges on 14 February 1979. This 34 Mbits/s Siemens system will be able to carry up to 480 telephone calls and is the first operating link to be used by the German public telephone system.

A 7 mm diameter cable containing a pair of 0.1 mm diameter optical fibres provides this 15.4 km link partially using existing telephone cable ducts and partially the direct laying of the cable in the ground. At the terminal stations pulse code modulation equipment combines the 480 telephone signals into a single time-division-multiplex signal. ▶

The USA:

The USA, like other countries, is convinced that optical fibre cables have a vital part to play in future telephone networks and is carrying out similar field tests to those already described in Europe. Only when the results of such field test become available will engineers know how well optical fibre links will perform in various places, how reliable they are, how easily they can be maintained, etc.

For example, Bell Telephones found that a 2.4 km link in Chicago provided substantially greater reliability than conventional electrical circuits used to carry the same mixture of signals. A fault rate of about one part per million (30 seconds per year) was estimated. The American Telephone and Telegraph Company have therefore decided that fibre optic links should be one of the options for connections between major switching centres. They plan to start installations in 1980.

An optical fibre cable developed by the General Cable Corporation of New Jersey is shown in Figure 3.

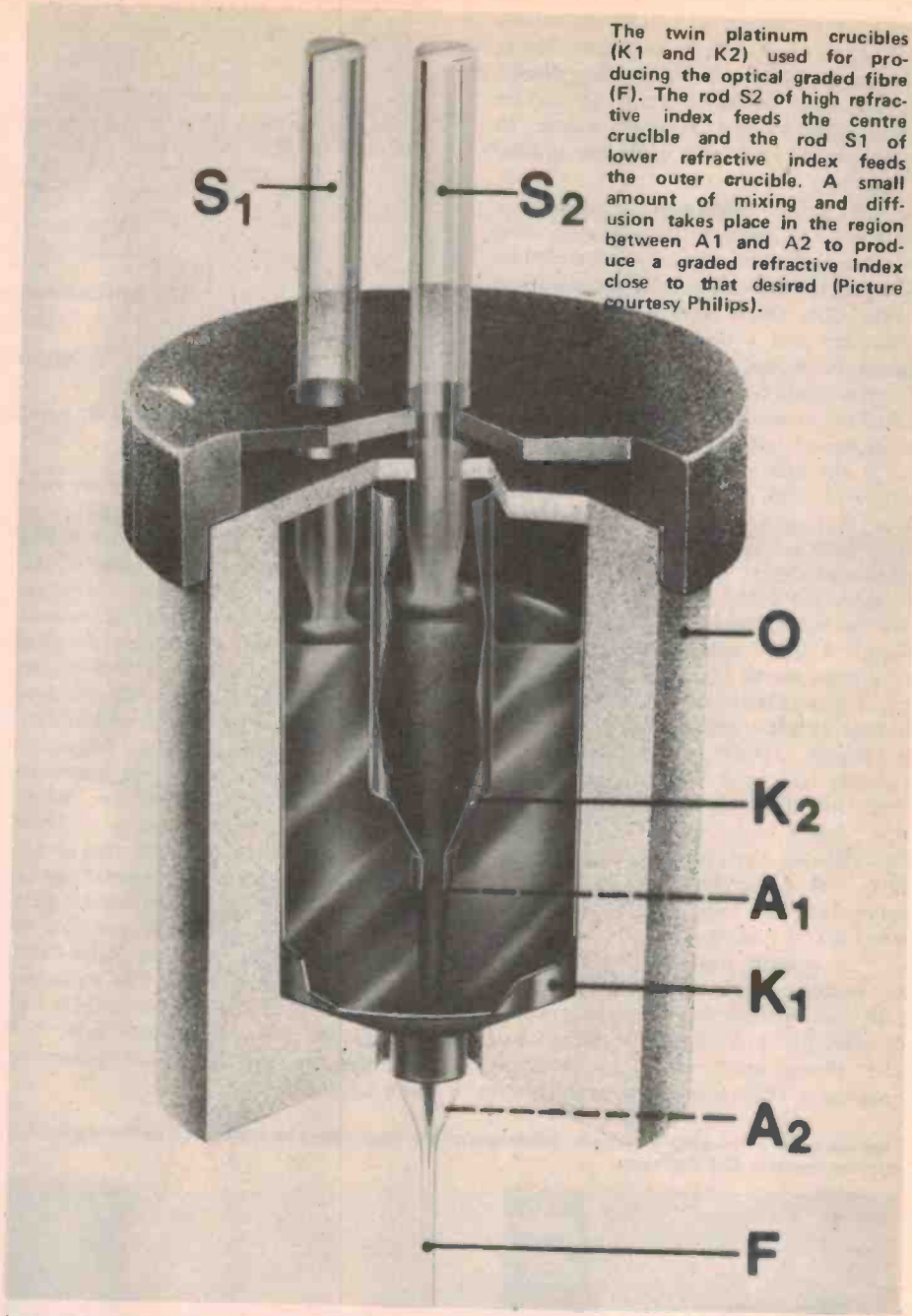
It has an overall diameter of about 25 mm and is very well protected against mechanical damage by the aluminium tube and the corrugated steel tape which is flooded with an anti-corrosion compound – apart from two polythene jackets. This hermetically sealed cable is normally supplied in 1 km lengths, but may be pressurised like a conventional telephone cable; the outflow of air then retards the entrance of water and may give an approximate location of the fault. The diameter of the optical fibres is about 125 μm and the core diameter 62.5 μm.

Canada:

On 12 December 1978 Bell Canada officially introduced a two year trial of fibre optic technology into 35 homes in the Yorkville area of Toronto; this is the world's first field trial of a fibre optic system with domestic telephones.

The integrated fibre optic system has been designed by Bell Northern Research and furnished by Northern Telecom Canada Ltd to demonstrate the capability of simultaneous transmission of telephony, data and video in the distribution network. Bell's overall initial investment in this trial is US$1.75 million.

The fibre optic customer loop system will use 1.2 km of graded index fibre optic feeder and up to 200 m of graded index fibre optic buried entrance service cable to each of the 35 subscriber participants and to a Bell Canada test site. The Yorkville area was chosen because it is being rebuilt. It was felt that a fibre optic telecommunications network could integrate telephone, television, data and new broadband services in one medium for everyone's benefit.



The twin platinum crucibles (K1 and K2) used for producing the optical graded fibre (F). The rod S2 of high refractive index feeds the centre crucible and the rod S1 of lower refractive index feeds the outer crucible. A small amount of mixing and diffusion takes place in the region between A1 and A2 to produce a graded refractive index close to that desired (Picture courtesy Philips).

A unique feature of the Toronto trial will be that four of the subscribers taking part will send and receive their telephone conversations on a single bi-directional fibre instead of the normal pair of fibres, though they will not be aware of this.

Light emitting diodes are being used in the Toronto work rather than lasers, since they are cheaper and are likely to remain cheaper for at least the next ten years. It is expected that the multiplexing of the analogue telephone carrier operating at 32 kHz and at 76 kHz, together with push-button signals in the 300 Hz to 3 kHz frequency range and the video signal at 5.75 MHz to 11.75 MHz will effectively demonstrate the broadband performance of the optical system. The subsequent use of digital signals will be much less demanding on the optical fibre system.

The 1.2 km feeder cable contains twelve graded index fibres, each contained in a helically-slotted polythene outer core surrounded by a stranded inner steel core which provides the tensile strength. The outside diameter is 11 mm. Special fibre cable-splice closures were provided by Northern Telecom who performed the fusion splicing operation. The service entrance or drop cable to each customer contains two,

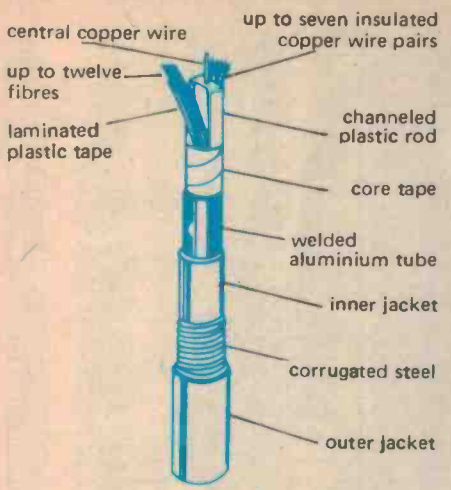


Fig. 3. **An optical fibre cable produced by General Cable Corporation of New Jersey.**

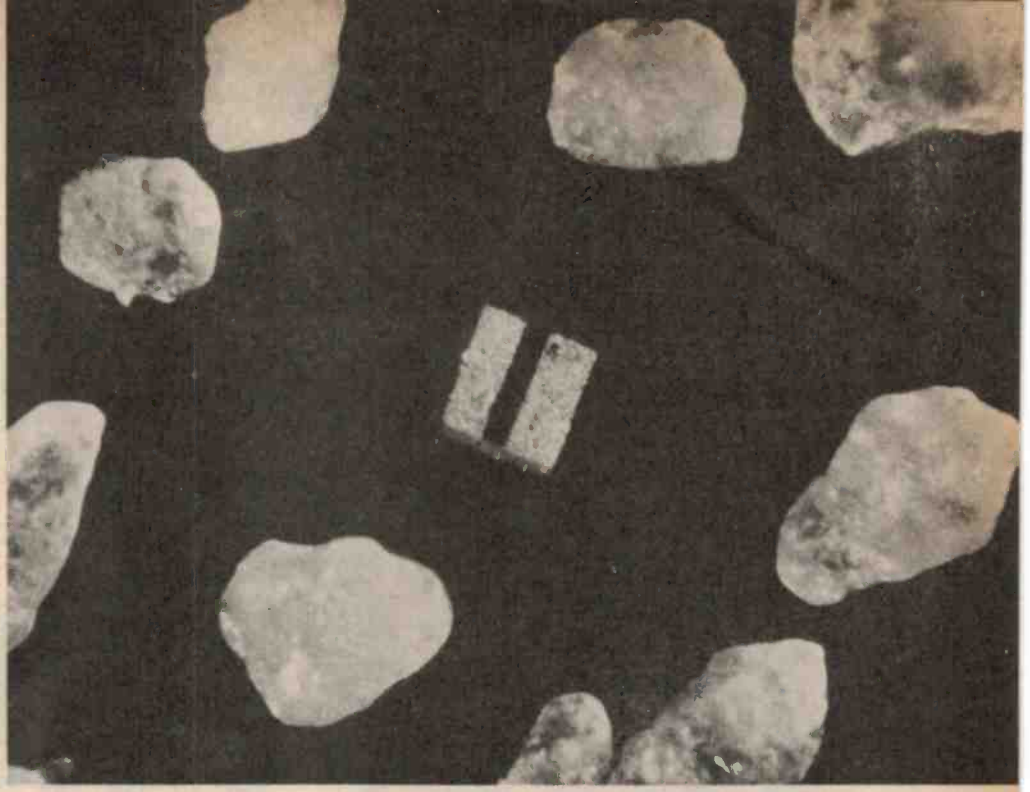
graded index fibres loosely contained in an aluminium/polythéne laminate sheath. These service cables are buried from each household to the manholes where they are spliced to the fibre optic feeder cables.

Specially designed customer terminals contain optical multiplex, optical transmitter/receiver, alarm systems, analogue carrier and a video converter amplifier. Power is obtained from the local electrical mains. Voice signals reach the customer's terminal as 76 kHz amplitude modulated carriers, whilst the ringing tone consists of a 20 Hz modulation of the 76 kHz carrier. The distant end sends a 32 kHz modulated carrier. The engaged condition is indicated by the presence of this carrier. Dial pulses interrupt the carrier from the subscriber; alternatively in-band push-button signalling can be employed.

The conventional copper loop facility to each customer served by the optical fibre is being maintained. If the optical system fails or if a power failure occurs, the conventional system will be switched back into service. Automatic restoration to the optical fibre will occur after a power failure.

Each facility is designed to carry a telephone channel together with the facility of a centrally switched one-way video channel from the central office to the customer with an associated low-speed data channel from the subscriber for video channel selection. This video facility will enable cable television or other video services to be added in due course.

This Toronto trial was inaugurated by a trans-Atlantic demonstration of a Confravision call. Confravision is a service offered by the British Post Office in which groups of people in two or three distant places are connected by video and audio links using studios



A photomicrograph of a semiconductor laser surrounded by some grains of sand (Picture courtesy Philips).

developed for the purpose by the Post Office. The video display is normally in monochrome using a 625-line display unit similar to a television receiver. The service is designed mainly to appeal to businessmen who wish to hold conferences without having to travel large distances.

The Confravision call between London and Toronto was the first trans-Atlantic video link to originate and terminate over optical fibres and the first colour Confravision link. The signals from London were passed through a 1.7 km optical fibre link to the Post Office Tower and hence to the Goonhilly earth station which transmitted them to an Intelsat satellite over the Atlantic Ocean.

This Confravision link took place exactly 77 years to the day after Marconi sent the first telegraph message across the Atlantic!

In the London studio Sir William Barlow, Chairman of the Post Office, was accompanied by the President of Bell Canada and three others, whilst in Toronto the Chairman of Bell Canada, Mr. A. Jean de Grandpré was accompanied by three others. They held a face-to-face discussion.

Conclusions

The use of optical fibres in telephone networks will undoubtedly increase rapidly in the coming years because a small diameter cable can carry many simultaneous calls. The writer feels that they may well make it possible for economical video and audio links to be made between subscribers over relatively short distances, but the wide bandwidth required for video links may make them prohibitively expensive for long distance calls for many years to come.

A single video link between two distant cities will require as much of the available bandwidth as rather more than a thousand telephone calls. Would you be willing to pay about a thousand times the cost of a normal telephone call for a video link?

This would not apply over short distances where optical fibres from a local exchange run to individual homes.

Interesting new developments include a Thomson-CSF diode which can serve both as an infra-red emitter and as an avalanche photodiode; known as EROS (Emitter/Receiver for Optical Systems), this gallium arsenide diode can operate at data rates of up to 30 Mbits/s and will simplify communications along a single optical fibre. A recent development from Bell Telephone Laboratories enables a subscriber's equipment to be powered completely by the light reaching it through a fibre optic link. The main problem is that of providing enough power to operate the ringing system, a highly efficient detector is required for this purpose. ●

DIODES/ZENERS

QTY.				
	1N914	100v	10mA	.05
	1N4005	600v	1A	.08
	1N4007	1000v	1A	.15
	1N4148	75v	10mA	.05
	1N4733	5.1v	1 W Zenner	.25
	1N4749	24v	1W	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25
	1N5349	12v	3W	.25

SOCKETS/BRIDGES

QTY.					
	8-pin	pcb	.16	ww	.35
	14-pin	pcb	.20	ww	.40
	16-pin	pcb	.25	ww	.45
	18-pin	pcb	.30	ww	.95
	20-pin	pcb	.35	ww	1.05
	22-pin	pcb	.40	ww	1.15
	24-pin	pcb	.45	ww	1.25
	28-pin	pcb	.50	ww	1.35
	40-pin	pcb	.55	ww	1.45
	Molex pins .01		To-3 Sockets		.35
	2 Amp Bridge		100-prv		.95
	25 Amp Bridge		200-prv		1.50

TRANSISTORS, LEDS, etc.

QTY.			
	2N2222M	(2N2222 Plastic .10)	.15
	2N2222A		.19
	2N2907A	PNP	.19
	2N3906	PNP (Plastic)	.19
	2N3904	NPN (Plastic)	.19
	2N3054	NPN	.55
	2N3055	NPN 15A 60v	.60
	T1P125	PNP Darlington	1.95
	LED Green,	Red, Clear, Yellow	.19
	D.L.747	7 seg 5/8" High com-anode	1.95
	MAN72	7 seg com-anode (Red)	1.25
	MAN3610	7 seg com-anode (Orange)	1.25
	MAN82A	7 seg com-anode (Yellow)	1.25
	MAN74	7 seg com-cathode (Red)	1.50
	FND359	7 seg com-cathode (Red)	1.25

9000 SERIES

QTY.		QTY.	
9301	.85	9322	.65
9309	.50	9601	.30
		9602	.45

MICRO's, RAMS, CPU's, E-PROMS

QTY.	
8T13	2.50
8T23	2.50
8T24	3.00
8T97	1.75
74S188	3.00
1488	1.25
1489	1.25
1702A	4.50
AM 9050	4.00
ICM 7207	6.95
ICM 7208	13.95
MPS 6520	10.00
MM 5314	4.00
MM 5316	4.50
MM 5387	3.50
MM 5369	2.95
TR 1602B	3.95
UPD 414	4.95
Z 80 A	22.50
Z 80	17.50
Z 80 P10	10.50
2102	1.45
2102L	1.75
2107B-4	4.95
2114	9.50
2513	6.25
2708	11.50
2716 D.S.	34.00
2716 (5v)	69.00
2758 (5v)	26.95
3242	10.50
4116	11.50
6800	13.95
6850	7.95
8080	7.50
8085	22.50
8212	2.75
8214	4.95
8216	3.50
8224	4.25
8228	6.00
8251	7.50
8253	18.50
8255	8.50
TMS 4044	9.95

C MOS

QTY.		QTY.		QTY.		QTY.	
4000	.15	4017	.75	4034	2.45	4069/74C04	.45
4001	.20	4018	.75	4035	.75	4071	.25
4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
				4066	.75	74C151	2.50

– T T L –

4.1.79

QTY.		QTY.		QTY.		QTY.	
7400	.20	7492	.45	74H20	.25	74LS76	70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.80	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	1.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.95
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.35	74LS51	.75		
7490	.55	74H11	.25	74LS74	.95		
7491	.70	74H15	.45	74LS75	1.20		

I^2L, LINEARS, REGULATORS, ETC.

QTY.		QTY.		QTY.	
MCT2	.95	LM320K24	1.65	LM373	3.95
8038	3.95	LM320T5	1.65	LM377	3.95
LM201	.75	LM320T12	1.65	78L05	.75
LM301	.45	LM320T15	1.65	78L12	.75
LM308	.65	LM323K	5.95	78L15	.75
LM309H	.85	LM324	1.25	78M05	.75
LM309 (340K-5)	1.50	LM339	.75	LM380 (8-14 Pin)	1.19
LM310	.85	7805 (340T5)	1.15	LM709 (8-14 Pin)	.45
LM311 (8-14 Pin)	.75	LM340T12	.95	LM711	.45
LM318	1.50	LM340T15	.95	LM723	.40
LM320H6	.79	LM340T18	.95	LM725	2.50
LM320H15	.79	LM340T24	.95	LM739	1.50
LM320H24	.79	LM340K12	1.25	LM741 (8-14)	.45
7905 (LM320K5)	1.65	LM340K15	1.25	LM747	1.10
LM320K12	1.65	LM340K18	1.25	LM1307	1.75
LM320K15	1.65	LM340K24	1.25	LM1458	.65
				LM3900	.95
				LM75451	.65
				NE555	.45
				NE556	.85
				NE565	1.15
				NE566	1.25
				NE567	.95
				TA7205	6.95
				76477	2.95
				95H90	9.95

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2SA 483	7.00	2SC 784	0.52	2SC 1550	1.65	HA1306W	4.44
2SA 484	3.91	2SC 789	1.84	2SC 1624	1.89	HA1322	02
2SA 493	0.78	2SC 799	9.89	2SC 1628	1.70	HA1342AR	4.58
2SA 495	0.44	2SC 815	0.73	2SC 1669	2.36	HA1452W	2.90
2SA 496	1.24	2SC 828	0.30	2SC 1674	0.49	SAS560S	5.32
2SA 550	1.30	2SC 829	0.32	2SC 1675	0.37	SAS570S	5.32
2SA 562	0.52	2SC 839	0.40	2SC 1678	2.48	TBA810SH	4.14
2SA 564	0.40	2SC 840	3.11	2SC 1728	1.42	M5115AP	7.59
2SA 606	3.44	2SC 867	12.07	2SC 1760	1.39	M5152L	2.08
2SA 607	3.92	2SC 897	5.48	2SC 1909	4.14	M5153P	8.40
2SA 634	1.28	2SC 930	0.39	2SC 1951	4.42	M51513L	3.54
2SA 640	0.64	2SC 933	0.43	2SC 1957	0.98	M51515L	6.67
2SA 671	1.87	2SC 945	0.28	2SC 1964	0.25	M51841P	3.30
2SA 673	0.56	2SC 959	2.32	2SC 1969	6.90	M5320P	1.03
2SA 678	0.84	2SC 960	2.72	2SC 1974	2.76	M53273P	1.84
2SA 683	0.72	2SC 973	32.20	2SC 1975	2.95	M53274P	1.84
2SA 684	0.73	2SC 995	2.72	2SC 2028	1.27	M53393P	5.98
2SA 697	0.78	2SC 1000	0.46	2SC 2029	2.40	UPC554C	2.95
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The exciting challenge of shortwave DX listening

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Bob Padula

OVER THE PAST couple of years there has been a tremendous upsurge in shortwave listening all over the world. Clearly, this has been due to the ready availability of general coverage, high quality communications receivers at affordable prices.

The choice of receivers is almost unlimited, depending on the user's personal hobby taste and the purpose of his listening. For the person wanting to keep in touch with the home country, or someone who wants to hear the latest in African musical presentations, there are many receivers available offering good audio quality.

For the more discriminating listener, wishing to explore frequency usage or changing propagation patterns and who wishes to make a systematic study of selected aspects of long distance radio transmissions, a whole array of interesting receivers is available. It is this aspect of the hobby that I would like to discuss in this present article, under the general heading of "DXing", and to offer some guidelines for newcomers compared with the rather limited scope that ordinary "shortwave listening" provides.

DXing has been defined as the "scientific study of international and long distance radio broadcasting" where systematic monitoring is the key to success. With this must be included the most important aspect: Verification collecting (QSLing) which is part and parcel of DXing, whether on shortwave, medium wave, or whatever. ▶

SWLing is, essentially, the practice of tuning in to overseas shortwave stations primarily for the message content or entertainment value. This may be for news events, political reports, music, or simply to have a background scene that is somewhat different to that available from local mediumwave commercial broadcasters.

Aims of the DXer

Most serious DXers have a dual objective. Firstly, they have invariably chosen to specialize in a particular area or areas of DXing, such as Africa, Latin America, or the USSR. In recent years, DXing Indonesia has become very popular as well. Other DXers concentrate on systematic study of the international bands, on the lookout for new frequencies, changed scheduling, new stations, unusual propagation patterns and non-standard transmissions. Many DXers specializing in this form of DXing are often invited to assess the quality and effectiveness of existing frequency allocations and to offer suggestions for improvement.

DXers generally have a deep involvement with QSL collecting for whatever area of the hobby interests them most.

A QSL is a letter, card, or other communication from the station acknowledging reception of the DXer's reception report, confirming the correctness of the information given in such a way that the DXer knows that it was indeed the station heard. The practice derives from the very birth of radio and is analogous to the exchange of QSLs between amateur radio operators who have maintained the tradition from the early 1900's to the present.

Many hobbyists have developed quite remarkable skills in the recognition of languages and language patterns, which serves them well if they have the opportunity of overseas travel. The art of reception report writing is important, where fluency and accuracy on the part of the DXer becomes essential and many DXers are able to write reception reports in a variety of languages.

Most DXers have as their primary aim the systematic collection of QSLs from as many different countries as possible – the top DXers in most clubs have verified over 200 countries on shortwave. Other DXers move into the specialized areas of QSLing as many different stations as possible, or obtaining QSLs from as many different operating frequencies for chosen broadcasters.

Strict reporting guidelines exist, developed by the DX clubs, for reception reporting for QSLs and substandard or inaccurate reports are both undesirable and generally rejected by stations receiving them.

Many DX clubs issue comprehensive report writing kits to their members on joining, as does the ARDXC.

Equipment

Many newcomers believe that by rushing out and buying the biggest and most expensive set available they can become top DXers overnight.

Not so!

Most of today's top DXers made their way through a variety of receivers, often starting with a very simple shortwave portable such as those available through chain stores.

My own involvement with radio began as a schoolboy building first, a crystal set then a one tube regenerative set, then a two valve set, eventually graduating to a multi-band, multi-tube communications receiver, home built.

RECEPTION PATTERNS

NEW DXERS generally find that the annual reception patterns in their location are difficult to understand. I found trouble in this area when I first became interested in DXing and I would like now to summarize what you may be able to expect if resident in the eastern Australian States.

SUMMER

Low frequency DX in the evening is often spoilt by high night-time noise levels, due to thunderstorm activity in the tropical regions. Despite this however, some good DX on 3 MHz and 5MHz is often available from Asian stations, particularly the Indonesians.

The late afternoons give good chances for the long-path DX from Europe, on the frequencies below 12 MHz, which are audible until as late as 1100 GMT on 25 metres.

During the day, there is often observed what we term the "Midday Asian" propagation mode, allowing Asian reception around local noon on the 25, 31, and 41 metre bands. The high frequency bands during the day are usually confined to Pacific based stations.

In the night though, the high frequencies generally give good DX from Europe and the Middle East. Some African signals can be heard on the 60 metre band prior to local dawn. Latin American signals on the 60 metre band are unreliable at this time of year, though occasionally some may be heard around 1000-1200 GMT.

AUTUMN

By the end of March, band conditions have started to show the signs of winter! Brazilian signals start to become audible late in February at around 0800-1000 GMT on 49 metres and African stations on 60 metres appear in our mornings from before dawn until about 2100 GMT.

Latin American signals are audible from around 0800 GMT on 49 and 60 metres. During March-April, daytime conditions improve, particularly for the 25 metre band, with the first of the Europeans starting to show up in our early afternoon, around 0200 GMT. Brazilian stations are often audible in this band from about 2100 GMT right through to their sign-off at 0200 GMT (0300 GMT). Strong European stations are heard from around 1600 GMT on the 49, 41, and 31 metre bands.

SPRING

By late September, the daytime reception peak has passed, with little DX activity around local noon. European signals start to hang on later in our afternoons, due to the later sunrise in Europe, and the high frequencies start to improve during our evenings. The Latin American signals in our evenings start to decrease as do the Africans in the breakfast period. Asian DX at night starts to come in well, on 60 and 49 metres after 1000 GMT.

By late November, we're well into the summer period, and the cycle once more repeats.

Obviously, this is only a very superficial look at a complex situation, variations will occur. For instance, in New South Wales and Queensland, much better Latin American DX is noted throughout the year, as compared with Victoria or Tasmania, on the LF bands. However, the southern States have the edge for winter DX during the day, particularly for the morning Brazilian openings on 60 and 49 metres observed around 2100-0000 GMT.

WINTER

Winter is traditionally regarded as the DX season! Around the June solstice (mid-winter's day) signals from Europe are often audible on the 49 metre band at our local noon, and this band is open for the full 24 hours. Latin American stations on 60 metres fade in at around 0500 GMT. African stations on the same band are heard until 2300 GMT and even later, and longpath African DX is available on 60 metres in the 0500-0700 GMT period.

High frequency DX at night can be good, during the high sunspot years. Asian reception on the low frequencies at night during our winter is not normally possible until late in the evening. On good nights this band is often full of Latin American signals carrying their local morning programs.

Over in the West, DXers hear Latin American signals on 60 metres around the 2300-0100 GMT period, with these signals propagating over the Atlantic and Middle East. However, Latin American DX in WA during the evening is not as good as in the Eastern States. African DX in the mornings in the West is considerably better than in the east, due to the shorter transmission paths.

By the way, get hold of a World Globe for checking out propagation routes – every good DXer must have one nearby!

As with any hobby, one must start out at the beginning, and work gradually upwards, so that progressive involvement and experience can be acquired. My advice to aspiring DXers is to get hold of a secondhand valve-type communications set such as the Lafayette HE230, or a Trio 9R series. These are frequently available for around $100 or so via the "For Sale" adverts (see Mini-Mart).

Learn how to operate this sort of set and just see what it can do. Then perhaps, you can start to think about a new, better class receiver, such as one having digital readout.

Many folk these days go out and spend $500 or so on a fancy receiver — bring it home — dial up a frequency, and then wonder why the station can't be heard! There's more to DXing than that, believe me.

By commencing with a simple receiver the new DXer can learn much more about the characteristics of propagation and reception patterns, a basic requirement for really getting into DXing seriously. Without this sort of knowledge, a DXer find himself very limited — he knows very little about *why* a particular area of the world can be heard and even less about *when* a given frequency can be expected to become audible.

The first thing that the newcomer should examine is the normal *daytime*, reception pattern that exists at his or her location.

We'll assume that you've connected up some sort of antenna — this can be very simple, such as a single wire as high above the ground as possible and about 20-30 metres long. You don't need elaborate or fancy gear, an ordinary piece of plastic covered multi-strand hook up wire is all that is necessary (see article on page 85 of the June '78 issue).

We'll also assume that you're listening around the middle of the day from somewhere in eastern Australia. Don't worry too much about the lower frequencies as there isn't much to be heard there at that time of day.

First of all you've got to be able to recognize where the main international shortwave bands lie on the dial of your set and you've got to be able to retune to those bands.

Frequency measurement

Let's have a look at the band allocations for a start:

11 metres: 25 600-26 100 kHz;
13 metres: 21 450-21 750 kHz;
16 metres: 17 700-17 900 kHz;
19 metres: 15 100-15 450 kHz;
25 metres: 11 700-11 975 kHz;
31 metres: 9500-9775 kHz;
41 metres: 7100-7300 kHz;
49 metres: 5950-6200 kHz.

These Bands are those officially recognized for International Broadcasting at the present time. Most international station transmissions occur within these particular bands, although some out-of-band stations exist. These 'OOB' channels may be used by broadcasters on a non-interference basis. Most are on frequencies allocated to the Fixed Services (international radiotelephone traffic, links to relay stations etc).

Now, for our initial test! You should remember that the higher frequencies propagate best when there is daylight between the transmitter and receiver. At night, the lower frequencies give best signals. This is a very broad generalization and depends on sunspot activity, the listener's location, transmitter power, antenna efficiency (at the transmitter and receiver) and modulation index.

For our purposes, we'll look at daytime reception, say, on the 19 metre band, and assume a location near to Melbourne. Let's assume that it's around noon local time (that's 0200 GMT) — you'll have to get used to talking and thinking in GMT, no matter what time zone is used at your location!

Draw a chart and hang it up near your radio showing the conversion from your local time to GMT; all international broadcasters use GMT, both on the air and in their printed schedules. You may also hear the term "Universal Time" given — this is the new standard which is the same, really, as GMT.

You should now try to locate the 19 metre band. Within this band will be found the daytime services of the Australian Broadcasting Commission beamed to outback areas of the continent. One of these uses 15 230 kHz, and comes on the air at 2230 GMT. It carries the programmes originating in Melbourne over 2LO or 3AR. It is easily heard within the Eastern States throughout the day, and can be regarded as a marker station for DXing purposes.

Towards the low frequency end of the 19 metre band is found the Radio Australia service on 15 160 kHz, originating in Lyndhurst, Victoria which comes on at 2100 GMT and goes through until 0700 GMT. This is beamed to the Pacific Islands and is reasonably well heard in the Eastern States. It has English programming, except between 0000-0100 GMT and 0400-0500 GMT when French is carried.

This sort of approach works just the same with the other bands. Make a study of the bands at your location, identify those stations that are audible at the same time each day and work out their operating frequencies. Pick stations at the centre and at each end of the band. These then become marker stations for those bands. Practice locating these stations first of all, then go ahead and find the various stations in between.

To do this takes a little time and effort, but it's well worth it. If you can understand the dial and its operations on your receiver you should be able to work out, even approximately, the frequencies of the strongest stations. As these will undoubtedly be in English, announcements over the air will give you further clues to the exact transmission frequencies. Even with very simple equipment, with virtually no detailed dial markings, one can do useful DX work by adopting this approach using marker stations. It works well when away from home, too, where the reception pattern is quite different.

— to be continued.

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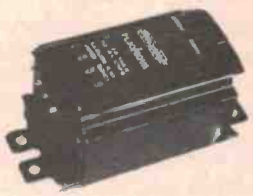

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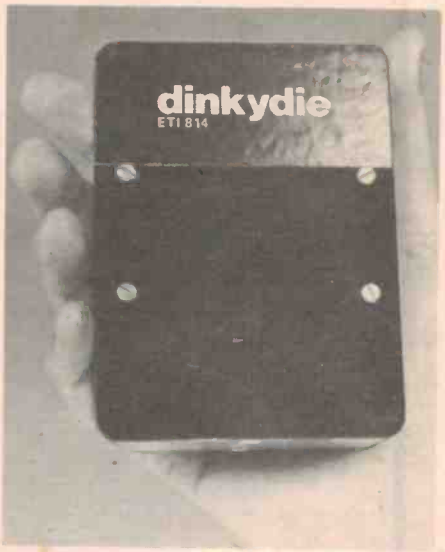
Project 814

THE 'DINKY-DIE'

Jonathan Scott

A single dice (die), fully electronic, featuring 'touch-throw' operation and a battery-saver circuit. Fun to build and fun to use it should make a novel addition to any game requiring a dice to determine players' turns.



FED UP WITH shaking rattling and rolling that boring set of wooden dice? Need something to brighten up that game of which the kids have grown tired?

We've spent some time designing this little project — an example of just how difficult it can sometimes be to get something 'just right': As few components as possible, all the desirable features, no obscure parts and nice low price for the constructor.

Operation couldn't be simpler: To 'throw' the dice, touch two fingers across one set of screw heads seen either side of the front panel in the picture here. Your 'throw' then appears in a dice pattern on the LEDs behind the perspex.

To throw again, touch the pair of screw heads once more.

If you leave the dice 'un-thrown' for a few seconds, the display fades and the circuit switches itself off, drawing only a miniscule current in its quiescent state.

When we took the Dinkydie along to the Home Computer Show in Sydney recently, it drew more attention than many of the main exhibits!

We built our dice into a locally-made box, as shown at right. If desired, you may devise your own layout, but we recommend you use the pc board.

The pc board has been designed to fit neatly in a small Horwood case. The top of the case was not used and a piece of transparent dark red perspex purchased and cut to sit on top of the case. The Horwood boxes are available from several outlets (such as Radio Despatch Service in Sydney or All Electronic Components in Melbourne). The perspex can be obtained from most plastics retailers. In Sydney, FX Plastics, Auto Sport or Blacktown Plastics (see the 'phone book) should be able to supply it.

The perspex is supplied with a protective paper covering. This should be left on until all drilling and cutting has been completed to prevent scratching. If the perspex does get scratched 'Brasso' or toothpaste will remove it with some hard rubbing.

The holes for the bolt touch contacts are drilled using the pc board as a template. Once the perspex has been cut and drilled, all the case drilling is complete!

The perspex is held in place on the end of the box with contact adhesive or epoxy cement.

Mount all the components on the board, placing the LEDs last. These should be spaced off the pc board by about 3 mm so to ensure that they are the highest components. If the bolts are level no spacers are needed as they can be tightened just enough to hold the LEDs hard against the perspex. If you wish, a piece of block cardboard may be cut to cover the other components to obscure the pc board.

Once the pc board is assembled the battery clip and battery may be connected and the device tested. Once bolted in the nuts on the underside of the board should be quickly soldered to the pads to ensure good contact. To complete the assembly the bottom of the case can be screwed in, and the battery jammed in place with a small piece of foam rubber or styrofoam. (Use the bit the CMOS IC's came in perhaps). Finally, if you fear for the coffee table top, four adhesive rubber feet on the bottom would be a good idea!

This picture shows how the pc board is mounted behind the red perspex front panel. The LEDs should sit close to the perspex.

PARTS LIST - ETI 814

Resistors all ¼W, 5%

R1	2M7
R2	10k
R3	100k
R4	56k
R5	4k7
R6	270k
R7	10k
R8	4k7
R9–R11	270R
R12	330R

Capacitors

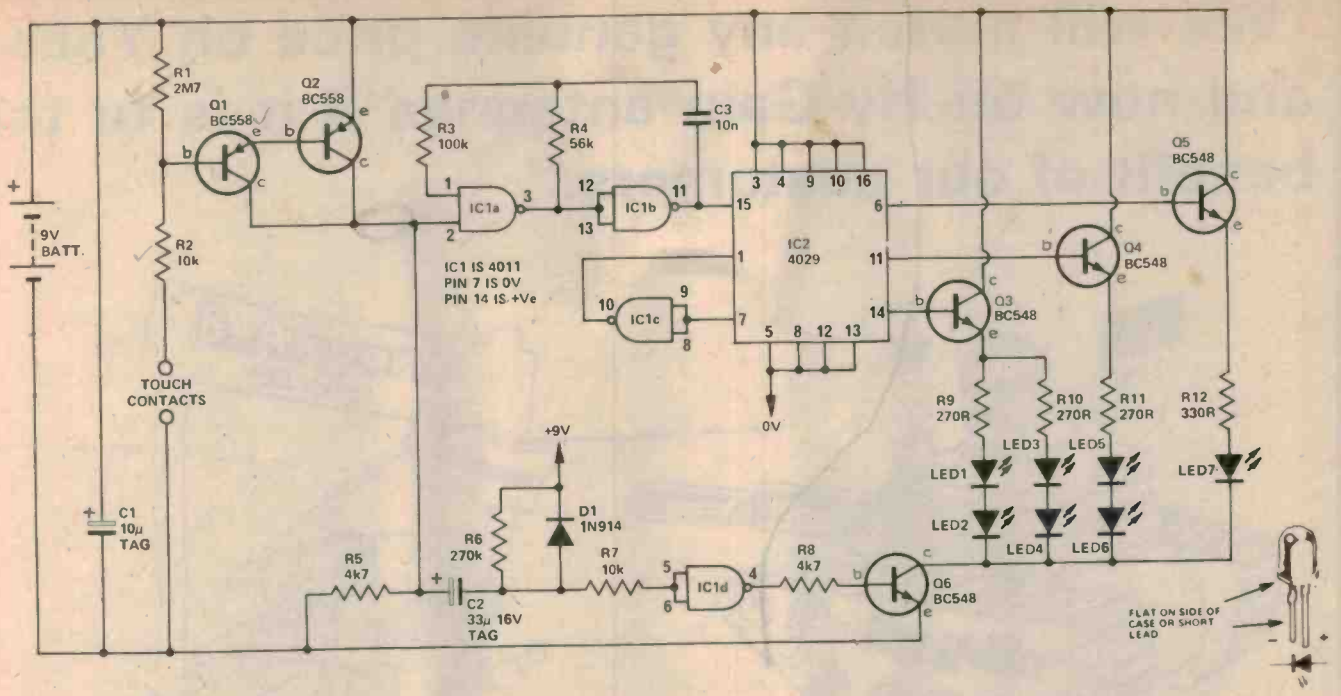
C1, C2	33µ 10V tant
C3	10n greencap

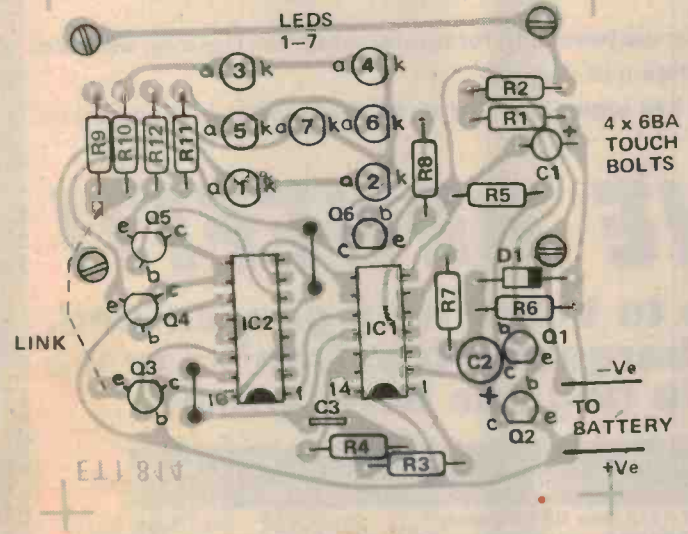
Semiconductors

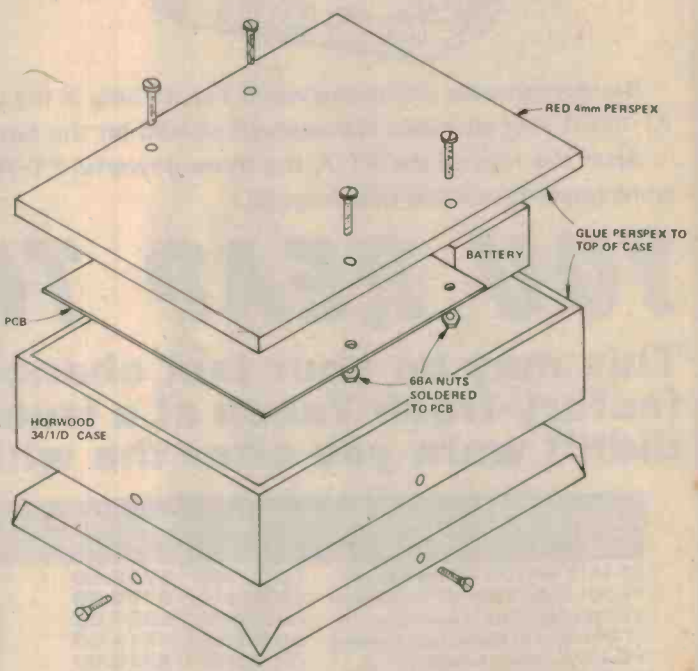
D1	1N914
LED1–LED7	Red LEDs, TIL220R, FLV112, etc.
Q1, Q2	BC558, DS558, BC178, etc.
Q3–Q6	BC548, DS548, BC108, etc.
IC1	4011B
IC2	4029B

Miscellaneous

Horwood case 34/1/D, No. 216 9V battery clip, glue, four 6BA nuts and 20 mm bolts, ETI 814 pc board.







The component overlay above shows placement of the components. The printed circuit pattern is reproduced on page 67. At right is an exploded view of the complete assembly indicating how the dice is secured in the Horwood box.

HOW IT WORKS – ETI 814

This device simulates a single dice 'die' electronically by illuminating LEDs in a die face pattern after you have held your fingers on two sensor contacts for a period to 'throw' the dice. The device operates by counting pulses from a free running astable multivibrator, hence the number finally displayed is defined by the duration of the touch.

As the quiescent current is well below 1uA, no power switch is used.

Initially, Q1 and Q2 are biased off. The astable multivibration, formed by IC1 a and b, is disabled and the display driver Q6 is also off. When the sensor contacts are touched, a small leakage current flows into the base of Q1/Q2, which form a Darlington pair, and the collectors go high.

This has two effects. Firstly, the astable multivibrator made up of two nand gates (IC1 a and b) is enabled and clocks the counter, IC2, at about 1 kHz. Secondly, C2 is discharged via D1, in preparation for initiating the display delay period. The duration of the touch defines the number which results, but the clock is sufficiently fast to prevent any form of cheating.

When the touch contacts are released the clock stops and the inputs of IC1 d are pulled low. The gate is connected as an inverter, and the output thus sources current to Q7 which enables the display by pulling the LED cathodes low. The contents of counter IC2 are thus displayed in die-face format by the LEDs. When C2 recharges to above the threshold of IC1 d via Q5 the display fades. Quiescent current is well below 1uA, so no power switch is required. The "all ones" state (i.e. 1111) is detected by the carry output and causes 1001 to be loaded by the parallel load input, IC1 c does the required logic inversion for the parallel load function.

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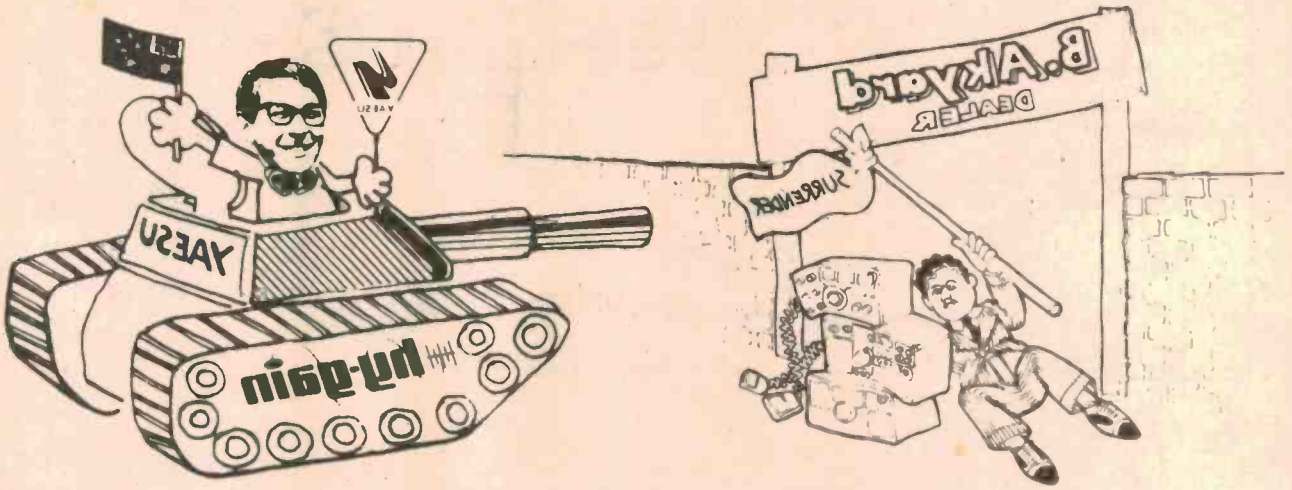

Reinforcements are on the way!! Yes, to help in the war we have sent for reinforcements. The long awaited FT-625R (6m all mode transceiver) should hit the beaches mid August.

After the loss of the FT-7, the more powerful FT-7B has joined the war to fill the gap for a good mobile transceiver (available mid August).

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FT-301 Solid State HF transceiver	Cat D-2870	**$795.00**	FT-901D Top class HF transceiver	Cat D-2854	**$1229.00**
FT-7B Mobile HF transceiver	Cat. D-2868	**$625.00**	FT-227RB 2m FM scanning transc.	Cat D-2891	**$379.00**
FT-227 2m FM transc with memory	Cat D-2890	**$319.00**	CPU-2500 computerised 2m transc.	Cat D-2889	**$549.00**
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Constructing a 'quad' antenna

Popular for 20 years, the quad antenna presents a number of mechanical difficulties to the intending constructor, particularly if a multi-band version is contemplated. However, an ingeniously designed, locally manufactured 'hub' — the heart of any well-built quad — solves the problems successfully. Construction of a 28 MHz quad is described as an example of the general technique.

ACCORDING TO acknowledged American antenna expert, William I. Orr, the quad antenna was sired by a team of his countrymen and born in Equador, high in the Andes mountains. The quad was developed to solve the antenna problems peculiar to the South American short-wave broadcast station HCJB. It did the job and the quad has fascinated amateurs and communications professionals alike ever since.

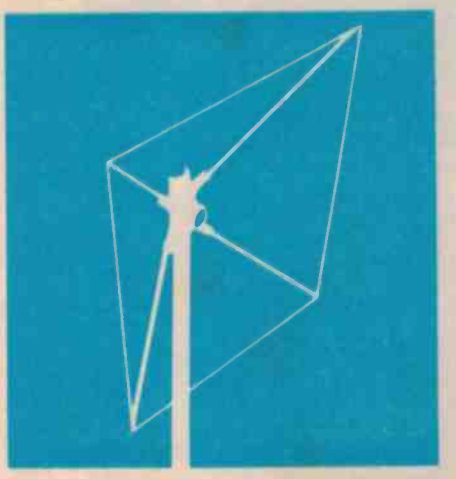
For the roll-your-own enthusiast however, the various methods of constructing and setting up a quad antenna has often brought both joy and headaches. But that's half the fascination of doing-it-yourself.

This article describes how a basic quad antenna is constructed and how it may be expanded into the various quad beam combinations – the cubical quad (a very popular beam), three element and four element quads.

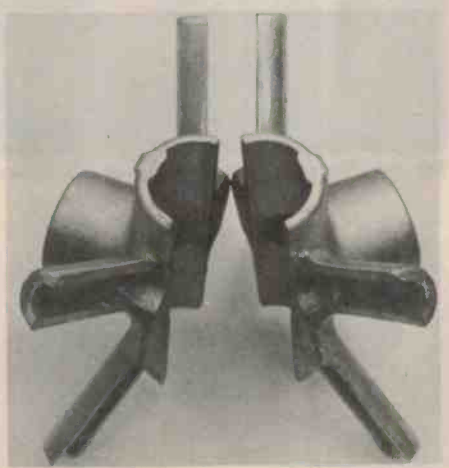
Construction is based around the "Bandit" quad 'spider hub' made by the Sydney firm of Ashpoint Pty Ltd. This aluminium casting considerably simplifies the whole operation. In fact it is possible to build a single quad loop antenna in under an hour and a cubical quad, a little longer.

The Bandit spider hub pieces are made from "corrosion resistant" grade aluminium. A boom-to-mast mounting bracket assembly is also available as an accessory.

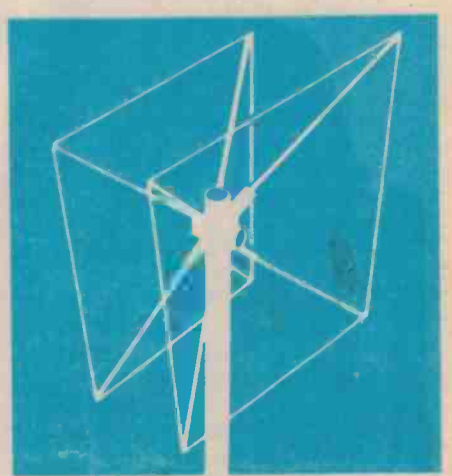
Each single hub piece has four short arms, each grooved to take a 19 mm diameter spreader arm. Wooden dowel or glass fibre rod (such as fishing rod blanks) are ideal. The spreaders are clamped into position with worm-drive hose clamps (such as those made by Utilux) available from garages and hardware stores. The hub piece has a groove ▶



The basic single quad loop antenna. Assembly is described in the article. It only requires one 'spider' hub piece.



Heart of the quad construction method illustrated here is the 'Bandit' quad spider hub as illustrated above.



A two element or 'cubical' quad beam consists of a single 'driven element' as above plus one complete loop mounted behind it. Two hubs are used.

along its length that fits to a standard 50 mm diameter pipe mast.

When the spreaders are mounted they project out at right angles to each other so that by stringing a wire to any four points on the spreaders, equidistant from the hubs, you end up with a square wire loop – a quad. The size of the quad loop is determined according to a particular formula so that the length of wire is very close to one complete wavelength at the frequency of operation.

The spider hub casting is so arranged that not only do the spreaders project at the correct angle to each other but a cubical quad can be constructed by putting two 'back-to-back' and the correct spacing between the two elements is automatically provided.

The Bandit hub also has a circular channel at right angles to the groove that clamps around the mast. This enables you to mount two, two element quads on a standard 50 mm diameter pipe boom to form a four element quad. The boom may then be clamped to a mast using the boom-to-mast mounting plate accessory resulting in a very strong minimum weight beam antenna.

The spider quad hub has the added advantage that it is extremely simple to add one or more quad loops concentrically on the spreaders for several frequency bands.

Quad construction using this method is almost foolproof. Certainly, most of the mechanical headaches are removed.

Once built, a cubical quad can be used as a portable antenna as it can be pulled apart easily and reconstructs in less than 20 minutes.

Single quad element

Items required:

- One single Bandit Universal Quad Hub with clamp plate bolts (see illustration)
- Two 8 mm (5/16 inch) by 38 mm long (1½ inch) bolts with nuts.
- Four lengths of 19 mm wooden dowel rod, 2.4 metres long.

(These are obtainable in this length from many hardware stores).

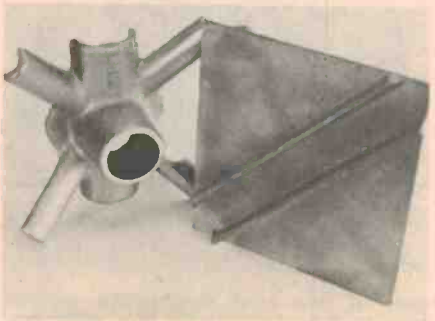
- Four worm-drive (Utilux or similar) hose clamps.
- Approximately 12 metres of 16 or 18 gauge copper wire.
- Two metres of 75 ohm RG59 coax.
- One PL259 plug.
- One S0239 double-female connector.
- Enough 50 ohm coax (RG8 or RG58) to run from your final antenna mounting position to your transceiver installation.
- 50 mm diameter pipe for mast.
- Nuts, bolts and sundry bits.
- Linseed oil or other wood-sealing compound.

First, gather together all the components and tools you will need to build your antenna.

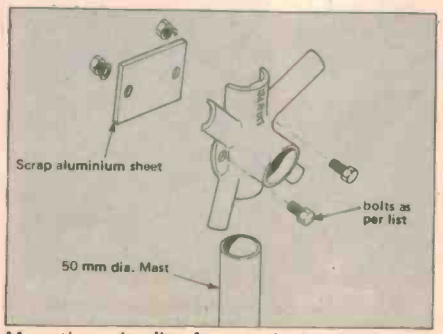
Cut the spreaders to length and weatherproof with Linseed oil or other sealer.

Secure each spreader with a hose clamp. Butt the end against the lug on the casting.

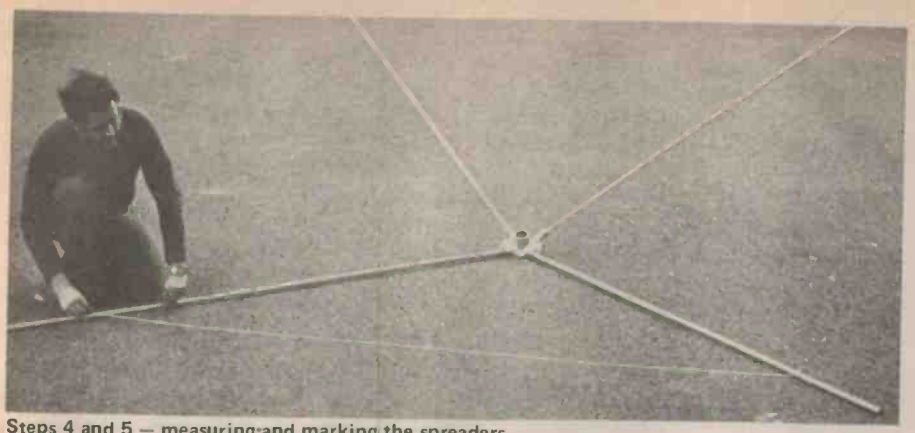
Securing the last spreader. The 'spider' is quite a size now!



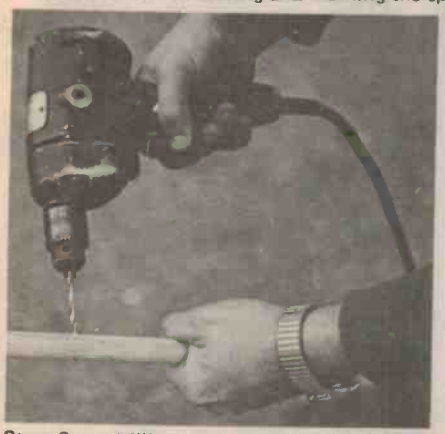
Single hub piece and the boom-to-mast mounting plate accessory for mounting



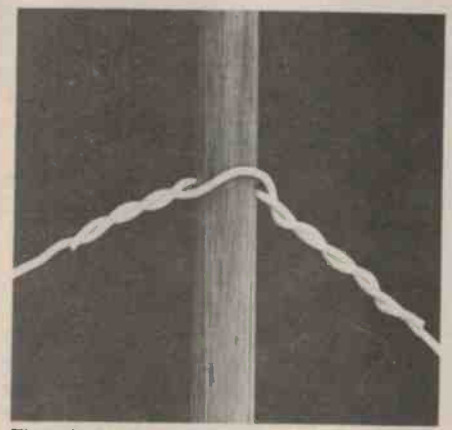
Mounting details for a single quad loop



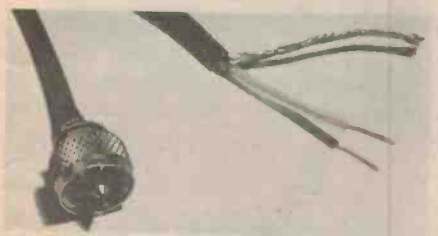
Steps 4 and 5 — measuring and marking the spreaders.



Step 6 — drilling the spreaders. Waterproof holes after drilling. This step is easier if you remove the spreaders first.

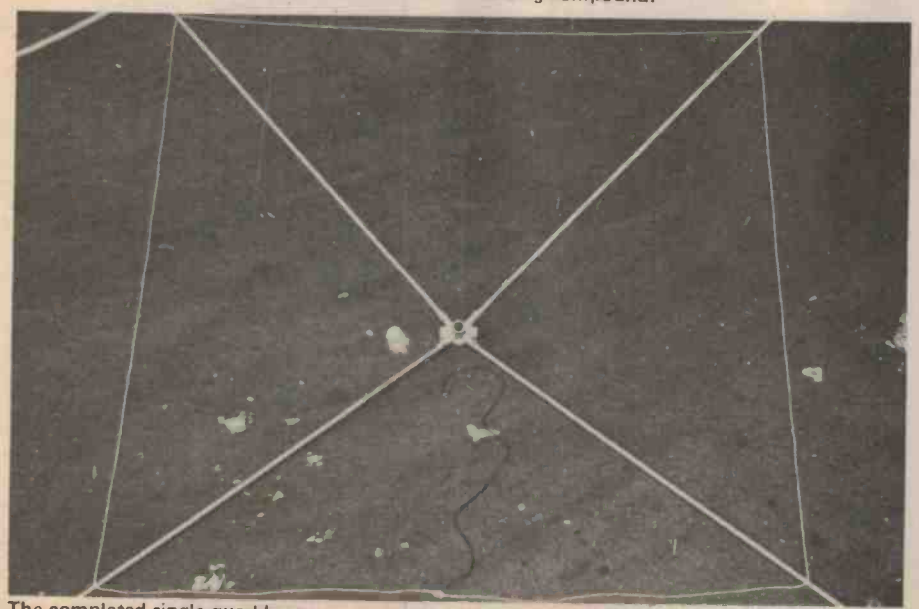


Thread wire through spreaders and tie lockwire across holes to prevent loop wire slipping. Solder in place after tuning the loop.



Install PL259 on one end of balun coax, cut to length and strip back other end 50 mm as shown above.

The balun is terminated at the egg insulator as per step 10 and sealed with 'Silastic' or similar sealing compound.

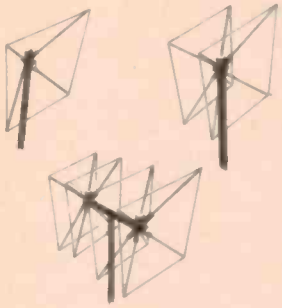


The completed single quad loop.

The length of wire recommended and the amount of RG59 coax (for matching balun) given, and mechanical dimensions, are for a 28 MHz antenna. Refer to the quad antenna handbook by William I. Orr for details on quad dimensions for other frequency bands.

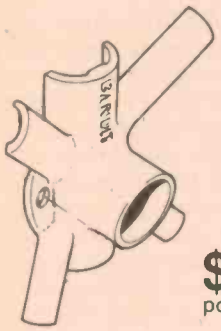
1. Cut the dowel spreaders to 2 m long.
2. Seal each of the spreaders against moisture and weather effects by painting thoroughly with linseed oil or other suitable wood preserving product.
3. Place each spreader in turn in an arm of the hub and secure with a hose clamp. The end of the spreader should butt up against the lug at the inner end of the hub arm as shown in the illustration. This ensures that the spreader will be held firmly.
4. When all the arms are secured, lay the assembly down so that two spreaders are flat on the ground.
5. Using string, tape or wire as a measure locate and mark a point on each spreader which is 2690 mm from a point on the adjacent arm. Measure the distance of each mark from the hub and, by averaging, determine and mark points on each of the spreaders which are equidistant from the hub and 2690 mm apart. (It's easier than it sounds).
6. Drill a 3 mm (1/8 inch) hole through each spreader at the point just determined. Soak with linseed (or whatever you are using) to waterproof the exposed wood. See illustration.
7. Decide which polarisation you want to use as this is determines where you place the coax termination in the loop. For horizontally polarized signals the termination is placed at the bottom (opposite the long axis of the hub), for vertical polarization it is placed on one side — opposite a hub bolt lug.
8. Terminate the square of wire by tying off the loop ends to a small egg insulator as shown in the accompanying illustration. Draw the wire fairly tight but not so tight as to distort the spreaders.
9. Now for the matching balun. Taking your length of RG59 75 ohm coax, put a PL259 connector on one end and then measure out (from the tip of the connector) 1790 mm of coax and cut it. Measure back 50 mm and, using a knife, remove the outer plastic sheath of the coax to expose the braid. Separate the braid and centre conductor.
10. Push this end of the balun through the two holes of the egg insulator and solder the coax braid and centre conductor to the two ends of the quad loop termination as shown. ▶

Are you into Quads yet?



BANDIT

UNIVERSAL QUAD ELEMENT HUB



$16 each post paid

The Bandit Universal Quad Element Hub is a single piece aluminium casting designed to locate a complete quad element.

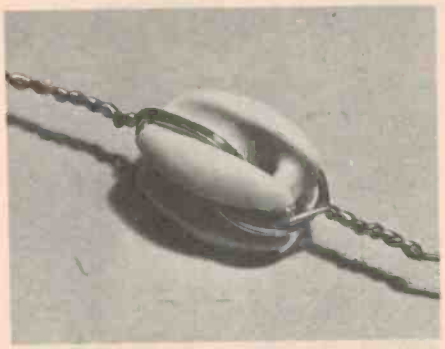
Use it by itself as a single element quad or use two back-to-back for a two, or multi-element, cubical quad style.

A two element cubical quad outperforms a three element Yagi beam.

Send a stamped, self addressed envelope for a free data sheet to:

ASHPOINT PTY. LIMITED
43 Moxon Road,
Punchbowl, NSW. 2196

11. The antenna is now more or less complete. Temporarily mount it on a mast at least six metres off the ground and well clear of any buildings etc. Connect it up to a rig and check the SWR. If any adjustment is needed, lengthen or shorten the loop. Small adjustments can be made by applying tension to the balun coax. If the SWR is below 1.8:1 you have no need to worry.



How to attach an egg insulator

The bandwidth of the quad is quite good and providing the SWR is below that recommended no adjustment is really necessary and will not result in any significant improvement.

It is a good idea to add a 'lockwire' where the quad wire passes through the spreader arm as shown in the picture on page 35. The spreaders of your quad assembly may be made of aluminium tubing to within 300 mm of where the quad loop wire passes through. The tips of the spreaders must be of a non-conducting material. Wood dowel may be forced down the end of aluminium spreaders, which is simple, cheap and effective. However, it should be treated as previously discussed to protect it from the effects of the weather.

Two element or 'cubical quad'

The assembly procedure is basically the same as for a single element quad loop, only two are made – one being a complete, closed wire loop. It is a 'parasitic' reflector and is not connected in any way with the 'driven' element, constructed as just described

This reflector element measures 2755 mm a side (a loop of wire 11 metres circumference).

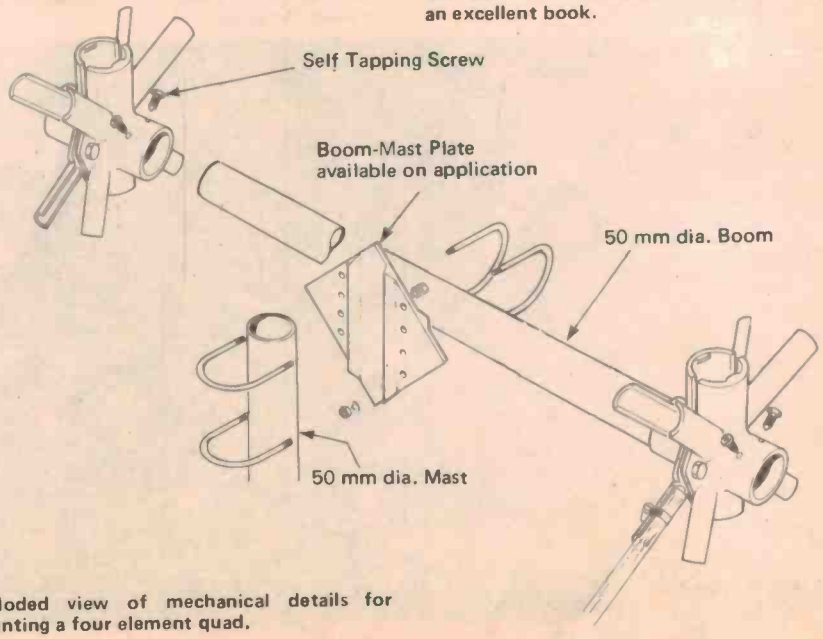
As the illustration shows, each element of the cubical quad, driven element and reflector, are each built on a single hub piece which then lock together around a 50 mm diameter mast.

The Bandit hub pieces are so designed that when a two element quad is constructed the spreaders are projected at precisely the correct angle to position the driven element and reflector at the optimum distance apart.

Multi-element arrays

To construct a three element quad, first make a two element cubical quad as just described. Then construct a single closed

For complete details on design, dimensions and especially tuning of quad antennas see 'All About Quad Antennas' by Bill Orr – an excellent book.



Exploded view of mechanical details for mounting a four element quad.

wire loop — to become the 'director' — measuring 2610 mm a side.

Mount the two element arrangement on a 50 mm diameter pipe boom and then place the director loop 1580 mm in front of the driven element.

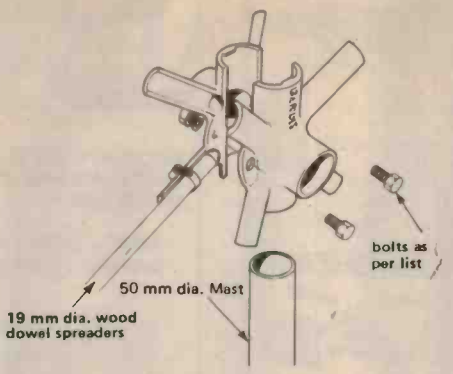
Mount the boom to your mast.

A four element quad is made in much the same fashion. However, the two directors (2610 mm a side) are made as for a two element quad, only complete closed wire loops are used of course.

The two assemblies are then mounted on a 50 mm diameter boom (refer to the illustrations) and the director nearest the driven element spaced about 1580 mm away.

Naturally, the quad antenna — in any of the forms described, will need to be rotated to gain optimum transmission and reception in the desired direction. The Single quad element and the cubical quad are quite light in weight and any of the light duty TV-type antenna rotators, such as the CD model AR22 (popular and inexpensive) should be more than adequate. Rotators are quite competitively priced these days so shop around.

The larger quad arrays will need a heavier duty rotator so buy accordingly.

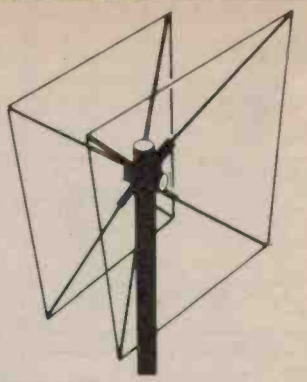


Exploded view of cubical quad mount.

Conclusion

That pretty well wraps up the basic construction of quad antennas. Performance really depends on how high you mount the structure, it should be well clear of nearby structures, trees etc — but that's worth another article in itself. The various amateur antenna handbooks give excellent advice on this subject. ●

This article was prepared with the assistance and cooperation of Michael Rychter of Ashpoint Pty Ltd.



OTHER BANDS

Approximate formulae for the quad loop lengths are:

Driven element = $\frac{30632}{f(MHz)}$ in cm

Reflector = $\frac{31394}{f(MHz)}$ in cm

Director = $\frac{29718}{f(MHz)}$ in cm

These give the approximate total length of the loop. For the length of loop between each spreader, divide by four.

TUNING

The parasitic elements may be tuned by means of a simple shorted stub inserted in the same place as the feedpoint in the driven element. Further details may be found in Bill Orr's book and the ARRL Antenna Book.

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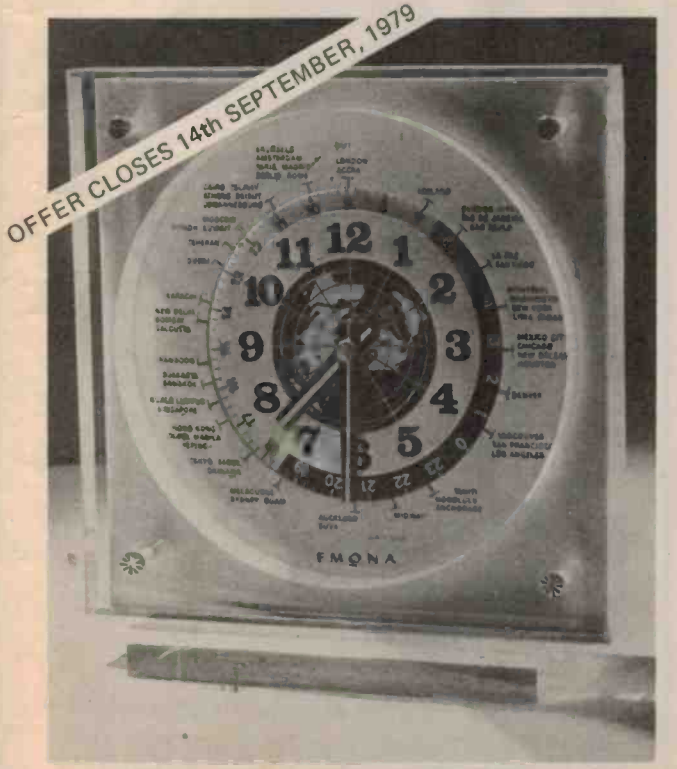

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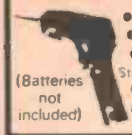

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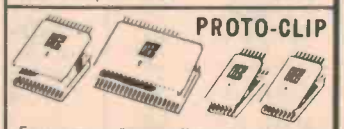
PROTO-CLIP



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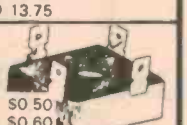

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Get going on radioteletype

For the avid communications enthusiast radioteletype — RTTY — can offer an extra 'fillip' to hobby pursuits. Radio amateurs have been exploring this communications mode increasingly in recent years as have a small band of shortwave enthusiasts. Join the gang — it's easier than you think!

Tom Moffat VK7TM

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THIS IS the first of a short series of articles covering the construction of a complete radioteletype system. Designed for easy home construction in self-completing stages, the project modules use commonly available components and will enable you to build a complete receiving and transmitting system, centred around the Teletype Corporation Model 15 machine readily available from surplus sources.

Construction is modular, so after each stage is finished you have something that works. Each succeeding stage allows the system to do more, until the system is complete. Modules to be described are a *demodulator, modulator with cassette interface, regenerator/speed converter, input filter,* and a *tuning oscilloscope.*

Ready? Lets get started.

The teleprinter is a clattering old bucket of bolts, or one of the finest machines ever devised by man — depending on your point of view!

They've been around for years, sending and receiving telegrams, churning out wire service news copy, and doing a myriad other jobs where it's necessary for written material to be sent from one place to another quickly.

As newer (quieter and faster) machines come into service, many old ones are finding their way into amateur hands. Most of these are Teletype Model 15s and Creed Model 7s. Although considered useless in commercial circles, these machines are ideal for two-way communication on the amateur bands, as well as a bit of eavesdropping on HF news and telex circuits. In Australia the teletype Model 15 is much more common than the Creed, so this series concentrates on the Teletype, although similar principles apply to the Creed.

The loop

The correct current to operate the selector magnets is around 60 mA. A quick Ohms law calculation will show that this current will flow with 12 volts across them. Many teletype converter construction articles show the magnets working from 12 V pulses, but it can be mathematically shown that this arrangement results in 40% distortion.

Here's why — the selector magnets are really two big inductors in series, and as we know, inductors oppose the flow of current. With 12 V applied it takes about 8 ms, or 40% of a pulse length, before the current builds up enough to close the magnets. The solution is to hit the magnets with a higher voltage so that the current builds up faster. But, a higher voltage causes more than 60 mA to flow, so a series resistor is required.

If a loop voltage of around 150 is used, the time for full current to build up in the selector magnets falls to around 1% of a pulse length. When the loop circuit first closes the full 150 V appears across the magnets because the inductor looks like an open circuit until current begins flowing. As current begins to flow the voltage across the magnets drops, the voltage across the series resistor then rises until a stable condition of 60 mA is reached. So, the loop voltage should be as high as possible. The limiting factor is the maximum voltage the switching transistor in the receiving converter will take. Voltage regulation is not important so a very simple loop supply circuit will suffice.

The transformer should be able to supply 60 mA continuously, and stay cold to the touch. The loop resistor will dissipate about 10 watts, so a resistor of about 2k5 ohms, 25 watts would be ideal. Some provision must be made for adjusting the resistance to set the loop current to 50 mA.

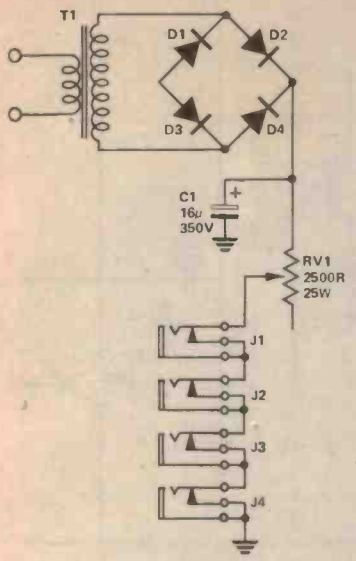
Once the machine is going, have a good fiddle with it, learn all its tricks. And perhaps now is a good time to learn to type!

Receiving converter

Now that you've got your teletype machine running on 'local loop' it's time to get it doing something useful, other than talking to itself. This section describes a receiving converter that takes the audio tones coming from a receiver and converts them into a series of dc pulses to drive the printer magnets.

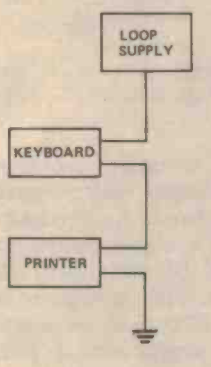
First, a look at the nature of the teletype signal:

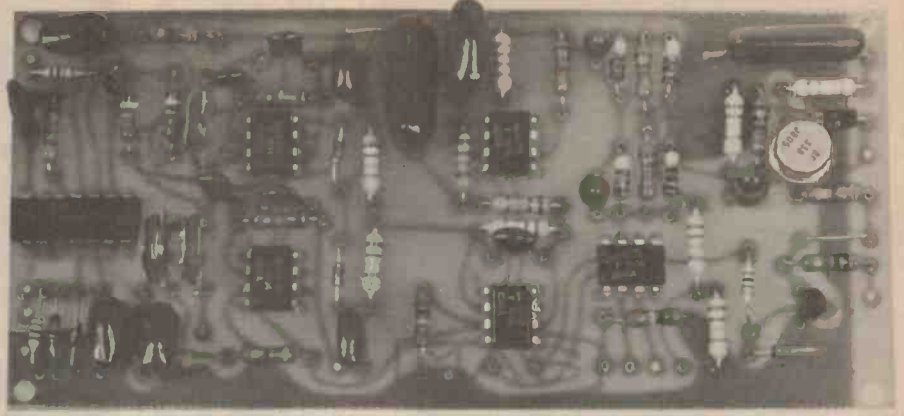
Pulses from the sending machine are arranged to frequency-shift key an HF transmitter so that during 'mark' a constant carrier of some frequency is transmitted. During 'space' the carrier swings higher or lower in frequency by an amount known as the 'shift'. Amateur stations normally transmit 170 Hz shift, and commercial stations transmit 440 or 850 Hz shift, although 170 Hz is sometimes seen. The narrower shifts are usually considered better as the two frequencies, being closer together, are less affected by selective fading. But, the equipment used to receive narrow shift must be more precise to pick one frequency out from the other.



LOOP SUPPLY

The transformer, T1, has a 125 Vac secondary rated at 250 mA. The diodes are 400 PIV types or a bridge. The jacks, J1 - 4, are shorting type 'phone jacks (insulated from case). To check out your machine, connect the 'bits' as shown below.





The completed RTTY decoder — this unit was constructed in the ETI lab. and tested with the kind assistance of Widge Lowe VK2ZWL. It compares very well with other popular units.

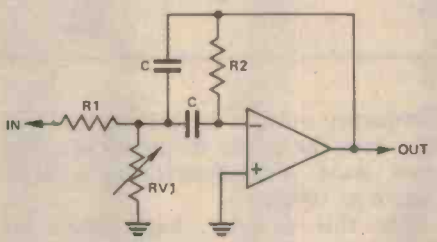


Figure 2: General circuit of the active filters used in the decoder.

This converter allows the copy of any shift from about 10 Hz to 1000 Hz, by simply setting a front panel control. It will operate alone, or as part of a more elaborate system. For stand-alone operation it needs a +12 and −12 volt supply, an audio input from an SSB receiver, and a connection into the loop supply. When used with the regenerator/speed converter to be described later, a jumper on the board is removed and logic-level signals are taken from the collector of Q1. The regenerated signals are fed back into the base of the loop switch transistor Q2. The converter gives a very good account of itself in received error-rate tests against some of the more popular 'ready-made' designs, mostly because of the type of filters used.

The filters

The received signal emerges from an SSB receiver as a pair of audio tones, by convention 2125 and 2295 Hz for 170 Hz shift. Either tone can represent the mark condition. In amateur RTTY service the mark tone is the higher one, although 'upside-down' signals are sometimes found. This converter can take them either way and squirt them out the right way around, selected by the flip of a switch.

Many older converter designs use passive filters, using toroidal inductors and capacitors, to detect the audio tones and turn them into dc voltages for the logic circuitry. Two problems arise. Once the filters are tuned there's no easy way to change their frequencies for different shifts. As well, they're ▶

THE TELETYPE MODEL 15

IF YOU'VE recently acquired a Model 15, chances are it's older than you are. Many were built during the second World War, so they've been in continuous use for nearly 40 years. But they were built to last, like a fine watch, and in amateur service they'll probably go another 40 years! Your Model 15 will probably be in going condition, although 'stiff' if it's been in storage any length of time.

To get the machine up and running, you'll need a 115 Vac supply for the motor (step-down transformer) and a loop supply, described elsewhere. Before applying power, make these few visual checks. First, the power cord. If it's rubber it's probably rotten. Replace it. There are probably two other cords with telephone plugs on them. Check their condition also.

Next, remove the machine cover by first pulling off the paper crank on the left hand side and lifting the case straight up. Check for any bits of string or wire used to hold the works in place during transport. Also check for any packing material that may be inside . . . one machine I know of had been packed in wood shavings, the innards were full of them, all nicely glued in place with oil!

Remove the typing unit by unscrewing the three or four large knurled screws holding it to the base. Lift it straight up and set it aside. Inspect the keyboard mechanism and motor assembly for foreign matter. When all looks well, replace the typing unit.

Make these electrical checks using an ohmmeter. Check across the power cord . . . it should show a few ohms resistance with the on/off switch (on the right side of the machine) on; it should look wide open with the switch off. Check each side of the power cord to the machine base. Any leakage foreshadows potential shocks, which the teletype is capable of delivering with considerable efficiency!

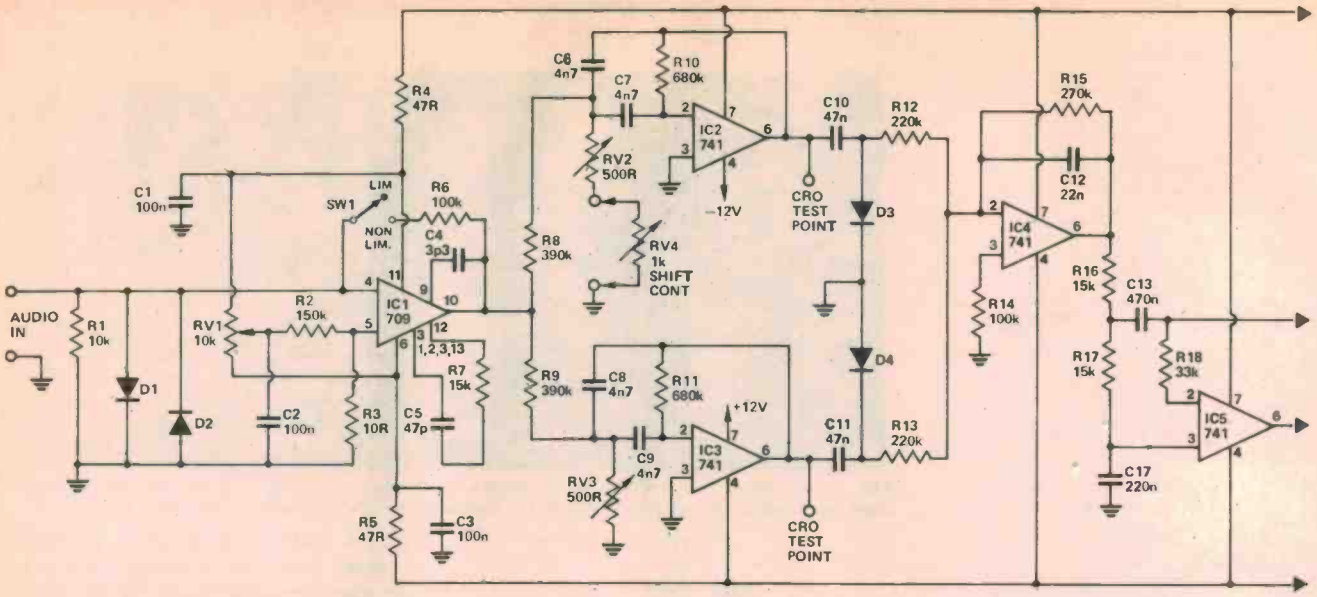
Now check the other two cords. One should show about 200 ohms from tip to sleeve, this is the receive line. The other should show a short. This is the send circuit.

To the left of the keyboard is a hole containing two levers, one on top of the other. The top one is the 'break' key; the other is the send/receive switch. Press down the break key and the transmit line should go open. Check both send and receive cords for leakage to earth. They should be clear; if not you've probably got some leaky capacitors somewhere or some oil has dripped into the circuitry. If the machine passes all these checks it's time to power it up.

The Smoke Test

First, apply 115 Vac to the power cord and switch on the motor. The machine should 'run open' with the innards rotating and the typing head jumping up and down. There should be no grinding noises. If there are find out where they're coming from before proceeding. Also, check between the machine base and a good earth for any voltage . . . there will probably be some indication due to insulation leakage. If it's not very high earth the machine base, and leave it earthed from now on.

With the machine turned off insert the send and receive plugs in any two loop supply jacks. Adjust the loop resistor for 60 ma, measured with a milliameter plugged into one of the remaining jacks. Now turn on the power. The machine should remain still, with only the motor and main drive shaft running. Carefully observe the area around the drive shaft, watching for smoke, ▶

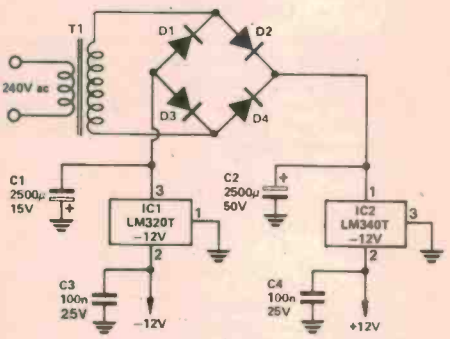


usually set up to have equal Q, so with the same Q and different centre frequencies the bandwidths will be different. The bandwidth of a filter affects the shape of the detected pulse – the narrower the bandwidth the more rounded the square pulse becomes.

This converter uses constant bandwidth active filters. Obviously, with constant bandwidth, their Qs will be different but who cares?, it's the bandwidth that counts.

The general circuit is shown in Figure 2. Resistor R1 mainly affects the gain of the filter, which in our case is set for slightly less than one. Resistor R2 affects the bandwidth. This is set for 100Hz as a compromise between easy copy of very narrow shifts and the amount of receiver tuning required to keep the signal within the filter passbands. Resistor RV1 affects the frequency only, so by varying RV1 you can tune the centre frequency wherever you want while maintaining a bandwidth of 100Hz.

In this coverter, both filters are identical, tuned by trim pots to 2295 Hz. But the lower frequency filter has another pot in series (the shift control) so its frequency can be pulled down to the lower tone of 2125 Hz, or whatever.



Construction

If you're etching your own board, you'll find it fits very nicely in a square two-litre icecream container. Once the board is etched and drilled, insert the components in the usual way, starting with the smallest. Try to get the resistors running all the same way to make checking easier, and make sure the diodes, tantalum capacitors, ICs etc, are the right way around. PC board pins are handy for external connections. There is a jumper on the power rail near the top of the board that must be installed. For stand-alone operation the top of R26 must be connected to the +12 V supply and a jumper inserted

ominous smells, or squeaking noises. There is a slipping clutch that prevents the machine from turning over; if it is dried up or too tight the resulting friction will cause smoke.

Operate the keys, and the machine should print. Run the machine for about ten minutes, then disconnect the power, remove the case, and feel the motor. It should not be uncomfortably hot. If it is, the machine is putting too much strain on it, or the motor itself is stiff and surgery is required.

Lubrication

It's probably a good idea to lubricate the entire machine, starting with the motor. Even if it doesn't run hot it's good for the peace of mind to know the motor is clean and properly greased.

Remove and disassemble the motor, noting exactly how it comes apart so it will go back together easily. There are two possible motor versions – syncronous and series governed – but there's nothing special about them mechanically. Just be sure the brushes, commutator, and bearings are all cleaned and in good condition. Although the Teletype Corporation specifies a special grease for the motor and gears, Golden Fleece Duralith 2A is suitable.

With the motor reassembled and back in position, dab some grease on the large gears in the drive chain and then switch the machine on. The gears should run freely without any backlash. This can be adjusted by shifting the motor around on its mounts.

Next comes the machine itself. Pour some light machine oil into a small bottle cap and fashion an oiling tool from a piece of number 22 wire. Dip the wire end into the bottle cap – the amount of oil it retains is the correct amount for each oiling point. Touch a drop of oil to each moving part. Oil everything in this way, in both printer and keyboard. The felt washers in the clutch assembly should be saturated. Wipe up any drips, and make sure no oil gets on any electrical contacts, especially those in the keyboard.

Adjustment

The only adjustments that should be attempted by the amateur new to teletype are machine speed and range setting. If there are other problems, it would be best to seek out the help of an experienced teletype repairman or at least another amateur who is more familiar with such things. If your machine has a series governed motor, you now have to decide what speed to set it on. If it has a syncronous motor, you're stuck with whatever speed it came with, unless you change the motor and gears.

The series governed motor has a drum on the back marked with black and white stripes around its perimeter. At the back of the drum are two slip rings and a slot with a rubber tyre protruding through it. The rubber tyre is the speed adjustment. The standard operating speed for amateur use is 45.45 bauds, or 60 words a minute. Most commercial circuits (or at least the ones you'll be able to copy) run at 50 bauds, or 66 words a minute. The machine speed must be syncronized to the transmitter speed or the machine will print garble.

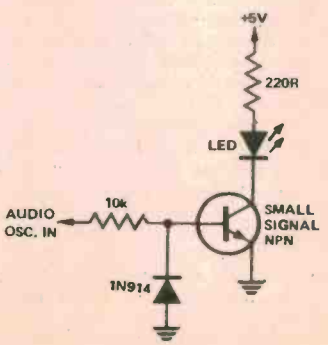
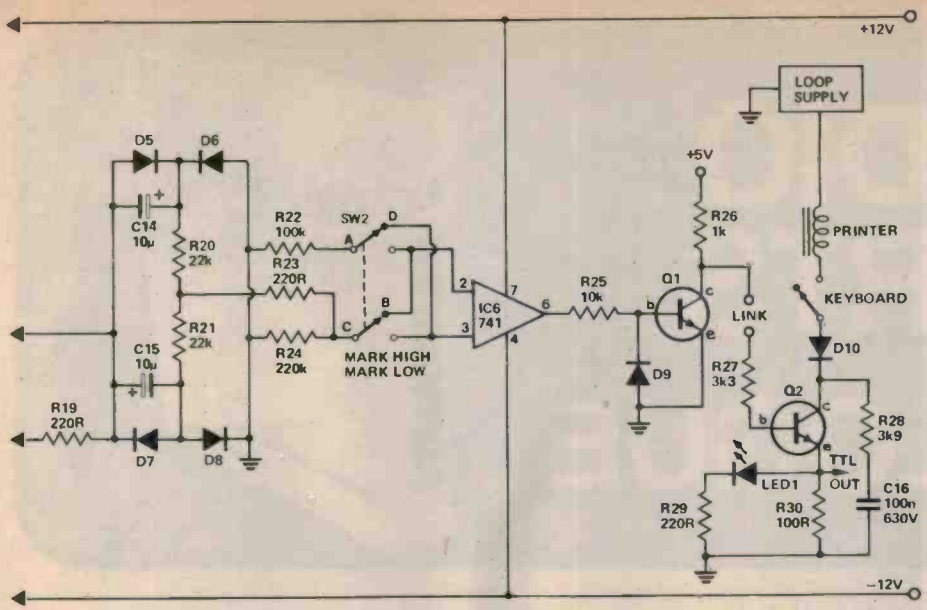
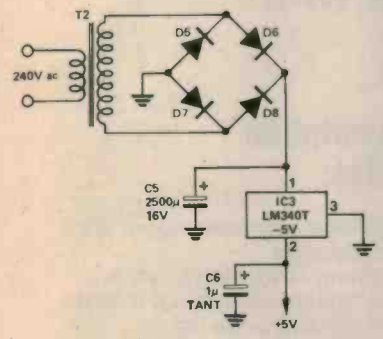


Figure 1. **Circuit of a simple stroboscope that may be used to adjust the machine's speed.**





The two circuits at left show the system power supply. The complete system requires +12, -12 and +5 volts. Design is conventional using three -terminal regulators, the two transformers were used as they were in hand although a single one would be better.

T1 – 12.6-0-12.6 Vac; T2 – 6.3-0-6.3 Vac; both 250 mA
D1 – D8 : 100 PIV, 1A diodes or two bridges.

HOW IT WORKS

IC1 is either a hard limiter or a buffer amplifier, depending on whether R6 is switched in. IC2 and IC3 are the mark and space filters. Their outputs are rectified by D3 and D4 and then combined into a dc level that swings high and low with the teletype pulses. IC4 and IC5 form a low pass filter that restricts transitions from the filters to the 50 baud rate or less. It effectively reduces the noise bandwidth of the system. D5-D8 and associated components are a circuit to cancel some bias distortion caused by selective fading. They average the mark and space transitions and set one side of the comparator half way between them. IC6 is the comparator, which squares the swinging waveform from the anti-distortion circuit. It's inputs can be reversed by a switch to allow 'upside-down' copy.

Q1 is a TTL/CMOS 5 V logic driver, which can also be used with +12 V to drive the loop switch directly. Q2 is the loop driver, requiring +12/0 V logic levels. The components in its collector circuit smooth out inductive kicks from the printer magnets. When loop current is flowing Q2's emitter is pulled up to +5 V; this voltage follows both received signals and keyboard signals and so becomes the logic signal to drive the modulator. The LED indicates the flow of loop current.

between the collector of Q1 and Q2's base resistor, R27. Connect + and – 12 volts and earth to the appropriate points, and connect the 'loop' output to the bottom of J4 in the loop supply. A small switch connected across the loop line to the converter will allow the loop to be closed for local testing while the converter is switched off.

Alignment

Equipment required: CRO (best) VTVM (second best) and an audio oscillator. For absolute accuracy a frequency counter would be a help.

Begin by shorting the audio input to the converter. Attach the CRO to pin 10 of IC1 and adjust RV1 for a noise trace centred about zero volts. If a VTVM is used adjust for zero volts. It will jump around a bit so go for an average.

Next, connect the oscillator to the audio input and set it exactly for 2295 Hz. Adjust the shift control for minimum resistance. Connect the CRO or VTVM to pin 6 of IC3 and adjust RV3 for maximum indication. Now observe pin 6 of IC2 and adjust RV2 for maximum. Set the oscillator to 2125 Hz, and adjust the shift control for maximum indication from IC2.

Now set the oscillator back to 2295 Hz and switch on the teletype. Operate the MARK HIGH/MARK LOW switch until the machine runs idle in the closed ▶

If the motor is badly off speed, probably because the governor has been fiddled with, you can set it roughly on speed in the following manner:

Starting from the left of the page, hold down the space bar, causing the machine to send continuous spaces. It should take about ten seconds before the 'end of line' bell rings. For the fine adjustment a stroboscope is required, and one can be made up quite easily by connecting a red LED directly to a square wave audio signal generator. Most generators have enough output to drive the LED directly; if yours doesn't, use a transistor driver as shown in Figure 1. Set the generator frequency to about 5 Hz and the LED should pulse on and off. Set the output to pulse the LED as brightly as possible without blowing it up (have another LED handy just in case).

Tape the LED to the machine so that it shines on the stripes painted on the motor governor. Now set the oscillator frequency to 350.4 Hz for 45 baud operation, or 384.76 Hz for 50 bauds. With the room darkened observe the stripes, which should be stationary when the speed is correct.

You'll have to turn off the machine and rotate the rubber tyre in the governor to make the adjustment. Many machines have a lever that can be pressed against the tyre when it's running to change the speed, but most of these short out the slip ring assembly, resulting in much sparking and electric shocks. So it's best to do it the slow way, by hand.

Rangefinder

Proper adjustment of the rangefinder depends on having a received signal available, known to be of good quality and on speed. You may have to wait until your receiving converter is built or you can borrow someone else's Model 15 or a tape transmitter to supply the signal. The rangefinder sets the receiving mechanism to allow the best possible copy.

The teletype signal is made up of a series of seven pulses. The first pulse, called the start pulse, is always a space (no current flowing in the loop). The next five pulses carry the code representing the character being transmitted. The last pulse is the stop pulse, and is always a mark (current flowing). The first six pulses are all the same length, 22 ms for 45 bauds, and 20 ms for 50 bauds. The stop pulse is about 50 percent longer. The start and stop pulses are necessary to synchronize the sending and receiving machines. The machine samples only about 20 percent of each code pulse to determine the character being received. The purpose of the rangefinder is to 'orient' the sampling period earlier or later in the code pulses with respect to the start pulse. The pulses themselves may become shortened or lengthened or displaced forward or backward in time, because of transmission conditions.

The rangefinder control is a locking knob attached to a pointer that can be moved along a scale from 0 to 120. The markings represent percentage of code pulse length. To adjust the rangefinder, start the machine copying RY's repeated, as these represent the most frequent mark-space transitions. Move the rangefinder first up the scale until the signal garbles, and then down the scale to the garble point. Note the readings and set the pointer half way between them, locking it off. If no signal is available, set it to 50, it will probably work.

A perfect machine will copy signals while the rangefinder is moved from about 10 to 90. If the range is considerably less, it indicates transmission conditions have mangled the signal, or the machine needs internal adjustments. If the range is displaced up or down the scale from a symmetrical position, it means the sending and receiving machines are not running at the same speed.

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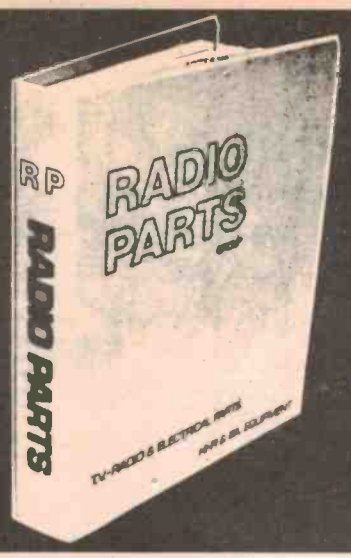

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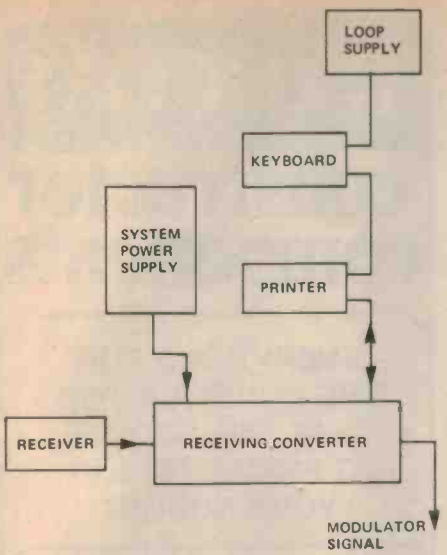


The system as it stands.

condition. Label this switch position as 'MARK HIGH'. Slowly move the oscillator frequency down to 2125 Hz. The loop should snap open, hopefully half way between the two frequencies. Switch everything off and feel the loop switch transistor Q2. It should be absolutely cold. If it feels warm (or hot) it means the gain is probably down a bit and it's not being switched all the way on. In this case change the base resistor R27 to a lower value until it does run cold.

You must now do a quick calibration of the shift control. With the CRO or VTVM connected to pin 6 of IC2, set the oscillator first for 2125 Hz and tune the shift control for maximum output. Label this position '170'. Set the oscillator for 1855 Hz and tune the shift again. Mark this spot '440'. Set the oscillator for 1445 Hz and tune again. Mark this position '850'.

IC1 can be run as either a hard limiter or a straight-through amplifier, in which case its gain is reduced by switching in R6 to provide negative feedback. It's normally used as a limiter except when there is an interfering signal. In a hard limiter the strongest signal always wins, so if it's not the signal you want, the limiter must be disabled. The 'non-limit' function must be set up to match the signal level from a particular receiver. This is done by tuning in a signal that reads about S9 on the meter and then selecting R6 so IC1's output (pin 10) is just below clipping. The limiting level can be made variable by using a pot (about 1M) in place of the fixed resistor. Be sure to retain the switch to take the pot completely out of circuit when hard limiting is desired.

With the alignment complete and the receiver connected to the converter it's now time to give it a try.

If an oscilloscope is available, an aid to station tuning can be obtained by obtaining a lissajous pattern on the screen. Connect the CRO 'x' and 'y' inputs to the test points on the pc board. The pattern should appear as two flattened ovals at right angles to one another when a station is correctly tuned. ●

– to be continued.

PARTS LIST - ETI 730

Resistors all ½W, 5%

R1	10k
R2	150k
R3	10R
R4, R5	47R
R6	100k - see text
R7	15k
R8, R9	390k
R10, R11	680k
R12, R13	220k
R14	100k
R15	270k
R16, R17	15k
R18	33k
R19	220R
R20, R21	22k
R22	100k
R23, R24	220k
R25	10k
R26	1k
R27	3k3
R28	3k9
R29	220R
R30	100R

Potentiometers

RV1	10k min trim pot
RV2, RV3	500k min trim pot
RV4	1k linear pot

Capacitors

C1–C3	100n ceramic
C4	3p3 ceramic
C5	47p ceramic
C6–C9	4n7 greencap
C10, C11	47n greencap
C12	22n greencap
C13	470n greencap
C14, C15	10µ 16V tantalum
C16	100n 630V greencap
C17	220n greencap

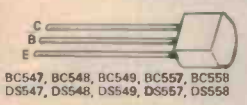
Semiconductors

D1–D4	IN914, or similar
D5–D8	OA91, OA95 or similar
D9	IN914 or similar
D10	IN4004, EM404, A14 or similar
Q1	BC548, BC108, DS548
Q2	BF338, 40327, 2N3440 or similar 300V VCE transistor
LED1	TIL220R Red led or similar
IC1	709 or 741 (if 741 used delete R7, C4, C5 - see text)
IC2–IC6	741

Miscellaneous

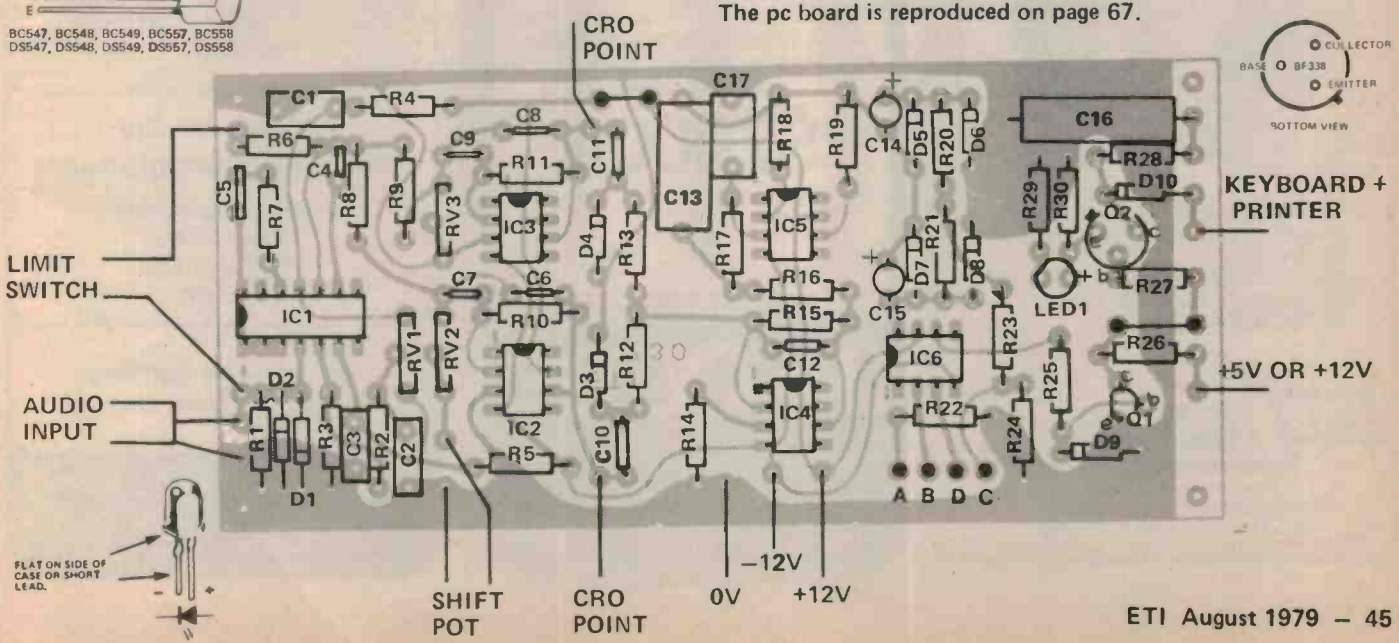
SW1	SPST min toggle
SW2	DPDT min toggle

Box to suit, ETI 730 pc board.



BC547, BC548, BC549, BC557, BC558
DS547, DS548, DS549, DS557, DS558

The pc board is reproduced on page 67.



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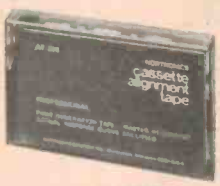

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TIP31C. . . 75	TIP32C. . . 82	2N2219 . . 46	2N2222A . 40	2N2368 . . 25	2N2646 . 1.15	
2N2647 . 1.15	2N2904 . . 50	2N2905 . . 50	2N2905A . 50	2N2907 . . 45	2N3107 . 1.00	
2N3053 . . 50	2N3054 . 1.20	2N3055 . . 75	2N3300 . . 75	2N3642 . . 35	2N3702 . . 16	
2N3704 . . 29	2N3740 . 1.70	2N3904 . . 29	2N4030 . . 92	2N4032 . . 97	2N4033 . 1.30	
2N4036 . 1.53	2N4037 . 1.15	2N4231 . . 99	2N4234 . 1.87	2N4238 . 1.67	2N5088 . . 30	
2N5458 . . 55	2N5459 . . 59	2N5462 . . 90	2N5485 . . 60	2N5871 . 1.53	2N5872 . 2.05	
2N5873 . 1.53	2N5874 . 1.67	2N6124 . . 92	2N6126 . 1.11	2N6129 . 1.28	2N6130 . 1.30	
2N6132 . 1.43	2N6134 . 1.53	MPS3565. . 18	MP53638. . 19	PN3565 . . 18	PN3566 . . 18	
PN3567 . . 18	PN3568 . . 18	PN3569 . . 18	PN3638 . . 18	PN3638A . 22	PN3641 . . 20	
PN3642 . . 20	PN3643 . . 20	PN3644 . . 22	PN3645 . . 22	PN3646 . . 22	PN3693 . . 29	
PN3694 . . 29	PN4121 . . 35	PN4248 . . 22	PN4250 . . 29	PN4355 . . 29		

● 74LS —

74LS00. . . 20	74LS01. . . 30	74LS02. . . 25	74LS03. . . 25	74LS04. . . 20	74LS05. . . 30
74LS08. . . 25	74LS09. . . 30	74LS10. . . 25	74LS11. . . 30	74LS12. . . 30	74LS14. . . 95
74LS20. . . 28	74LS21. . . 30	74LS27. . . 30	74LS28. . . 40	74LS30. . . 30	74LS32. . . 30
74LS37. . . 38	74LS38. . . 38	74LS40. . . 30	74LS42. . . 70	74LS73. . . 60	74LS74. . . 46
74LS75. . . 55	74LS78. . . 50	74LS85. . 1.40	74LS86. . . 50	74LS90. . . 70	74LS92. . 1.10
74LS93. . . 80	74LS95. . 1.00	74LS109. . 50	74LS113. . 50	74LS114 . . 50	74LS125 . . 70
74LS133. . 30	74LS138. 1.10	74LS151. 1.15	74LS157. . 75	74LS160 . . 60	74LS163 . . 70
74LS164. 1.30	74LS165. 1.15	74LS165. 1.65	74LS174. . 55	74LS175 . . 85	74LS190. 1.25
74LS191. 1.20	74LS192. 1.15	74LS193. 1.00	74LS194 . 1.15	74LS195. 1.00	74LS196. 1.20
74LS197. 1.50	74LS221. 1.50	74LS251. . 85	74LS253 . . 85	74LS257 . . 75	74LS259. 3.30
74LS279. . 55	74LS290. 1.15	74LS365. . 70	74LS366 . . 70	74LS367 . . 70	74LS368. . 65

● CMOS —

4000 25	4001 25	4002 25	4007 30	4008 . . . 1.20	4011 25	
4012 25	4013 60	4014 . . . 1.30	4015 . . . 1.30	4016 50	4017 . . . 1.30	
4018 . . . 1.20	4020 . . . 1.40	4021 . . . 1.30	4022 . . . 1.30	4023 25	4024 90	
4025 35	4027 70	4028 95	4040 . . . 1.30	4042 . . . 1.10	4043 95	
4044 95	4046 . . . 1.55	4049 55	4050 55	4051 . . . 1.20	4052 . . . 1.20	
4053 . . . 1.20	4060 . . . 2.20	4066 75	4068 35	4069 30	4070 35	
4071 35	4072 35	4076 . . . 1.75	4077 35	4078 35	4081 35	
4082 35	4093 70	4441 95	4502 . . . 1.20	4506 60	4510 . . . 1.40	
4511 . . . 1.30	4518 . . . 1.40	4520 . . . 1.40	4528 . . . 1.20	4553 . . . 6.99	4555 . . . 1.10	
4581 . . . 3.00	4582 . . . 1.00	4584 80	40014 . . . 60	40097 . . . 90	40098 . . . 90	
74C02 . . . 35	74C04 . . . 40	74C08 . . . 40	74C10 . . . 40	74C14 . . 1.60	74C20 . . . 45	
74C48 . . 2.40	74C73 . . 1.10	74C76 . . 1.15	74C90 . . 1.50	74C93 . . 1.50	74C175. . 1.75	
74C192. 1.85	74C193. . 1.85					

● TTL —

7400 20	7401 20	7402 20	7403 25	7404 20	7405 25	
7406 45	7407 45	7408 30	7409 34	7410 30	7413 54	
7414 45	7416 50	7417 45	7420 30	7421 30	7422 30	
7426 40	7427 40	7430 30	7432 30	7437 50	7438 40	
7439 40	7440 30	7442 83	7447 90	7448 95	7450 30	
7451 30	7453 30	7454 30	7460 30	7470 50	7472 45	
7473 50	7474 50	7475 65	7476 40	7480 95	7483 . . . . 1.10	
7485 . . . 1.40	7486 50	7489 . . . 2.90	7490 40	7491 . . . 1.00	7492 70	
7493 40	7494 . . . 1.05	7495 92	74100 . . 1.95	74107 . . . 55	74121 . . . 50	
74123 . . . 85	74132 . . 1.10	74145 . . 1.80	74150 . . 1.60	74151 . . 1.00	74153 . . 1.00	
74154 . . 1.40	74157 . . 1.00	74160 . . 1.30	74165 . . 1.45	74172 . . 1.10	74173 . . 2.40	
74175 . . 1.45	74180 . . 1.12	74188 . . 2.50	74192 . . 1.33	74193 . . 1.33	74367 . . 1.00	

● VOLTAGE REGULATORS —

7805 . . . 1.00	7812 . . . 1.00	7815 . . . 1.00	7818 . . . 1.00	7824 . . . 1.00	78H05 . . 7.50	
78H12 . . 7.50	78HG. . . 7.95	78L05 . . . 40	78L12 . . . 40	78L15 . . . 40	78L18 . . . 40	
78L24 . . . 40	7905 . . . 1.50	7908 . . . 1.45	7912 . . . 1.50	7915 . . . 1.50	7918 . . . 1.50	
7924 . . . 1.50	79HG. . . 9.95	79L03 . . . 80	79L15 . . . 80	79L18 . . . 80	79L24 . . . 80	
78CB . . . 2.30	723 50	309K . . . 1.90	317K . . . 2.90			

● DIODES —

AAY30. . . 30	OA90. . . . 15	OA91. . . . 15	1N3493 . 1.70	1N3493R 1.70	1N4002 . . 11	
1N4004 . . 11	1N4007 . . 20	1N4148 . . 06	1N5401 . . 43	1N5404 . . 43	1N5408 . . 45	

● DIODE BRIDGES —

W02. . . . . 90 VM48 (dil). . . . 1.25 MDA201. . . . . 95 MDA3501 . . . . 3.40

● ZENER DIODES —

½ WATT. 3.3 to 33V . . . . . 19 1 WATT. 3.3 to 33V . . . . . 30 2½ WATT. 8.2 to 18V 65

● SCR's/TRIACS —

C103YY . . . . 99 C106D1 . . . 80 C106Y1 . . . 39 C122D1 . . 1.80 SC141D 1.30

● LINEAR IC's —

301 40	307 86	308 . . . . 1.20	311 75	324 . . . . 1.00	380 . . . . 1.70	
381 . . . . 2.87	382 . . . . 1.95	3900 99	3909 . . . 1.60	555 35	556 . . . . 1.20	
565 . . . . 3.45	567 . . . . 3.12	741 30	747 . . . . 1.15	748 59	CA3046 . 1.65	
CA3140 . 1.50	MC1494L 6.65	RC4136 . 1.45	TL071 . . . 73	TL080 . . 1.15	TL081 . . . 52	
TL082 . . . 95	TL084 . . 1.90	709 65				

● MICRO ETC —

SYP2102A-4. . 1.90 TMS1000 . . 7.95 2708 . . . 15.00 93448 . . . 10.20 1488 96

● OPTO —

9368 . . . 1.90	MCT2. . . . 65	FND357 . 1.40	FND500 . 1.40	DL747 . . 3.50
LED green . 30	LED yel . . 30	LED til 209 18		

LED red . . 20

● RESISTORS — ½/¼W E24 3c, 1W E12 7c, 5W W/Wound 25c, Min. Presets 18c, Min. Trimpots 48c, Min. Multiturn Trimpots 1.25.

● TANTALUMS—

0.1uf 35V . . . 15	470uf 6.3V . . 20
0.22uf 35V . . 15	470uf 16V . . . 16
0.33uf 35V . . 15	470uf 25V . . . 32
0.15uf 35V . . 20	470uf 50V . . . 60
0.47uf 35V . . 15	470uf 63V . . . 77
0.68uf 35V . . 15	640uf 16V . . . 42
1uf 35V 15	1000uf 16V . . 32
1.5uf 35V . . . 15	1000uf 25V . . 48
2.2uf 35V . . . 15	1000uf 35V . . 53
3.3uf 35V . . . 15	2000uf 35V . . 71
4.7uf 35V . . . 22	2200uf 16V . . 50
6.8uf 35V . . . 23	2200uf 35V . . 88
10uf 35V. . . . 24	2500uf 16V . . 62
15uf 35V. . . . 55	
22uf 35V. . . . 74	**● CAN TYPE—**
10uf 25V. . . . 25	2500uf 35V . 1.50
4.7uf 16V . . . 20	5600uf 40V . 1.99
47uf 6.3V . . . 25	6800uf 50V . 4.80

● CERAMICS—

1pf to 0.0047uf	**● POLYESTER GREENCAPS**
. . . . . all 5c	0.001 to 0.018
0.0056uf to 0.01uf	100V . . . all 10
. . . . . all 8c	0.022 to 0.033
0.022uf to 0.1uf	100V . . . all 11
. . . . . all 12c	0.039 to 0.056
0.22uf 18c	100V . . . all 13
0.47uf 28c	0.068 to 0.082

● TRIMMER CAP

5pf to 65pf . 30c

● SUPP. CAP.

NS5 0.05uf . 60c
NNS30 3uf. . . $2

● ELECTRO CAPS. PCB TYPE

0.47uf 50V . . . 8	100V . . . all 16
0.47uf 63V . . . 8	0.1uf/100V . . 19
1uf 50V 6	0.12 & 0.18uf
1uf 63V 8	100V 20
1.5uf 25V 8	0.22/100V . . . 30
2.2uf 25V 8	0.27/250V . . . 30
2.2uf 35V 8	0.33/250V . . . 34
2.2uf 50V 8	0.39/250V . . . 44
2.2uf 63V 8	0.47/250V . . . 47
3.3uf 25V 8	1uf/250V 55
3.3uf 35V 8	0.047/630V . . 28
3.3uf 50V 6	0.47/630V . . . 60
4.7uf 10V 8	
4.7uf 25V 8	**● FUSE-HOLDERS**
4.7uf 50V 6	Size 3AG
4.7uf 63V . . . 10	Panel Mount . 99
10uf 16V. . . . 8	Line Type . . 28
10uf 25V. . . . 8	Clip In 46
10uf 35V. . . . 11	
10uf 50V. . . . 8	**● FUSES 3 AG**
10uf 63V. . . . 12	0.25A, 0.5A,
22uf 10V. . . . 10	0.75A. . .all 16c
22uf 16V. . . . 12	1A, 1.5A, 2A, 3A,
22uf 25V. . . . 8	4A, 5A . .all 10c
22uf 50V. . . . 13	
25uf 25V. . . . 12	**● FUSES M205 (20 mm)**
25uf 63V. . . . 15	0.25A, 0.315A,
33uf 16V. . . . 8	0.4A, 0.5A all 30
33uf 25V. . . . 10	0.63A, 1A, 1.6A,
33uf 50V. . . . 15	2A, 3.15A .all 20
47uf 16V. . . . 12	
47uf 25V. . . . 10	**● RELAYS—**
47uf 50V. . . . 12	12V 220 Ohm coil,
47uf 63V. . . . 16	. . . . . 1A cnts
100uf 10V. . . 12	12V 220 Ohm coil,
100uf 16V. . . 15	. . . . . 5A cnts
100uf 25V. . . 18	15V 530 Ohm coil,
100uf 35V. . . 18	. . . . . 5A cnts
100uf 50V. . . 16	All $5.85
100uf 63V. . . 23	
220uf 16V. . . 15	
220uf 25V. . . 24	
220uf 35V. . . 21	
220uf 50V. . . 23	
220uf 63V. . . 37	
330uf 25V. . . 24	
330uf 63V. . . 40	

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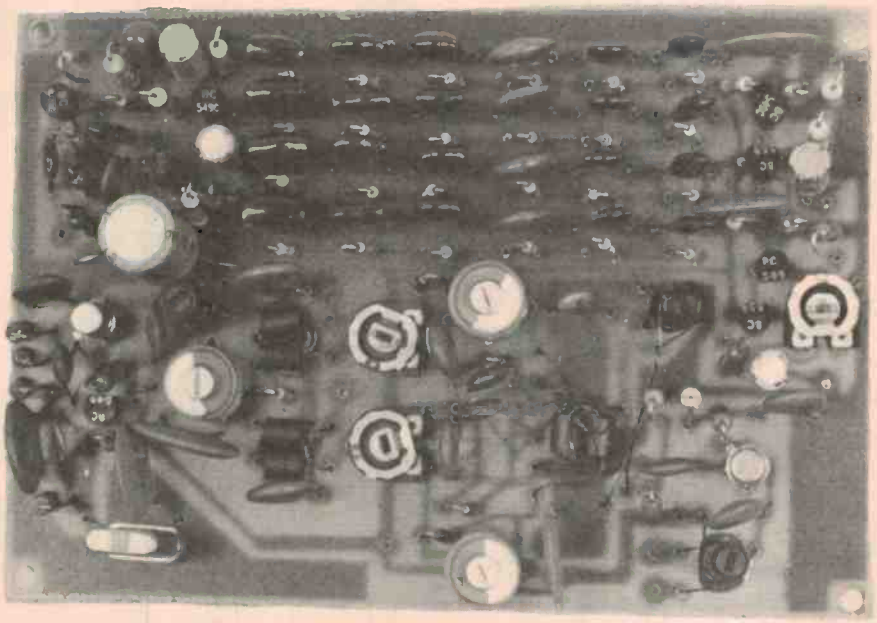
Project 725

Simple SSB generator employs 'polyphase' network using standard components

This project may serve as the basis of an inexpensive home-built SSB transmitter or as the sideband generating source for an RF speech processor — the latter being a popular and efficient method of increasing transmitter 'talk power'.

J.R. Hey

The author is G3TDZ. This article comes via our German edition, 'Elrad', and first appeared in 'Radio Communication', September 1976. The circuit has been re-drawn and the pcb modified to suit locally available components.



SOME YEARS AGO, when the author first took to the air, one could actually venture onto at least one band for a modest sum with modified surplus gear. The price of commercial amateur SSB transmitting equipment might encourage more home construction if it were not for the filter alone costing between $30 and $50. One would hardly risk this expenditure on one component where little trust existed in one's own construction. There has always been the phasing method but the average amateur, on seeing those very odd component values in the audio phase shifter, must be somewhat inhibited. The 'third method' of SSB generation offers a new approach provided one turns a blind eye to the mathematical explanations!

To the rescue has come Mr. M.J. Gingell who has described a new method (References 1 & 2) of achieving the audio phase shift using off-the-shelf values. Now the "thirty buck" SSB rig could become a reality rather than an absurd dream.

While information so far published has been sufficient for the knowledgeable amateur to have a go, the less experienced have shown some doubt. It is the purpose of this article to convert the purely symbolic into practical nuts and bolts.

The exciter

Mr. Gingell's 'polyphase' network is shown in Figure 1. It consists of six groups of RC networks, each connected in a ring configuration. The network is driven in push-pull. At the four outlet ports, equal amplitude signals are present, each shifted through 90° from its neighbour. As any adjacent pair of outputs carries the required signals, a and b will be used and the other two ignored. Many such networks in audio work must be driven from a low impedance source and terminated in a load of much higher impedance; in this network the load will be around 1M.

Under the banner of economy the performance must not be allowed to suffer, so by applying just a little extra thought the desired result can be achieved. The functions of microphone amplifier, bass roll-off, low-pass filter and phase splitter are accomplished with only three inexpensive transistors, and dc coupling enables a few electrolytics to be omitted. The low value capacitor, C7, working into the Q3 input resistance provides the desired rising response or bass roll-off; Q3 alone producing all the necessary gain from an average dynamic microphone. A 'Sallen & Key' low-pass filter around Q4 gives a sharp attenuation above 3kHz, Q5 then providing the push-pull drive. Bias for Q3 is derived from Q5's emitter; the circuit working points are stable over a wide temperature range. Separately decoupled, this is all the circuitry necessary before the polyphase network.

A pair of feedback amplifiers based on the compound emitter-follower principle terminates the phase-shift network, each possessing three properties: high input impedance (mentioned earlier); low output impedance to drive

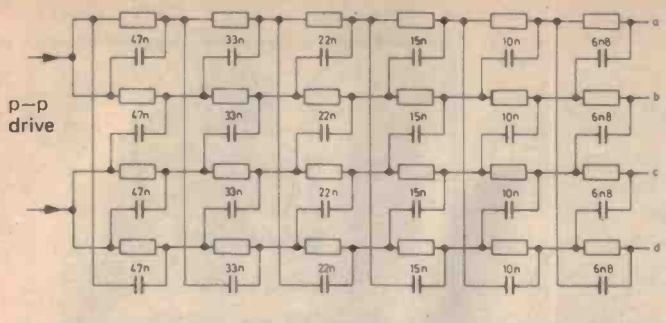


Fig.1: **The polyphase network, the basis of this project. Note that all resistors are 10k.**

the balanced modulators and a specific low gain. One of the circuits however, has a pre-set resistor enabling the gain to be varied by a small amount; this affords a means of equalizing the amplitude of the two audio signals. A signal level of between 200 and 400mV is required for feeding the balanced modulators.

The phasing method further demands two RF signals having a 90° phase relationship. The output from a 10.7 MHz crystal oscillator is amplified by Q2 to the required level. A link winding, L2, feeds two ferrite transformers. These are made by placing two ferrite beads side by side and winding up through one and down through its neighbour, this forming one turn; round again would be regarded as two turns.

Both coupling transformers have four primary turns, except that T1 has a further four turns forming an overwind which provides part of the means of achieving the 90° RF phase shift. From the overwind, a 270 ohm resistor connects to T2 primary, together with a capacitive coupling C29 C54 from T1 primary. T2 secondary has six turns to make up for losses in the coupling elements.

After spending a few cents on ferrite beads, extravagance in the balanced modulators is avoided by using simple diodes! The resistive element of each modulator is easily balanced by a small value trimpot; capacitive balance was discovered to be more critical. It was found necessary to determine by experiment which diode required the extra capacitance; not a method which satisfactorily lends itself to easy reproduction. The answer was to add a fixed capacitor to one diode, then balance this with a trimmer across the other. A 15 pF fixed value is fitted, its opposite number being a 30 pF trimmer.

The sets of sidebands generated in the balanced modulators are combined in a ferrite transformer, T3, which has two centre-tapped primaries and a single secondary. This might sound somewhat daunting till one notices how few turns are involved. Again, two ferrite beads are granted this most important task for here, the actual single sideband is created. A tuned amplifier lifts the low level SSB signal to a more sensible value of some 100-200mV, its tuned circuits tending to reject any spurii.

Construction

The circuitry so far described is housed on one printed board. For consistent results this method of construction is recommended. Moderate component density is employed, with order and symmetry in layout where demanded. Provision has been made for both small HC25/U or HC18/U crystals and the large HC6/U types.

Where some constructors might wish to build this basic SSB generator for use at some lower frequency, a large crystal might possibly produce sufficient voltage without its amplifier. By connecting a link between the collector of Q1, where a hole in the board is provided, and Q2 collector point, all Q2 associated circuitry is then omitted. Obviously L1-L2 would require some modification, also R17-C29 would need some adjustment to maintain the 90° shift accurately. At the design frequency, and for all miniature crystals where the amplifier stage is wired, connect Q1 collector to supply by the link shown in the overlay.

Coils are wound on 4 mm Neosid formers, type 7010 which fit tightly into the holes in the printed board.

As mylar polyester ('Greencaps') film capacitors were used in the prototype polyphase network, dimensions and spacing have been made to suit these in the pc board layout. Actual capacitor values are not too important; provided all four capacitors in each value group are alike. A tolerance of five percent is desirable although those in the prototype were in fact 10 percent. The Siemens polycarbonate range may be used but the pc board would have to be altered.

Before the author prepared this article, local interest prompted other amateurs to copy the circuit – a valuable means of checking all was well before putting pen to paper. In one case, where the local supply of 6800pF (6n8) capacitors had run dry, another four 10n capacitors were fitted into the polyphase network and the four associated resistors changed to 6k8: the unit produced fine SSB.

The two audio drives connect to the balanced modulator input transformers via external leads, which must be screened. If "A" is connected to "A", and "B" is connected to "B", then upper sideband is produced. A simple reversing switch fitted into these two wires furnishes instant sideband switching.

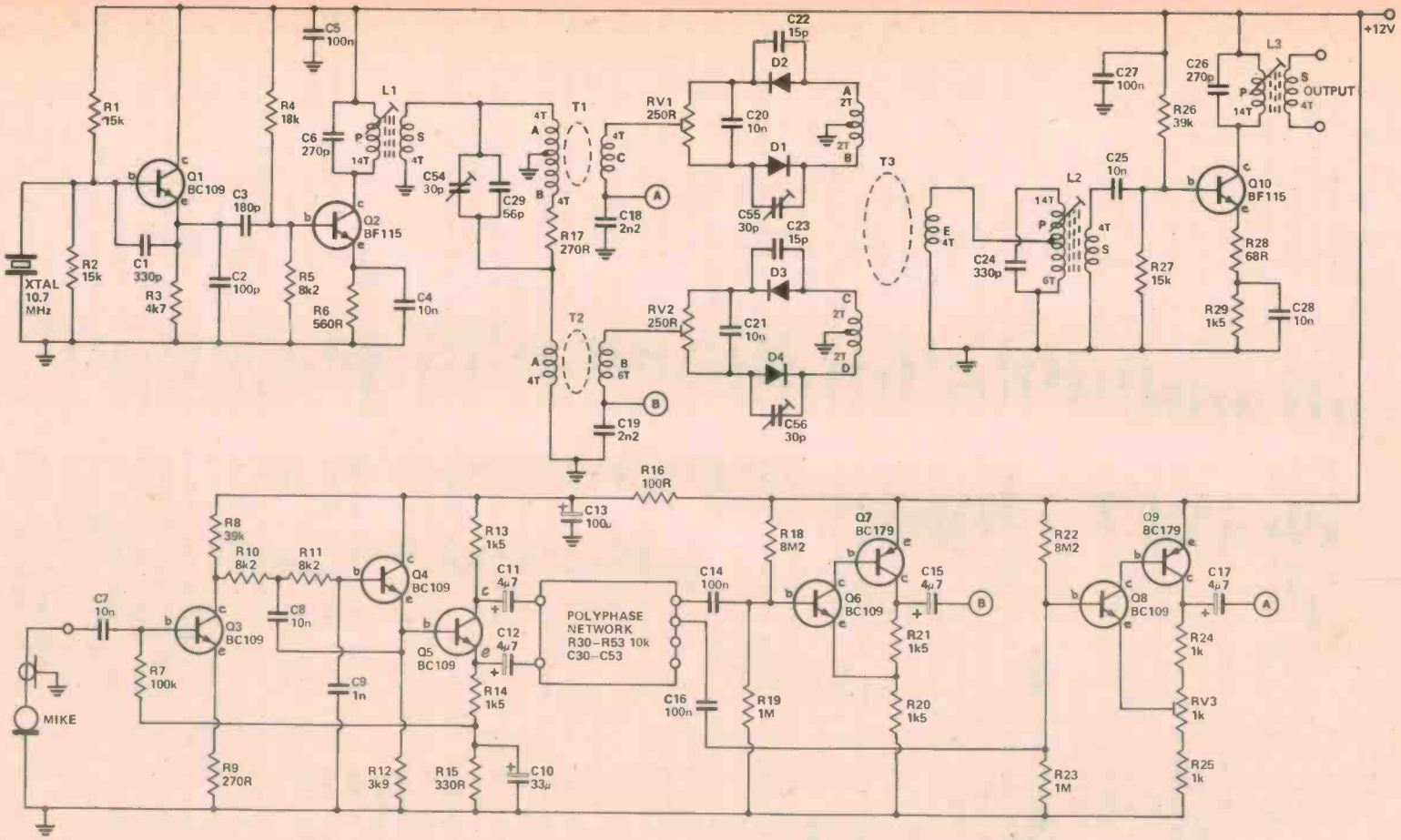
When winding the ferrite transformers guide the loops carefully into the beads to avoid the sharp hole edges stripping the enamel insulation and causing possible short circuits later. At first sight, T3 might appear a challenge. It has been found easier to wind the secondary first and fit to the board in a position shown in the overlay. Cut off a short piece of enamel wire, clean one end and solder into the upper primary hole adjacent to the D2 cathode (+) connection. Passing the free end to the nearest bead, wind on two turns and preparing end, fit into second hole, but do not solder. Now cut and prepare a second length of wire, fit into second hole and solder both wires. Winding always in the same direction, complete two turns and fit into hole three – solder. Starting at hole four, similarly wind the other primary, in the same direction.

No special skills or techniques are demanded in assembling the other components; refer to the overlay during assembly.

Setting up

Alignment is carried out using an audio generator and oscilloscope. Alternatively, a sensitive RF probe and meter may be used, or even a general coverage receiver; however, there is nothing quite like seeing what is going on. After checking most carefully for poor solder joints and bridging, apply a supply of 12 Vdc and check transistor voltages for normality.

Connect the audio generator to the microphone and oscilloscope to point "B" adjacent to C15. With an input signal of about 3 mV at 1kHz, a clean waveform of some 400 mV should be seen. Transfer the oscilloscope to point "A" adjacent to C17 and observe a similar waveform; adjust RV3 for an amplitude equal to that at "B". ▶



PARTS LIST - ETI 725

Resistors all ¼W, 5%

R1, R2 . . . . . 15k
R3 . . . . . 4k7
R4 . . . . . 18k
R5 . . . . . 8k2
R6 . . . . . 560R
R7 . . . . . 100k
R8 . . . . . 39k
R9 . . . . . 270R
R10, R11 . . . 8k2
R12 . . . . . 3k9
R13, R14 . . . 1k5
R15 . . . . . 330R
R16 . . . . . 100R
R17 . . . . . 270R
R18 . . . . . 8M2
R19 . . . . . 1M
R20, R21 . . . 1k5
R22 . . . . . 8M2
R23 . . . . . 1M
R24, R25 . . . 1k
R26 . . . . . 39k
R27 . . . . . 15k
R28 . . . . . 68R
R29 . . . . . 1k5
R30–R53 . . . 10k

Trimmer Potentiometers

RV1 . . . . . 250R min flat mounting
RV2 . . . . . 250R
RV3 . . . . . 1k

Capacitors

C1 . . . . . 330p ceramic
C2 . . . . . 100p ceramic
C3 . . . . . 180p ceramic
C4 . . . . . 10n ceramic
C5 . . . . . 100n greencap
C6 . . . . . 270p ceramic
C7, C8 . . . . . 10n greencap
C9 . . . . . 1n greencap
C10 . . . . . 33µ 6.3V electro
C11, C12 . . . . 4.7µ 16V electro
C13 . . . . . 100µ 16V electro
C14 . . . . . 100n greencap
C15 . . . . . 4.7µ 16V electro
C16 . . . . . 100n greencap
C17 . . . . . 4.7µ 16V electro
C18, C19 . . . . 2n2 ceramic
C20, C21 . . . . 10n ceramic
C22, C23 . . . . 15p ceramic
C24 . . . . . 330p ceramic
C25 . . . . . 10n ceramic
C26 . . . . . 270p ceramic
C27 . . . . . 100n greencap
C28 . . . . . 10n ceramic
C29 . . . . . 56p ceramic
C30–C33 . . . 47n greencap or block
C34–C37 . . . 33n greencap or block
C38–C41 . . . 22n greencap or block
C42–C45 . . . 15n greencap or block
C46–C49 . . . 10n greencap or block
C50–C53 . . . 6n8 greencap or block
C54–C56 . . . 30p trimmer

Semiconductors

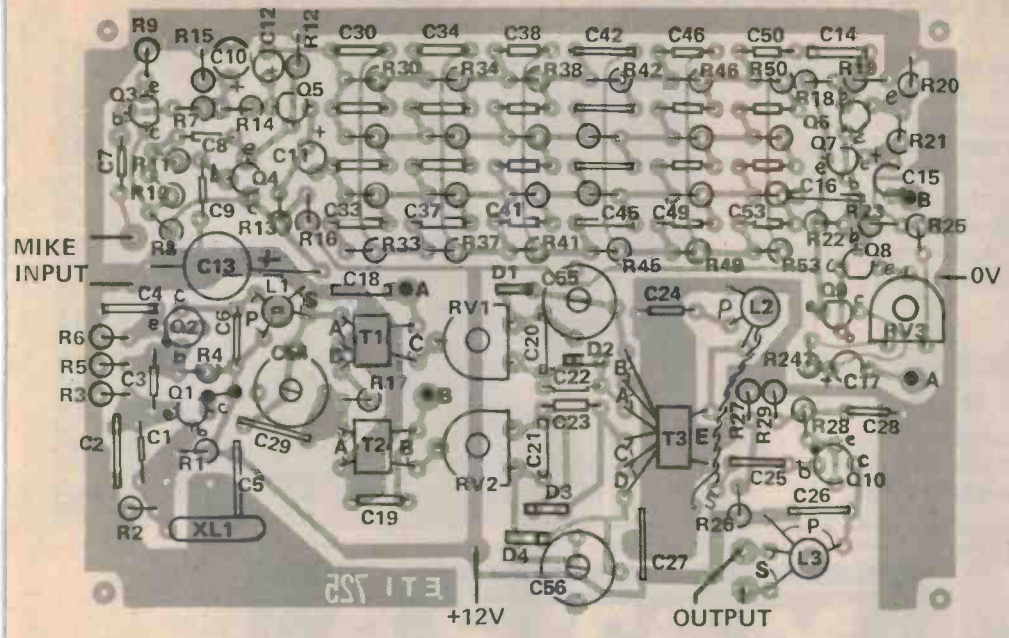
D1–D4 . . . . . IN914 or similar
Q1 . . . . . BC109, BC549, DS549
Q2 . . . . . BF115, BF185
Q3–Q6 . . . . BC109, BC549, DS549
Q7 . . . . . BC179, BC559, DS559
Q8 . . . . . BC109, BC549, DS549
Q9 . . . . . BC179, BC559, DS559
Q10 . . . . . BF115, BF185

Miscellaneous

L1–L3 . . . . . Neosid 7010 formers with slugs
T1–T3 . . . . . Six FX1115 ferrite beads

ETI 725 pcb, 10.7 MHz crystal, (parallel 30pf).

The pc board is reproduced on page 67.



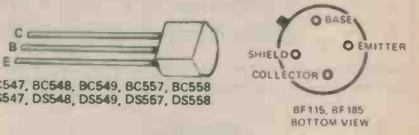
Coil Data - ETI 725

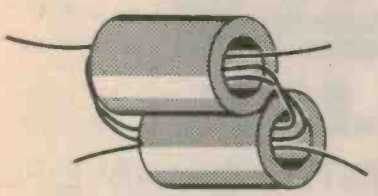
All coils and toroids are wound with 30 B+S enamelled copper wire. L1, L2 and L3 are wound on Neosid 7010 cores with F8 or F14 slugs.

- L1 primary 14 turns, secondary 4 turns
- L2 primary 13 turns, taped 6 turns from earth end, secondary 4 turns
- L3 primary 14 turns, secondary 4 turns

T1, T2 and T3 are wound through two Philips FX1115 ferrite beads. One pass of the wire through each bead makes one turn.

- T1 A, B, C windings, 4 turns each
- T2 A winding 4 turns, B winding 6 turns
- T3 A, B, C, D windings 2 turns each, E winding 4 turns





Shown above is the pc board component overlay. The transformers T1, T2 and T3 are wound in the manner shown at left and the connections terminated as indicated above – with reference to the circuit diagram also. Take particular care with T3.

Remove the audio generator and connect the scope to the two tags marked "out", switching the timebase and the Y sensitivity up high. With no attempt at balancing having yet been made, a small 10.7 MHz signal should just be observable. Adjust L1, L3 and L5 for maximum level, it should be possible to back off the "Y" attenuator considerably. Adjust RV1 and RV2 for minimum amplitude. With an insulated trimming tool, adjust C55 and C56 for minimum, lowering the Y attenuator. Then adjust for an absolute minimum or zero Y lowering the Y attenuator. An absolute minimum or zero Y deflection might not yet be possible at this stage.

Connect an AF generator to "A"; set to 1 kHz, 200 mV; select low oscilloscope scanning speed to portray audio content rather than RF. Adjust RV1 so that the 'lobes' on the trace are equal in size and shape. Adjust C55 for sharpest crossing point on the X axis.

Transfer generator to "B" with time base still set for AF and repeat the above procedure, adjusting RV2 for equal envelope shapes and C56 for sharpest crossing. The unit is now producing two sets of double sideband signals. Connect "A" to "A" and "B" to "B" with screened wire. Lower the AF generator's output to about 5 mV, and connect it to the microphone input. Increase the CRO's timebase speed to show a 10 MHz signal and observe for signs of a sinusoidal wave among the mush. As C55 and C56 are carefully readjusted, the waveform will become purer. Now adjust C54 and RV3, noting purity of the signal. Make sure L3 and L5 are still peaked for maximum output.

It must be pointed out that only good high speed oscilloscopes will show the output clearly and one might easily be misled. Instruments rated well above 10 MHz are fine, but for those who can only lay hands on lesser beasts it will be found easier at this stage to switch the timebase down to AF again. The screen should show a typical AM envelope of very low modulation. The final adjustments are made as above, aiming for minimum ripple on the envelope. Should the carrier reappear at any time, indicated by a bright line starting to appear in the screen centre, reset C55 and C56 for no carrier.

The residual ripple on the top and bottom of the envelope represents the unwanted sideband and should be very small. Turning down the audio, only a single thin line should remain on the screen. Should carrier be thought too great when increasing Y sensitivity, very careful adjustment of C55 and C56 should remove it.

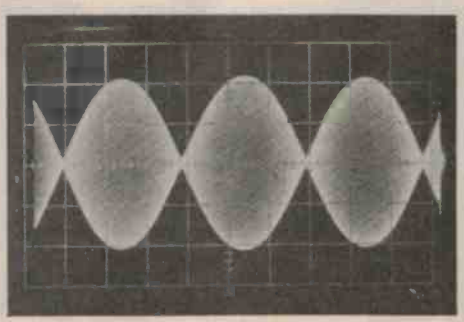
If now the oscilloscope is replaced by a receiver, and the generator by a microphone, one should be able to judge the SSB quality.

The output signal level of 100 Mv to 200 mV should be about right for driving a frequency converter heterodyning to the desired band. ●

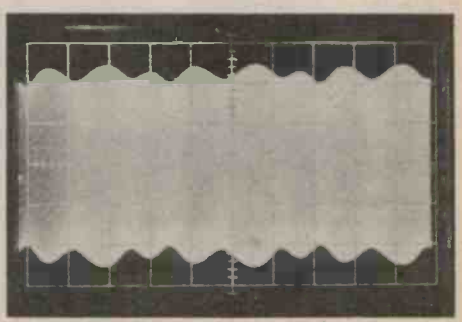
References

1: Radio Communication, Oct. 1973, p 698.
2: Radio Communication, Dec. 1973, p 852.

The author would like to thank G8FUW, G8GJR and G8INL for their assistance.



DSB output from one balanced modulator



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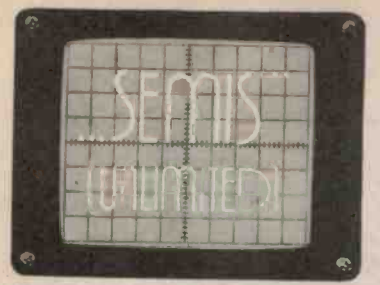

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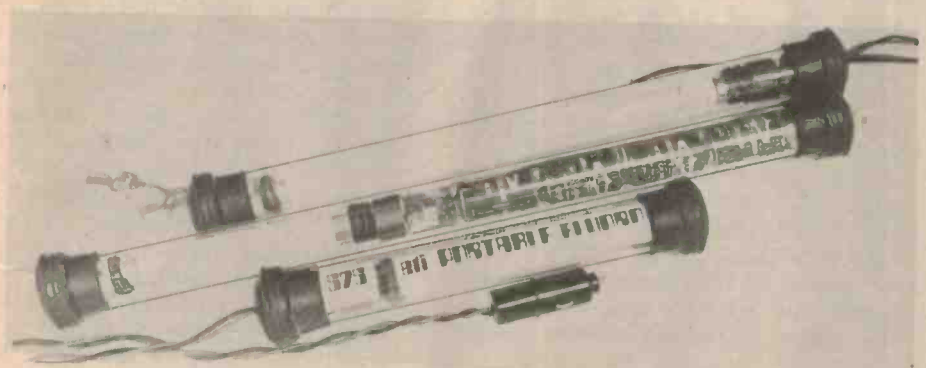
Project 575

Portable fluorescent "light wand" for car, camping — even caving!

by Jonathan Scott and Eric Mills

A portable, battery operated light has a thousand and one uses. Torches are fine, but their narrow beam limits their application. This project describes a highly practical, battery operated fluorescent light that is highly efficient and may be built in several versions.



FLUORESCENT torches, fluorescent lights on buses and trains and battery backed-up fluorescent emergency lights have been with us for some time now. The motivation for designing this particular circuit, however, was a need to get the most light for the weight carried on a caving helmet. The design had to be compact, reliable, able to take a wide range of input voltages, but above all — efficient.

Our basic model — the 8 W one — uses parts which we readily obtained from various suppliers in Sydney, and which should be available in most major cities (see the Construction section). We also built two special variations — the caving helmet unit, with a belt pack 12 V dry battery source, and the 'Light Wand' which holds four 'C' size Nicad batteries in the same acrylic tube as the converter, thus making it self-contained. The latter required a modification to allow for the 5 V supply rail while the caving light required a custom fibre glass housing. This was supplied most kindly by Mr. Paul Hinds of Sydney University. Finally we built a 4 W version similar to the 8 W one simply by using the smaller tube directly. This is physically nicer, but inherently less efficient.

Construction

Neatness and care is important in this project, though construction is not difficult. The first step is to assemble the pc board according to the overlay. If the protection diode, D1, is in position (a), ignore position (b). If it is in position (b), link should be inserted in position (a).

The next step is the most important and the most time consuming — winding T1. Ensure that you have adequate 26 B & S (0.5 mm) and 32 B & S (0.2 mm) wire; about 2 m of the first and about 20 m of the second will be required. Have a sharp blade, some ordinary clear sticky tape and about 90 minutes on hand.

Start with the secondary winding. Leaving about 3 cm of wire projecting, close wind the 32 B & S wire onto the former. There is no need to count turns if you have exactly the same former and wire as we used because 150 turns is 4 layers almost exactly. When the first layer is complete cut a strip of sticky tape the correct width and, without letting the turns unravel, insulate the layer with the tape. Repeat this procedure, layer by layer until you have wound four layers.

Next, lead out a loop of the wire. Do not cut the wire, but twist loop and continue winding. Proceed 10½ turns, and tape these, leaving another loop projecting from the other side, but at the same end of the former. Continue winding until this layer is complete, and then tape it. Add three further layers finishing at the same end but the opposite side to where you started. This completes the secondary. Cut the wire, about 3 cm from the former.

You should now have one loop and one single wire coming out each gap at the end of the former.

Next, wind five turns of 32 B & S for the feedback winding and tape these. Start and finish in one of the gaps in the other end of the spool. They can be close wound or spread — we tried both with no perceptible difference. Leave about 4-5 cm of wire on the end of this coil as the feedback winding connections on the pc board are further away. Finally, wind 2 layers of primary similarly, starting and ending at the unused spool gap. The former will fit into the core leaving four groups of two connections each.

The core is a gapped one. It is rather fragile and should be handled with care and reverence. It is also somewhat conductive. The secondary connections will need to be insulated from the core at the point where they leave it. Use either some thin spaghetti, or insulation stripped from thin hookup wire. When this is done, fit the core around the former. It should be held there with a clip (provided). There is, however a small plastic inset tapped to take a 6 BA thread in one half of the core. Since this is plastic and not attached tightly to the core half a bolt may be used with it to secure the halves together. Under no circumstances should they be held very tightly by a screw through the centre, and at no time by a metal nut and thread.

Next it is necessary to tin the wires, scraping away the enamelling, being careful not to break the wires. Finally the correct phase of the windings needs to be determined. Temporarily connect the primary wires to the two primary connections on the pc board, ▶

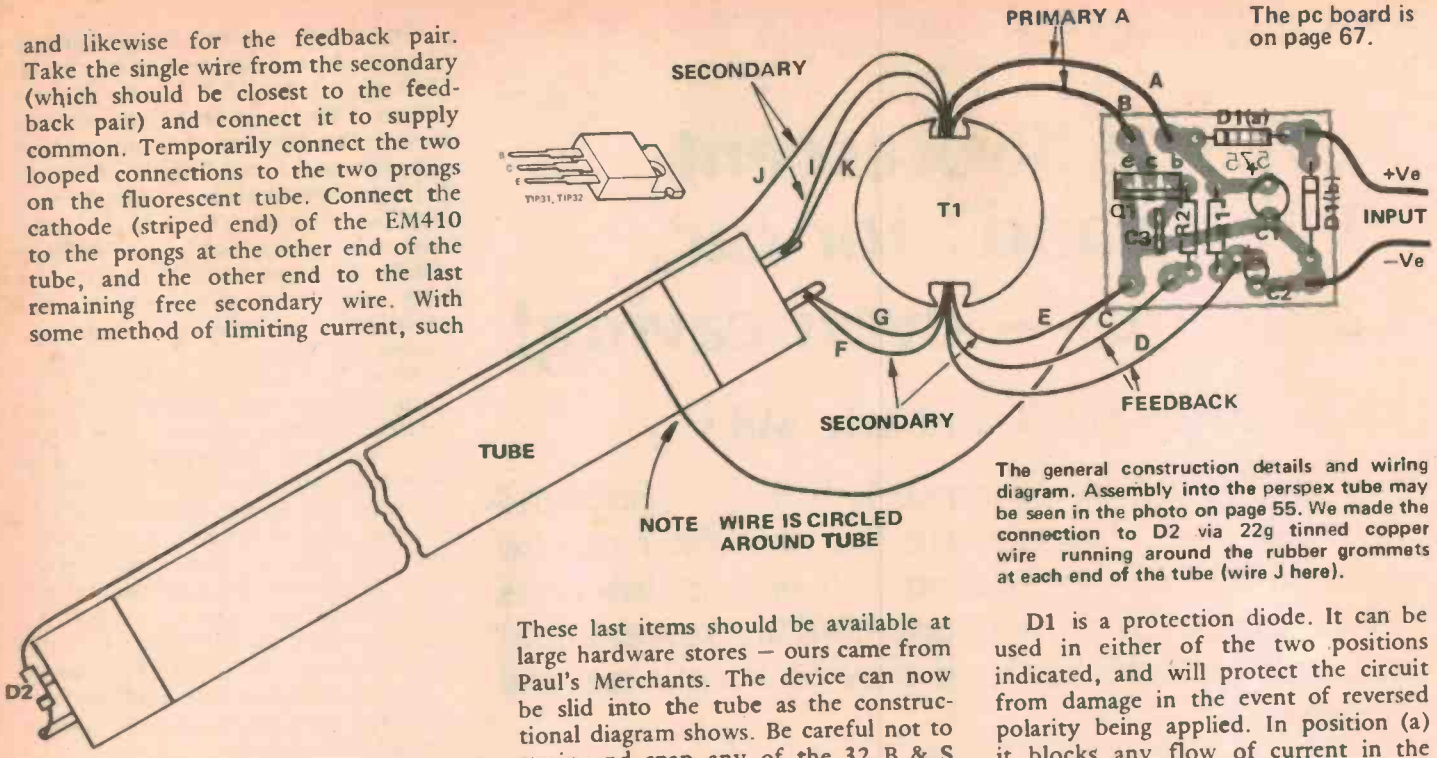
The pc board is on page 67.

and likewise for the feedback pair. Take the single wire from the secondary (which should be closest to the feedback pair) and connect it to supply common. Temporarily connect the two looped connections to the two prongs on the fluorescent tube. Connect the cathode (striped end) of the EM410 to the prongs at the other end of the tube, and the other end to the last remaining free secondary wire. With some method of limiting current, such as a supply limiting at about 200-500 mA, or a 22 ohm resistor in series with a 12 volt supply, apply power. Now, one of three conditions will exist:

1. No oscillation. If there is ac on the secondary, the device is oscillating. If you wish to check this without a multimeter, bridge the EM410 momentarily. Any flicker indicates oscillation. If there is none, reverse the phase of the feedback winding by swapping its wires. This should get you to condition (2) or (3).
2. Oscillation, but tube glows dimly or only with the EM410 bridged out. This means that the secondary sense is wrong. Swap both the primary and feedback wire pairs. This should get you to condition (3).
3. It works.

Now connect the wires firmly, rather than temporarily as before. Check the power consumption next. If it is more than 400 mA, or the transistor gets too hot to touch, increase R1 to 1K or 1k2. If the whole draws less than 200 mA or is dim, decrease it to 680 or 560 ohms.

The remaining construction is up to you, depending upon how you have chosen to house the assembly. The description which follows pertains to the 8 W version, intended for under-car or camping uses. You will require a 380 mm length of acrylic tube, 26 mm 1/D and 32 mm 0/D. We purchased ours from FX Plastics, but it is available from any large perspex dealer. Also a pair of 32 mm (1¼") rubber chair feet — the type that push over the tubular legs, and a few grommets which just fit within the acrylic tube.



The general construction details and wiring diagram. Assembly into the perspex tube may be seen in the photo on page 55. We made the connection to D2 via 22g tinned copper wire running around the rubber grommets at each end of the tube (wire J here).

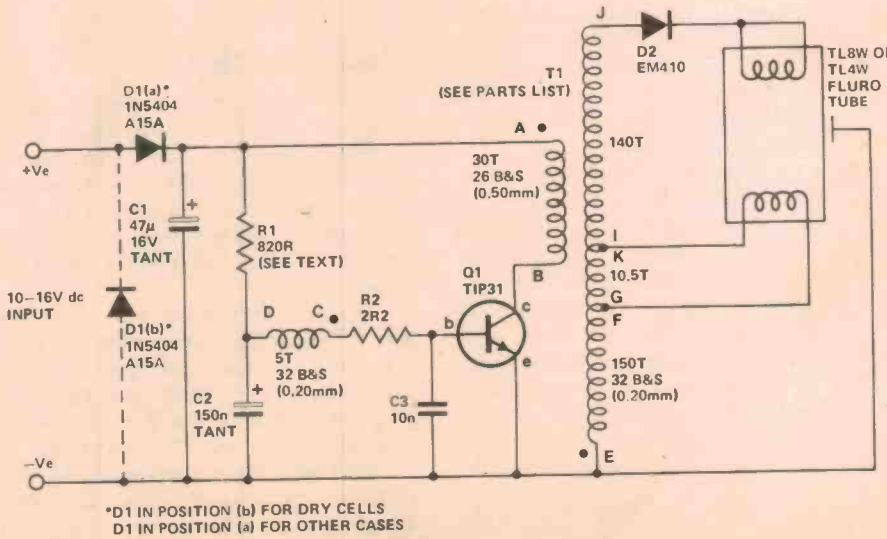
These last items should be available at large hardware stores — ours came from Paul's Merchants. The device can now be slid into the tube as the constructional diagram shows. Be careful not to strain and snap any of the 32 B & S wires — it is singularly disheartening to have to start again! Jam the parts in place with foam rubber or similar padding. You may then fit a suitable connector onto the power cable — we built one 8 W device with alligator clips and a 4 W one with a cigarette lighter plug fitted (for plugging into vehicle dashboard). A reflector may be formed by sliding some white paper behind the tube. We used a card with the project name and number on it.

Circuit notes

This converter circuit is actually much more complex in its operation than the circuit diagram appears! Hence the long 'How it works'.

D1 is a protection diode. It can be used in either of the two positions indicated, and will protect the circuit from damage in the event of reversed polarity being applied. In position (a) it blocks any flow of current in the reversed polarity condition but drops about 0.8 V from the supply in normal operation. Where a car battery or rechargeable battery pack is used and efficiency is not at a premium, this is satisfactory. When the diode is used in position (b) it shorts out the supply in the event of it being connected in reversed polarity. This protection is used when the supply is dry batteries since they cannot deliver sufficient current to destroy D1. No power is lost due to a forward voltage drop in series with the supply during correct operation. Two positions are provided on the pc board for D1; the (a) position must be linked when D1 is used in position (b).

Capacitor C1 is the supply bypass capacitor. Due to the high speed



*D1 IN POSITION (b) FOR DRY CELLS
D1 IN POSITION (a) FOR OTHER CASES

switching transients present this capacitor needs to be a tantalum type. It should be wired close to the rest of the circuit.

Actual power consumption and apparent light output can vary from unit to unit. The amount of power delivered to the tube and hence the power consumption overall can be varied by adjusting R1. The value of 820 ohms is given only a guide. In order to have a current consumption of about 250 mA, which seems to be the best compromise, as little as 560 ohms or as much as 1k2 might be required. Generally, if the supply current exceeds 400 mA R1 should be increased and if starting is unreliable it should be decreased.

One final note; Q1 appears to be very overrated being a 40 W device that can carry many amps. Much more than necessary. However, we have found that transistor dissipation goes up (and efficiency down) if a transistor of smaller rating is used. This seems to be because the beta falls if the knee current is exceeded and the transistor dissipates power during switching as a direct result. Thus, we recommend the use of a TIP31 rather than, say a BD139 or Philips BDY50. ●

PARTS LIST – ETI 575

Resistors all ½W 5%
R1 . . . . . 820R
R2 . . . . . 2R2

Capacitors
C1. . . . . 47u 16V TANT.
C2. . . . . 150n 35V TANT.
C3. . . . . 10n Greencap

Semiconductors
D1 . . . . . 1N5404, A15A or similar
D2 . . . . . EM410 or similar 1kV PIV diode
Q1 . . . . . TIP31

Miscellaneous
T1. . . . . Phillips 26/16 3H1 ue68 pot core with former, 4322-022-28250 (See 'Shop Around').
F1. . . . . Fluorescent tube; TL8W (8 watt) or TL4W (4 watt).
Wire 32 B & S (0.2 mm) and 26 B & S (0.5 mm) enamelled wire.
Perspex tube, 32 mm O.D. by 26 mm I.D., length to suit.
Rubber chair feet, 32 mm I.D. (see text).
Grommets, 26 mm O.D.
Lengths of automotive cable (one red, one black) 24/020 or similar.
Alligator clips or cigarette lighter plug.
Nicad batteries, if used.

HOW IT WORKS – ETI 575

R1, R2, C2, C3, Q1 and T1 comprise a self-oscillating dc-dc converter.

Initially, Q1 is turned off. At switch-on, current flows through R1, charging C2. Subsequently C3 charges up via the five-turn feedback winding and R2. When C3 reaches about 0.55 volts, Q1 begins to conduct. The feedback winding then forces more current into C3 via R2 because of the phase of its connection. Q1 is then turned hard on. During this positive feedback cycle C2 is actually forced to discharge. R2 limits the maximum base current, and C3 removes fast spikes from the base circuit. These together serve to protect Q1's base.

Eventually, the magnetic field induced by the collector current of Q1 in the primary ceases to increase and the positive feedback ceases. Q1 then begins to turn off and. the magnetic field in the core begins to collapse. This produces a negative voltage across the feedback winding which biases Q1 hard off. Then the cycle repeats, R1 and C2 defining the frequency and the power delivered to the tube, since a constant amount of energy (equal to 1^2max times L) is transferred to the load each cycle.

The magnetic field collapsing in the core induces a very narrow high voltage spike in the secondary. When the unit is first turned on, the fluorescent tube will appear as an open circuit and a high positive potential will be present across it as a result of the 140 turn winding. Also, the negative (cathode) end of the tube is pulled positive by the 150 turn starter winding. As these voltages add a very high potential exists from the anode to the external 'earth' contact. This is enough to force some gas to ionize and the tube breaks down or 'strikes'; This occurs for a few cycles until the 10½ turn winding heats the cathode filament and the tube conducts completely.

Once started, the increased temperature and traces of unrecombined gas permit it to conduct quickly each cycle and the tube no longer relies on the earth electrode for breakdown. Once this condition is reached the secondary voltage is held low by the tube conducting, the inductance of the core and secondary limiting the current, as in a conventional 240 V balast. Diode D2 prevents any conduction in the reverse phase which would upset the magnetic field buildup. If a high voltage is applied to the circuit and D2 is absent ac can flow in the tube and efficiency falls markedly. Hence the circuit in its correct mode acts in a magnetic pumping fashion rather than a pure transformer action. While the cathode is heated, tube life is reduced by the fact that the dc flow of current eventually strips the cathode. Theoretically, when the cathode is stripped to the point of failure the tube should be able to be physically reversed, since the anode end filament will not have been used at all. The tube does however have quite a long life.

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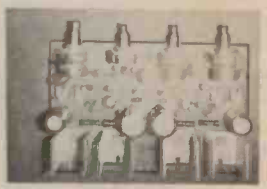

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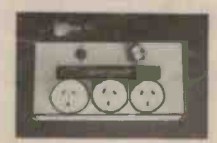

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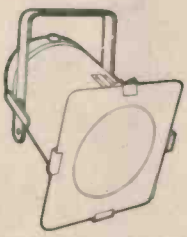

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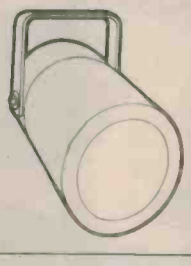

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Project 252

The 'Passionmeter'

Staff member Phil Cohen (see page 15) believes *passionately* in the English maxim, "All work and no play makes Jack a dull boy". This project of his should put a sheen on those dull moments that occur at every party!

— a party novelty project!

MANY OF YOU have probably seen those small glass vessels, available from 'joke' and 'magic' novelty stores, sold as 'passionmeters'. They consist of a series of glass bulbs, one above the other, containing a red liquid at the lower end. At the touch of a hot palm the liquid bubbles its way toward the top – how high it bubbles depending on how hot the grasping palm happens to be!

The ETI passionmeter uses an electronic technique to measure the passionate user's level of excitement – or stress – indicating this on a 'ladder of LEDs'.

Now, a person in the throes of a passion (or under some stress, all the same thing for our purposes) undergoes certain physiological changes (see reference 1). Amongst such obvious and observable alterations as bulging eyes, flushed visage, foaming at the mouth and steam issuing from the auditory orifices . . . are more subtle phenomena. The one we are concerned with is skin resistance.

Skin resistance has a number of characteristics which make it a suitable variable for measuring the level of personal passion. The *lower* the skin resistance of a subject, the greater level of emotional stress (reference 1). And vice versa.

*Reference 1: "Zen and the art of motorcycle maintenance", Robert M. Pirsig. Corgi.

Skin resistance increases with age, decreases with perspiration (as from exertion) and varies according to the activity recently engaged in. A finger which has just finished the washing up will exhibit a lower skin resistance than one which has just assisted reading a newspaper.

With high skin resistance, (few or none at all!) of the LEDs will light. With decreasing skin resistance more of the LEDs in the ladder will light, climbing all the way to the top with a subject at the height of passion – or one who has just finished the washing up.

You will notice the lack of an on/off switch. As a CMOS IC is used in this project, the 'no-finger' (i.e. non-operating) current consumption is so low that battery drain is three-fifths of five-eights of half of 30% of the leakage across the battery terminals – negligible in fact. Hence, no switch.

We built the project into a small plastic and aluminium 'jiffybox', with a hole in the front panel for the insertion of a finger. This size of box is very handy as the battery just fits in behind the printed circuit board and is neatly held with a little packing.

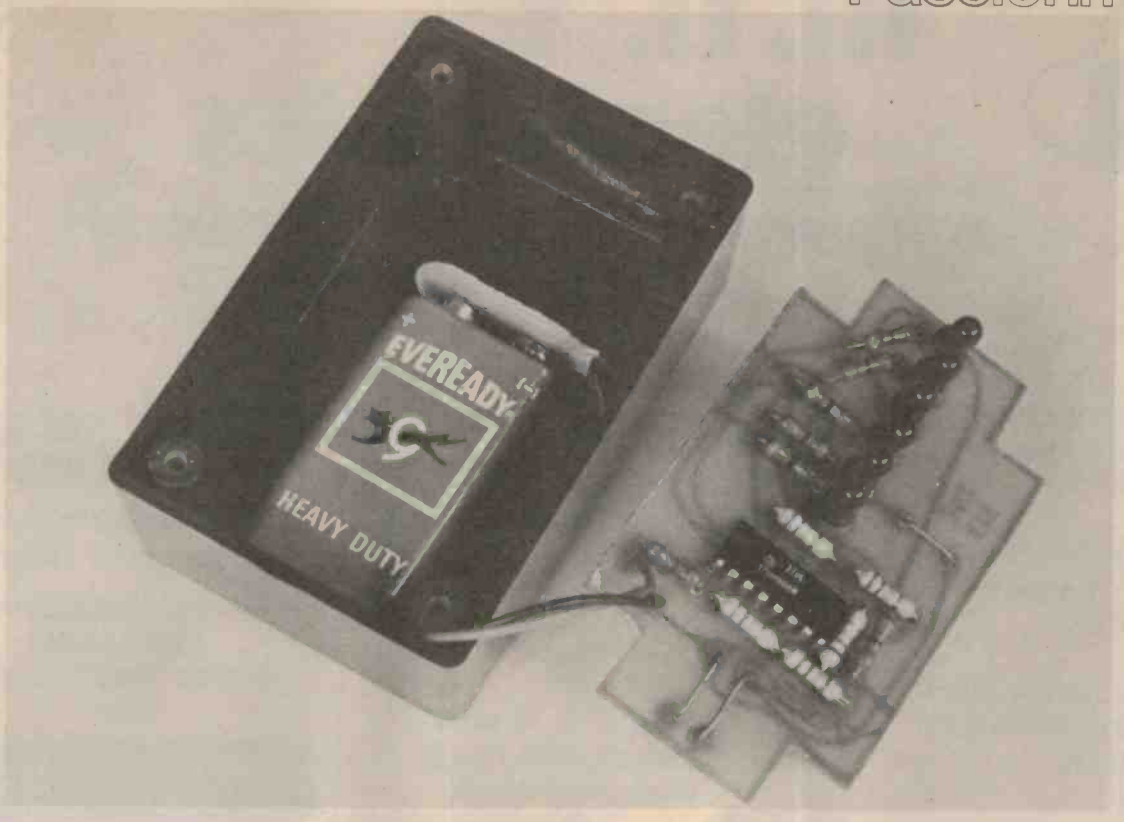
The LEDs poke through the holes in the panel – you can get clips to hold them in place but we decided to dispense with them.

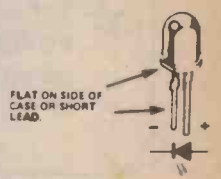
When soldering the components in, keep all of them (with the exception of the LEDs) as close to the board as possible. The LEDs should be stood a few millimetres off the board, with their flanges, which butt up against the front panel, level with the top of the IC.

Make sure that all of the LEDs are the right way round (notice the flat face, indicating the cathode, on one side of each). Also make sure that the integrated circuit is fitted the right way round.

Don't forget the wire link LK3. LK1 and LK2 are the contacts, which are soldered in to the circuit board in exactly the same way that a wire link would be, except of course that you must use un-insulated wire.

It's also a good idea to cut a piece of hard paper or card to fit between the circuit board and the battery to prevent shorting when a finger is pressed down onto the contacts. ●





HOW IT WORKS – ETI 252

The operation of this circuit depends on the difference in skin resistance between different people. The lower the skin resistance, the more of the LEDs will light up.

This resistance is measured between LK1 and LK2. As the finger of the person to be tested is pressed against the circuit board, it will cover both of these links and the resistance between them will drop from its 'un-fingered' state in which the resistance across LK1/LK2 is high) to a value less than 1M. This will cause the voltage on the resistor chain R1 to R6 to drop.

The 'gates' in the 4049 integrated circuit are inverters. That is, whatever happens on the inputs, the opposite will happen at the outputs. In this case, the Inputs are being dragged to a low voltage. When the voltage on the input of any particular gate drops below about 4.5V (half the supply voltage) the output will change from 0V to 9V. This will drive current through the appropriate LED.

As the resistance across the contacts decreases, more of the gates will be turned on, causing LEDs in the line to light up.

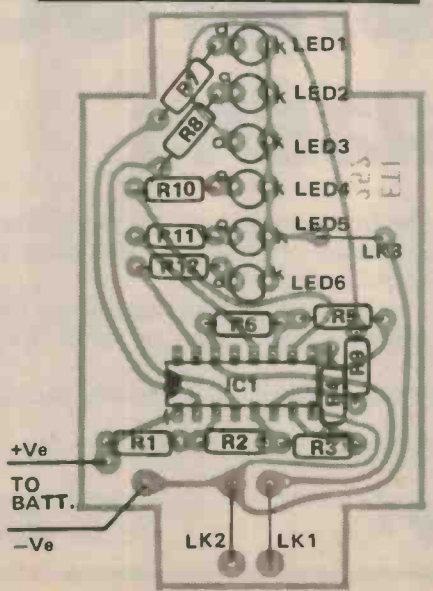
When no finger is present, none of the LEDs are lit and the current drawn by the circuit is so small that an on/off switch is unnecessary.

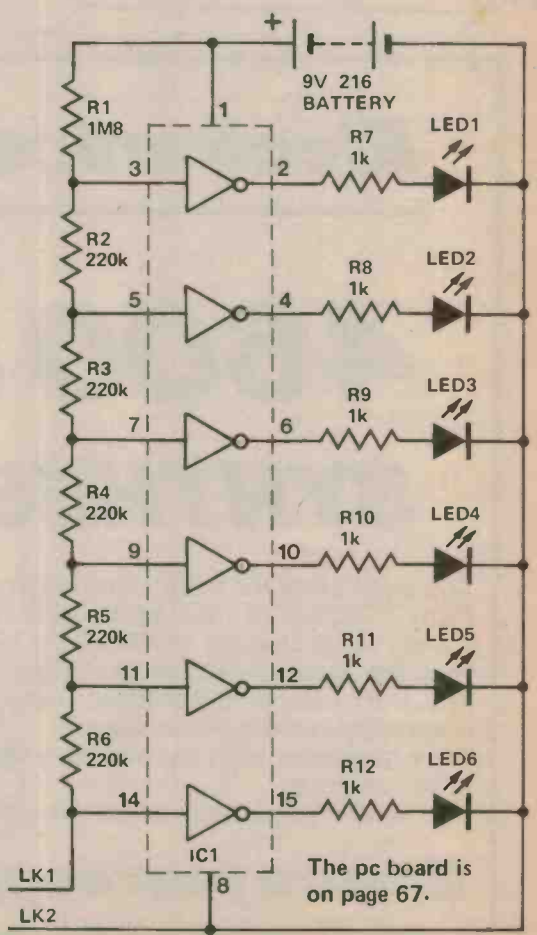
PARTS LIST – ETI 252

Resistors all ½W 5%
- R1 . . . . . 1M8
- R2-R6 . . . . . 220k
- R7-R12. . . . . 1k

Semiconductors
- IC1 . . . . . 4049B
- LED1-LED6 . . TIL220R Red LEDs or similar

Miscellaneous
- B1. . . . . 216 9V battery
- Battery clip, ETI 252 pc board, small 'zippy' box to suit.





The pc board is on page 67.

hi.fi. & electronics

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The International Synthesizers have gained a reputation as being the most flexible and versatile of electronics instruments available.
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This book is available now as a limited edition of 2000 copies only.

Ensure your copy!

Send $12.50 to Electronics Today International,
15 Boundary Street, Rushcutters Bay,2011.

Shoparound

STOP PRESS!

News just to hand on the Series 4000 stereo amplifier: ELECTRONIC AGENCIES are offering kits of each module as well as complete kits. They're at 115-117 Parramatta Rd, Concord 2137, (02) 747-6472.

TO ASSIST readers in the continual search for components, kits and printed circuit boards for ETI projects, this column has been instituted to put you in touch with suppliers. Conversely, suppliers – we would like to hear from you if you stock kits or parts for our projects.

PC boards

Printed circuit boards for *every* project *ever* published in ETI are available through the following companies (to the best of our knowledge):

RCS Radio
651 Forest Road
Bexley, NSW 2007

Radio Despatch Service
869 George Street
Sydney, NSW 2000

We have arranged to supply board manufacturers with pc board and front panel artwork for our projects in advance of publication. Commencing with the August 1979 issue, we will publish a regularly updated list of those suppliers taking advantage of this service. Suppliers wishing to join this scheme should contact Phil Wait on (02) 33-4282.

Polyphase SSB gen.

It's now possible to generate a good quality SSB signal for less than the cost of a crystal filter alone. This circuit should find its way into QRP rigs and many have already been built.

Choosing good quality components should make all the difference. In fact if you have the ETI capacitance meter (ETI 136, March 1976) you can select lesser quality components so they are matched.

Phillips film dielectric trimmers and polycarbonate block capacitors are available from Silicon Valley stores or Cema Electronics. For film dielectric trimmers, Neosid coil components, pc boards, and other parts for this project try Radio Despatch Service in Sydney if you can't get them locally. Try also All Electronic Components in Melbourne.

The Light Wand

Yes, we know that it's all been done before but we think this one's better!

You may have to really shop around for the parts for this one. All the mechanical parts (grommets, rubber ends, perspex tube) we obtained from Pauls Hardware in Sydney but most large hardware stores should have them.

A friend of ours once said that Philips have a great range of components – if only you could get your hands on them! We aren't quite sure what the problem is – but we are working on it!

We have made sure that the Philips pot core for this project is available – so we've done our bit as far as this component's concerned. The pot cores for our prototype Light Wands were purchased from George Brown and Company in Sydney.

Other suppliers should note that a Philips spokesman has informed us that they have large stocks of these pot cores in Sydney just *waiting* for orders!

True RMS Voltmeter June issue

The True RMS Voltmeter, ETI 144, is one of the most useful pieces of equipment for experimenters. Now you can measure the RMS voltage of noise, switched waveforms and just about anything else.

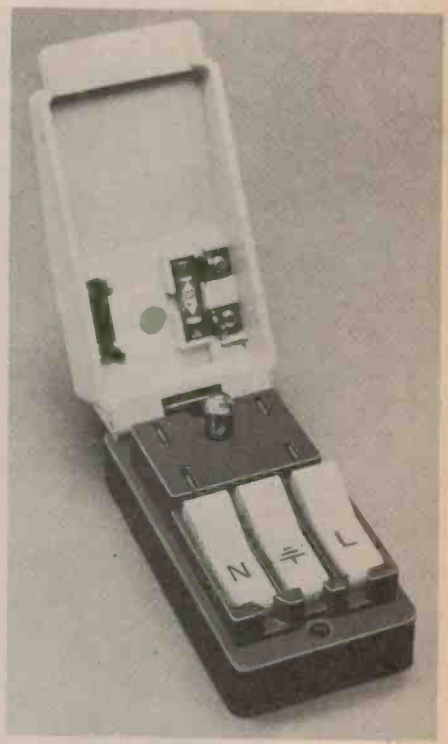
All the components (particularly the 2% resistors) including the meter, 10 turn trimpots, transformer and pc board are available from Radio Despatch Service, Broadway, Sydney.

Ferrite materials

Ferrite rods, beads and toroids as mentioned in our article on RF breakthrough (page 125) may be obtained from Davred Electronics, Sydney or from Neosid Pty Ltd, Sydney.

Dimensions of the components are not critical and the material can be either F7, F8, or F14.

All the toroids mentioned in our April article on "Wideband Antenna Baluns" (page 70 of that issue) are available from Watkin Wynne, Sydney as well as Neosid Pty Ltd.



Safety mains connections

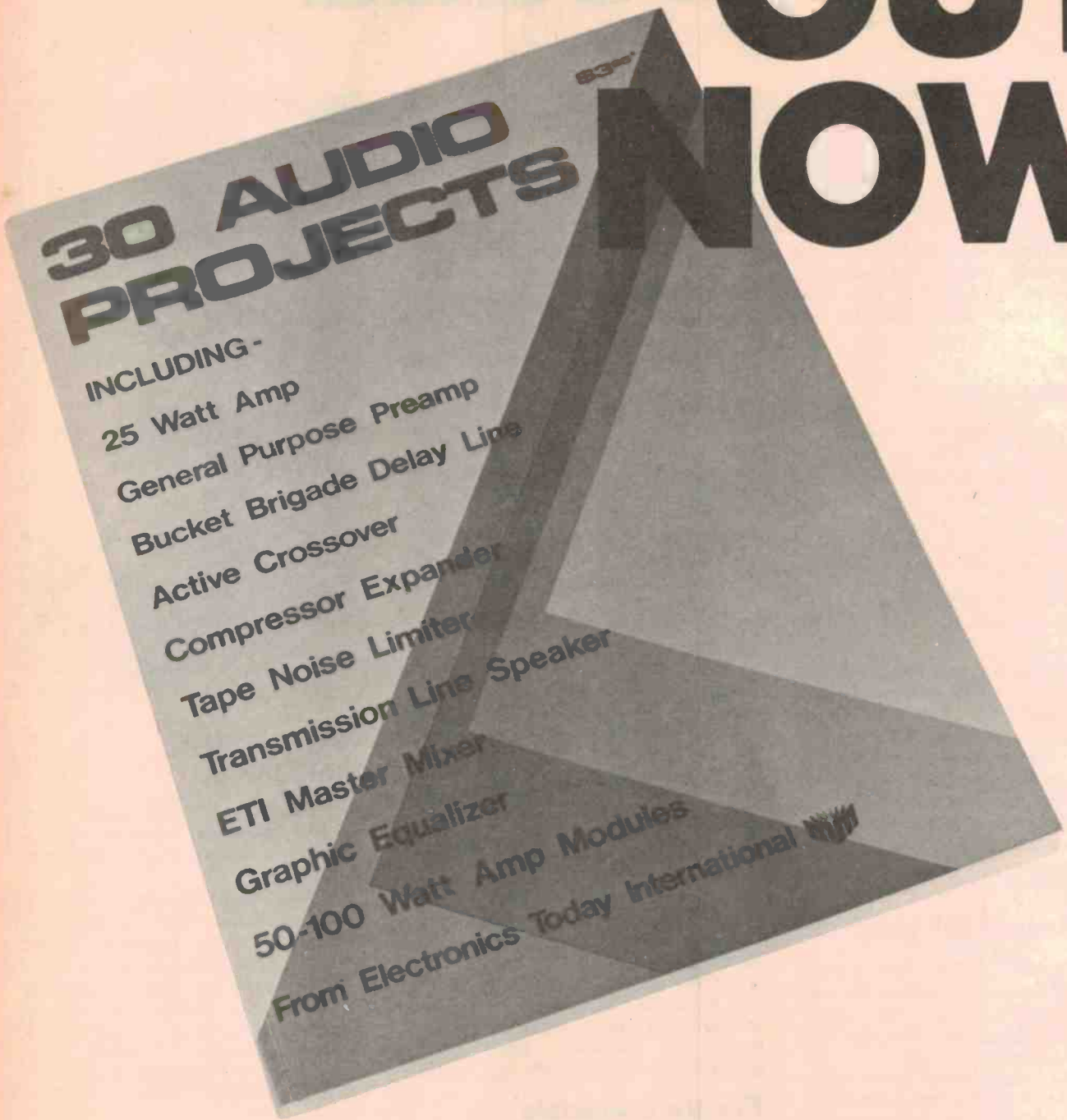
When temporarily hooking up mains-operated equipment many constructors make up a 'danger plug' – very aptly named!

To avoid the possibility of shock or electrocution from this dangerous, but common, practice Delsound P/L in Brisbane have brought out a fused, 13 amp capacity safety connector. Called the 'Quicktest', it is made by Cliff Plastic Products of England and sells for $12.50 – pretty cheap insurance. See Delsound, 1 Wickham Terrace, Brisbane 4000 229-6155.

Component suppliers

Readers are anxious to hear about what you have in stock regarding ETI projects or what you may have in the way of special components. Please do not hesitate to contact us directly or speak to our advertising representatives: John Colquhoun in Melbourne, Geoff Horne in Brisbane, Peter Ryan in Adelaide.

OUT NOW



Thirty Audio Projects is the latest in our line of books designed especially with the serious constructor in mind. Ever found yourself leafing through back-issues of ETI for the circuit of a low-noise input stage? Or looking for some information on bucket brigade devices? Or do you need to know that the design you're using has been checked and re-checked for circuit errors and built by people all over the world before it is published? Thirty Audio Projects contains just that – thirty projects of the highest ETI standard, checked and re-checked and then presented in a compact and complete form.

The price is $3.95 – that's under fifteen cents per full project design – and they're all audio projects, thirty of our most sought-after designs. Projects include: Simple 25 watt amp; Bucket brigade delay line; Active crossover; Compresser/expander; Tape noise limiter; ETI speaker system; Professional-feature mixer; Howl-round suppressor; the ever-popular 50/100 watt amp modules; Graphic equaliser; Spectrum analyser; audio millivoltmeter.

Ideas for Experimenters

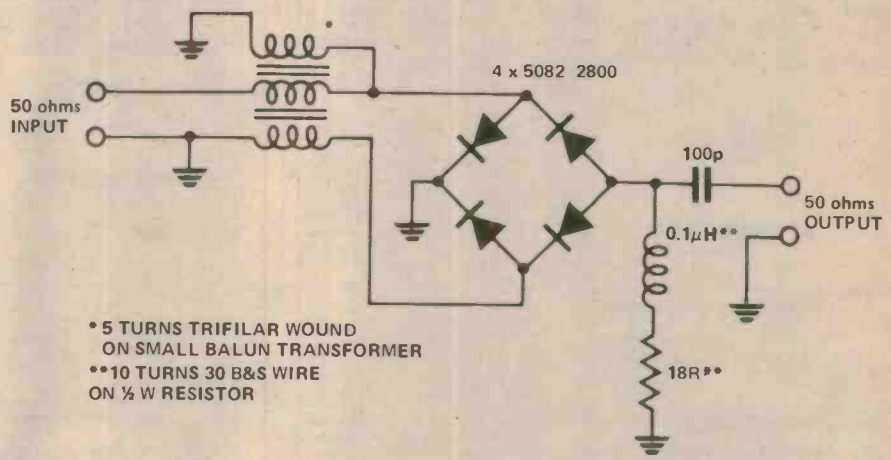
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

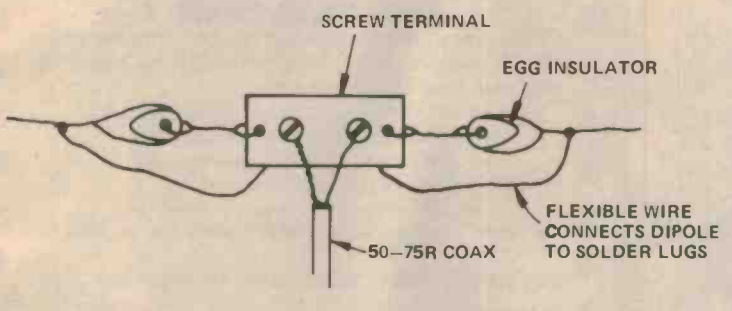
Frequency doubler

This circuit from staff files can be used to double the frequency of an RF signal generator. A generator with a top range of say, 100 MHz, can be used to provide signals of up to 200 MHz. Fundamental, third and fourth harmonic are about 20 dB or more below the second harmonic (desired) content provided the diodes are all well matched.

Input and output impedances are around 50 ohms. All wiring should be as short and direct as possible. The whole circuit may be mounted in a short piece of tube with a BNC connector on each end.

This could also be used in an oscillator/multiplier chain and for VHF/UHF converters or transverters and would most likely be followed by some sort of tuned amplifier.

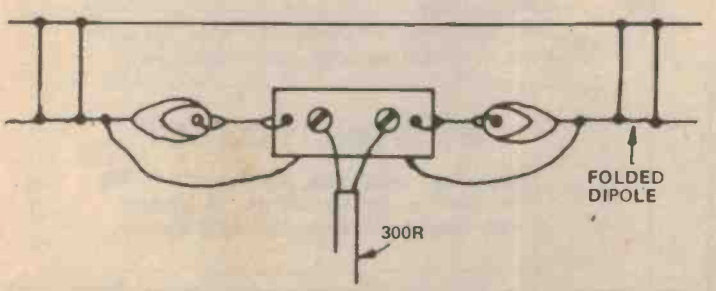




Simple dipole connector

This idea may save you a bit of cash. It comes from G. Armitage of Melbourne.

Those cheap two-way screw connectors made out of a bit of cardboard or plastic with a couple of terminals screwed into them can be used as centre connectors for dipoles. The egg insulators take the strain off the solder connections. They can be tied to the connector using a bit of string or nylon rope. The flexible wire shown connecting the dipole to the solder lugs should be included in the dipole length.



Have you had any interesting ideas lately, or discovered an interesting circuit modification for one of our projects? We are always looking for items for these pages and so naturally, we'd like to hear from you.

We pay between $5 and $10 per item – depending on how much work we have to to on it before we publish it.

The sort of items we are seeking, and the ones which other readers would like to see, are novel applications of existing devices, new ways of tackling old problems, hints and tips.

Some of **AUSTRALIA'S LOWEST COMPONENT PRICES**

Note:: Regular Prices not temporary specials — keep us in mind for that next order. (Diggerman Electronics)

POTS 38c (LINEAR ¼" ALUM. SHAFT)
Linear potentiometers rotary carbon 38c ea. 500 Ohm, 1K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M.

TRIMPOTS 15c (10mm)
Values: 100, 250, 500 Ohm, 1K, 2K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M

LEDS $12 a 100 17c each
Quality Large red LEDS well difused wide viewing angle. 17c each, $1.50 per 10, $110/K
Quality MOUNTING CLIPS 5c ea. $4/100

Trade/govt./S.T. exempt: welcome. Send for special lists (e.g. $26 a 100 pots and $99 a 1000 LEDs plus tax if applicable. Small quantities also.
TRADE ENTRANCE Schools Credit Okay

BC 107 BC 108 BC 109 13c
METAL CAN TRANSISTOR
BC 108 - 13c
10 for $1.20
100 for $11

1 Amp. DIODES
50V 1N4001 - 6c
100V 1N4002 - 7c
400V 1N4004 - 8c
1000V 1N4007 - 12c
10% off 100 SAME

$4 a 100 SIGNAL DIODE **IN4148**
$30 a 1000 5c each

ZENER DIODES: 15c each 400 mW 5%
E24 values 3V to 33V

5c ELECTROS (UPRIGHT)
(per 100 prices in brackets)

Cap. 0.47 uF thru to	16V all	25V all	50V all
10uF	5c($3½)	6c($3¾)	7c($4)
22uF	6c($3¾)	7c($4)	8c($5)
33uF	8c($4)	9c($5)	10c($6)
47uF	9c($5)	10c($6)	11c($7)
100uF	10c($6)	12c($7)	14c($11)
220uF	12c($8)	16c($10)	35c($17)
470uF	16c($12)	22c($16)	45c($30)
1000uF	22c($18)	30c($25)	75c($50)

1000uF/16V axial — 20c ea. $8 per 50
2200uF/50V PCB — 95c ea. $9 per 10
Full axial price list — SAE

5c POLYESTER FILM CAPS
E12 10% 100V

.001 - 5c
.0012 - 5c
.0015 - 5c
.0018 - 5c
.0022 - 5c
.0027 - 5c
.0033 - 5c
.0039 - 5c
.0047 - 5c
.0056 - 5c
.0068 - 5c
.0082 - 5c

.01 — 5c .1 — 10c
.012 — 6c .12 — 11c
.015 — 6c .15 — 12c
.018 — 6c .18 — 14c
.022 — 6c .22 — 15c
.027 — 6c .27 — 16c
.033 — 7c .33 — 18c
.039 — 7c .39 — 19c
.047 — 7c .47 — 20c
.056 — 8c
.068 — 8c All values
.082 — 9c in uF
10% off 100 same uF

SCRs C106Y1 40c C122E $1.20

SCRs:
0.8A 30V C103Y — 35
0.8A 200V C103B — 60
4A 30V C106Y1 — 40
4A 400V C106D1 — 75
8A 400V C122D — $1.05
8A 500V C122E — $1.20

TRIACS:
6A 400V SC141D — $1.30
10A 400V SC146D — $1.50
DIAC ST2 — 35
Chart to identify leads Plus trigger info. — 10c

25 A 400V
SC260D TRIAC
C37D SCR
EA. **$2.50**

2c RESISTORS ¼W
$1.80 per 100 SAME RESISTANCE

Our 3 year old price still current. Opposition hoped we would go broke but our price remains at 2c ea.
1 Ohm to 10 M ¼W 5% E12 carb. film.

APPROX. SIZE:
½W miniature metal glaze
1 Ohm to 1M 5% E12
1M2 to 10M carb. film (larger)

RESISTORS 3c
$2.50 per 100 SAME RESISTANCE
Some carb film instead

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LCD WATCH
with rechargeable battery.
Worth over $100. But our price
ONLY **$69** includes postage
Truly solar powerable.
Daily need 2 minutes full sunlight. electric light also charges.
Stainless steel.
5% off two or more

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LADIES LCD WATCH
4 digit 5 function
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ONLY **$49** Includes postage
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Both watches feature:- 12 months guarantee - digits constantly displayed. Hour, minutes, seconds, month, date. Nightlight Satisfaction guaranteed or return within 14 days. Competable trade discounts. Agents wanted every town.

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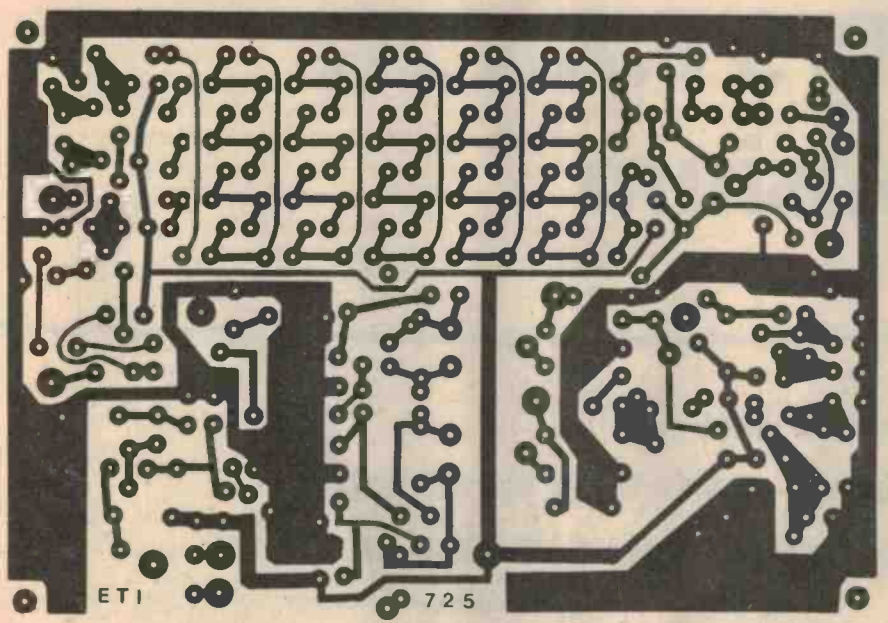
NEW PRODUCTS
150 NEW PRODUCTS, INVENTIONS, MAIL ORDER ITEMS, IMPORT EXPORT OFFERS, WHOLESALE CATALOGUE SOURCES, Illustrated (This item suitable business use mostly).

Dealer for world famous WHITES metal detectors Best selling detectors in Australia. Brochures 10c

Sorry our special reference July issue still under study. Instead we offer; while stocks last:-

RESISTOR SELLOUT
$1 per 100 pack same resistance ¼W 5%
1 Ohm to 1M stocked at ad booking
All values must go - new brand coming

DIGGERMAN ELECTRONICS P.O. BOX 33, CORAMBA, N.S.W. 2466



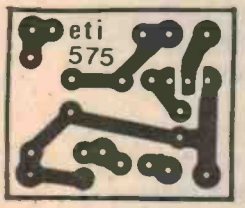
Using ETI PCB Artwork

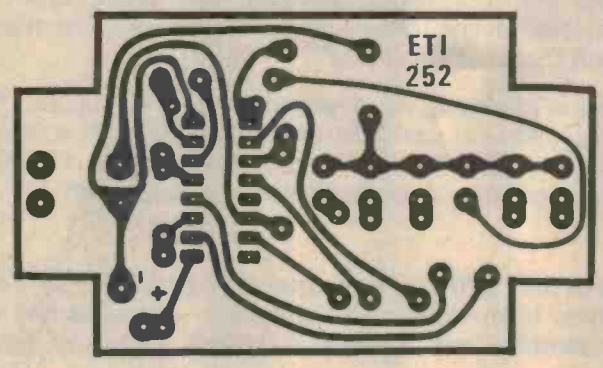
This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007 which is UV sensitive and can be used under normal subdued light.

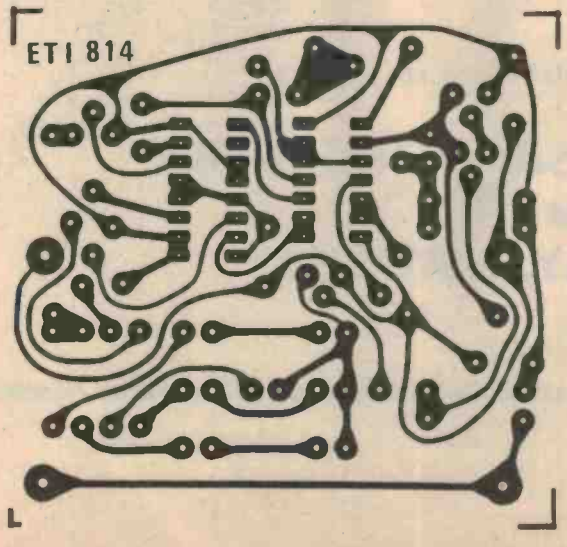
Cut a piece of film a little larger than the PC board and expose it to UV light through the magazine page. The non emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner - it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

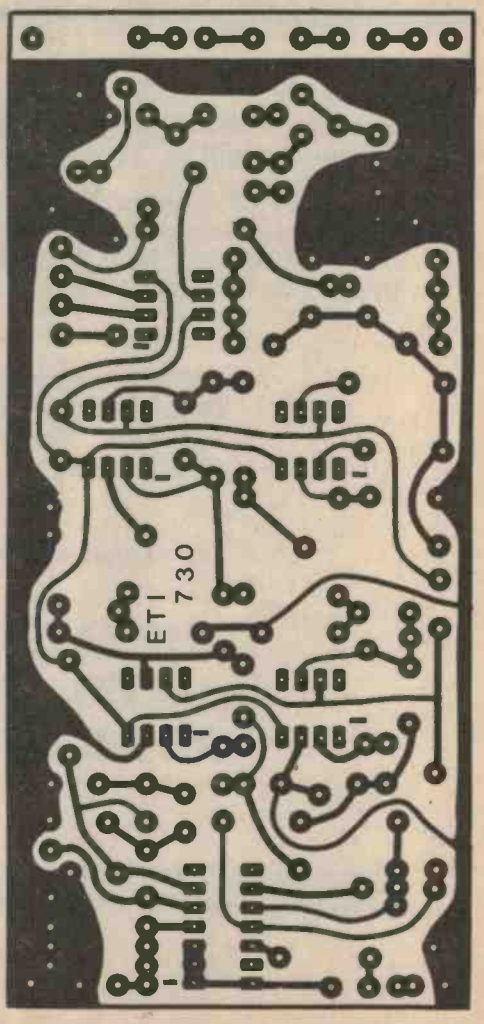
The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

Further information on Scotchcal and PCB manufacture can be found in the September and December 1977 issues of ETI. Please note also, that occasionally pressure on space may unfortunately prohibit the printing of blue type behind all PCB's, in which case the reader must resort to more conventional photographic techniques for PCB manufacture.









Presenting: A Symposium on 'Future Amateur Communications Techniques'

The 1979 F.A.C.T. Symposium

to be held over the weekend

29-30th September — 1st October in congenial

surroundings at Noah's Northside Gardens Hotel

52 McLaren St, North Sydney

Following the highly successful and enthusiastically attended 1978 Symposium held in May last year, the organisers are planning another event to stimulate and enthuse. The theme for this year's Symposium will be "Propagation and Circuit Techniques".

The series of lectures and workshops planned will cover the following topics: The coming solar cycle peak; Propagation research in Australia; Long distance VHF work; Practical SSB equipment; Circuit design and analysis using a computer; Amateur microwaves; Amateur applications of microprocessors; Building and using test equipment. A trade display is also planned.

For a registration fee of only $20 you can enjoy two and a half days of stimulating lectures and discussions from well-known amateurs — lunches and coffee breaks included! Those attending will receive a bound copy of the Symposium 'Proceedings'.

For further information, registration forms, etc., contact:

THE FACT SYMPOSIUM ORGANISER
c/o ETI, 15 Boundary St,
RUSHCUTTERS BAY, NSW 2011

Organised by Roger Harrison VK2ZTB and a committee of amateurs; sponsored by Ansett Airlines of Australia and Electronics Today Magazine.

U.H.F. CB antenna strength loss is no longer a problem.

Philips introduce the battery operated Field Strength Meter which lets you measure the efficiency of your U.H.F. C.B. band antenna. F.S.M. sensitivity is such that measurements are normally made at distances greater than 20 metres from the antenna being monitored or tested. The small detachable quarter wave pick-up antenna is inserted into the INPUT socket on top of the F.S.M. If a remote antenna is required in place of the one provided the feeder from the antenna is connected to the input socket.

The F.S.M. enables day to day checks of transmitted radiated power, comparison of relative gain between antennas, and accurate measurement of radiated power to construct a polar diagram.

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Service

PHILIPS

An important addition to your U.H.F. C.B. radio operation. For further information contact your local Philips Service Branch on the following telephone numbers, or bring your rig in for a test.

Sydney 736 1233, Newcastle 61 1631, Canberra 95 0321, Melbourne 699 2731, Hobart 28 0121, Brisbane 221 5422, Townsville 79 7422, Adelaide 223 4735, Perth 322 4653.

Specifications of the Philips U.H.F. field strength meter

Frequency Range	477MHz + 5MHz. Input Impedance...50 Ohms.
Input Level	−30dBm (+ 1.5dB) at maximum sensitivity.*
Scale Calibration	−10dB to + 1dB, relative to −30dBm input.
Power Supply	2 Standard 9V transistor radio batteries.
Battery Life	With normal intermittent use – over 150 hours. This will be double with long life batteries.

*When the sensitivity control is set at MINIMUM, a further reduction of approximately 10dB is provided. This control is combined with the ON/OFF switch.

(Also illustrated are 2 of the new Watt meters for signal measurement)

McCANN 184.0013

Spectrum space war

When the World Administrative Radio Conference (WARC '79) opens in Geneva on 24 September, the 154 member nations will be well-prepared to sort out the compromises necessary to accommodate the burgeoning services requiring frequencies in what seems to be shrinking spectrum space.

Decisions taken at the Conference will affect every service over the next two decades.

Pre-conference planning sessions between nations — both official and behind-the-scenes sessions — have largely mapped the changes that will be made to the regulations of the International Telecommunications Union (the body which governs international spectrum usage).

For many, particularly the newly-emerged African nations, this will be their first WARC. It will also be the first for the People's Republic of China.

Many of the smaller 'third-world' nations are lining up to tackle the industrial giants and demand for frequencies, particularly in the already-crowded 3-30 MHz high frequency band and in the microwave region, is pretty intense.

When planning for WARC '79 got under way six years ago it was thought that the demand for HF space would be less than it had been over the previous two decades.

While some existing services using HF will move, or have decreased requirements, many others wish to expand. Among the latter are broadcasting, the military and radio amateurs.

The third-world nations see great propaganda value in shortwave broadcasting. It's cheap in terms of potential audience, and for some, represents the only avenue available for a broadcasting service of any sort.

Military demand for spectrum space in the HF band has increased in recent years. The general world-wide recession and consequent cut-back in funds for military projects has created a demand for inexpensive communications systems for both medium and long range use.

The improved technology appearing in communications equipment over the last decade, together with greatly improved ionospheric predictions for HF communications, is an added factor.

Reduced spectrum space for 'utility' services in the HF spectrum is likely to be recommended. The move away from 'feeder' transmitters for HF broadcasting services, in favour of satellite facilities, has meant that many parts of the 3-30 MHz band reserved for utility and fixed services are now under-utilised.

Many shortwave stations have made use of the vacant spaces adjoining allocated broadcast bands in anticipation of a favourable decision.

Britain, the US, Australia and some European nations will support proposals for three new HF amateur bands at 10, 18 and 25 MHz.

It seems that the requirement for amateurs to have morse code qualifications for operating on bands below 144 MHz may become optional, at the discretion of the country's licensing authority. Several nations, including the US, will be supporting an alteration to the existing ITU regulations along these lines.

It seems highly likely, also, that CB radio will get a look in on WARC proposals. There are now 29 countries around the world with some form of 'citizens' or 'personal' radio service operating in the 27 MHz region.

Any proposals on private radio are likely to come in for considerable flak as there are many nations that consider this 'free' use of the airwaves as a threat to national security.

Demand for spectrum allocations in the VHF and UHF regions for land and aeronautical mobile services is very high. It is strongly tipped that there will be considerable pressure on broadcasting services, chiefly television, to be relocated in the UHF broadcasting band.

FM broadcasting is likely to be little affected, although planning requirements may change dramatically.

Much of the VHF/UHF spectrum will be vacated by satellite services as reliability has not proved to be what the planners first expected. The equatorial ionosphere has considerable effect on signals at frequencies right up to 1000 MHz and reliability, particularly with regard to data communications, suffers on circuits using geostationary satellites.

Recent ionospheric research has provided engineering planners with more data but the decreasing cost of suitable equipment for the super high frequencies (above 3 GHz) has attracted satellite services away from VHF/UHF.

A series of 'quiet', 'protected' segments throughout the 3-30 MHz, 30-300 MHz and UHF/SHF bands will be recommended for radio astronomers, in addition to the few scattered bands they now enjoy.

Electronics Today will be reporting on the progress and outcome of WARC '79 through our European offices. Watch this space.

Amateur report programme celebrates its first year

A group of Sydney amateurs who provide amateur band reports to Radio 2GB recently celebrated their first year of service.

It is believed to be the longest running programme of its type.

The reports are compiled by a team of local amateurs, coordinated by Sam Voron VK2BVS, and telephoned to the station at 10.30 pm each night.

The reports are broadcast just after midnight, 1 am and 2 am each day of the week.

The aim of the programme is to promote interest in amateur radio. It is supported by advertising from Trio-Kenwood's amateur equipment section and local supplier, Custom Communications.

If you would like to help promote amateur radio in this way, contact Sam Voron on 407-1066 between 7 and 9 pm any night.

National CB Festival

The National Citizens Radio Association will hold a National CB Festival in Canberra over the weekend of 8th and 9th September.

Styled as an 'economy' event, transport and accommodation costs have been deliberately kept to a minimum.

Attractions include mass eyeballs, portable stations, trade displays and a Saturday night bash to be compered by Nick Ervy of 'National Country Music Jamboree' fame — a programme heard on radio stations Australia-wide.

Featured will be Bluegrass country band 'Roadapple', supported by soloist Peter Colton.

The event replaces the NCRA's National Convention, held in September for the past two years, and is designed to attract the grass roots CBers to a National get-together, minus the politicking that dominated the 1977 and 1978 Conventions.

Greyhound have been appointed national travel coordinators for the Festival. Excellent travel rates are available.

Accommodation ranges from deluxe motel units ($32 per night) to chalet units ($5 per person, $22 family) as well as on-site vans, van parking sites and camping sites.

More information is available from: The NCRA CB Radio Festival Organiser, P.O.Box 242 Clayton Vic 3168.

Townsville College of Advanced Education — venue for the convention.

CREST heads for new horizons

Since CREST's new National Director, Mike Hurst-Meyers, took over the top seat last April, the CBers' emergency organisation has gained new vitality.

Now a registered charitable organisation (all donations over $2 tax deductible . . .) CREST was incorporated on June 8th last.

The National CREST Bulletin, a 40-48 page newspaper format publication, will be out this month, issued free to all monitors.

The '9-code', devised by CREST as a working code to save time and ambiguity in on-air reporting, was recently approved for use by monitors operating on channel 5 in both the HF and UHF CB bands.

While the P & T Department would prefer plain language or use of the international Q-code, they realised the limitations there and conceded that use of the 9-code would reduce channel loading and ambiguity of messages.

The Annual General meeting of CREST is to be held over 1st-2nd September at Brassey House in Canberra.

Mike Hurst-Meyers — the new National Director of CREST.

CREST is a national organisation of volunteer CBers engaged in monitoring the emergency channels on each CB band in Australia.

New antennas, fittings

The range of locally-made Jackson antennas, fittings and accessories was recently expanded to include new HF, VHF and UHF models for mobile and base station application.

Included in the new range of base station antennas are groundplanes, coaxial dipoles, colinears and yagis. All models are pre-tested and may soon be available with individual quality control test results.

Mobile whips are available constructed in fibregalss or stainless steel and the range of models includes high gain, unity gain and tuneable types.

A comprehensive range of antenna mounts and fittings are available to accommodate virtually every conceivable mobile mounting position. All mountings may be used for HF and VHF antenna models. UHF versions are also available.

To complement their antenna range, IFTA list a range of RF cables, including Teflon dielectric types.

For further information, contact IFTA Australia, 1 Greville St, Randwick NSW 2031, (02) 665-8211.

North Queensland Convention

The Townsville Amateur Radio Club will be host to the fourth bi-ennial North Queensland Convention for radio amateurs, to be held in Townsville from Friday evening 14 September to Sunday afternoon 16 September 1979.

This year's Convention promises to be the best ever, according to the club President, Peter Snell VK4APS.

The venue, Townsville College of Advanced Education, offers modern air-conditioned convention facilities. High standard residential accommodation is available on campus and it is recommended that attendees avail themselves of this feature.

The Club hopes to attract a number of overseas amateur operators to the Convention.

Registration forms are available from the club or from Ansett Convention Consultants in capital cities and major towns.

Popular convention activities planned are: homebrew competitions, transmitter hunts, technical seminars and films.

There will be a dinner dance on the Saturday evening.

A trade display and bookstall as well as demonstrations have also been arranged.

For further information, contact: The Convention Committee, Townsville Amateur Radio Club, P.O. Box 964 Townsville QLD 4810. Registration is $18 single, $32 double and $35 family including meals.

Staley speaks at WIA convention

The Minister for Post and Telecommunications, the Hon. A.A. Staley, addressed the 1979 Federal Convention of the Wireless Institute of Australia, the first Federal Minister to do so in the Institute's 68 year history.

Speaking at Brighton (Vic.) on Sunday 29 April, Mr Staley assured the delegates, from all States, that it was the Government's intention to restrict the installation of Channel 5A TV transmitters to those services for which large financial commitments had already been made.

He confirmed the policy of using UHF channels for Ethnic television services.

Channel 5A installations threaten the 144-148 MHz amateur VHF band. Interference to TV sets in Channel 5A service areas, and to the amateur service from 5A transmitters which operate in the 137-144 MHz allocation (unique in the world), is the problem according to a special committee's report, drafted earlier this year.

Mr Staley paid tribute to the Wireless Institute for its preparations for WARC '79, to be held in Geneva from September.

He said that the amateurs of Australia had been outstanding in quantifying their needs and requirements and was impressed with the way in which amateur delegates to WARC 79 had worked in collaboration with his Department in preparing Australia's submission.

The WIA, official body of Australian radio amateurs, is the oldest radio organisation in the world. Formed in 1910, it predates the Radio Society of Great Britain by three years and the American Radio Relay League by five years.

Amateurs increase

Figures for the March quarter show amateur licencees are up 813 for a total of 11 400 throughout Australia.

It is interesting to note that 23 percent of the total amateur population now hold Novice grade licences, although the proportion of dual-licence holders, i.e.: those with both Limited and Novice qualifications, is unknown.

(Item courtesy Vicom's "Ham News")

jackson

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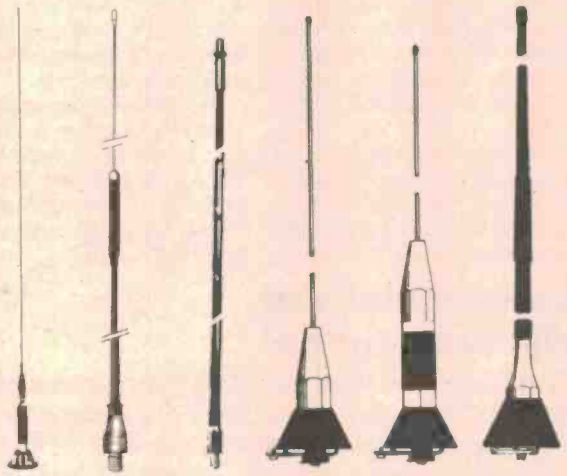
- Tuneable Helical 26-28 MHz
- Mini Flexible Rubber Helical
- Mini Flexible S/S Unity Gain
- Twin Truckers 27 MHz
- 9',12', Marine 27 MHz



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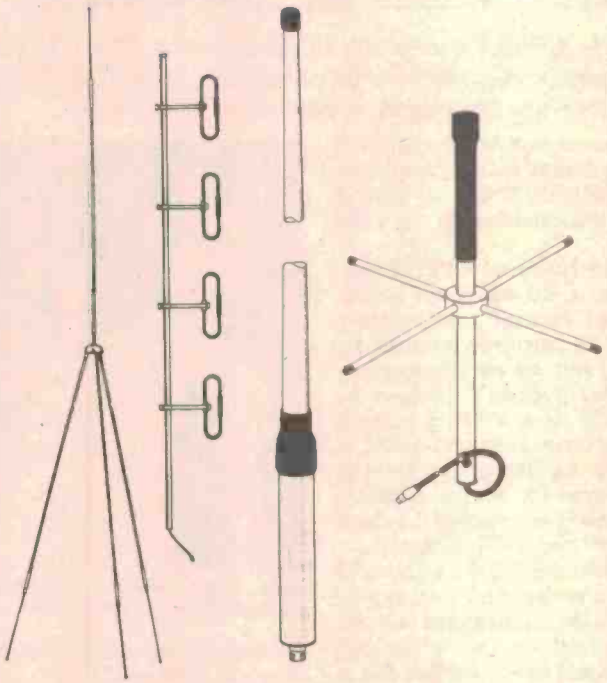

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- Quick Disconnect
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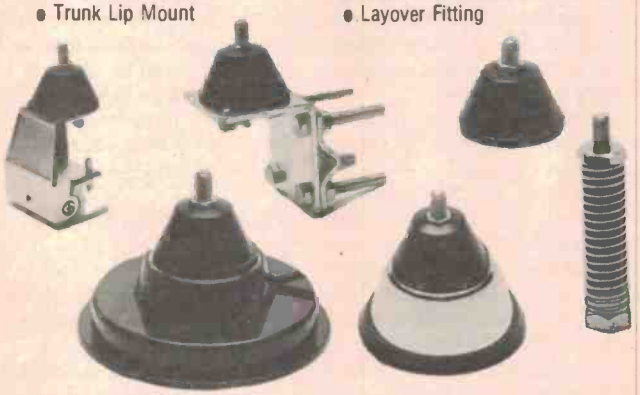
- Layover Fitting



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3.75. D19. 21 dB gain 3 outlets $61.35
4.75. D19. 21 dB gain 4 outlets $61.84

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The Atlas '110' combo

Whilst competing for a share of the low cost end of the amateur transceiver market, this rig does not skimp on performance.

THIS receiver-transmitter and power supply combination must surely be the *simplest* piece of amateur gear on the market. Sporting a total of five knobs and two switches (*including* the on/off switch) the complete combo is the essence of simplicity.

The Atlas RX/TX-110 transceiver combination consists of a separate, stand-alone, receiver – the RX-110 – covering 500 kHz on the 80, 40, 20 and 15 metre bands and 1 MHz on the 10m band, plus the companion TX-110 solid state five-band transmitter driven by the receiver VFO output. This combination is intended primarily for mobile operation from a 12-14 Vdc supply. A matching ac supply, the PS-110-H is available for 240 Vac, 50 Hz mains operation.

We tested the transceiver as a trio, as shown in the photograph.

Other than the VFO, this rig has no tuning controls – consistent with the current trend.

The receiver is a single conversion design, having an IF on 5595 kHz. A series of bandpass filters, one for each band, feeds signal to the first mixer directly. This is a double-balanced diode mixer to obtain high dynamic range. The first IF amplifier is an RF power transistor (!), also to preserve dynamic range, feeding into a six-pole crystal lattice filter. More or less conventional IF and audio follows.

The transmitter couples to the receiver for transceive operation, the receiver's IF becoming the sideband generator and the mixer becoming the transmit heterodyne mixer, producing output on the dialled frequency. The TX-110 itself incorporates a mic amp and sidetone oscillator (for CW), plus all the transmit driver stages.

There are several transmitter models. The basic TX-110L runs 20 watts input, while the TX-110H runs 200 watts input. The latter was supplied for review.

On the air

Despite the lack of frills, this transceiver gave a remarkably good account of itself. As you would expect, operation is absolutely straightforward. Set the band, turn up the AF Gain and turn the dial!

The receiver behaves very well, *really* strong signals are coped with in a "big signal? . . . big deal!" fashion. Audio quality is very good, regardless of signal strength. Blocking and crossmodulation were not noticeable – even from a station less than 1.5 km away running 400 watts PEP output!

The lack of an S-meter makes signal

strength reporting quite difficult. The AGC, whilst not as harsh as on some receivers around, makes S3 signals sound much the same as S9 signals. If intended primarily for mobile use, the lack of an S-meter is not really a serious disadvantage. 'Loud and clear' is all you need for good copy, regardless!

The lack of a clarifier we found a minor hassle. Nets with more than three stations involved could be problematical, we think, unless everyone carefully netted to the Atlas' signal.

The dial was a little stiff, and mildly 'springy'. It didn't give the sort of 'feel' we'd like, although, again, for mobile operation this sort of characteristic may have advantages. A mild annoyance was having to set two bandswitches when changing bands. The bandswitch on the transmitter selects filters between the antenna and the PA output/Rx input.

On-air reports of the audio quality were quite flattering. Mic gain adjustment is quite non-critical. The microphone itself is a fairly conventional handset type with PTT button and is quite comfortable to hold and use.

The transmitter won't tolerate much of a load mismatch — it would be advisable to keep the antenna SWR under 2:1. Fortunately the transmitter incorporates protection circuitry to guard against any possible traumas.

As supplied, the three components of the combo — transmitter, receiver and power supply — come separately packaged. To assemble the rig into a transceiver, two brackets (supplied) are used to secure the transmitter to the receiver. One running the full width of the two cabinets at the front, secured by the feet. A small bracket secures the rear of the two cabinets to one another. It's quite a sturdy arrangement.

The dial linearity was quite reasonable. Set to be correct at mid-band, the band-edge error was about 1 kHz on 80 through 15 metres, somewhat more on 10 metres. This seems acceptable.

On the test bench

Atlas have produced quite a remarkable little rig for the price. Sensitivity of the unit supplied was marginally above the manufacturer's specifications, but nevertheless quite acceptable. Atmospheric and manmade noise are the limiting factors — even on 28 MHz ambient noise was discernable with the receiver. At -129 dBm, the receiver noise floor is quite good, but certainly quite a way from the best receivers available. But, one must remember the price.

RF blocking and crossmodulation performance of the receiver is pretty well exemplary. With band activity hotting up as the sunspot activity increases, it'd need to be!

Stability of the VFO is quite adequate for most amateur applications.

The transmitter acquitted itself reasonably well, although the second harmonic from 28 MHz was a bit high at -35 dB to full output. Harmonics on the other bands were lower than -40 dB, as were all other spurious products. In fact, the TX-110 has a remarkably clean output spectrum.

Summary

Overall, the RX/TX-110 combo is quite a good performer as a basic or mobile rig. At a price near $500 sans power supply, it's very good value indeed.

A clarifier would be a nice addition, as would an effective noise blanker. But there's little else one would desire in a basic station.

Choices in this area of the market these days are becoming difficult to make! There's so much nice gear about it requires careful shopping. We think this Atlas is worth very careful scrutiny.

(Reviewed by Roger Harrison VK2ZTB and Phil Wait VK2ZZQ, with the kind assistance of Mike Farrell VK2AM and Keith Gooley VK2BGZ).

ATLAS RX/TX-110 TRANSCEIVER

Supplied by:
G.F.S. Electronic Imports
15 McKeon Rd.,
Mitcham Vic, 3122
(03) 873-3939
Serial Nos: Tx — T1529AH; Rx — R1400A; P/S — HC1239
RRP: $608

MANUFACTURER'S SPECIFICATIONS

Frequency range:	80 — 10m bands, 500 kHz segments, 1 MHz on 10m
Voltage supply:	200-260 Vac, 50-60 Hz 12-14 Vdc, 200 mA Rx, 16A, Tx.
Weight:	Tx: 1.9 kg Rx: 3.2 kg
Dimensions:	Tx: 105mm (w) x 95mm (h) x 250 mm (d) Rx: 206mm (w) x 95mm (h) x 284mm (d)
Transmitter	
Emissions:	SSB (A3J — USB/LSB) CW (A1)
Input power:	250 W on 80, 40 & 20 m 200 W on 15 m 150 W on 10 m
Carrier suppression:	Better than 40 dB
Opposite sideband suppression:	Better than 50 dB
Spurious emissions:	Harmonics — better than —50 dB
Distortion products:	About —30 dB
Antenna impedance:	50 ohms
Mic. impedance:	high — suit dynamic or crystal
Receiver	
Sensitivity: 10 dB SINAD	0.25 µV, 80 — 15 m 0.4 µV on 10 m
Third order intercept:	+3 dBm
Image rejection:	Better than 60 dB
Internal spurii:	Less than 2 µV equivalent
Stability:	Less than 2 kHz during first 30 min., Less than 500 Hz per hour thereafter, less than 100 Hz for 40% voltage change.
Selectivity:	2.7 kHz @ —6 dB 2.2 shape factor 6 to 60 dB Ultimate rejection; over 100 dB
AGC:	Less than 10 dB audio change from 5 µV to 3 V input
Audio output:	2 W @ 10%

MEASURED PERFORMANCE

Voltage supply	*240 Vac, 50 Hz*
Transmitter	
RF power output: *SSB (PEP)*	*50 W (all bands)*
Spurious outputs:	*—35 dB or better (2nd harmonic on 28 MHz)*
Carrier suppression:	*44 dB*
Opposite sideband suppression:	*57 dB*
Receiver	
Sensitivity: *at 10 dB SINAD*	*3.5 MHz: 0.28 µV* *28.1 MHz: 0.5 µV*
Noise floor:	*—129 dBm*
RF blocking:	*100 dB to 1 µV* *Desired signal 60 dB above 1 µV with blocking signal 20 kHz away, amplitude set to reduce desired signal by 3 dB*
Crossmodulation:	*over 100 dB to 1 µV* *Signals as above to produce crossmod. products 30 dB down on desired signal.*
Stability	*Less than 1 kHz during warmup, less than 200 Hz thereafter*

TEST EQUIPMENT

Hewlett Packard 8553B spectrum analyser & 8443A tracking gen./counter
Hewlett Packard 8558B signal generator; Krohnhite function generator
AWA F242A noise and distortion meter
Sierra 500 W dummy load and wattmeter

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ANALOGUE MULTITESTERS:
"HIOKI" 3010, 100K ohms, $65.22; "HIOKI" 3002,20K ohms, $33.91; "Y.F." YF330A, 20 ranges, 20K ohms, $23.48; "Y.F." YF370A, 15 ranges & transistor checker 20K ohms, $20.00; "Y.F." YF20K, 15 ranges, 20K ohms, $15.22; "FUTURE" YT63,2K ohms, $12.60.

CALCULATORS:
TEXAS INSTRUMENTS:
• Prices in brackets include sales tax.
T.I. 25, $32.00 ($35.00); T.I. 30 Student Pack, $23.00 ($25.00); S.R. 40, $28.00 ($32.00); T.I. 50, $36.00 ($40.00); T.I. 55, $53.00 ($59.00); T.I. 57, $74.00 ($85.10); T.I. 58, $109.00 ($120.50); T.I. 59, $247.00 ($275.00); T.I. 5050M, $81.00 ($90.00); Little Professor, $16.00 ($17.90); Data Man, $23.00 ($25.00); T.I. First Watch, $20.00 ($22.00); T.I. Spelling Bee, $28.00 ($31.00); T.I. Business Analyst, $33.00 ($37.95); T.I. Business Analyst 11 (LCD), $39.50 ($43.00); T.I. MBA, $75.00 ($87.40); T.I. Programmer, $53.00 ($59.00); T.I. MM Money Manager, $21.00 ($23.50); PC-100A Printer, $213.00 ($236.00); T.I. 5025 H/Held printer, $77.00 ($85.00); Library Modules for T.I. — 58/59, $31.00 ($35.00); Blank Mag. Cards for T.I. — 59, $14.00 ($16.10); Programming Forms — Pads, $2.20 ($2.80); TP-30250 (3 rolls of paper, PC100A), $10.00 ($11.50). **Full range of accessories!**

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BUSINESS MACHINES
• Prices include sales tax.
UNITREX DESK TOP PRINTERS:
CLASSIC 20-printer only, $140.00; CLASSIC 40-printer 12 dig. display, $170.00; CLASSIC 50-printer 12 dig. display, $190.00.
ELECTRONIC CASH REGISTERS:
CLASSIC R-200A, $450.00; CLASSIC R-250A, $650.00; "BIE"-JOTTO 10, Mini dictator, $75.00; "BIE"-STENO 30, Transcriber with foot pedal & h/phones, $225.00.
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DIGITAL WATCHES (LCD):
"CONSO" — 1/100 stop watch chronograph, $45.00; "KESSEL" — K579 men's alarm, $60.00; "KESSEL" — K568 6 function men's, $30.00; "KESSEL" — K563, K567 6 fn. (S/S) ladies, $35.00; "KESSEL" — K571G 6 fn. (gold pl.) ladies, $40.00.
ANALOGUE QUARTZ WATCHES:
"NEUCHATEL", (Swiss made) — day, date & sec's, $120.00; "NEUCHATEL", date & sec's, $99.00; "NEUCHATEL", slim (no sec's), $89.00.
INTERCOMS:
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HEADPHONES:
"TOKUMI" — TE 1017, lightweight individual volume, $25.00; "TOKUMI" — TE 1025, mono/stereo switch, individual volume control, $21.00; "TOKUMI" — TE 1035, stereo, $10.60; "TOKUMI" — TE 2025, HI-FI stereo, individual volume & tone controls, $38.00; "TOKUMI" — TE 1074, HI-FI stereo, lightweight (excellent value), $32.95; "TOKUMI" — 8100, TV h/phones, 6.5m cord & spearate volume control, $16.00.
MICROPHONES:
UD-147 — Dual imp. Uni dir. Dynamic, $26.95; WM-22 — FM Wireless Electret., $24.95; UEM-601 — Low imp. Uni dir., $34.95; EC-70S — Low imp. Electret. stereo, $33.95.
RECORD CARE EQUIPMENT:
ES⅝50J — Excel. linear tracking auto record cleaner, $6.95; "SONICA" — Cleamatic 5, auto record cleaner, $6.50.

NOTE: P&P for all goods: NSW $2, Interstate $3 (up to $50 value). NSW $3, Interstate $4 (up to $100 value). Goods valued over $100 delivered by carrier — freight paid by receiver.

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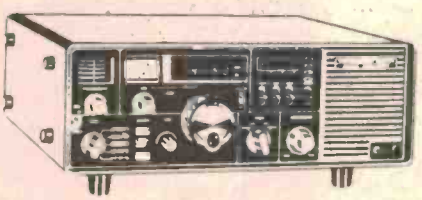

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2650 BASIC

Written by Ian Binnie this Microsoft Tm compatible 6K basic is a breeze to use. The program is supported with a 75 page manual.
Microworld Basic V1. 1.2 Pipbug (cassette + manual) . . . $27.50
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If you have a DG640 VDU you can play graphic chess on your 2650. Written by Tony Scott and Ron Harris this is directly equivalent to "SARGON CHESS".
2650 CHESS TAPE & MANUAL . . . $19.75

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This reliable Cassette Interface is easily assembled without a CRO. It is an ideal interface to any micro computer system and uses KANSAS CITY STANDARD with TTL compatible outputs. A computer generated test tape is included with each kit.
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DREAM 6800

As described in EA. May, June, July 1979 this is an ultra low cost beginners project.
CHIPOS $25.00
DREAM PCB . . . 11.50
For full parts list refer to our Secret Catalogue.

AIM 65

AIM.65. The head start in Microcomputers. This 6502 based machine comes assembled and tested with on-board printer and a real keyboard.
AIM 65 4K $499.00
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2650 EURO CARDS

A single board computer features 2650A chip, "PIPBUG" in E PROM, 1K RAM, CRYSTAL CLOCK, fully buffered address, data line on a top quality plated through hole PCB.
DB1001. EUROCARD 2650 . . . . (kit) $135.00
(assembled and tested) $160.00
(PCB. with manual) . . . . $ 35.00

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A very useful module for any memory expansion . . . Utilizes 2114 RAMS and features sockets for all memory IC's and 8 way DIP switch for address selection.
DB1008 EUROCARD RAM . . . . (kit) $175.00
. . . (assembled) $195.00
. (PCB/manual) $ 35.00

4/8K ROM

This module supports 2708 or 2716 EPROMS on the EUROCARD BUS. Ideal for MICROWORLD BASIC or User programs.
DB1048 EUROCARD ROM
(kit with 2 EPROMS) $130.00
(PCB/manual) . . . . $ 35.00

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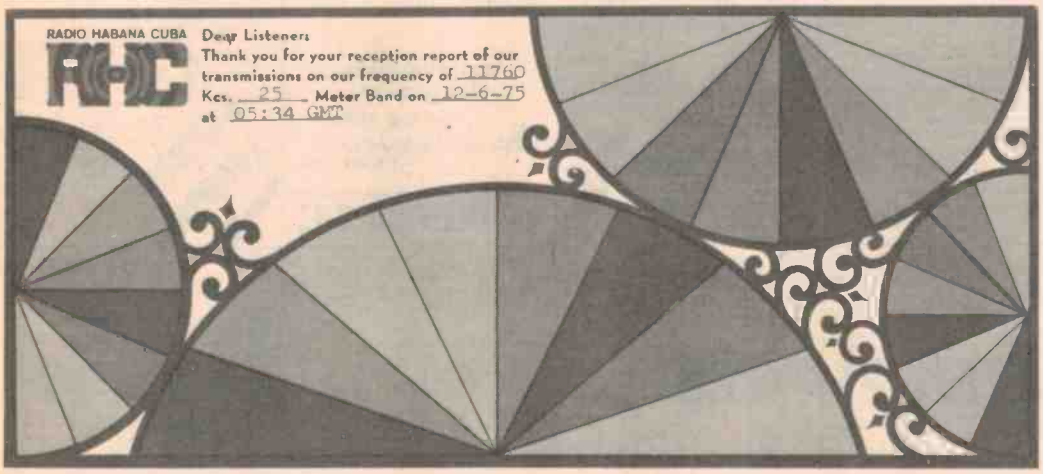
Moscow and Havana in relay swapping



In a major new development, Radio Moscow and Radio Havana have entered into an arrangement so that Moscow programmes are now heard over transmitters in Cuba, while Radio Havana now has the benefit of its programmes being relayed over Moscow's transmitters at certain times.

The Radio Moscow World Service in English is heard via Cuba between 1100 and 1300 daily on 9600, and then from 1330 until 2200 on 11 840.

This has resulted in much improved reception of Radio Moscow programmes in North America, especially during the 1100-1300 service on 31 metres.

Meanwhile, Havana has been given the benefit of Moscow transmitters for the programmes in English 1700-1800 on 17 710, and 2200-2300 on 11 700. These relays have been introduced in a bid to improve reception of Havana's programme in Europe and the Middle East.

Programmes are fed from the respective studios to the relay transmitters via a Soviet satellite.

This is the first confirmed use by any communist country of transmitters outside their own territory, although it is generally believed that certain Radio Moscow programmes are broadcast via transmitters in Bulgaria made available by Radio Sofia.

It will be interesting to discover the policy of both Moscow and Havana when it comes to confirming listeners' reception of these relayed broadcasts.

At present, Radio Moscow is adopting a very co-operative attitude to DXers' requests for details of transmitter locations on verification cards.

With Radio Moscow programmes broadcast via transmitters throughout the length and breadth of the Soviet Union — from Riga in the west to Vladivostok on the Pacific coast — DXers have been able to gain some unique QSLs, even though the transmitter locations given by Moscow on the card are quite possibly incorrect.

The Soviet Union is also relaying some of Havana's foreign language transmissions, including Spanish 1800-2000 and Portuguese 2000-2100, both carried on 11 860 and 17 710.

Meanwhile, Havana's French programme, 2100-2200 is relayed from the USSR on 11 700 and 17 725.

New Australian beam from Finland

The Finnish International Radio has a new outlet for programmes broadcast to Australia.

Helsinki has moved from 21 495 to 21 465 for English every day 0930-1000. The new 21 465 channel also has the Sunday Best programme each week 0800-0930, also in English for Australian listeners.

A regular programme highlight from Helsinki is "Compass North" a weekly news review of the main stories from the Nordic countries. You can hear Compass North at 0940 each Saturday.

Angolan stations at their peak

The various Angolan shortwave stations are being well heard in east Australia currently.

Best signal is from Radio Nacional in Luanda, using 7245. This service is also heard on 4820 and 3375 between 2100 and sign-off at midnight GMT.

Due to advancing daylight here in Australia, both the 4820 and 3375 channels will not usually be heard beyond 2230, but 7245 remains audible until close down.

Programmes are in Portuguese, but for African music fans Radio Nacional provides some very entertaining listening.

In Angola, there are also several regional stations on shortwave. Currently heard are Emissora Regional de Huambo on 5060, noted between 2030 and 2200, plus Emissora Regional de Benguela on 5040.

Radio Nacional in Luanda has recently been replying to DXers' reception reports, and these may be sent to C.P. 1329, Luanda. The regional stations may also soon begin answering monitoring reports from overseas DXers as the political situation within Angola has now stabilised.

New Costa Rican station

With the Latin listening season now in full swing, a new station on the air from the Costa Rican capital of San Jose is well heard in east Australia.

The station is identifying as "Radio Noticias del Continente" and is audible between 0330 and 0500 on 9615. Programmes are in Spanish, and consist of mostly news reports and musical items. These are announced as initial test broadcasts and the transmission suffers from some instability, varying sometimes between 9610 and 9615.

NOTE! All times are given in Greenwich Mean Time (GMT). To convert GMT to Australian Eastern Standard Time, add 10 hours. To convert to Central Time, add 9 hours, and for Western Time, add 8 hours. All frequencies are in kHz.

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of ARDXC may be obtained from either PO Box 67, Highett, VIC 3190, or from PO Box 79 Narrabeen, NSW 2101, for a 30c stamp.

loggings

Mediumwave guide for DXers

A most up to date guide to Australian, New Zealand, Indonesian and Pacific mediumwave stations is now available from the Australian Radio DX Club.

The Guide gives details of transmission times, transmitter power and transmitter location, all arranged in frequency order.

A bonus for DXers is the very comprehensive list of radio station addresses in the Mediumwave Guide, essential for mailing listening reports to distant broadcasters in order to obtain verifications.

An added feature is an up to date report on each station's verification policy, thus indicating whether you would be likely to receive a reply from a particular station, and in what form the reply would be.

For example, some Australian mediumwave broadcasters will not respond to DXers' reports unless a 20c stamp is enclosed to cover return postage of the verification. A similar policy is adopted by some Papua New Guinea stations, where often, PNG mint stamps are required.

The new Mediumwave Guide is available from ARDXC, for a dollar, and you can order from the address in this column.

Big plans for Nigerian Radio

In line with Nigeria's growing oil wealth, the country is in the process of extending radio coverage within its vast territory.

In order to improve radio reception in the rural areas where most Nigerians live, many new shortwave transmitters are to commence operations within the next couple of years.

One station already carrying out tests is the Imo Broadcasting Corporation, at the state capital of Owerri, recently observed on 4755 between 2100 and 2255. A new 10 kW transmitter has recently been installed at Owerri, and regular broadcasts on both 60 metres and 49 metres are expected shortly.

Other Nigerian states shortly to install new shortwave transmitters are Benue State at its capital of Makurdi, Niger State at Minna, Rivers State at the capital of Port Harcourt, and Bauchi State at Bauchi city. Like the new transmitter at Owerri, all these units will be rated at 10 kW. Frequencies will be used in either the 90, 60, or 49 metre bands.

Canada in three varieties

At present, Dxers are able to note the three varieties of Canadian broadcasting stations on shortwave.

First, there is the international service, Radio Canada International, with transmitters at Sackville in New Brunswick, and studios in Montreal.

Although RCI doesn't broadcast programmes directly to Australia, the station is easily heard during our mornings beaming to listeners in Europe, the Americas and Africa.

Some programmes which you should be able to hear with little trouble are English, every day 1900-1930 and 2000-2030 on 15 325, 9555, and 5995. The 1900 programme is also heard on 17 875, the 2000 service on 17 820.

If this is a bit early for you, try for the English programme beamed to Africa at 2130-2200 every day on 11 940, 15 150, 15 325, 17 780 and 17 820.

For those really after the latest news from around the world, then RCI has "The World at Six as it happens" each Monday to Friday from 2200-2300, on 5995, 15 325 and 17 820. This programme is live from the Montreal studios and includes up-to-the-minute reports from RCI correspondents worldwide.

The second variety of station from Canada is the Canadian Broadcasting Corporation's Northern Service programme, which is beamed for those in the remote north west territories and Canadian Arctic regions.

This is probably the only station on shortwave which broadcasts in both the Eskimo and Cree languages!

The Northern Service also has a good deal of programming in English and French. You can hear the Northern Service on 6195 between 2200 and 2400, and on 9625 2400-0600. The station has news and interviews, but mostly lots of music, usually by Canadian artists.

The third type of station you may hear from Canada is the handful of low powered shortwave outlets operating out of several cities. These are usually used for relays of a station's mediumwave channel.

The easiest to log is station CFRX in Toronto, on 6070. This is the shortwave outlet of commercial broadcaster CFRB, and uses a 1 kW transmitter.

Best time to log this one is from 0630 until 0750, when the Indonesian station at Jayapura opens transmission on 6070, drowning out CFRX.

Another station recently heard in east Australia fairly regularly is CKZU at Vancouver, British Columbia, on the Canadian west coast.

This can be tuned in between 0730 and 0805 when transmission ends for the day with both the Canadian anthem "O Canada" and God Save the Queen. Station CKZU uses a transmitter rated at 500 W according to a recent letter from Frances Buchan, who is responsible for issuing QSL cards. CKZU is a Canadian Broadcasting Corporation network station.

The good thing about these Canadian low power stations is that DX reports from far away listeners — listing 15 minutes of programmes heard, plus date, time (in GMT) and frequency received — will generally be very promptly verified with a detailed card or letter.

South Korea Calling

Radio Korea in Seoul has recently adjusted its schedule and English programmes of half-hour duration are now on air to South East Asia at 1130 on 9525; and at 1400 on 11 665.

The General Service has English 0230-0300 on 7275 and 9640; 0430-0500 on 9640 and 17 740; 0730-0800 on 7275, 9640 and 11 810;; and finally 2300-2330 on 15 385.

The European Service should also provide good reception in Australia, and has English daily 0730-0800 on 15 570 and 15 350.

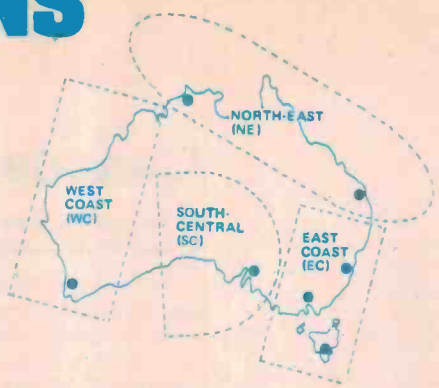
PREDICTIONS

SEPTEMBER 1979

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time — commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

ETI — Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.



These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

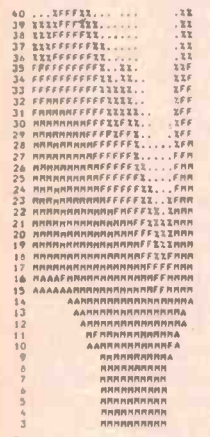
F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

M . . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

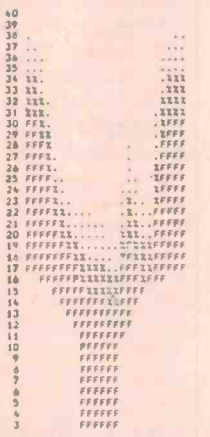
S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

A . . . . . High absorption indicated. Expect weak signals.

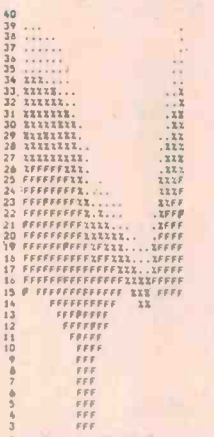


East Coast to Japan
(Also serves N.E. and S.C.)

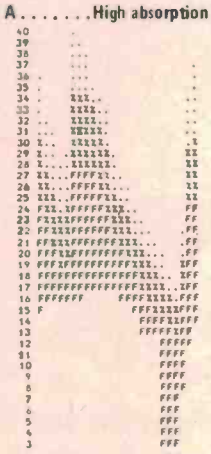
East Coast to South Pacific



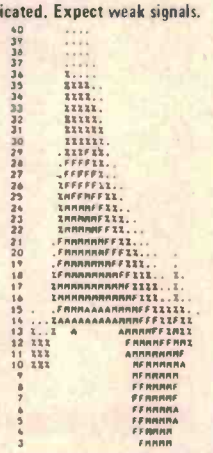
East Coast to North America
(Also serves N.E. and S.C.)



East Coast to South America
(Also serves S.C.)

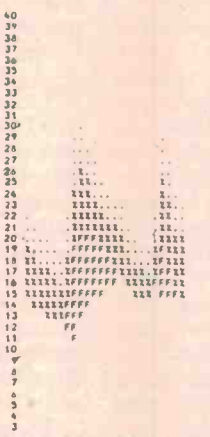


East Coast to North Africa
(Also serves S.C.)

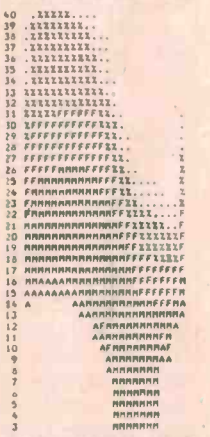


East Coast to South Africa
(Also serves S.C.)

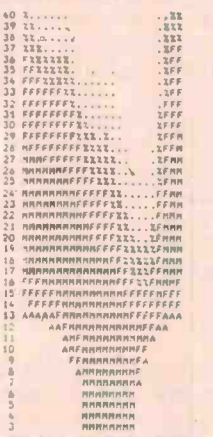
East Coast to Europe
(Short Path)



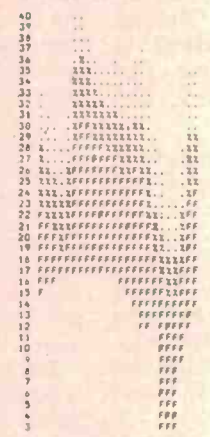
E.C. and S.C. to Europe
(Long Path)



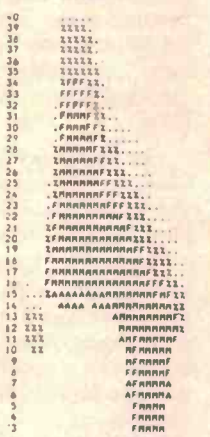
East Coast and S.C. to Persia



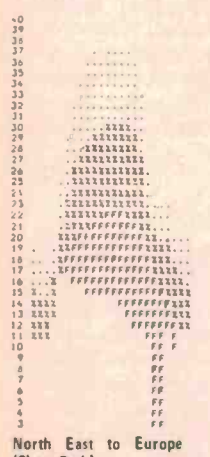
North East to South Pacific
(Also serves S.E.)



North East to North Africa

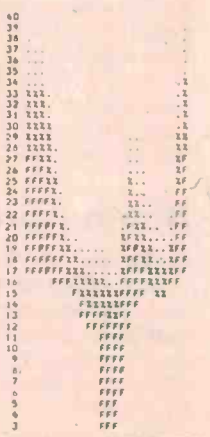


North East to South Africa

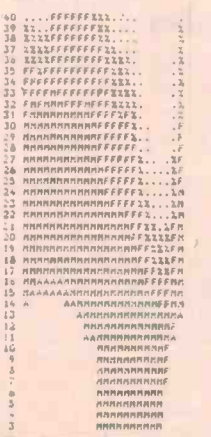


North East to Europe
(Short Path)

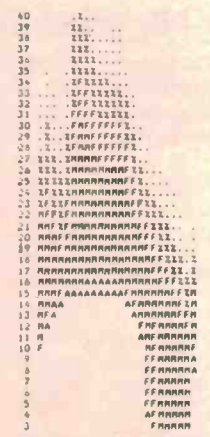
S. Central & W.C. to Europe
(Short Path)



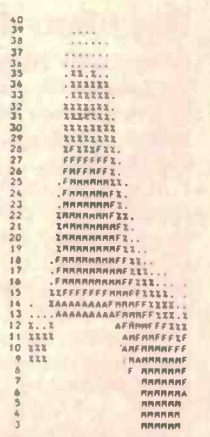
West Coast to North America



West Coast to Japan



West Coast to North Africa



West Coast to South Africa

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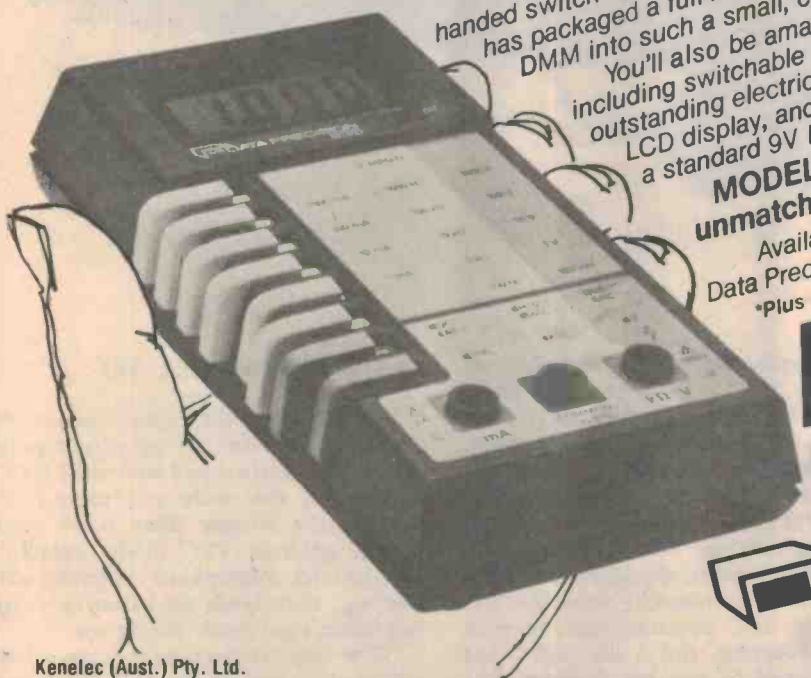

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"... can leap tall signals in a single bound!"

THE IC-701

Digital control (including tuning!), all solid state construction, compact size and top performance puts this rig amongst the technology leaders in the transceiver stakes.

THE FIRST amateur transceiver to employ digital tuning, push-button selectable tuning rate and the capability of external microprocessor control was the IC701.

Featuring all solid state construction, it uses 128 transistors, 23 FETs, 56 ICs and 256 diodes – all neatly arranged in a 111 x 311 x 241 mm cabinet. It all goes to show that good things can certainly come in small boxes!

What's more, performance lives up to promise in this amazing little rig – as we shall soon see.

The transceiver offers operation on all bands from 1.8 to 28 MHz, three transmission modes – SSB (A3j), CW (A1) and RTTY (F1), 200 watts input, split frequency operation at the press of a button (*both* frequencies user-selectable), VOX, internal speech processor, 1.2 MHz coverage on the 20 m band, 2 MHz coverage on the 10 m band, RIT on receive *and* transmit, noise blanker, selectable AGC characteristics, receiver passband tuning and a dial light that adjusts itself to suit the ambient light level!

(Take deep breath ... Ed)

Then there's the digital readout, the 'scope output (for 'seeing' what's on the band), the narrow and wide shift RTTY capability, the wide and narrow CW filters (the narrow filter is an audio type), external VFO input capability, the electret microphone (supplied with the rig) that needs no batteries – and we haven't got *inside* the rig yet.

The basic transceiver is intended for 12-14 Vdc operation, a mains power supply – the IC701PS – is an extra.

A remote control unit, the RM3, is a microprocessor-based controller that can program the transceiver to perform a number of cunning stunts. For example: scan an entire band, scan portion of a band, automatically switch bands and tune to specific (programmed) frequencies.

The bandswitch on the front panel of the IC701 actually controls a motorized, multi-section rotary switch. Changing the position of the band switch results in a series of very business-like 'clunks' as the rotary switch steps its way through to the selected band.

Inside the IC701

This transceiver employs a digital phase-locked loop (PLL) circuit to derive the local oscillator frequency for both transmit and receive. The PLL output is 9.0115 MHz higher than the frequency of operation.

The tuning dial operates an optical 'chopper'. This generates a series of pulses as the dial is turned. These are digitalized by an up/down counter in the LSI chip which forms the PLL and used to control a programmable divider — on the same chip.

This programmable divider controls the phase-locked loop circuitry which determines the frequency of a voltage-controlled oscillator providing the heterodyne frequency 9.0115 MHz above the desired frequency.

A front panel button selects the tuning rate (by changing the divide ratio) by setting the synthesizer to vary in 100 Hz steps (normal tuning rate) or 10 kHz steps ('dial fast').

In the normal tuning mode, one revolution of the tuning dial corresponds to a 5 kHz change in frequency, while in the 'dial fast' mode one revolution produces a 500 kHz change.

Apart from the main dial, there are no tuning controls on the IC701 — it is completely broadband in operation.

On receive, signals from the antenna pass through a low pass filter (for the band selected) and are amplified by a MOSFET RF amplifier stage. There are six — individually optimised for each band. The first mixer is a Schottky diode, double-balanced type to obtain good dynamic range in the front end.

The first IF stage, on 9.0115 MHz, incorporates a 10 kHz-wide monolithic filter. This is followed by the noise blanker gate, thence to a second 9 MHz filter with a bandwidth of 2.4 KHz.

The passband tuning uses a reheterodyne system mixing to 10.75 MHz with a variable crystal oscillator which changes the position of the signal within the 10.75 MHz filter passband.

The CW/N facility employs an active audio filter to reduce the passband to 200 Hz.

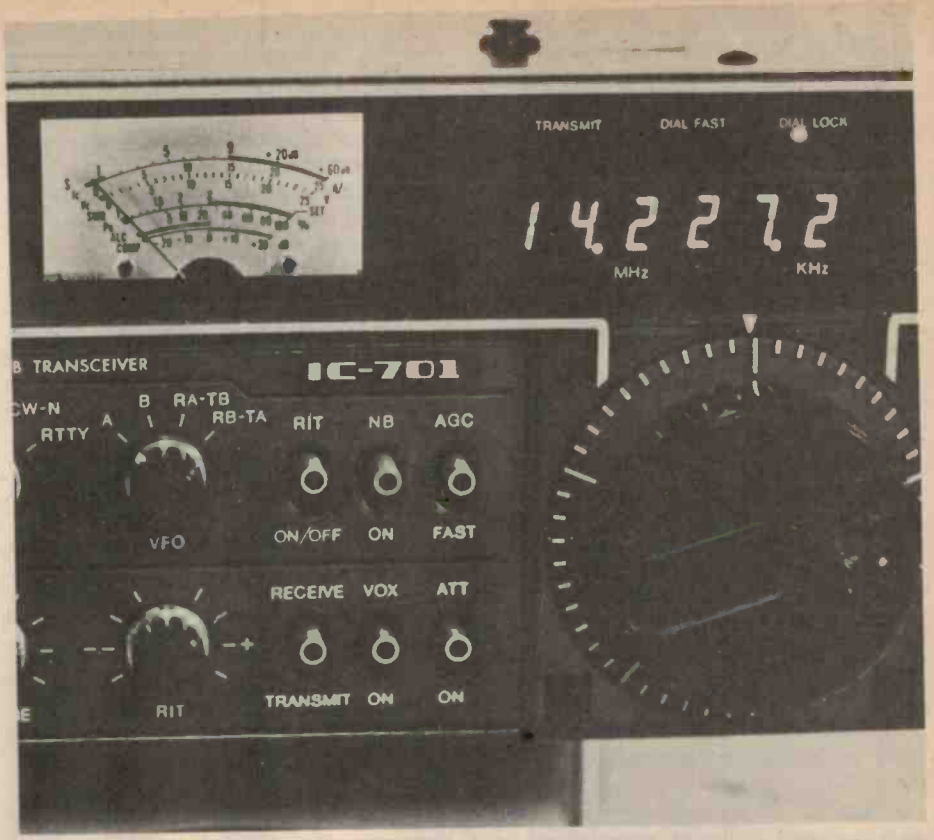
The AGC system uses a combination of IF and audio-derived gain control with selectable attack/decay characteristics. The FAST position is for cw break-in operation while SLOW is for SSB work and features a 'hang' characteristic.

Split frequency operation is accomplished by the use of *two* internal VFOs. The receive frequency may be fixed while you proceed to dial up an appropriate transmit frequency (in the same band) — known as 'Receive A, Transmit B'; or you may fix the transmit frequency while you proceed to dial up the receive frequency desired — known as 'Transmit A, Receive B'. You can't quite get duplex operation (!) but the facility is very handy for coping with DX pile-ups and rare DX operating 'splits', a common occurrence these days.

The transmitter is a quite straightforward heterodyne affair. A double sideband signal is generated on 9.0115 MHz, filtered to produce the required single sideband signal and then heterodyne to the desired frequency. This is then buffered and amplified in a three stage broadband amp before passing to the antenna. Individual low pass filters are switched in for each band and are operative on both transmit and receive.

Speech processing is of the RF compression type, performed at 10.75 MHz using the usual re-heterodyne system.

Load mismatch protection circuitry prevents damage to the PA stage should the SWR rise above an unacceptable level. Output power is automatically lowered in the event of mismatch, prior to the protection circuitry operating.



The distinctive dial, centre position S-meter and control groupings make the Icom IC-701 stand out amongst the many transceivers on the market. The split transmit-receive frequency facility, provided by the 'VFO' switch is a feature that comes in very handy when trying to work DX through a dog pile. The RIT control — equivalent to the usual clarifier — can be selected to operate on both the transmit frequency and the receive frequency.

On the air

Despite its compact size, the IC701 is a 'breeze' to use. It took us less than 60 seconds to find our way around the front panel — no 'drivers licence' will be necessary to get this rig up and running (. . . but, an amateur licence *will* be, it should be pointed out!).

The big question everybody asks is: How do you cope with tuning in 100 Hz steps?

The straightforward answer is: fine! We found no instances where an SSB or CW signal could not be tuned in 'on the nose'. After half an hour's operation, it's just not noticeable.

When changing bands, the VFO ▶

always commences at the lower frequency band edge. This is where the 'dial fast' facility comes into its own. At 500 KHz per revolution, it's easy to skip up to the portion of the band where you wish to operate. It's also very handy for rapid hops within bands.

Transmitter audio quality on air was reported as very good. The inbuilt compressor is quite effective, but some care is needed in setting the controls to avoid background noise, breathing effect and over compression.

The transmitter tolerates load mismatches as high as 3:1 or so without stress.

The receiver is little short of exemplary. There were no detectable 'birdies' and it coped with strong and weak signals with equal ease. A station located less than 1.5 km distant from our test QTH, running 400 watts PEP output, had no discernable effect on other signals quite close on the band. In fact, we didn't know he was there until we tuned across him!

Sensitivity is such that atmospheric noise is the limiting factor on all bands through to 28 MHz.

The AGC system is quite effective, not as 'hard' as we've experienced in some receivers. The noise blanker does its job effectively and has no serious effect on the strong-signal performance of the receiver. The dual RIT is a handy feature when in a large net and it seems to have more than adequate range. The attenuator provides about a 20 dB cut in signal strength, though we found no occasion to use it.

Audio reception quality is quite good, best described as 'well balanced'.

The self-adjusting dial light level is a handy feature, although we managed to (accidentally) arrange a situation in which reaching for the controls caused it to 'blink' disconcertingly.

The FAST AGC is best used on CW. Plosive speech sounds on strong signals caused noticeable distortion – cured by switching to the slow AGC (normal) position.

On the test bench

This is where it tells! A number of paramaters proved difficult to measure. Stability being the hardest. The dynamic range of the front end is very good. As our signal generator only went to 2 V output we were unable to determine the overload point!

Receiver sensitivity, as noted, is more than ample to get below the ambient noise. Noise floor at –132 dBm is excellent. Anyone for meteor scatter on 28 MHz?

Selectivity was not measured, though a rough check confirmed the manufacturer's figures.

The transmitter did its thing without fuss. There are a number of odd output products, but well down to the main transmission.

Summary

Good things certainly do come in small boxes. General operation and performance is effortless.

Despite their small size, and some piggyback arrangements, all controls operate in a positive manner and have a good 'feel'. Using the rig presented no traumas.

With the features included, this rig clearly represents the vanguard of future transceiver trends. ●

(Reviewed by Roger Harrison VK2ZTB and Phil Wait VK2ZZQ, with the kind assistance of Mike Farrell VK2AM and Keith Gooley VK2BGZ).

ICOM IC 701 TRANSCEIVER

Supplied by –
VICOM
68 Eastern Rd
South Melbourne, Vic 3205
(03) 699-6700
Serial No: 80002810 RRP: $1633 (Inc. IC701PS)

MANUFACTURER'S SPECIFICATIONS (abbreviated)

Frequency coverage:	All bands 160) 19 m (20m extends to 15.2 MHz, 10m extends to 30 MHz)
Voltage supply:	AC: 230 V, 50 Hz (separate supply) DC: 13.6 V, ± 15% @ 18 A

Transmitter

Emissions:	SSB (A3n), CW (A1), RTTY (F1)
Input power:	200 W (A1 and A3j)
CArrier suppression:	Better than 40 dB
Opposite sideband suppression:	Better than 40 dB @ 1 kHz
Spurious emissions:	Better than –60 dB
Harmonic emissions:	Better than –40 dB
Frequency stability:	Less than 500 Hz change after switch on 1 min. to 60 min., and less than 100 Hz after 1 hour.
Antenna impedance:	50 ohms unbalanced
Microphone impedance:	600 ohms.

Receiver

Sensitivity:	SSB/RTTY:	0.3μV for 10 dB S/N
Selectivity:	SSB/RTTY:	2.4 kHz @ –6 dB
		4.0 kHz @ –60 dB
	CW:	0.5 kHz @ –6 dB
		1.4 kHz @ –60 dB
	CW/N:	0.2 kHz @ –6 dB
		1.0 kHz @ –60 dB
Spurious response rejection:	Better than 60 dB	
Audio output:	More than 1.5 W	

TEST EQUIPMENT

Hewlett Packard 8553B spectrum analyse & 8443A tracking generator/counter.
Hewlett Packard 8558B signal generator
AWA noise and distortion meter F242A
Sierra 500 W dummy load and wattmeter
Kronhite function generator.

MEASURED PERFORMANCE

Voltage supply	*240 Vac*

Transmitter

RF power output SSB (PEP):	*50 W (all bands)*
Harmonic emissions:	*–45 dB or greater*
Spurious emisslons:	*–60 dB or greater*
Carrier suppression:	*–50 dB to full output*
Opposite sideband suppression:	*–45 dB to full output*

Receiver

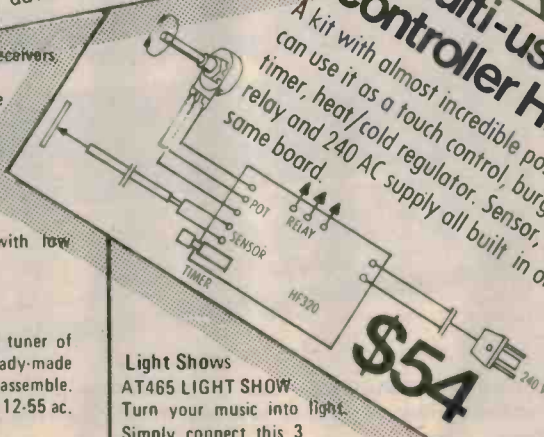
Sensitivity at 10 dB (S+N)/N ratio:	*SSB: 0.32 μV (–116 dBm)*
	CW: 0.26 μV (–119 dBm)
	CW/N: 0.22 μV (–120 dBm)
Noise Floor:	*–132 dBm*
Selectivity:	*not measured*
Stability:	*difficult to measure!*
RF Blocking:	*100 dB to 1 μV Desired signal 60 dB above 1 μV with blocking signal 20 kHz away, amplitude set to reduce desired signal by 3 dB*
Crossmodulation:	*93 dB to 1 μV Signals as above to produce crossmod. products 30 dB down on desired signal.*
Spurious rejection:	*Better than 80 dB*
AGC performance:	*8 dB signal change for 120 dB signal level change above 5 μV*

Check out these sophisticated kits from Denmark

JostyKits . . . Denmark's finest, offer the kind of innovative design inside and outside that you'd expect from Scandinavia. Created by qualified electronic engineers, they feature solid-state space age technology advanced enough for the most demanding kit builder. Each comes with a comprehensive instruction booklet. Whether you're a novice or experienced builder – JostyKits will give you hours of satisfaction in construction and performance!

Multi-use AC/DC controller HF320

A kit with almost incredible possibilities! You can use it as a touch control, burglar alarm, timer, heat/cold regulator, sensor, timer, relay and 240 AC supply all built in on the same board.



$54

Audio

AF300 AUDIO AMPLIFIER – 3 WATTS
A real work-horse, this universal power amp has a wide range of applications such as car radio, record players and small receivers. Due to its well designed electronic circuit, the AF300 can be used over wide voltage ranges without deterioration of the specification parameters.
Kit AF300 – $25.00

AF340 40 WATT AUDIO AMPLIFIER MODULE
High quality 20-20,000 Hz, 37w RMS with low distortion. Kit AG340 – $35.00

FM Tuners

HF325-2 QUALITY FM TUNER MODULE
The HF325 is a complete high quality FM tuner of professional standing. The tuner unit is ready-made and pretrimmed, making it child's play to assemble. Tuning range 88-108 MHz, operating voltage 12-55 ac.
Kit HF325 – $79.00
Stereo decoder HF 310

HF310 FM RECEIVER
The HF310 is a very reasonable priced HF FM tuner. Fully trimmed, the sensitivity according to IHF standards is better than 10uV. Features 60 dB S/N radio and low harmonic distortion.
Kit HF310 – $49.00

HF330 STEREO DECODER
Gives 40-45 dB channel separation, just add to a good quality FM receiver. Kit HF330 – $24.00

Pre-amps (RF)

HF395 RF PREAMPLIFIER
Gain 30 dB to 20 MHz, 10 dB to 100 MHz and 5 dB to 226 MHz. Ideal to boost reception on short-wave receivers. Kit HF395 – $6.00

HF385 VHF/UHF ANTENNA PREAMP
Superb quality with two aerial inputs and one down lead which simultaneously supplies current from the power supply. Frequency range 40-250 MHz and 400-820 MHz. Gain 9-18 dB, depending on frequency. Kit 385 – $30.00. Box B850 – $6.00. Optional Power Supply NT410 – $20.00

Light Shows

AT465 LIGHT SHOW
Turn your music into light.
Simply connect this 3 channel light show to the audio terminals of your amplifier and this quality kit does the rest for you!
Kit AT465 – $64.00
Attractive box and knobs B6065 – $25.00

AT468 4 CHANNEL LIGHT SHOW
This superb kit drives 4 lights (400w per channel) from the audio amplifier output. Kit AT468 – $75.00
Attractive box and knobs B3265 – $48.00

AT365 LIGHT SHOW
This quality kit uses microphone input instead of connection to the audio output. 1599w max.
Kit AT365 – $69.00
Box and knobs B3265 – $48.00

FM Transmitter

HF65 FM TRANSMITTER 60-148 MHz
Will run 5w output with heat sink. Ideal for signal testing of for a miniature transmitter which could be received on a standard FM receiver. Kit HF65 – $9.00

Receiver Converter

HF305 VHF CONVERTER
Converts FM 105-148 MHz to 105 MHz.
Kit HF305 – $28.00
Box B3405 attractive chassis kit – $24.00

AM Receiver

HF61 MEDIUM WAVE RECEIVER
540-1600 KHz receiver complete with ferrite coil antenna. Kit HF61 – $19.00

Power Supplies

NT415 LAB POWER SUPPLY
0-30V 1 amp well-regulated supply for professional use. Complete with box and transformer.
Kit NT415 – $128.00

NT300 LABORATORY POWER SUPPLY
2-30V High quality supply, regulated 2-30V dc at 2 amps with overload protection. Complete with box and transformer.
Kit NT300 – $110.00

Quick assembly kits

JK01	GENERAL PURPOSE AMP 0.5w	$18.00
JK02	MICROPHONE AMPLIFIER	$19.00
JK03	SINE WAVE GENERATOR 20-20,000 Hz	$30.00
JK04	FM TUNER 88-108 MHz	$30.00
JK05	27 MHz RECEIVER	$33.00
JK06	27 MHz TRANSMITTER	$29.00
JK07	DUAL TONE DECODER FOR R/C MODELS	$43.00
JK08	230 Vac LIGHT OPERATED RELAY	$20.00
JK09	SIREN KIT inc. SPEAKER	$19.00
JK10	PHOTOGRAPHIC TIMER 240 Vac	$23.00
JK101	CAR BURGLAR ALARM KIT	$55.00

VICOM

Mail Orders: Direct to VICOM, 68 Eastern Rd., 5th. Melbourne VIC. 3205. **Enclose $1 extra** for handling and postage costs.

JostyKits are available now from:

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Melbourne: Eastern Communications, 898 Riversdale Rd, Camberwell, Ph: 836-8635. Rod Irving Electronics, Shop 499, High St, Northcote, Ph: 489-8131. Tasmon Electronics, 12 Victoria St, Coburg, Ph: 354-5062. J.H. McGraths & Co. P/L. 208 Little Lonsdale St, Ph: 663-3736.
Brisbane: Delsound, 1 Wickham Tce, Ph: 229-6155.
Launceston: Advanced Electronics, 5A Quadrant, Ph: 31-7075. Tasmanian Hi-Fi Company, 87A Brisbane St, Ph: 31-5815.

and all authorised Vicom dealers

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Launceston 44 3882
Brisbane 38 4480
Wellington (N.Z.) 287 946

The McKay Dymek DR22 'all wave' receiver

Looking and feeling like a piece of hi-fi equipment, this unusual receiver features digital frequency programming and display, coverage from 50 kHz to 30 MHz and some impressive specifications.

ONLY RECENTLY released in Australia, this receiver is a fully synthesized, solid state, triple conversion unit covering 50 kHz to 29.7 MHz for reception of AM, SSB/CW and radioteletype (RTTY) signals featuring a digital display with readout to 5 kHz.

It incorporates a phase locked, digital frequency synthesizer for tuning. The frequency is set by means of the four large knobs on the front panel to the left of the 'fine tune' control. From left to right, these set the tens of MHz, units MHz, hundreds of kHz and the five kHz steps. The fine tune control, almost in the centre of the front panel, has a range of about +/- 5 kHz. The frequency control knobs are continuous rotation types.

Crystal filters in the first and second IF stages and a ceramic filter in the third IF determine the bandwidth. The DR22 has two selectable bandwidths – 4 kHz and 8 kHz. The receiver is intended for shortwave listening and monitoring of HF broadcast stations. These operate on channel spacings of 5 kHz – hence the 5 kHz synthesizer steps. However, as many strong broadcast stations only 5 kHz apart produce a considerable number of 5 kHz heterodynes, the receiver incorporates a notch filter to remove this most annoying whine.

The 'Band' switch is an interesting feature on the DR22. This enables selection of the RF preamp with full bandwidth or restricted bandwidth, switching the preamp in or out as required also. This is to avoid receiver overload by strong local broadcast stations.

With the Band switch set to '0.05 - 29.7 MHz PREAMP' the receiver operates at full gain across the entire tuning range. Set to the position not showing PREAMP, the RF amplifier stage is bypassed. This is useful when only moderate sensitivity is required.

Set to 'LOCAL' the sensitivity of the receiver is reduced by about 30 dB.

Sporting a brushed, satin-finish aluminium front panel and wooden end cheeks, the DR22 looks distinctly like an item of hi-fi gear. It would certainly blend well with many sound set-ups.

This is intended for use when listening to strong local broadcast stations, to prevent front end overload. On the 2.5 - 29.7 MHz position (the third position), a filter is inserted in the antenna circuit, providing some rejection of signals below 2.5 MHz. This is convenient when only moderate sensitivity is required for listening to shortwave stations where the receiver may experience problems from very strong local broadcast-band stations. With the Band switch set to '2.5 - 29.7 MHz PREAMP', the receiver operates at full gain across the HF band, signals below 2.5 MHz being attenuated by the filter.

A conventional (audio type) noise limiter is included. Upper and lower sideband modes are switch selectable.

The manufacturers say that special care has been taken to avoid overload problems caused by strong signals. Interestingly, a socket on the rear panel provides a 455 kHz output from the third IF for connection to a monitor oscilloscope.

The DR22 comes with an internal speaker. An external speaker jack is provided for use with a separate speaker, tape recorder or hi-fi system. A headphone jack is on the front panel. A Tuner Output jack is also provided. This takes audio from after the 5 kHz notch filter, but before the volume control. A level preset on the rear apron, next to this jack, is provided. A 'Mute' jack – short to operate the receiver – is also included.

On the air

The DR22 certainly acquits itself well. Operation is smooth and unflustered. All controls operate in a positive manner and do exactly what is expected. The front panel is laid out logically, quite uncluttered, all the controls being readily accessible. The digital frequency readout is a little spread out for our liking, but the numerals appear above their respective program switches so it is at least logical. The Fine Tune control smooth in operation and has adequate range without making tuning of SSB signals at all critical.

The bandwidth switch is a great asset. For good quality reproduction from a broadcast station, the 8 kHz setting produces fine sounding audio – particularly if an external speaker is used. Set to 4 kHz, the 'monkey chatter' from adjacent stations in the crowded shortwave bands is much reduced. Single sideband reception is quite good and the 4 kHz bandwidth is a reasonable compromise between 'narrow' band AM reception and SSB reception requirements.

The four-knob frequency selection system is both a handy feature and a damn nuisance. For example; when seeking out the maximum usable frequency (MUF) at a particular time of day, being able to skip through the bands MHz or tens of MHz at a bound is a very handy facility. A technique used by the reviewers to determine the available bandwidth in the shortwave spectrum – from the lowest usable frequency (LUF) to the MUF – is to check the various standard time and frequency transmissions on 5, 10, 15 and 20 MHz. With conventional receivers this is a tedious task. With the DR22? – fantastic!

However, for searching across a relatively small band, the switch system on this receiver is somewhat of a handicap. As the DR22 is intended primarily for shortwave listening and monitoring activities, where the desired frequency is dialled up and the receiver left on that channel, then the system works fine. As for accuracy – with the fine tune at centre, all the standard time/frequency stations came out right 'on the nose'. Good stuff!

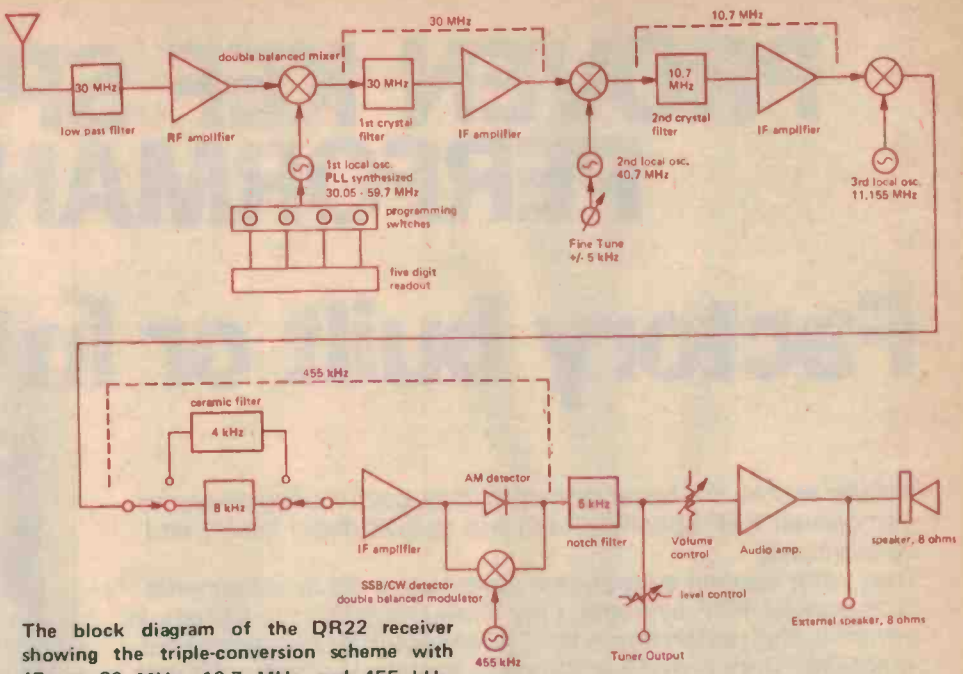
The S-meter is quite large and easy to read but is not what could be called a 'calibrated' device. Useful nonetheless.

The various outputs available on the back panel could come in quite handy. Being able to attach a tape recorder to the Tuner Output and record material at a level unaffected by the setting of the front panel volume control, is quite a handy feature. The IF output is good for monitoring modulation characteristics of a signal, amongst other things. Indeed, this facility allows the DR22 to be used much more widely than as a straight receiver. Thinks . . .

The noise limiter we found to be one of the most effective we've come across in a long time. It works on both AM and SSB signals. However, it does introduce some audio distortion, which is a little unpleasant. The distortion though, is much preferable to the impulse noise.

The antenna and external speaker connections on the rear panel are spring-loaded push type connections. We found them somewhat flimsy, which is a surprise on a receiver in this price class.

Sensitivity was generally more than adequate across the whole frequency range, particularly on SSB. Strong signal performance was very, very good – the best we've seen in a general coverage receiver offered on the consumer market. We found little occasion to use the mode switch to avoid overload problems. It's a cunning idea that – certainly more versatile than having a conventional RF gain control.



The block diagram of the DR22 receiver showing the triple-conversion scheme with IFs at 30 MHz, 10.7 MHz and 455 kHz.

On test

All the good points about this receiver that we found in on the air testing were confirmed by test measurements. All the parameters measured exceeded the manufacturer's quoted specifications – which are very good in the first place!

Sound engineering certainly pays off.

Summary

The appearance, presentation and performance of this receiver puts it right up on the top shelf – the price certainly does! However, you get a lot for your money. The sort of performance delivered by the DR22 never comes cheap.

The few minor quibbles are of no great import, though more robust speaker and antenna terminals on the rear panel would add that finishing touch.

The DR22 delivers the goods – and the stations! – in fine style.

(Reviewed by Roger Harrison VK2ZTB and Phil Wait VK2ZZQ, with the kind assistance of Keith Gooley VK2BGZ).

MCKAY-DYMEK DR 22 RECEIVER

Supplied by:–
Vicom
68 Eastern Rd
South Melbourne, Vic 3205
(03) 699-6700
Serial No: 1519 RRP: $1700 (inc. tax)

MANUFACTURER'S SPECIFICATIONS

Frequency coverage:	50 kHz to 29.7 MHz in 5 kHz steps, plus fine tune
Reception modes:	AM, USB/LSB, CW, RTTY
Sensitivity at 10 dB (S+N) N ratio, 4 kHz bandwidth	AM: 10 µV @ 100 kHz reducing to 1 µV @ 400 kHz 1 µV across 0.4 – 20 MHz 1.5 µV across 20 – 29.7 MHz SSB/CW: 5 µV @ 100 kHz reducing to 0.5 µV @ 400 kHz 0.5 µV across 0.4 – 20 MHz 0.75 µV across 20 – 29.7 MHz
Selectivity:	4 kHz: 4 kHz @ –6 dB, 10 kHz @ –60 dB 8 kHz: 8 kHz @ –6 dB, 28 kHz @ –60 dB
Stability:	± 40 Hz @ 25°C in any 8 hour period after 30 min. warm up
Image rejection:	70 dB
RF Blocking (desired signal 60 dB above 1 µV, blocking signal 20 kHz away adjusted to reduce desired signal by 3 dB)	100 dB to 1 µV
Crossmodulation (desired signal 60 dB above 1µV, undesired signal 20 kHz away adjusted for crossmod. products 30 dB lower than desired signal)	65 dB to 1 µV
Intermodulation (Level of two undesired signals 30 kHz away from desired signal to produce same output as desired signal 30 dB above 1µV)	65 dB to 1 µV
Hum and noise below full output	55 dB
Audio output	2 watts @ 4 ohms
Power supply	220-240 Vac 50-60 Hz at 30 W consumption
Dimensions	430(w) x 130(h) x 370(d) mm
Weight	6.8 kg

Noise limiter, 5 kHz audio notch filter, 100 mm dia dia. internal speaker, external speaker connection, headphone socket; RCA and spring terminal antenna connectors.

MEASURED RESULTS

Sensitivity (10 dB SINAD)	*AM: 1 µV @ 1.5 MHz, 1.5 µV @ 29 MHz* *SSB: 0.11µV @ 1.5 MHz, 0.1 µV @ 29 MHz*
Selectivity:	*as per quoted specs.*
Stability:	*too small to measure*
RF blocking:	*greater than 100 dB to 1µ V*
Crossmodulation:	*70 dB to 1 µV*
Intermodulation:	*not measured*
AGC performance:	*Audio output changes less than 8 dB for 100 dB change in input signal*

TEST EQUIPMENT

Hewlett Packard Signal generator 8558B, with digital counter.
AWA Mode F242A Noise and Distortion analyser
Krohnhite function generator.
Hewlett Packard 8553B spectrum analyser

PROVEN KEF SPEAKER PERFORMANCE

Factory built or in Kit form

Kefkits enable the home constructor to build loudspeakers to well proven KEF specifications, and to build them simply and economically.
They offer several exceptional advantages. As developments from popular KEF systems, they allow the builder to assess in advance, the performance he can expect from his completed speakers. They provide a complete system — drive units and dividing network ready connected on their baffle. In this form, KEF can test every kit in its recommended enclosure, checking its performance and consistency against a laboratory-maintained system before allowing it to leave the factory. It is this extra assurance that enables every Kefkit to carry a five-year guarantee.
When the builder assembles his Kefkit, he knows with confidence that every vital component has been produced in KEF factories, under stringent quality control. In particular, the all-important drive units are exclusively KEF made, to the design and production standards that have made them a world choice.
To achieve a higher level of natural, uncoloured sound reproduction, KEF have rejected conventional paper diaphragms in favour of newer materials. These advanced diaphragms in moulded plastics or metal and plastics combinations, avoid the unwanted resonances that lead to colouration in ordinary drive units.
Behind every Kefkit, is a team of speaker engineers with an international reputation for their uncompromising standards in sound reproduction.
Now, with Kefkits, that KEF quality comes surely and easily within reach of every serious lover of high fidelity sound.

The new Kef Concerto Kit makes it easier. These kits include grille cloth and fully machined baffles and grilles.

KEF

CONCERTO

Superb floor-standing speaker will realise the full potential of the largest domestic hi-fi installations. Buy it factory built or build it yourself with Kefkits.

Ask your retailer about the range of KEF speaker units, speaker kits & baffle kits.

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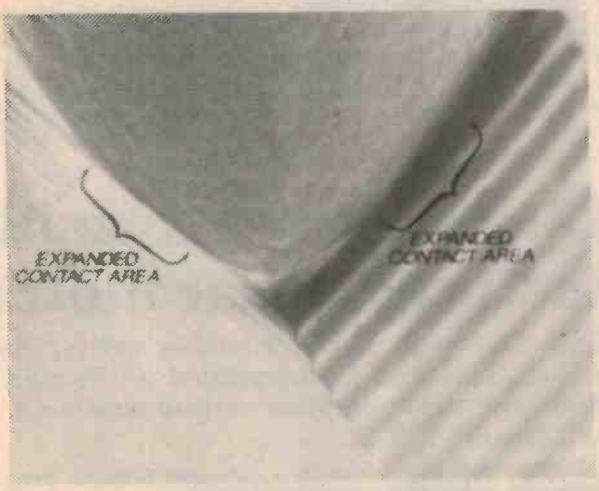
P.O. Box 361, Brookvale, NSW 2100
Phone: 938 1186, 938 1195.

PROFESSIONAL

Nashville, the Center of Country Music, is Stanton Country, too!

Kitty Puckett checks out 45 rpm stamper, while auditioning one at 33⅓ rpm.



The Nashville Production Co., uses Stanton exclusively throughout its two Disc Cutting Studios. Naturally, they are mostly involved with Country Music, but they also get into Pop and Rock.

John Eberle, Studio Manager, states that they use the Stanton Calibrated 681A "for cutting system calibration, including level and frequency response" . . . and they use the Calibrated 681 Triple-E in their Disc Cutting operation . . . with plans to soon move up to the new Professional Calibration Standard, Stanton's 881S.

Each Stanton 681 series and 881S cartridge, is guaranteed to meet its specifications within exacting limits, and each one boasts the most meaningful warranty . . . an individually calibrated test result is packed with each unit.

Whether your usage involves recording, broadcasting, or home entertainment, your choice should be the choice of the Professionals . . . the Stanton Calibrated Cartridge.

STANTON!

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

Sole Australian Distributors

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

Half-speed cassette deck claims response to 15 kHz!

Nakamichi has introduced a two-speed cassette deck with tape speeds of 48 and 24 mm/sec having a claimed frequency response flat to 15 kHz at the slower speed.

At a time when many cassette deck manufacturers are releasing two-speed machines with the standard 48 mm/sec and a 95 mm/sec facility, Nakamichi might seem to be heading in the wrong direction.

Half-speed capability is considered a highly attractive feature as it allows a long-playing format for cassettes for the first time. A C90 used at half-speed provides three hours of playing time.

Designated the model 680, it features a claimed frequency response flat to 15 kHz at 24 mm/sec and uses a micro-precision Crystalloy playback head having a 0.6 micron wide gap.

The record head azimuth is user-adjustable, employing a system similar to that used in the Nakamichi 1000 and 700 three-head cassette decks.

Even thought the 680 uses the "discrete" head configuration, in which the physically separate record and playback heads are inserted into the cassette's centre opening, azimuth alignment by the user becomes a periodic necessity for optimum high frequency response, Nakamichi say.

Metal tapes may be used with this new machine as it incorporates Nakamichi's new high efficiency erase head (the type E-8L) as used in their 580 series decks (the 582 was reviewed last month), and a Crystalloy record head having a 3.5 micron gap.

The phenomena of 'spontaneous erasure' — partial demagnetization of the high frequencies during playback when the erase head is inactive — is a problem at half speed with conventional erase heads, but Nakamichi claim virtually no sign of this problem occuring with the 680 deck.

The 680 is also Nakamichi's first deck to provide random access capability. A microprocessor system may be switched in during the cueing mode to provide automated search for specific selections on one side of the cassette. Called the Random Access Music Memory (RAMM), the system senses and counts the silent spaces between selections during fast-wind.

It works in both forward and reverse directions.

Other features include fluorescent bar-graph level indicators, Nakamichi's asymmetrical diffused-resonance transport, double Dolby noise reduction, full off-tape monitoring capability, built-in 400 Hz test tone, pitch control, tape-start memory, timer auto-start, mpx filter and high-output headphone amp.

Remote control units are optional.

A convincing demonstration of the machine's capabilities was given to members of the trade and the IREE's Audio Group, by Mr. Ted T. Nakamichi, at Convoy International's premises early in July.

The model 680 deck was released at the Chicago Consumer Electronics Show in June and was due to be shown at the Australian CES over 19-22 July.

Direct-drive turntable features linear motor

To overcome problems of rumble and low starting torque, Sanyo have incorporated a 120-pole synchronous linear motor system in their latest direct-drive turntable the TP929.

The turntable platter is an integral part of the motor, all the drive electronics being mounted in a stationary position, minimising the total number of moving parts.

Wow and flutter is claimed to be as low as 0.03% WRMS. The turntable platter is made of heavy die-cast aluminium and includes a stroboscope to allow accurate speed adjustment with the controls provided.

The tone-arm is a static-balanced S-shape design and includes a viscous-damped cueing device. The plug-in type headshell facilitates mounting, adjusting and interchanging of cartridges.

The TP929 is supplied with a full-width dust cover and will sell for a suggested retail price of $313.

For more information contact: Sanyo Australia, 14 Mars Rd, Lane Cove NSW 2066, (02) 428-5822.

Marantz looking for feedback

Recent advertisements in US trade publications indicate the Marantz Company are looking for feedback from US dealers who handle their product.

Running advertisements featuring the two pictures reproduced here, Marantz say "We'll take whatever you dish out."

They're asking dealers for their feelings about Marantz products, what marketing aids work and what don't, how they can do more etc. Marantz aim to publish their responses to suggestions.

It'll be interesting to see the results.

DBX now with Electro-Voice

Electro-Voice Australia Pty Ltd has taken over the distribution of DBX consumer products from Superscope (A'asia) Pty Ltd.

A new, separate company will be formed in July to carry on the marketing of DBX products throughout Australia. John Penhallow, has left Superscope to join the new concern as National Sales and Marketing Manager. The new company will also take over the DBX warranty service responsibility from Superscope.

DBX of Boxton, USA, was recently acquired by BSR (USA), the largest turntable manufacturer worldwide.

DBX Inc, is the manufacturer of a line of tape noise reduction systems, dynamic range expanders and signal enhancement processors for the consumer, semi-professional and professional markets.

Set for formal introduction at the 1979 Australian Consumer Electronics Show in Sydney are DBX models 1BX and 2BX stereo linear dynamic range expanders.

For further details of DBX products, contact John Penhallow, Electro-Voice Australia Pty Ltd, 174 Taren Point Road, Taren Point NSW, 2229; (02) 525-8588.

'State of the art' from Audionics

M.R. Acoustics recently announced the release of two new components from Audionics — the BT2 and CC2 'high definition' preamp and power amp units.

The BT2 stereo preamp is a so-called "straight line" unit having no tone controls or tape-to-tape dubbing. It features constant input impedance across the frequency range, selectable RIAA or IEC frequency response curves for phono playback and 0.01% max THD and IMD at 4 V RMS output.

The preamp is housed in a black-anodised aluminium rack-mounting case 480 mm wide by 90 mm high and 190 mm deep.

The CC2 power amp features 70 watts RMS per channel into 8 ohms with not more than 0.18% THD or with both channels bridged in the mono mode, 225 watts into 8 ohms at not more than 0.35% THD.

Quoted frequency response is 20 Hz to 20 kHz within plus or minus 0.5 dB, the -3 dB points being at 5 Hz and 70 kHz. It is housed in a similar case as the BT2.

For further information, contact M.R. Acoustics, P.O. Box 165 Annerley, Brisbane Qld 4013.

You have to be very confident before you claim anything will permanently remove static electricity from a gramophone record.

Today anyone who makes a claim on behalf of a product had better be able to prove it. Or faster than they can say Norman Jesky they'll be in big trouble.

Derek Pugh of Concept Audio confidently introduces to Australia a remarkable new product. It's called Permostat. And it permanently renders records free of static electricity.

What is this thing called static?

The contact of two dissimilar materials is liable to cause an exchange of electrical charge. Thus when a record is removed from its sleeve, subjected to cleaning by a pad or brush or is in contact with a stylus, the record surface is inevitably left in a highly charged state.

What are the effects of static?

Not unlike a common magnet attracting iron particles, static scavenges and draws dust particles onto the record surface where they can be pushed along the grooves, creating various degrees of distortion. A highly charged record surface can cause micro discharging, uneven cartridge attraction and alteration of the stylus tracking force, resulting in wow and flutter, distortion and record stylus wear.

Permostat?

Permostat is a uniquely formulated fluid which when applied to a record totally and permanently eliminates static.

How permanent is permanent?

It is claimed that playing a record one hundred times corresponds to the normally expected use of a given record by a consumer. This is also the number of plays used by record companies for evaluating their products. Tests prove that Permostat eliminates static for at least one hundred continuous plays.

Are there any adverse effects?

Laboratory tests confirm no detectable change in sound quality, surface noise, frequence response and fidelity.

Who produces Permostat?

Permostat has been researched, developed and produced by the British firm, Milty Products, a leader in the field of record care and maintenance, whose Pixall record cleaner has already won the coveted Japanese Grand Prix award.

Where can I buy Permostat?

You'll find Permostat in all good hi-fi, audio, record and department stores. However, if you have any difficulty in obtaining Permostat, please fill in the coupon below.

Dear Derek Pugh. Permostat had better permanently render my records free of static. Or I shall be making one or two phone calls.

(BLOCK CAPITALS PLEASE)

Name _____

Address _____

_____ Postcode _____

Please supply (state quantity required) _____

Permostat Kit(s) @ $13.95 ☐ Permostat Refill @ $8.95 ☐

P&P Incl. I enclose a Cheque/P.O. value $ _____

Concept Audio.

Where only the very best is good enough.

Concept Audio Pty. Ltd.

22 Wattle Rd, Brookvale, NSW. 2100. Tel: (02) 938-3700.

CA302

Permostat by Concept Audio.

sound news

Die-cast cassette

TDK have released a new cassette mechanism featuring a precision die-cast zinc core sandwiched between a two-part transparent outer shell.

Called the 'RS Mechanism' (. . . oh, oh! — Ed) for Reference Standard Cassette Mechanism, it is intended for metal tape cassette decks. The mechanism features very close tolerance construction 'true-circularity' hubs and redesigned dual spring pressure pads to ensure precise positioning of the tape to give accurate left-right channel orientation and true parallel running of the A and B sides, say TDK. For information, contact: TDK (Australia), 4 Dowling St, Woolloomooloo, NSW 2011, (02) 358-2088.

More MOSFET

Two New Zealand-manufactured hi-fi amplifiers featuring MOSFET devices in the output stage were released in Australia recently.

Made by Perreaux Sound and distributed in Australia by Zephyr Products, an 80 watt per channel and a 175 watt per channel model are offered.

The SA80B is an integrated amplifier with a power output of 80 watts RMS per channel into 8 ohms with THD of no more than 0.012%, claimed by the manufacturers.

The model PM2150 claims a THD of no more than 0.015% and a minimum power putput of 175 watts RMS per channel with both channels driven into an 8 ohm load.

The PM2150 is designed to be teamed with Perreaux's SP100 or SP150 preamps.

Meanwhile, Hitachi are tipped to release another MOSFET power amp this year, although when — or if — it will become available in Australia is not known.

For more information on the Perreaux MOSFET power amps, contact: Zephyr Products Pty Ltd, 70 Batesford Rd, Chadstone Vic 3148, (03) 568-2922.

Supex transformer

Supex distributors, International Dynamics, recently released a new moving coil step-up transformer, SDT 722.

Specifically designed for use with a cartridge impedence of 3.5 ohms or less, the SDT 722 matches the design criteria of the Supex SD 900E Super MC cartridge.

A special alloy in the transformer's magnetic core is said to boost the weakest signals without loss of fine detail. Each channel has been individually shielded to ensure crosstalk is virtually eliminated.

A sensible switching arrangement allows comparison between two cartridges, and the output can also be switched between two preamps for comparison of different systems.

Gold plated input and output jacks are also utilised to eliminate surface oxidation.

For further information, contact: Interdyn, 23 Elma Rd, Cheltenham North, Melbourne 3192 Vic; Phone (03) 95-0366.

New noise reduction system for cassettes

The US firm, Nakamichi Corp., and West Germany's Telefunken, have cooperated to produce a new noise reduction system for cassette recording systems.

Built around Telefunken's HighCom compander integrated circuit, the Nakamichi-produced instrument is called the "HiCom II".

The unit processes the audio signal in two frequency bands using a 2:1 compression/expansion ratio to achieve a claimed 20 dB improvement in a cassette deck's dynamic range.

The system claims to virtually eliminate noise modulation (pumping or 'breathing effect'), a problem which plagues most simple compander systems particularly when used with the inherently limited dynamic range of cassettes.

High transient signal accuracy is also claimed for the HighCom II. A wide range of attack and release times are available to the system designer. Each frequency band can be optimised with regard to dynamic characteristics. Freedom from colouration of transient signals, a problem with many noise reduction systems, is a feature, according to Nakamichi.

The HighCom II will be available as an add-on unit for cassette deck systems.

The unit was demonstrated, in conjunction with the Nakamichi 680 cassette deck, to trade and professional representatives at Convoy International's premises in Sydney early in June.

A four-frequency band system is available for professional recording applications, designated the HighCom IV.

For more information, contact: Convoy International, 4 Dowling St, Woolloomoolo NSW 2011, (02) 358-2088.

sound briefs

More Metalloy

The Japanese Fuji Co. has commenced marketing C46 and C60 metal alloy cassettes. Hitachi Maxwell is believed to have a C46 almost ready for production and should have longer running limits available shortly after. Other companies currently producing metal alloy tapes are 3M, TDK and Sony. Nakamichi's ZX metal tape cassettes are produced for them by TDK.

Meanwhile

Cost of metal tapes, despite performance advantages, will engender market resistance so Nakamichi have introduced a half-speed cassette deck to double playing times. While most of the competition is rushing out double-speed decks to get extra performance from conventional tapes it would seem the wrong way to go but with a claimed response to 15 kHz at 24 mm/sec for Nakamichi's new 680 machine, few will argue we predict (see Sound News).

Value for money

Japanese hi-fi gear still offers the best value for money say retailers in a survey just published in the USA.

First in price/performance is Technics followed by Kenwood. The retailers say that, in terms of quality, Yamaha is streets ahead followed by Luxman, Technics, McIntosh and Kenwood in that order.

Opposite reaction

Sony is currently seeking (UK) patent protection on a new technique for damping loudspeaker drive unit reaction forces.

A second magnet and dummy load (equal in mass to the main diaphragm) is attached to the rear of the main magnetic drive assembly. An extended voice coil drives both magnets but in equal and opposite directions thus cancelling out reaction forces. Sony claim that the zero nett reaction force eliminates mechanical vibrations in the speaker frame.

The above information comes from UK patent application 2 001 827 A. In case you're wondering, new patent laws in the UK now permit patent applications to be published.

Trio-Kenwood in Singapore

A wholly owned manufacturing company has been established in Singapore by Trio-Kenwood. The plant, which will produce stereo components for Europe, Asia and Oceania (that's us!) will come into full operation early next year.

Videodisc latest

Magnavox' video disc player has been raised in price — from US $695 to US $775. So far the machine is available only in Atlanta and Seattle — and then in such small quantities that in some instances potential customers have offered up to $2000 for the units! Price of the discs has also been raised. Some from US $15.95 to as much as US $24.95.

Sharp Corporation has signed a licencing agreement with Philips enabling Sharp to acquire Philips' video disc technology. Nevertheless Sharp claims this arrangement is simply to enable them to gain experience — a Sharp spokesman says they have no plans for commercial production.

Meanwhile

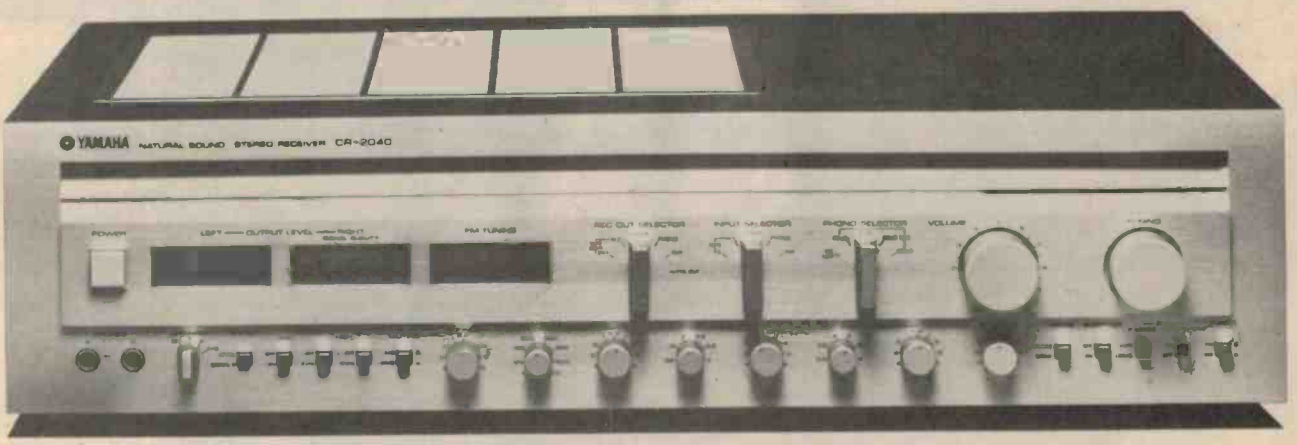
Matsushita has introduced a videodisc system called 'Visc-O-Pac'. A variable speed drive stores 60 minutes video on each side of a 230 mm disc. Playing speed varies from 300 rpm to 900 rpm providing constant stylus velocity. More details when available . . .

This ticket tells you how good it is.

And one of the few receivers you'll find it hanging from is the Yamaha CR2040.

The reason–because few receivers can match its lasting quality or technical specifications.

- ☐ RMS output power of 120 watts (both channels driven into 8 ohms, 20-20 kHz).
- ☐ Low 0.02% Total Harmonic Distortion.
- ☐ Independent recording and audition.
- ☐ Switchable moving coil head amp.
- ☐ Variable Turnover Frequencies on tone controls.
- ☐ Continuously variable loudness contour.
- ☐ Ultra low distortion FM section with NFB PLL MPX and OTS.
- ☐ Auto local/DX FM



Y278/R

Accuphase E303

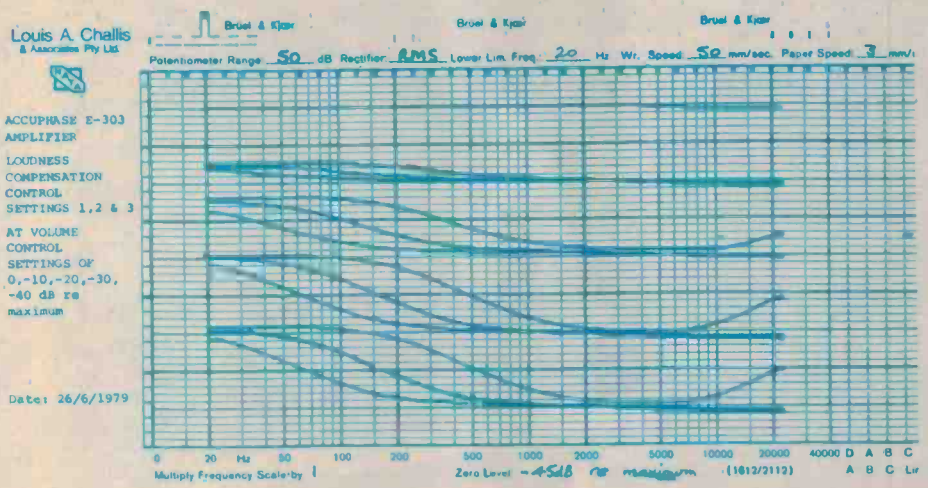
Featuring power MOSFETS in the output stages and complementary-symmetry amplifier circuitry, Accuphase have produced an amplifier with performance figures "... bordering on perfection".

THE ACCUPHASE E303 is a large and impressive contender in the super-amp market place. With a guaranteed 130 watts per channel into 8 ohms, the E303 provides more performance, more push buttons and more operational frills than most.

The front panel is particularly impressive with logically grouped controls in three basic rows. On the top left hand end are the speaker push buttons, in the centre are two direct reading power VU meters flanked on the right hand side by the phono 1 input impedance switches, with values of 100 ohms for moving coil and normal inputs of 47 k, 82 k and 150 k for conventional cartridges. The central row of controls is dominated by loudness compensation and bass and treble controls.

The bottom row contains the power switch, head phone jack, push-button-selectable turnover frequencies of 200 Hz and 500 Hz for the bass and 2000 Hz and 7000 Hz for the treble control, a centrally grouped array of push buttons for tape selection, a sub-sonic filter, stereo/mono switch, a 20 dB attenuator switch and a balance slider control below the volume control. On the right hand side of the amplifier are four push button switches for selecting phono 1, phono 2, tuner or auxiliary input.

At the rear of the amplifier are the normal coaxial input sockets with a facility to separate the pre- and main amplifiers. An improved screw type terminal is provided for speaker connections instead of the more conventional spring loaded socket. An IEC type mains power socket is fitted so that the mains lead is removable. The normal auxiliary power sockets



have been disconnected to meet the requirements of the Australian electrical power authorities. The IEC plug provided for the mains lead is of the straight in-and-out type rather than a right angled bend type which would in our opinion be preferable.

Circuit features

Inside the amplifier are massive heat sinks with the left and right power channel amplifier stages firmly attached to each. The separate preamplifier stage has its own power supplies. The manufacturer uses a C-core transformer to provide higher efficiency with lower flux leakage and better regulation concurrent with smaller size and lighter weight.

The manufacturers state that the symmetrical push/pull amplifiers are "extravagant circuitry" incorporated primarily to reduce transient intermodulation distortion (TIM). These are complemented by the use of metal oxide semi-conductor (MOSFET) power output transistors which approach the quality of Class A operation.

An additional feature that this unit offers is the incorporation of a head amplifier for low output moving coil cartridges. Many purists believe this type of cartridge offers the highest possible quality and performance.

The manufacturer has incorporated a servo-controlled dc amplifier in the tone control circuit so that no noise is introduced when the tone controls are switched on or off. The use of the complementary symmetry push-pull amplifiers throughout the circuitry is a concept that Accuphase have featured since they produced their first models. They have supplemented this feature by the virtual elimination of capacitors in the signal path from both auxiliary and tuner inputs right through to the final output stages.

One feature which puzzles us is the incorporation of selectable turnover frequencies in the tone control. The user of this amplifier would normally expect the ultimate in linearity and flatness of response and should not need multiple combinations of tone controls.

Another puzzling feature is the incorporation of a three-step loudness compensation circuitry (see chart

— continued page 102. ▶

Louis A Challis and Associates Pty Ltd

Our Ref: E9

MEASURED PERFORMANCE OF

ACCUPHASE E303 INTEGRATED STEREO AMPLIFIER, SN D8Y 989

FREQUENCY RESPONSE:

(-3dB) 1.6Hz to 106kHz

SENSITIVITY:

(for 1 Watt in 8Ω)

AUX/TUNER/TAPE	12.5mV
DISC (47kΩ Head Amp off)	191µV
(100Ω Head Amp on)	113µV

INPUT IMPEDANCE:

AUX/TUNER/TAPE	36.3kΩ
DISC 1	370Ω, 43.5kΩ, 73.5kΩ, 135.5kΩ

OVERLOAD MARGIN:

DISC 1 Head Amp off:	320mV
INPUT Head Amp on :	20.7mV

OUTPUT IMPEDANCE: 0.168Ω

TOTAL HARMONIC DISTORTION:

		100Hz	1kHz	6.3kHz
(at rated power - 130W in 8Ω)	2nd	-70dB	-85.5dB	-87.5dB
	3rd	-70.5dB	-92.5dB	-98.5dB
	4th	-71dB	-101.5dB	-
	5th	-72dB	<-117dB	-
	THD	0.058%	0.0059%	0.0044%
(at 1 watt in 8Ω)	2nd	-73.5dB	<-105dB	<-93dB
	3rd	-83.5dB	<-105dB	<-97dB
	4th	-93.5dB	-	-
	5th	-	-	-
	THD	0.022%	<0.0006%	<0.003%

TRANSIENT INTERMODULATION DISTORTION: 0.9% (see attached photograph)

NOISE AND HUM LEVELS:

(re 1 watt in 8Ω)	AUX	-68dB(lin)	-89dB(A)
with volume control set for 1 watt output from 0.5V input (Aux) 5mV input (Disc) input short circuited	DISC	-68dB(lin)	-89dB(A)

MAXIMUM OUTPUT POWER AT CLIPPING POINT: 110V p.p 8Ω

(1HF-A-202 - 20mS burst repeated at 500mS intervals) = 189 watts

∴ Dynamic Headroom = 1.6dB

CROSSTALK:

(re 2.828V RMS pink noise in each one third octave in other channel) <-95dB <1kHz

-87dB 6.3kHz

26th June, 1979.

If you thought REVOX made the world's finest integrated Hi Fi equipment

B790 turntable
B77 tape recorder
B750 stereo amplifier
B760 digital FM tuner
Speaker systems
Accessories
Audio rack

You're right.

For details and name of your nearest Revox dealer, contact . . .

Syntec International Pty Ltd — 53 Victoria Ave, Chatswood. NSW. 2067. Telephone: (02) 406-4627.
Syntec Victoria — 136 Langridge St, Collingwood. Vic. 3066. Telephone: (03) 419-4644
Athol M. Hill — 33-35 Wittenoom St, East Perth. WA. 6000. Telephone: (09) 325-7811.
Sydney G. Hughes — 154-158 Arthur St, New Farm. Qld. 4005. Telephone: (07) 358-1422.
Blackwood Sound — 4 Coromandel Pde, Blackwood. SA. 5051. Telephone: (08) 278-6888.

REVOX

Trade enquiries welcome

A splendid performance....

deserves a splendid performer

Priced at around $350.

The TEAC A-300 is a surprisingly affordable 3-head cassette deck that really gets down to business when it comes to reproduction performance. The reason is an exceptionally stable transport system.
With three heads, the requirements for tape-to-head contact, flutter and tape speed stability are critical.
An inferior transport can actually result in reduced recording and playback quality—even though the unit may boast independent erase, record and playback heads.
That's why we put so much effort into making sure that the A-300 transport complements the three-head system perfectly.
We even went so far as to add a mechanical tension servo in the tape path between the supply reel and heads to assure optimum tape-to-head contact from the beginning to end of every reel.
Technically, the result is improved recording efficiency and extended frequency response with playback level fluctuation and dropouts virtually eliminated.
To you, it simply means stunning sound quality plus the convenience of real-time monitoring.
You can even monitor your tapes Dolby-decoded as you record,
since the A-300 has a double Dolby NR system—four processors instead of the usual two.
And there's a whole list of other features that make recording more convenient and enjoyable.
Try a TEAC A-300, and find out what 3-head reproduction is really all about.

TEAC AUSTRALIA PTY. LTD., 165 Gladstone Street, South Melbourne, Vic. 3205. Telephone 699 6000.
INTERSTATE AGENTS: BTS Sales, 66 Dickson Ave., Artarmon, NSW. 2064 Phone 439 6262. BTS Sales, 51 Norma Rd., Myaree, WA. 6154. Phone 330 1255. BTS Sales, 91 Robertson Rd., Fortitude Valley, QLD. 4006. Phone 52 8900. P.G.A. Associates Pty. Ltd., 62 Hindmarsh Sq. Adelaide, SA. 5000. Phone 223 3024.
RETAILERS: VIC. Brashs, Douglas Hi-Fi, QLD. Stereo Supplies, NSW. Douglas Hi-Fi, Miranda Hi-Fi, Hamilton Hi-Fi Centre, Newcastle, SA. Truscott Electronics, WA. Albert's Hi-Fi, Audio Centre, A.D. Urquhart, TAS. Quantum Electronics, Hobart, United Electronics, Launceston, Audio Services, Burnie, ACT. Kent Hi-Fi, NORFOLK ISLAND Miltons Department Stores, N.Z. Direct Imports, Hastings.

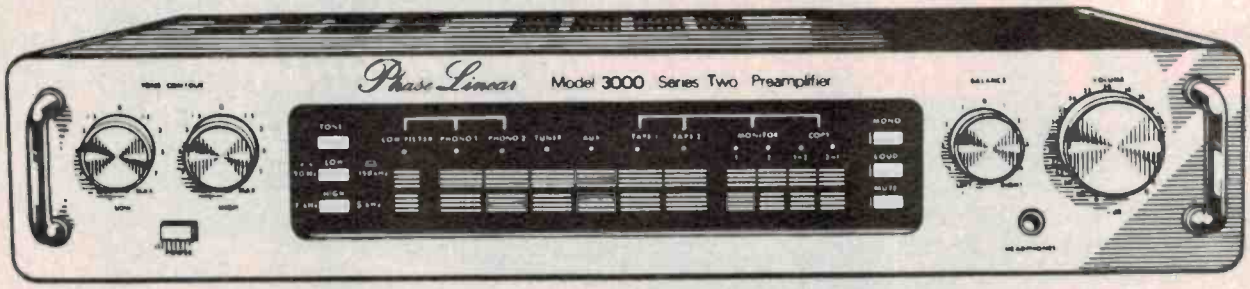
(LEA)3051

TEAC

Where Art and Technology Meet

"Dolby" is a trademark of Dolby Laboratories.

A new preamp for the perfectionist who can appreciate the difference.



Phase Linear 3000 Series Two.

The new Phase 3000 Series Two was designed for the music-lover who has a passion for accurate sound, an eye for elegant, yet functional design, a feel for craftsmanship, and an unfailing determination to maximise return on investment.

The Phase 3000 incorporates the latest technological advancements in preamp design. Transient overloading that plagues preamps has been virtually eliminated, whether amplitude, frequency, or slew induced. Now you can enjoy the flexibility, performance and features that are priced substantially higher in other equipment.

CMOS Logic Memory System.

Most preamps use dated mechanical switching devices that force signals to travel long, noisy, circuitous routes from the inputs to the front panel, then back to the outputs. Ours doesn't. The Phase 3000 uses CMOS-digital logic to energise switching relays located where they belong, at the input jacks. This shortens critical signal paths. Noise, hum, and the "crosstalk" that's characteristic of mechanical switching is virtually eliminated.

Want more?

A listening session with a pair of headphones will convince you just how much of a difference a true headphone amp makes. Turn the 3000 around, and see how easy it is to patch in your noise reduction unit. Two complete taping circuits allow you to copy between decks while listening to another source.

If you're serious about state-of-the-art performance it's time for you to do some listening.

Hear the difference at your audio specialist's, or write for complete information.

Distributed in Australia by Acoustic Monitor Co Pty Ltd (Member of the Thomas & Coffey group), 12-18 Gould Street, Enfield, NSW 2136. Phone: (02) 642-7888. Telex: 26778. Cables: "Tomcoffy" Sydney.

Phase Linear®

THE POWERFUL DIFFERENCE

Phono Cartridge Flexibility

The two independent RIAA phono stages eliminate all low-level switching. As a result, noise is reduced to theoretical limits.
Phono 1 is designed for moving-magnet cartridges and has three selectable capacitance values.
Phono 2 is used with moving-coil cartridges and has three selectable resistance values. The expensive outboard head amp usually required for a moving-coil cartridge is already built into the 3000.

SMA/AM5

The Laser range of quality loud speakers represents a new level of excellence in sound engineering, matched with a price that even the most budget minded speaker buyer can afford. Laser speakers have rapidly gained acceptance among audiophiles, both locally and overseas, and are held in high regard as a speaker that competes more than favourably with most other top models.

Sizes range from a powerful 6½ inch woofer right through to a heavy duty 15 inch musical instrument speaker. Every model is fitted with a high density ferrite magnet assembly, and a large high compliance spider which permits extended Linear excursions. An up-to-the-minute frame design improves the strength while giving superior performance for size and weight parameters. The Laser range also offers two and three way crossovers on heavy phenolic printed circuit boards and a Comprehensive Booklet is available showing Loudspeaker, Enclosure and Crossover Specifications for all Laser Speakers

LA 65 6½" woofer	$19.33
LA 65T 6½" wide range	$19.33
LA 65M 6½" mid range	$19.33
LA 80 8" woofer	$19.97
LA 80S8" super woofer	$19.97
LA 80T 8" wide range	$18.91
LA 12/30W 12" woofer	$50.45
LA 12/30T 12" wide range	$52.90
LA 12/30G 12" musical instrument speaker	$52.90
LA 12/50W 12" super woofer	$80.20
LA 12/50G 12" music instrument speaker	$80.20
LA 15/100W 15" ultra super performance woofer	$94.02
LA 15/100G 15" heavy duty musical instrument speaker	$84.80
2 way Cross Over Network	$10.58
3 way Cross Over Network	$18.47

radio parts group

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1097 Dandenong Rd, East Malvern (03) 211-8122

Trade Enquiries Welcome

LASER

OR SYDNEY

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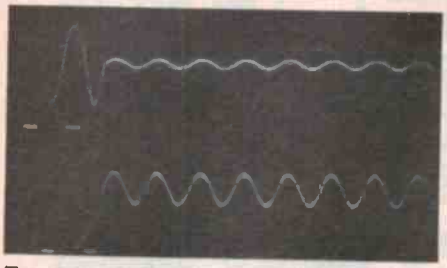
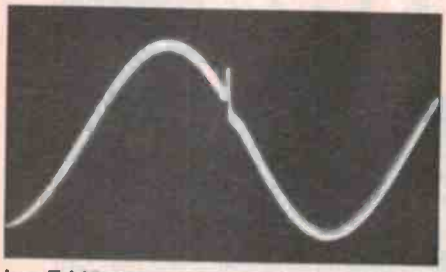
GROUP

104-106 King St, Newton
Phone 519-6361

Trade Enquiries Welcome



Transient overload recovery test (1 ms/div.).



Lux T.I.M. test.

– from page 97.

reproduced here). The aim is to allow the intending user to tailor the loudness response of various programme content at low listening levels to suit his or her own individual physiological response. We regard such a feature as a contradiction of concepts.

On test

The objective testing of the Accuphase E303 provided results which matches this amplifier's reputation.

The manufacturer's power ratings are very conservative and the maximum power output into 8 ohms load is 189 watts in accordance with IHF test procedure. The measured distortion at both the 1 W level and at the 130 W level was substantially lower than claimed by the manufacturer. Distortion components were typically −105 dB at 1000 Hz, −97 dB at 6.3 kHZ and −73 dB at 100 Hz. These performance figures are *bordering on perfection* and tested the ability of our low distortion oscillators and our measurement equipment to the very limits of their capability. Even the phase response is exemplary, allowing the manufacturer to claim that it offers laboratory type performance.

The transient intermodulation distortion of the unit is unusually low (evaluated by our Lux TIM test unit). Hum and noise is exceptionally low, response is clean and the extended frequency response, even at 130 W, extends from 3 Hz to 106 kHz and is within ±0.1 dB from 10 Hz to 40 kHz. For our subjective tests we used a Nakamichi MC1000 moving coil reference cartridge, a GH Hadcock Super Arm and STD305D turntable and JBL monitor speakers. Distortion and colouration were negligible and we liked the clean way in which the amplifier was able to handle transients.

Our conclusions – the Accuphase E303 is one of the finest amplifiers we have had the pleasure to evaluate.

ACCUPHASE E303 INTEGRATED STEREO AMPLIFIER

Dimensions: 445 mm wide x 370 mm deep x 160 mm high
Weight: 24 kg RRP: $1698
Manufactured by Kensonic Laboratory (inc), Japan. Available through Arena Distributors.

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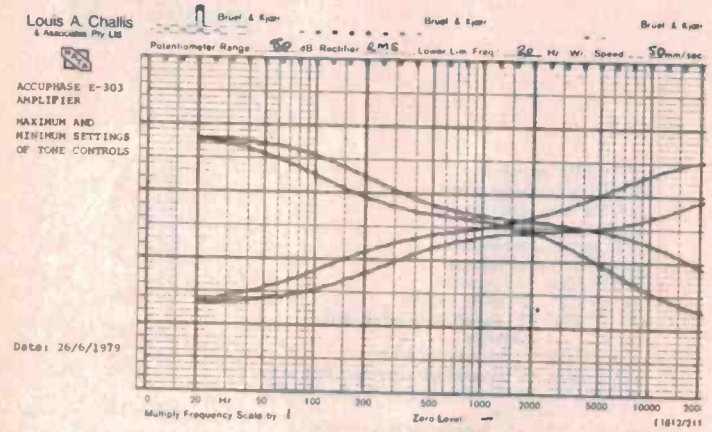
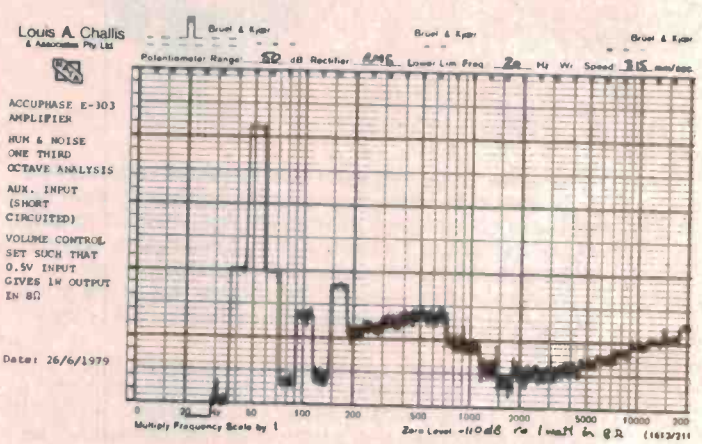
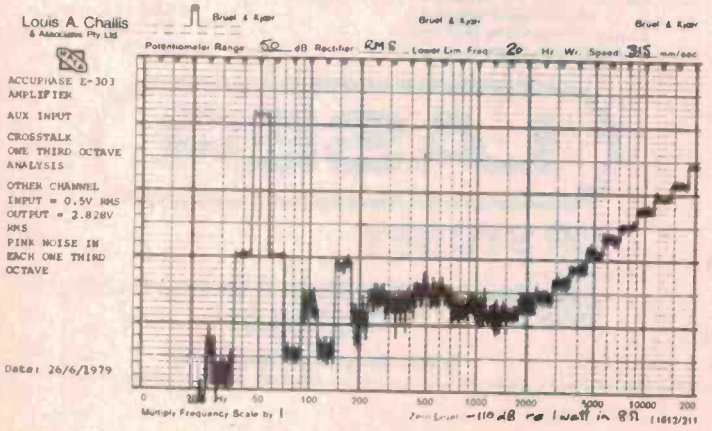
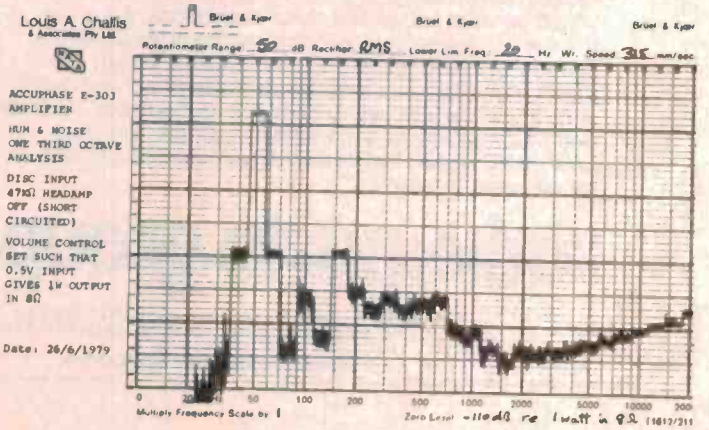








Toshiba's 335 System Components are a reflection of high technology from the inside out. It takes precision engineering to give you this coordinated, well-balanced sound.

For your records there's a fully automatic direct drive turntable (SR-F335) with auto-repeat up to six times, arm cueing control, stroboscope, anti-skating, and a die-cast aluminium platter. Wow and flutter measures an incredibly low 0.035% and the S/N ratio is better than 65 dB (DIN B).

As for the tuner (ST-335), it uses flat group delay ceramic filters, instead of the ordinary coil and capacitor type, for high selectivity — rarely heard in a tuner near its price.

The main amplifier (SC-335) delivers 40W+40W RMS (1 KHz, 8 ohms) with total harmonic distortion less than 0.1%. The pre-amplifier (SY-335) is separate for maximum performance without distortion and offers mic mixing, professional click-stop controls, polystyrol capacitors, carbon resistors, and achieves ±0.5 dB response (RIAA).

For maximum convenience and superb fidelity, the cassette deck (PC-335) features a soft eject, 3-step bias and equalization and a Dolby* noise reduction system.

From the innermost circuitry to its rich, full sound. The Toshiba 335 System Components are Toshiba technology throughout.

*Dolby is a trademark of Dolby Laboratories.

TOSHIBA

TOSHIBA (AUSTRALIA) PTY., LIMITED
16 Mars Road, Lane Cove, N.S.W. 2066
Tel: Sydney (428)-2055 Telex: AA27235

Total Toshiba sound packs a powerful punch.
40W + 40W RMS.

Another Achievement of Toshiba Technology
The 335 System Components

TDK's HD-01 HEAD DEMAGNETIZER BUILT INTO A CASSETTE SHELL.

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

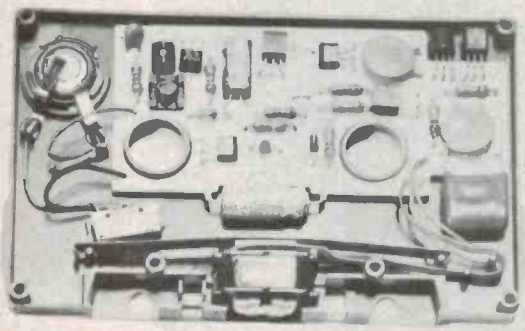
WHY IS DEMAGNETIZING SO IMPORTANT?

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

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

Record/Playback heads do generate a residual magnetic field over a period of time. This can be strong enough to act as an erase head, is capable of partial erasure of high frequency signals, and at the same time loads additional noise/hiss onto the original recording.

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



The TDK HD-01 Head Demagnetizer features:

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

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

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

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

TECHNICAL DATA

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

Power Supply — Control Section — Oscillation Section — Head Section

Specifications:

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

TDK®

TDK (Australia) Pty. Ltd.,
4 Dowling Street,
Woolloomooloo. N.S.W. 2011
(02) 358-2088

THE ULTIMATE MACHINES.

SA CASSETTES: OVERTURE TO THE WORLD OF QUALITY MUSIC

Features of SA:

- Greater coercivity and much finer magnetic particles with greater length-to-width ratio than conventional magnetic materials.
- Magnetic particles of SA gives personal treatment to each and every signal, thereby helping to yield a clearly defined sound which is crystal clear. It extends the flat frequency response range from the lowest lows to the highest highs, giving expression to the many sounds and moods of music as they were intended to be heard.
- It handles exceeding high signal inputs without distortion which is due to increased MOL providing a full dynamic range for both recording and playback. SA uses the 70 micro-second playback equalization position (High or CrO_2) on your deck for a greatly enhanced signal-to-noise ratio and reduced noise level.

AD CASSETTES: FAITHFUL 'REAL LIFE' REPRODUCTION

Features of AD:

- High MOL (Maximum Output Level) at the high end is perfectly capable of recording and playing pop, rock and jazz music sources with plenty to spare.
- Frequency response which extends right up to the high ends. That is why the treble comes through loud and clear.
- Features a bias curve which is broad and this enables the tapes to cope with a wide range of different tape decks.
- Does not require selection of special bias and equalization settings, the Normal position will do. This means that anyone can play back and record the tapes on any kind of deck.

Both SA and AD feature the new TDK super precision cassette housing made to 10 times the accuracy of the original specifications.

TDK®

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4 Dowling Street,
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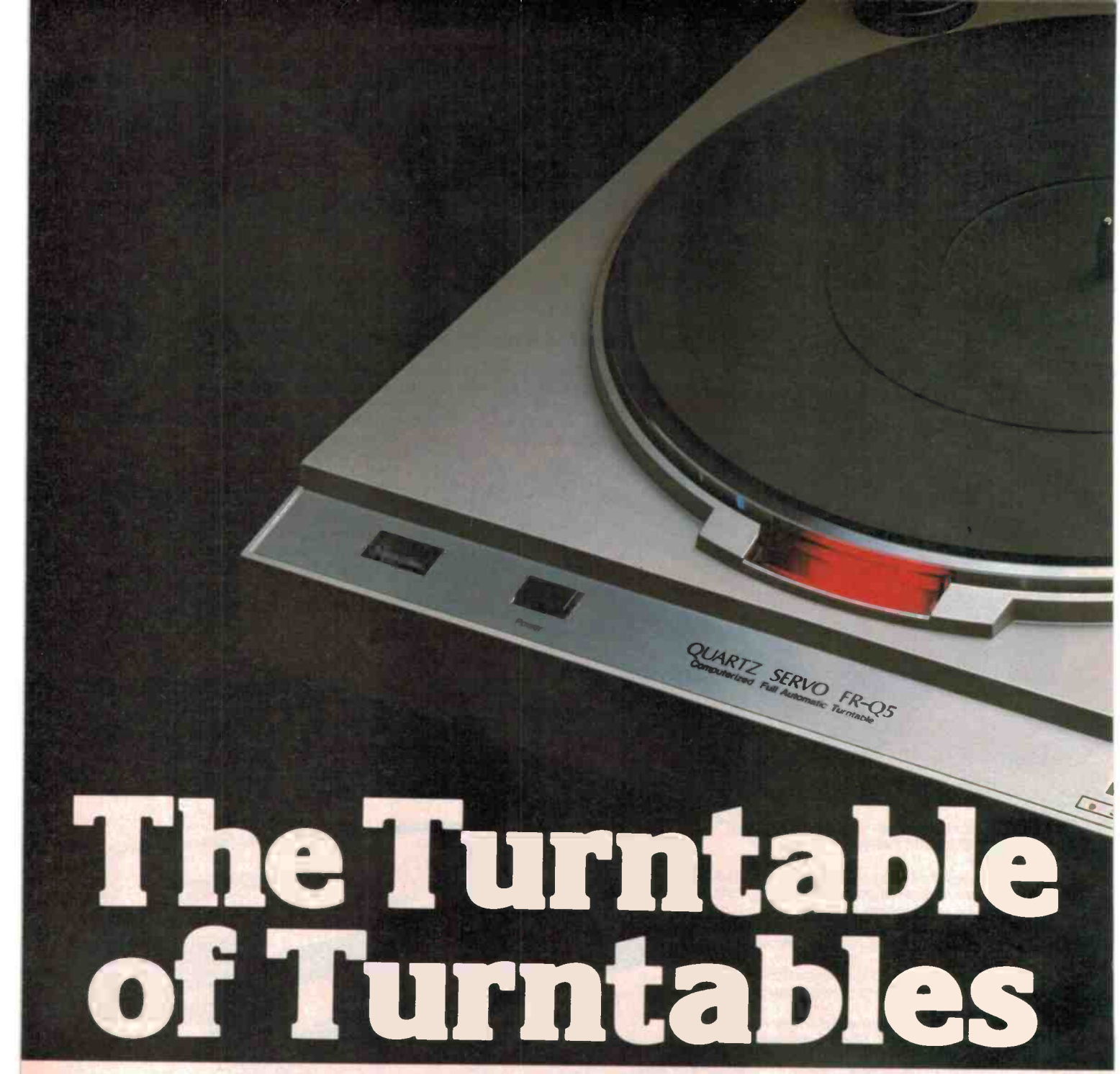
(02) 358-2088



The Turntable of Turntables

Records are probably the most satisfying and popular hi-fi music source. Yet the turntable and arm are probably the most complicated hi-fi units to design correctly. A wow & flutter spec of 0.02%, for example, is excellent but absolutely meaningless if spurious vibrations muddy the sounds you hear. And what good is a quartz-servo feedback circuit without a practical safe way to place the tonearm on the record so that both the stylus and valuable records are carefully protected from damage?

After realistically investigating all aspects, Sansui's turntable design team superbly integrated the latest advances in three different technologies: audio, mechanics, and computer electronics. The result is the FR-Q5 — unparalleled excellence in all performance parameters and exceptional ease of operation.

Here are the exciting details.

Computerized operation.
All operations — lead-in, return, stop, continuously play — are activated by feather-touch buttons which instruct the microcomputer controlling the tonearm motor. Flawless and virtually silent, the Sansui-developed computer configuration combines true operational ease with maximum protection of your valuable records.

Quartz-servo Direct Drive system.
A 30-slot 20-pole brushless DC motor assures a high torque and all the proven benefits of direct drive without intermediate distortion-producing devices. And a specially selected fully-aged quartz crystal's precise oscillations assure accurate platter revolutions.

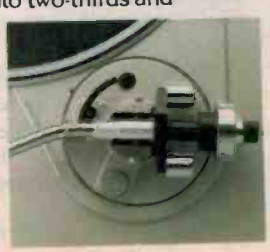
The FR-Q5 is ahead of others.
Unlike ordinary units, this Sansui turntable has a head that keeps it ahead. That head electronically "reads" magnetic marks on the inside rim of the platter and by comparing that "reading" with the quartz reference, instantly "instructs" the motor to make any necessary adjustments. Unlike devices that merely monitor the motor, this Sansui system assures far greater accuracy because it monitors the actual speed of the platter. Wow & flutter is under 0.018%. S/N is better than 75 dB. (DIN-B)

Only hi-fi, everything hi-fi.

Sansui

New tonearm theory: Dyna-Optimum-Balanced Tonearm System.

Sansui engineers have newly applied a basic principle in physics which posits certain impact transmissions in relation to mass fulcrum divisions. If the total mass of the tonearm is perfectly divided by the fulcrum into two-thirds and one-third, important benefits result. On the one hand, any external impact or vibration from the base of the tonearm has theoretically



zero affect on the stylus. On the other hand, even warped records can be flawlessly tracked, and transmission of stylus oscillations to the tonearm are sharply reduced. A special balance mechanism radically reduces feedback distortion caused by the stylus' twisting in the record groove. You will, in short, hear subtle nuances of recorded sound that are ordinarily twisted with distortion but are miraculously clear with the innovative D-O-B tonearm.

The FR-Q5 is indeed the turntable of turntables. A host of its many advantages will also be found on the more economically priced FR-D4 and FR-D3 Sansui turntables.

SANSUI

FR-Q5

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku. Tokyo 168, Japan
VANFI (AUST.) PTY. LTD. 162, Albert Road, South Melbourne, Victoria 3205, Australia Tel: 699 5473
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929 0293

Sanyo's TP1030 direct-drive turntable

This turntable offers good performance and is ". . . delightfully easy to use".

SANYO'S TP1030 direct drive turntable has the usual features consumers now expect — cueing levers, S-shaped tone arm, balance adjustment ranging between 0 grams and 3 grams, anti-skating facilities and a built-in stroboscope. There are two sets of strobe rings on the outside of the turntable, one for 50 Hz mains operation the other for overseas 60 Hz use.

Features

Controls are the push button type, simple and functional. There are knurled controls for the fine adjustment of speed for 33 1/3 and 45 rpm. All controls have adjacent LEDs to indicate the function selected. The tone arm assembly, which is particularly rugged, incorporates a simple but effective balance weight and a dial for setting anti-skating force.

The head shell is unusual and although it may be effective and economical what concerned us was that it might have unusual resonance problems. Whilst we could not find any trace of this in the tone arm resonance tests, there were some unusual higher frequency resonance problems.

The turntable platen weighs 1 kg. This is a compromise between the higher turntable mass desirable to stabilise speed and the effect that this added weight would have on the start-up speed/torque

relationship of the brushless dc motor used. The time to reach full speed is 2.8 seconds which is quite acceptable.

The TP 1030 has another feature worthy of note. This is the stylus mirror over which the stylus can be positioned to check for the presence of dust. Whilst this works, it would work better if the mirror were positioned to allow for the relative angle between stylus and head.

Performance

Objective testing highlighted a number of features, most of which were positive.

Frequency response of the type MG-10J cartridge was particularly smooth even though there was a typical drop in sensitivity of 2½ dB to 3 dB (relative to the 1 kHz reference) in the frequency region 5 kHz to 10 kHz. Whilst this may not be as flat as some audiophiles may desire, this drop-off was more than compensated for by the smooth response in the 12 kHz to 20 kHz region which exhibited a very clean square wave response without any sign of ringing. The smooth high frequency response also showed up as a significantly better high frequency separation in the 10 kHz to 20 kHz region than has the majority of other high quality cartridges. Separation between the left channel and the right channel was 34 dB and between the right channel 25 dB, at 1 kHz. This difference is caused by the anti-skating control which provides inexact compensation.

The vibration isolation fell short of what we would desire. There were two significant resonances, the more pronounced being at 55 Hz with a second resonance at 80 Hz. This record player

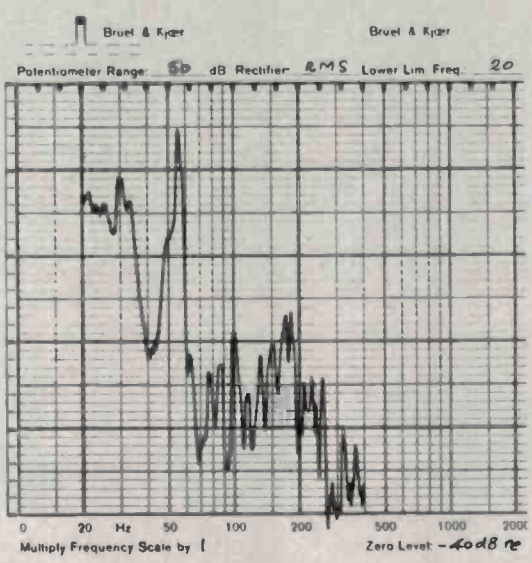
— continued page 113. ▶

Louis A. Challis
& Associates Pty Ltd.

SANYO TP 1030
DIRECT DRIVE
TURNTABLE

OUTPUT FROM
PICKUP DUE TO
CONSTANT
VERTICAL
VIBRATION
LEVEL OF
1mm/sec. RMS
APPLIED TO
TURNTABLE
MOUNTING FEET.

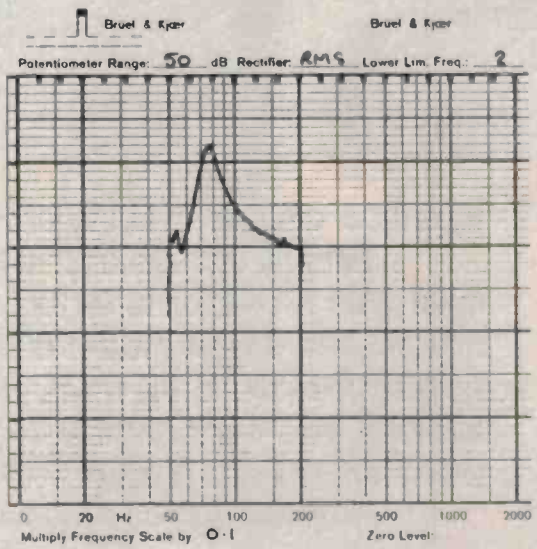
DATE: 22/6/79



Louis A. Challis
& Associates Pty Ltd.

TONE ARM
RESONANCE
OF
SANYO TP 1030
DIRECT DRIVE
TURNTABLE

DATE: 22/6/79



Louis A Challis and Associates Pty Ltd

Our Ref: E10

MEASURED PERFORMANCE OF
SANYO TP1030 DIRECT DRIVE TURNTABLE, SN 63130204

RANGE OF SPEED ADJUSTMENT: 33 1/3 RPM +5.7% -6.4%
45 RPM +4.1% -4.2%

WOW & FLUTTER: Wow: 0.2% p-p
Flutter: 0.035% weighted RMS
0.09% unweighted RMS

RUMBLE:
(re 2.24cm/sec at 1kHz) -26.8dB unweighted
-39.5dB weighted (BS4852)

FREQUENCY RESPONSE: 20Hz to 20kHz $^{+3}_{-2}$dB

SENSITIVITY: (at 1kHz)	Left	Right
	0.94mV/cm/sec	1.05mV/cm/sec

CROSSTALK:	100Hz	1kHz	6.3kHz
Left to right	-27.5dB	-34.5dB	-27dB
Right to left	-25.5dB	-25.5dB	-30dB

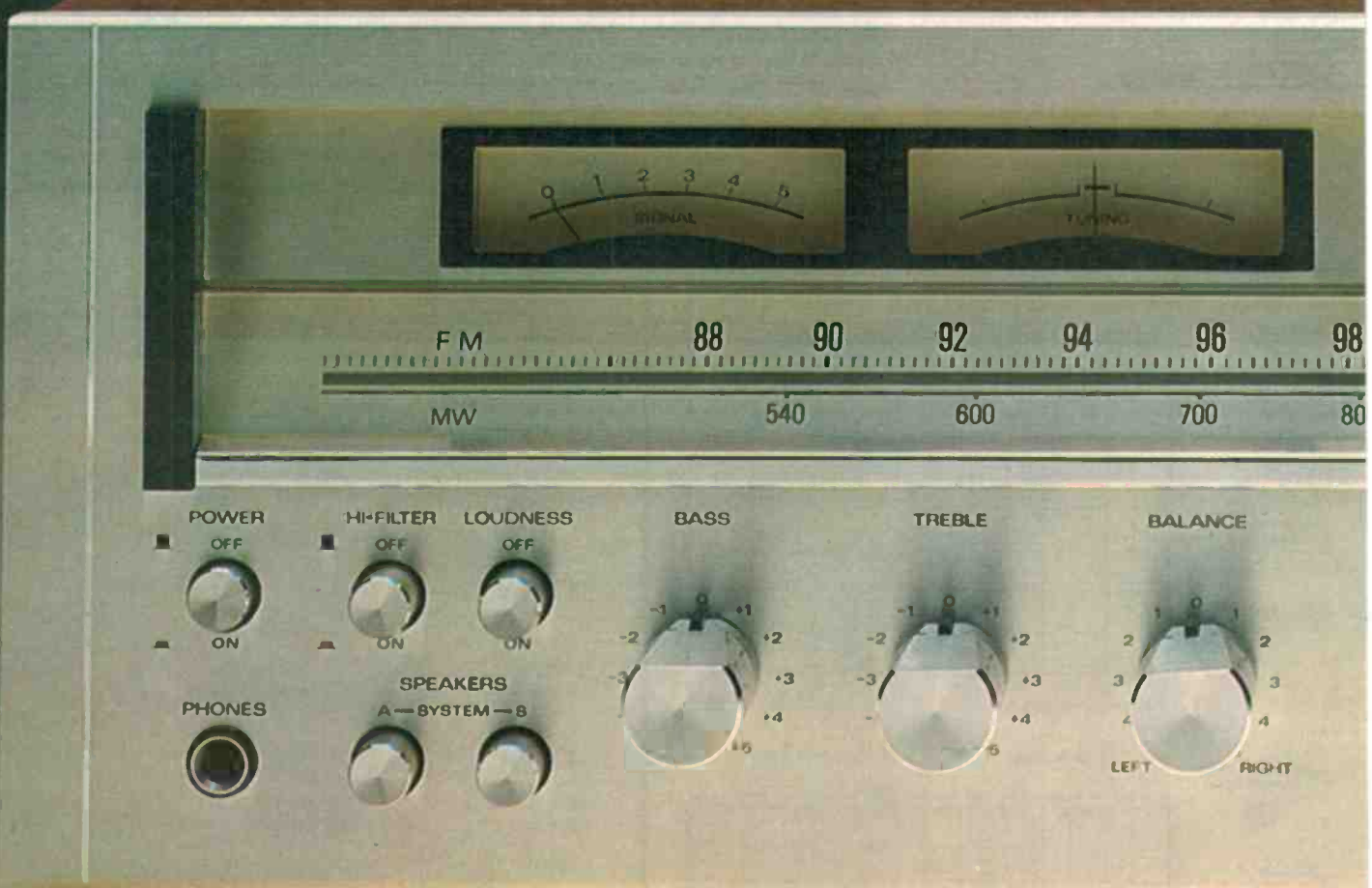
TONE ARM RESONANCE: 7.8Hz (see attached graph)

TOTAL HARMONIC DISTORTION: (2.24cm/sec at 1kHz)	100Hz	1kHz	6.3kHz
Left	2.2%	1.5%	6.1%
Right	1.7%	2.4%	9.1%

SENSITIVITY TO EXTERNAL VIBRATION:
Suspension resonance: 55Hz
Vibration level applied: 1mm/sec RMS constant velocity
Pickup output: +4.5dB re 2.24cm/sec at 1kHz
(see attached graph)

26th June, 1979

A good tuner/amp shouldn't put



It's going to receive an excellent reception in Australia.

Not just for its price. But for its sheer value-for-money.

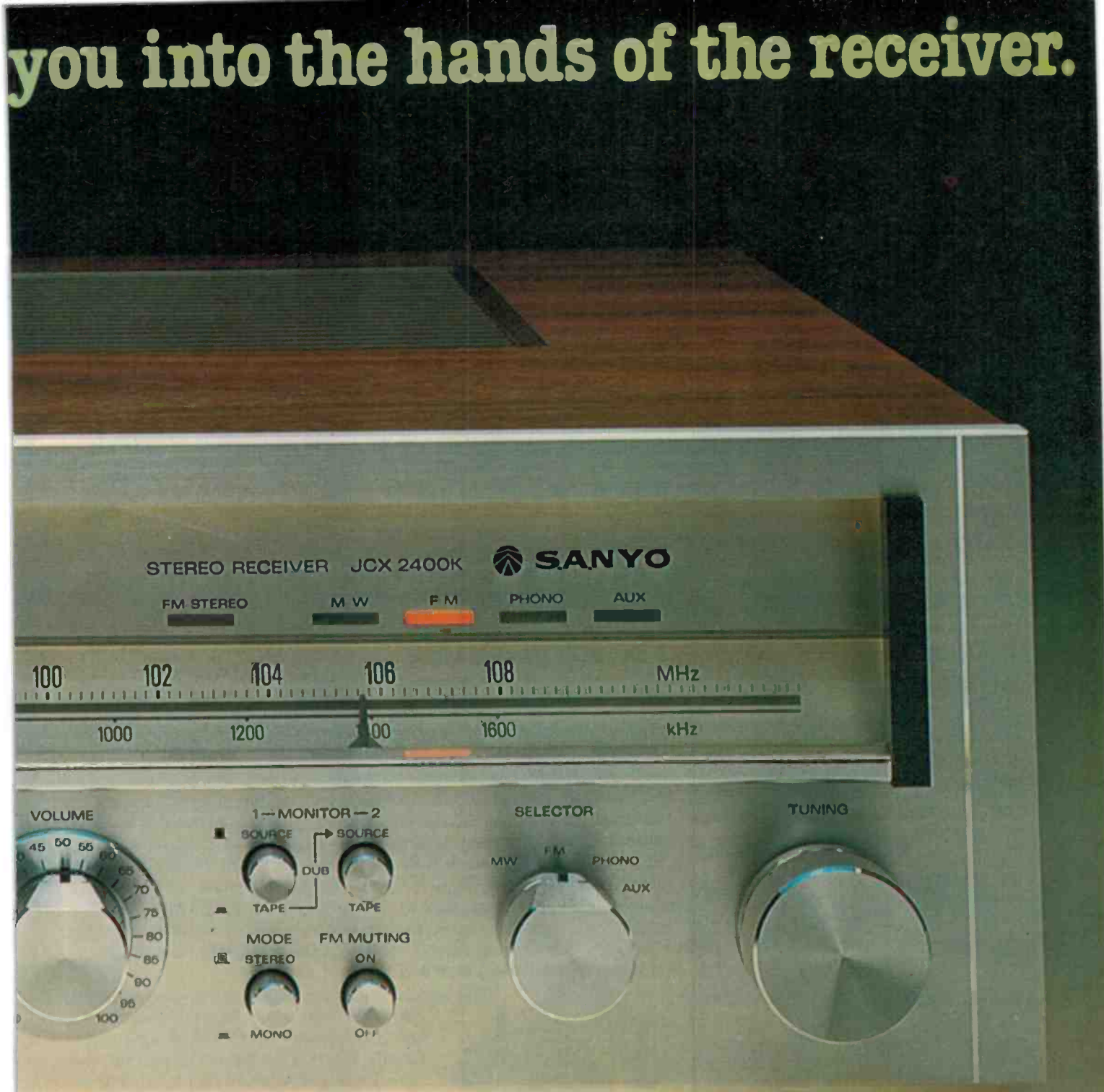
It's the JCX2400K, one of two exciting new tuner amps. from Sanyo.

They both have a computer-designed power supply that holds ripple in critical circuits to 0.1% or less.

An FM section that employs a dual-gate MOSFET to amplify incoming signals and a wide Automatic Gain Control that picks up weak distant stations, while preventing overload distortion on strong local ones.

Stereo separation greatly exceeds

you into the hands of the receiver.



that of turntable pickups in FM stations. And the power amplifiers use the latest solid state devices, highly advanced bias circuitry and massive heatsinks.

The phono pre-amplifier sections give an equalisation accuracy within 1/5dB of the perfect RIAA playback curve.

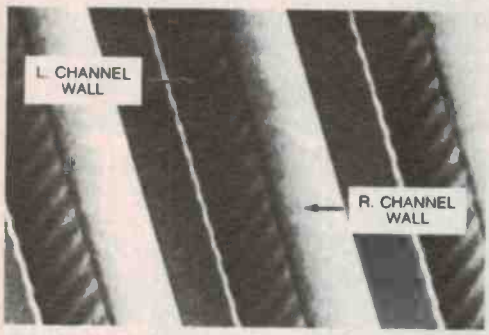
And signal to noise ratio is at least 10dB better than the vast majority of records sold.

Sanyo's tuner amps. truly meet our philosophy of Hi-fi without Hi-finance.

SANYO Hi-fi, not Hi-finance.

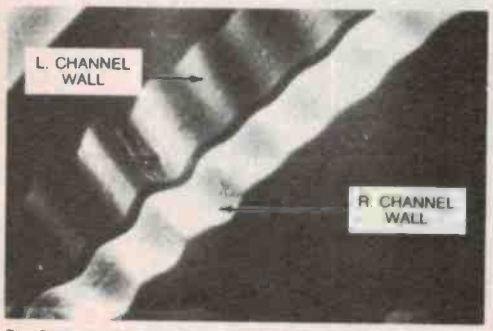
SAN 3245/4

fact: one mistrack damages grooves more than 25...50...even 100 plays.



CBS STR 100 Played 75 Times With a V15 Type III Cartridge.

Mistracking Damage
A Commercial Recording After Just One Play With Top-of-the-Line Name Brand Cartridge at 1.0 Gram Tracking Force. Mistracking — Critical Damage.



The Same Commercial Recording After 50 Plays With Shure V15 Type III Cartridge at 1.0 Gram Tracking Force. Normal (Inaudible) Wear — Excellent Tracking.

The Optimist's View:

The cartridge that tracked the grooves shown in the top photomicrograph caused no PERCEIVABLE wear after 75 plays. But because these grooves are cut at relatively low velocities and have a continuous 20 kHz signal (only on one channel), they don't present a very challenging test. As a matter of fact, any reasonably good cartridge should produce the same results. However, under greater magnification these same grooves would probably reveal some amount of record wear (although not enough to alter sound quality). That's because record wear is a gradual but constant phenomenon . . . like tire wear every time you drive.

The Terrible Truth:

The middle photomicrograph shows a record of musical material cut at today's "hotter" velocities after only one play with a well-known competitive cartridge at its rated tracking force. This cartridge mistracked the record. Clearly, critical damage resulted. Notice the deep gouge marks on the groove walls.

A single mistrack can result in MORE damage than 25, 50 or even 100 plays of a record! Continuing our tire analogy, a mistrack is like a blowout. Once your cartridge mistracks a record passage, the damage has been done and that passage will never sound the same.

TRACKABILITY is the single most meaningful yardstick by which to measure cartridge performance. That's because TRACKABILITY encompasses virtually every performance factor by which a cartridge is judged . . . including velocity of the recorded signal, frequency, compliance, and effective mass.

The bottom photo shows the same groove played 50 times with a V15 Type III at a record- and stylus-saving force of only one gram. Clearly, there is no cartridge you can buy — for any amount of money — that will protect your record collection more from the damage of mistracking than the Shure V15 Type III.

Shure V15 Type III

SHURE®

Outperforms the best of the rest

AUDIO ENGINEERS P/L
342 Kent Street,
SYDNEY 2000 N.S.W.

AUDIO ENGINEERS (Vic.)
2A Hill Street,
THORNBURY 3071 Vic.

AUDIO ENGINEERS (Qld.)
51A Castlemaine Street,
MILTON 4064 Qld.

ATHOL M. HILL P/L
33 Wittenoom Street,
EAST PERTH 6000 W.A.

AE141/FP

– from page 109.

should not be mounted in a location where there is a strong likelihood of significant vibration feed-back from the loudspeaker or where building or floor vibration can be readily transmitted to the plinth. The tone arm resonance, which is broad and quite reasonable, occurs at 7.5 Hz which is well below the normal operating frequency range of the unit. Fortunately, it is also well below the other resonance characteristics of the base.

Speed stability

Speed stability of the turntable, once set shows no perceptible variation and indicates that in normal use the basic characteristics of the dc brushless servo motor are almost comparable with many more expensive motor systems.

The range of speed adjustment provided by the unit exceeds the manufacturer's stated ±4% and is more than adequate for normal use. Wow measured at 0.2% peak to peak and flutter at 0.035% (as an average of four different measurements with the test record rotated through 90° increments). The flutter figure is quite acceptable and was completely imperceptible on all programme content.

The rumble figure, at -39.5 dB weighted, is particularly good and fully comparable with the performance from much more expensive turntables.

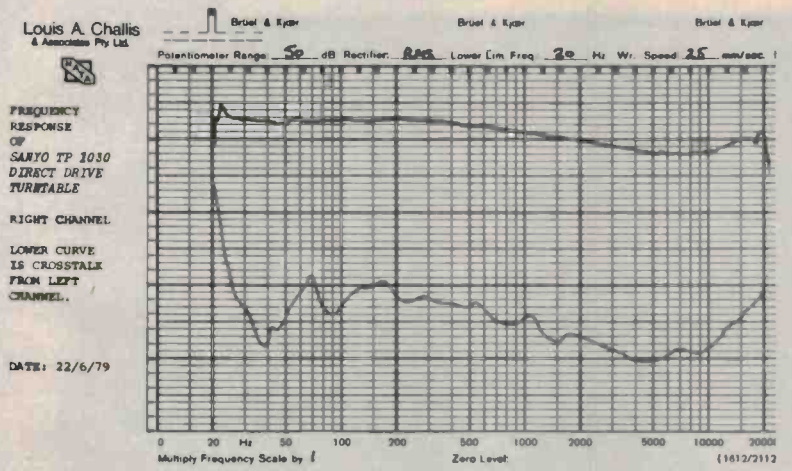
Summary

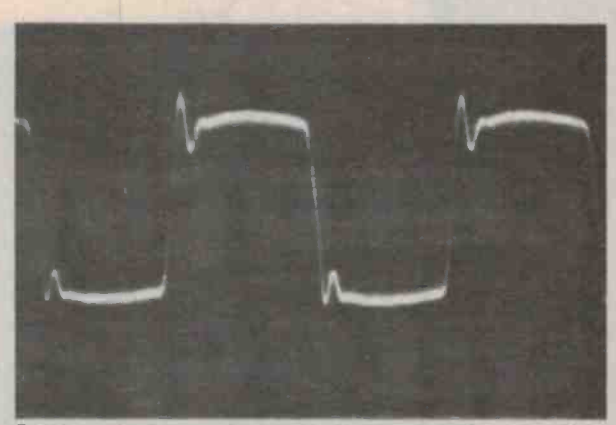
The TP1030 is delightfully easy to use. We were particularly impressed by the smooth way the tone arm drops onto the turntable and switches off at the end of a record. When tested with the Shure Test Record TTR101 Audio Obstacle Course the turntable consistently provided a Level 5 performance, which is excellent. On all the programme content evaluated, the fidelity of the sound produced was excellent and a credit to the cartridge's designers.

Two features deserve criticism. Firstly, the cueing lever is not as well damped as it should be – it lowers the tone arm far too rapidly onto the turntable and equally significantly lifts it again too quickly. The cueing lever, if operated quickly can result in the tone arm bouncing up in a rather disconcerting manner.

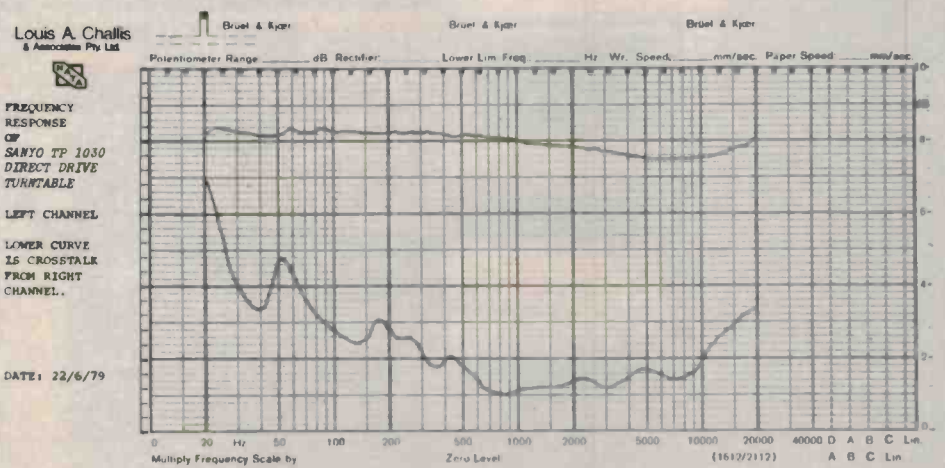
The second criticism relates to the vibration isolation characteristics of the mounts. In our listening room they allowed a just perceptible level of vibration to be fed back.

Sanyo's TP1030 turntable offers a good integrated performance. Provided it is mounted carefully, it should give an excellent account of itself. ●





Response of Sanyo's TP1030 system to 1 kHz square wave at equivalent sinusoidal velocity of 7 cm/sec RMS.



SANYO TP1030 TURNTABLE, WITH REMOVABLE PLASTIC DUST COVER

Dimensions: 472 mm wide x 380 x deep x 150 mm high

Weight: 6.4 kg RRP: $312

Manufactured by Sanyo Electric Co. Ltd., Osako, Japan.

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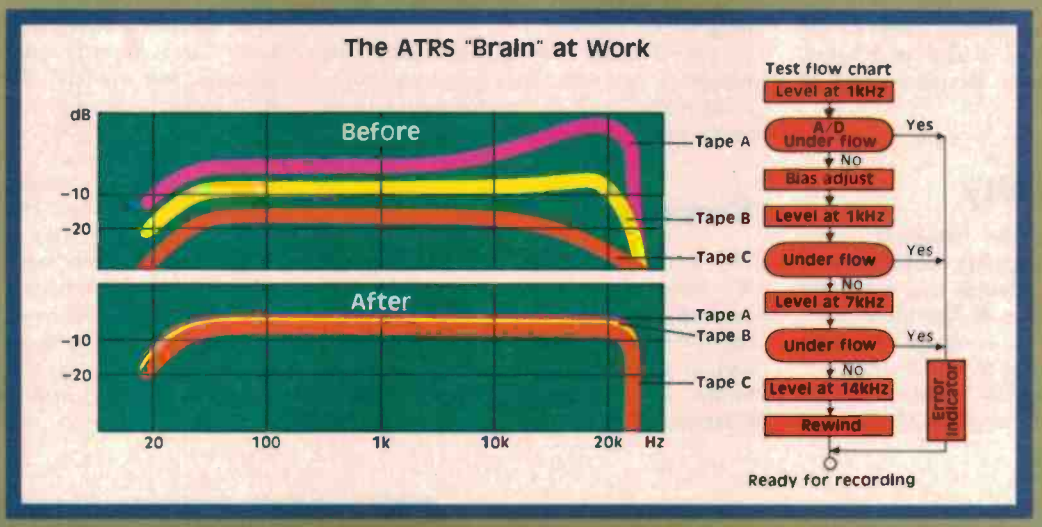
The brain.

Hitachi puts it in charge of sensitivity, bias and EQ.



ATRS

(Automatic Tape Response System)

The ATRS brain is a sophisticated microcomputer that's built into the Hitachi D-5500 Cassette Deck. Because there are hundreds of different tapes on the market, ATRS was designed to match bias and EQ settings to the precise characteristics of each one you use.

Press the test button while in record and in 20 seconds ATRS carries out six calibration functions. It also has three individual memories for the test results of the three tapes you use most frequently.

The D-5500 adds to that little miracle of technology a few more Hitachi firsts. Like a full IC logic detachable control block that doubles as a wireless infrared remote unit. A direct-drive Unitorque™ motor (0.028% WRMS wow and flutter). And a close-gap R&P three-head system.

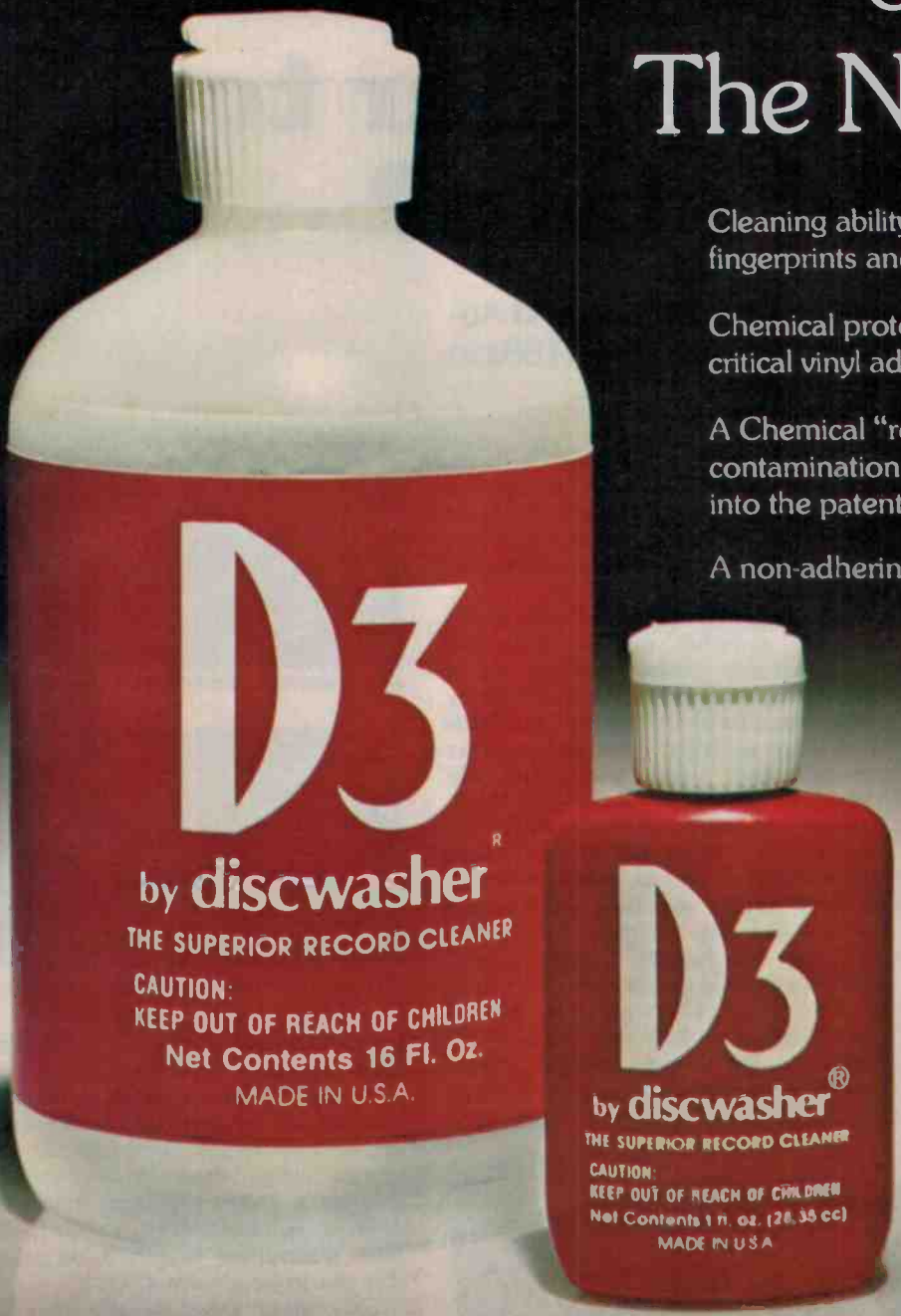
The Hitachi D-5500 Cassette Deck with ATRS. It never stops thinking about your music.

D-5500

HITACHI

Hitachi Sales Australia Pty. Ltd., 153 Keys Road, Moorabbin, Victoria 3189 Tel: 95 8722

A Choice: Disposable Records or The New D3



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A valve amplifier to rival solid state?

The TVA-1 from British manufacturer Michaelson and Austin delivers 70 watts per channel from push-pull KT88s in the output.

THERE HAVE been many claims that the best valve amplifiers provide a more natural, uncoloured sound than do transistor amplifiers. The TVA-1 Thermionic Valve Amplifier gave us an opportunity to evaluate these claims.

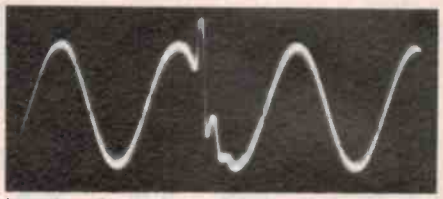
The unit is in no way revolutionary but is remarkable for its 32 kg (70lbs) weight, its beautiful chrome-plated chassis and the marvellous talking point of the power dissipated by those lovely heaters in each of the KT88 beam power tubes!

Ventilation is important

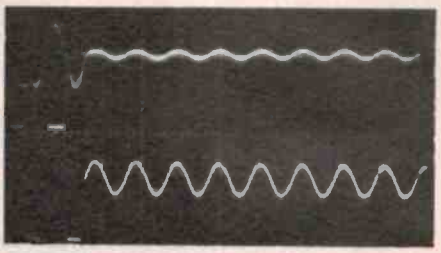
The TVA-1 amplifier, because of its size, weight and thermal dissipation should ideally be placed in a ventilated cupboard, on a shelf and most certainly in a position where the continual 150 W power dissipation would not be a problem, and used with a separate preamplifier (preferably a unit made by Michaelson & Austin) located near the record player, tape recorder or cassette deck.

The amplifier is about as attractive as a valve amplifier can be, with the chrome-plated chassis covered by a plastic escutcheon on the front lower edge, two coaxial sockets for input leads and four universal terminals for the speaker lead connections. The top cover, to protect the valves and transformers, is black perforated steel. The top of the chassis has all the valves mounted in a central group with two massive output matching transformers at one end and a slightly smaller but still large mains power transformer and electrolytic capacitors at the other.

The power output valves are KT88s, which were, in their day (circa 1959) amongst the most modern valves available in Europe. Valve technology has not, however, advanced significantly since that time.



Lux transient intermodulation test



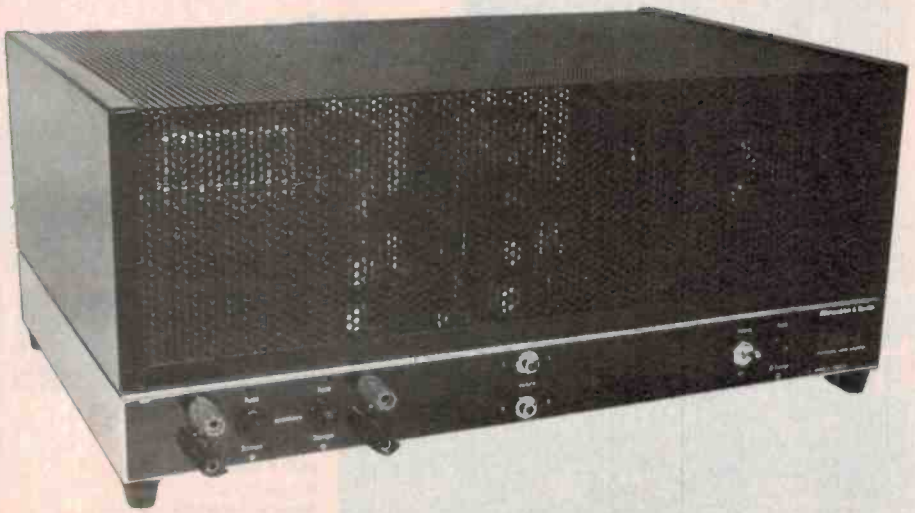
Transient overload recovery test

It was with trepidation that we started our evaluation and to some extent our feeling was justified. We initially blew fuses because of the amplifier's dislike of having inputs and outputs simultaneously earthed, but once we realised what was happening this was no longer a problem.

Our initial tests showed that the frequency response of the amplifier was exemplary – being 2.5 Hz to 52 kHz +0 -3 dB. The total harmonic distortion was reasonably low being typically -58 dB (ref. 1W into 8 ohms) and typically -47 dB (at 1 kHz for 70 W into 8 ohms).

Noise and hum levels were -61 dB unweighted and -76dB (A) weighted (ref. 1 watt). Maximum power output at the clipping point was 100 W into 8 ohms with a dynamic headroom of 1.5 dB.

Crosstalk between channels was also exemplary being -60 dB (ref. 1 W at 1 kHz) and -53 dB (ref. 1 W at 10 kHz).



Transient intermodulation distortion performance, whilst better than that of any other valve amplifier we have seen, still fell short of the best transistorised amplifiers currently on the market. Our objective laboratory investigations proved conclusively that all the manufacturer's stated performance figures were achieved.

We set up the amplifier with our monitor speakers and with a series of demonstration tapes from the International Electro-technical Commission. The subjective performance was gratifying with no distortion products detected in our testing. The amplifier provided a neutral characteristic to all the recorded programme material. We tried to detect the difference between this amplifier and our normal monitoring amplifiers but were unable to hear any signs of colouration on programme content.

Summary

The primary claim made for class AB_1 amplifiers, be they valve or transistor, relates to the lower third order harmonic distortion components. These components are readily detectable in either the steady-state or transient distortion mode. The third order distortion characteristics of this amplifier are so low as to be inconsequential. It is this factor, together with the low levels of second order distortion, which make this amplifier much superior to the 'run of the mill' transistor amplifiers so common today.

The TVA-1 meets all the manufacturer's claims. What more can one say?

THE TVA-1 THERMIONIC VALVE AMPLIFIER

Dimensions: 460 mm x 300 mm x 100 mm
Weight: 32 kg Price unavailable at press time
Manufactured by Michaelson and Austin of London, UK. Review sample from Audio 2000, P.O. Box 107, Brookvale 2100.

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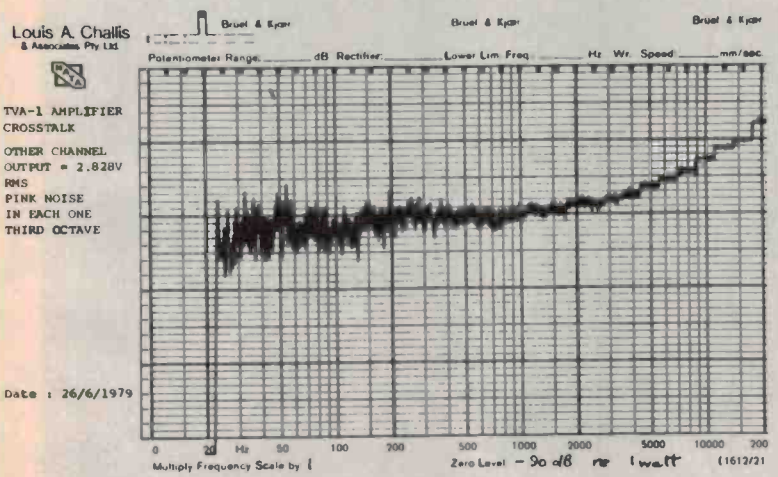
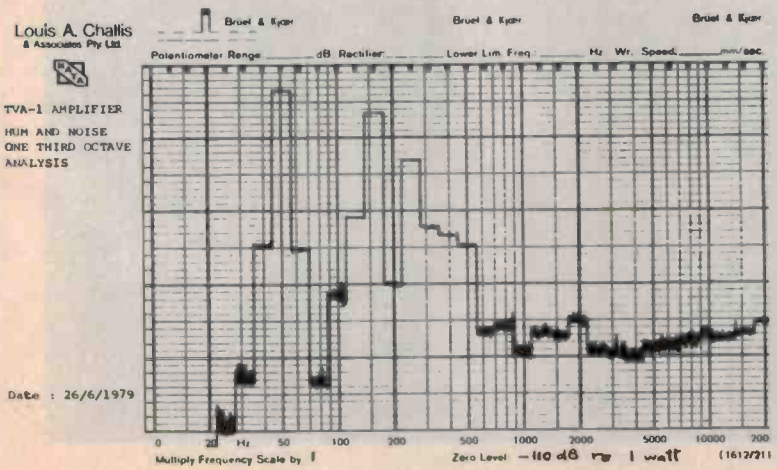
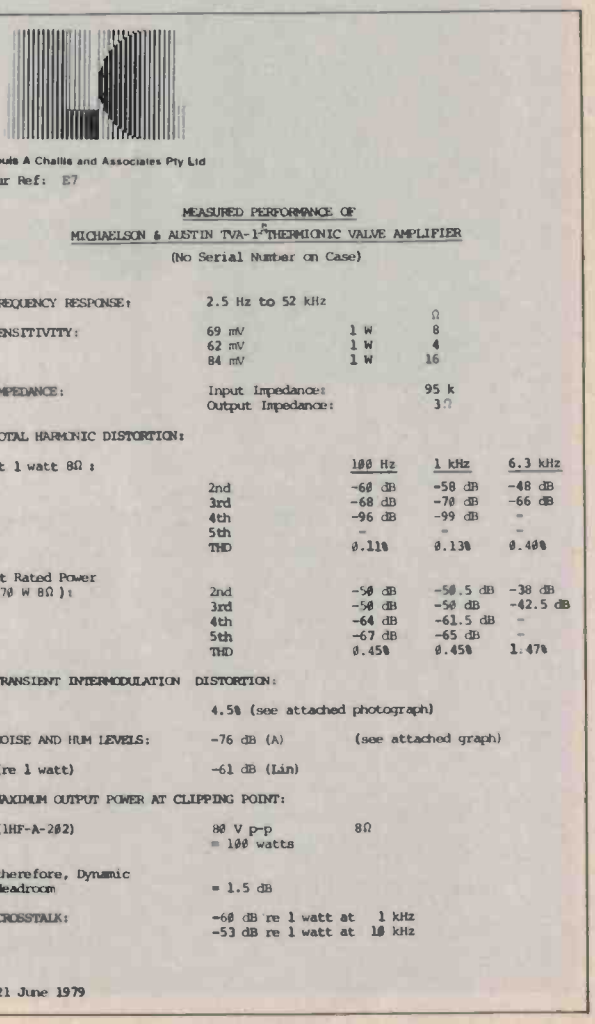


It was not worth reproducing a frequency response chart that simply showed a straight line!





Louis A Challis and Associates Pty Ltd
Our Ref: E7

MEASURED PERFORMANCE OF
MICHAELSON & AUSTIN TVA-1 THERMIONIC VALVE AMPLIFIER
(No Serial Number on Case)

			Ω
FREQUENCY RESPONSE:	2.5 Hz to 52 kHz		
SENSITIVITY:	69 mV	1 W	8
	62 mV	1 W	4
	84 mV	1 W	16
IMPEDANCE:	Input Impedance:		95 k
	Output Impedance:		3Ω

TOTAL HARMONIC DISTORTION:

At 1 watt 8Ω :		100 Hz	1 kHz	6.3 kHz
	2nd	-60 dB	-58 dB	-48 dB
	3rd	-68 dB	-70 dB	-66 dB
	4th	-96 dB	-99 dB	-
	5th	-	-	-
	THD	0.11%	0.13%	0.40%
At Rated Power (70 W 8Ω):	2nd	-50 dB	-50.5 dB	-38 dB
	3rd	-50 dB	-50 dB	-42.5 dB
	4th	-64 dB	-61.5 dB	-
	5th	-67 dB	-65 dB	-
	THD	0.45%	0.45%	1.47%

TRANSIENT INTERMODULATION DISTORTION:
4.5% (see attached photograph)

NOISE AND HUM LEVELS: -76 dB (A) (see attached graph)
(re 1 watt) -61 dB (Lin)

MAXIMUM OUTPUT POWER AT CLIPPING POINT:

(1HF-A-202) 80 V p-p 8Ω
= 100 watts

therefore, Dynamic Headroom = 1.5 dB

CROSSTALK: -60 dB re 1 watt at 1 kHz
-53 dB re 1 watt at 10 kHz

21 June 1979

'D' series high efficiency speaker systems

The LD D Series enclosures are an excitingly new concept in loudspeaker design — the component parts and range have evolved from the highly successful LD A Series — the first enclosures produced by LD some five years ago. This range of enclosures reflects the latest trend in speaker design plus a most pleasing departure from the conventional.

Model LD-D-12522H

System Type	12" 4 way 5 Speaker
Speaker Component:	
Bass Driver	12" Roll Surround High Compliance Bass Drive Unit
Mid Range	5" Curvilinear Cone Type
Tweeters	Two x 2" Cone Type and one x 3" Super Horn
Power Capacity	50 watts RMS Integrated Programme
Frequency Response	25 Hz to 20,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000-10,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	685mm H x 470mm W x 340mm D
Colour	Australian Walnut

Model LD-D-104H

System Type	10" 3 way 3 Speaker
Speaker Component:	
Bass Driver	10" Roll Surround Bass Drive Unit
Mid Range	4" Curvilinear cone type
Tweeter	3" Horn
Power Capacity	30 watts RMS Integrated Programme
Frequency Response	35 Hz to 18,000 ± 3 dB
Crossover Frequency	1,000-5,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	610mm H x 360mm W x 270mm D
Colour	Australian Walnut

Model LD-D-1555H

System type	15" 3 way 4 Speaker
Speaker Component:	
Bass Driver	15" Cast Chassis — Edge Treated High Compliance Bass Drive Unit
Mid Range	Two x 5" Curvilinear Cone Type
Tweeter	High Efficiency 3.5" Metal Horn Super Tweeter
Power Capacity	65 watts RMS Integrated Programme
Frequency Response	20 Hz to 20,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000-10,000 Hz at 12 dB/octave
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	795mm H x 510mm W x 360mm D
Colour	Australian Walnut

Model LD-D-125H

System Type	12" 3 way 3 Speaker
Speaker Component:	
Bass Driver	12" Roll Surround Bass Drive Unit
Mid Range	5" Curvilinear Cone Type
Tweeter	3" Horn
Power Capacity	40 watts RMS Integrated Programme
Frequency Response	30-18,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	685mm H x 390mm W x 340mm D
Colour	Australian Walnut

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Anyone else would be Proud to win One Grand Prix Award. Accuphase have just Won their 9th

The new Series II C-200 Pre-Amplifier and P-300 Power Amplifier are exceptional even by Accuphase standards

The technology embodied in this new combination is so advanced that it is no surprise that it was the outright winner against all comers.

Its design specification is 300 watts RMS power output frequency response of 1-250,000 Hz (+ - 3dB) direct current power amplifier; fully Class A pre-amplifier with ultra low transient intermodulation distortion and minimal negative feedback.

Tests using Arena's sound technology 1710B analyser have proven these specifications to be very conservative, with actual output tested to 380 watts RMS with .01% distortion at full power.

Accuphase's research, technology and engineering have been blended to create a musical performance that must be heard to be appreciated.

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New power devices offer improved performance in hi-fi amplifiers

Power MOSFET devices are rapidly finding application in new audio equipment. They offer a number of advantages over conventional transistors, rivalling VFETs. Here's a short look at what they are and what they're capable of.

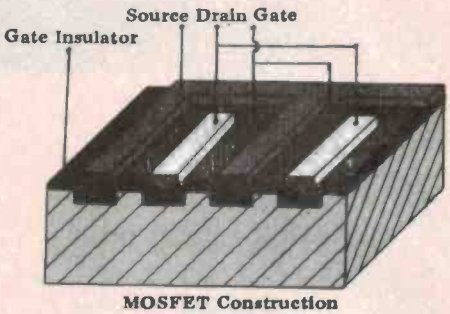


Figure 1. Internal structure of a power MOSFET device.

THE FIRST company off the mark with power MOSFET devices for general distribution seems to have been the Japanese-based Hitachi company – they were certainly first to offer hi-fi equipment incorporating these devices.

MOSFET power devices are excellent not only for use in the conventional type of linear power amplifier, but also in Class D switching amplifiers which employ pulse width modulation to provide a very high power efficiency. Unlike bipolar devices, power MOSFETs do not suffer from secondary breakdown and offer much greater thermal stability.

The term MOSFET stands for 'metal oxide silicon field effect transistor'. Small-signal (low power) types have been around for more than a decade, but recent research has produced power types that provide a number of significant advantages over conventional bipolar transistors in audio power output stages, including much better frequency response and a very fast switching ability.

The MOSFETs

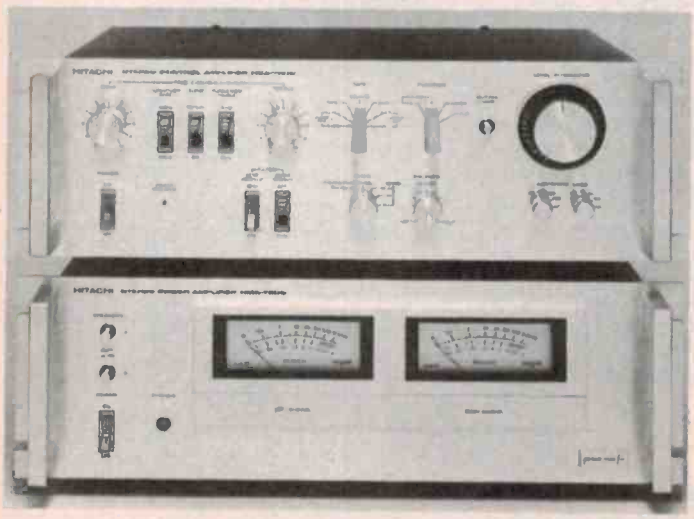
Currently available n-channel and p-channel MOSFET devices in the Hitachi range have channel current ratings (I_{DS}) of 7 A and operating voltage (V_{DSX}) capabilities of 120 V to 160 V.

Another p-channel Hitachi MOSFET power device has been described which can handle 20 A with an 85 V breakdown voltage; it has a 5 mm x 5 mm chip size and a vertical drain electrode to raise the maximum permissible drain current.

The internal construction of a Hitachi MOSFET silicon power device is shown in Figure 1. The gate is formed in a meshed pattern, whilst the source and drain regions are arranged in a checkerboard fashion. The channel current is not concentrated in such a small surface volume as in the case of more conventional devices so the MOSFET power devices tend to be considerably more reliable and less easily destroyed.

The frequency response of the devices is about ten times better than that of typical bipolar transistors. Figure 2 shows how the current gain of a fairly typical high power bipolar device falls off with increasing frequency.

The power MOSFET is a very high input impedance device and it is most convenient to consider it as being driven by a gate voltage rather than a current



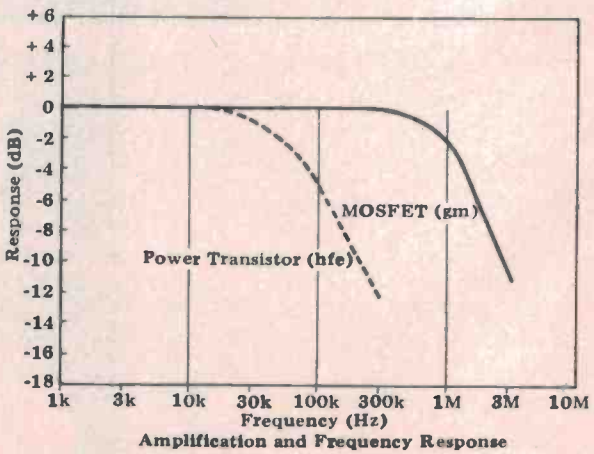


Figure 2. Variation of bipolar and MOSFET device gain versus frequency. This graph compares audio power types.

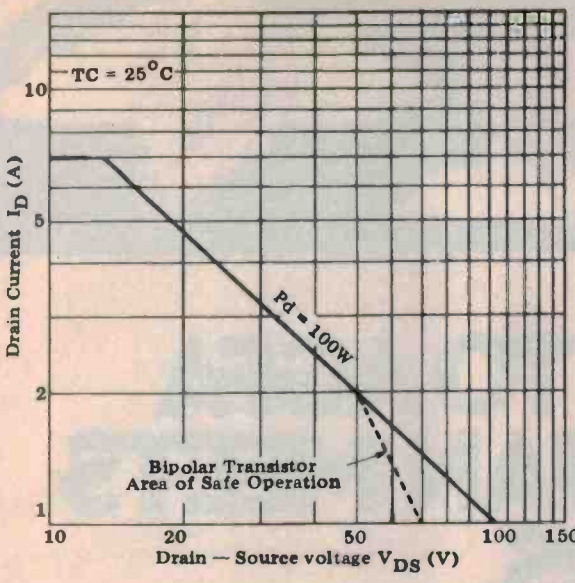


Figure 3. A MOSFET device has a larger safe operating area than a similar bipolar transistor.

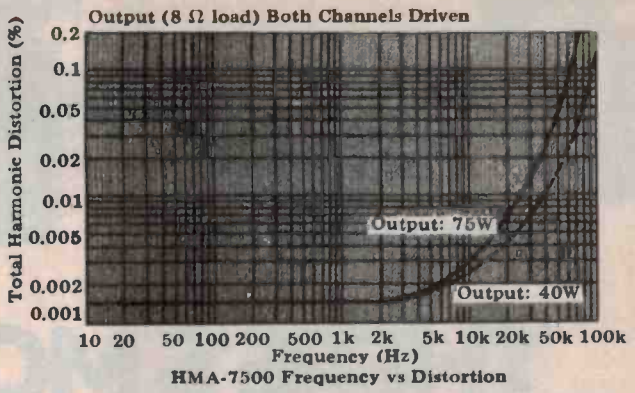


Figure 4. Distortion versus frequency at two power levels for Hitachi's HMA-7500 amplifier which used power MOSFETs.

(such as the base current of a bipolar transistor). Thus, the bipolar transistor current gain of Figure 2 is conveniently compared with the variation of mutual conductance, g_m, of the MOSFET device with increasing frequency.

The MOSFET mutual conductance is very flat up to some hundreds of kilohertz, whereas charge storage in the base region limits the response of bipolar power transistors at much lower frequencies.

At high current levels the drain current of a power MOSFET device has a negative temperature coefficient. Thus, these devices do not suffer from the thermal runaway effect one meets in a conventional power transistor in which an increase in current causes an increase in temperature which results in a still greater current and temperature with eventual breakdown of the device.

In addition, secondary breakdown is eliminated since any tendency of the current to concentrate in one region of the channel will be opposed by the rise of temperature in that region. The MOSFET channel regions may operate at temperatures as great as 180°C with complete stability.

As indicated in Figure 3, the safe operating area of a MOSFET power device is appreciably greater in the high voltage region than that of conventional power transistors of about the same ratings. Power MOSFET devices are thus quite resistant to electrical destruction and this enables them to be used in relatively simple circuits in which a minimum of overload protection is used. An example of equipment using these new devices is Hitachi's stereo power amplifier, the HMA-7500. (See also our review of the Accuphase E303 in this issue).

The HMA-7500

The new HMA-7500 Hitachi stereo power amplifier has a claimed rating of 75 W mean power into an 8 ohm load; this power can be supplied over the frequency range 20 Hz to 20 kHz with a maximum of 0.01% total harmonic distortion. At a level of 40 W mean, the total harmonic distortion is only 0.005%.

As in all amplifiers, there is some increase in the distortion level with increasing frequency. In the HMA-7500 amplifier a maximum distortion of 0.05% is claimed at a mean power output level of 40 W per channel (8 ohm load) between 5 Hz and 80 kHz.

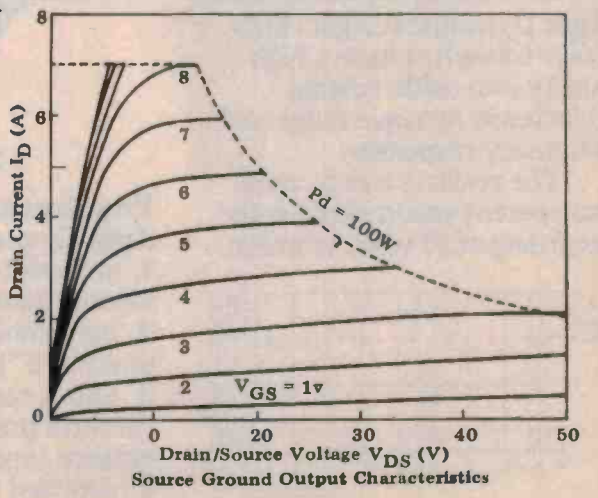
The relationship between frequency and total harmonic distortion at the 40 W and 75 W mean output levels is shown in Figure 4. These very low distortion levels are made possible by the inherent linearity of the power MOSFET devices employed in the output stages. The signal-to-noise ratio is about 120 dB, Hitachi claim.

All stages in the HMA-7500 power amplifier (including those in the negative feedback loop) are directly coupled. The absence of coupling capacitors avoids signal degradation at extremely low frequencies so that a response from zero frequency (that is, dc) to 200 kHz is obtainable with a maximum gain variation of 1 dB.

A sub-sonic filter can be switched into the circuit, the response is flat from about 6 Hz to 200 kHz to within 1 dB according to the manufacturers.

An interesting feature of the HMA-7500 power amplifier is the use of separate power supplies for each of the stereo channels. If one channel is handling a particularly intense transient signal, the other channel can continue to reproduce a steady signal without any mutual interference between the two channels.

Figure 5. Typical power MOSFET characteristics.



THERE'S MORE TO AGFA FERRO COLOR THAN MEETS THE EARS.

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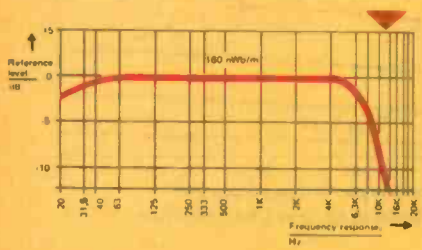
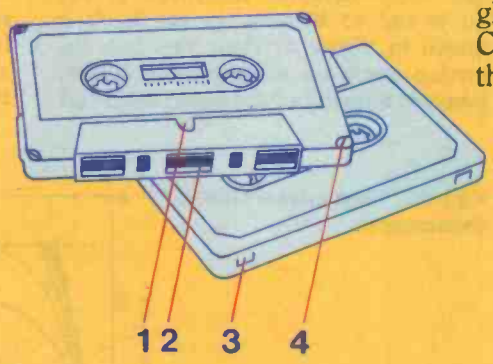


A Better Designed Case: Cases are of smooth lines, with rounded edges and corners to improve handling and efficiency.

A Better Designed Cassette: The Cassettes are of the screwed type and side one can be easily identified.

Inside the cassette is a special noise shield to avoid unwanted 'hum'.

To prevent unintentional erasure, knock-out tabs are located in the rear. These are optional either side.



Practical aids in Agfa-Gevaert cassettes:

1. immediate positive identification of side one.
2. metal noise-shield avoids unwanted "hum".
3. knock-out tabs at rear of cassette prevent unintentional erasure (optionally either side).
4. screwed cassettes.

For the convenience of colour-coding and for superb sound reproduction you'll be glad you chose Agfa Ferro Color Cassettes – there's more to them than meets the ears!

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K381

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All Sony decks are designed with what we call Human Engineering.

It means that our controls are comfortable and convenient. Whether it's a sophisticated LCD display or an air-cushioned eject system.

Whether it's an advanced auto-reverse function, or a remote control capability. Or even a considerate automatic shut-off that disengages all mechanisms.

As you would expect, there's more, for Human Engineering is the way we operate.

So if this is your year to buy a deck you can either do a lot of tiresome shopping.

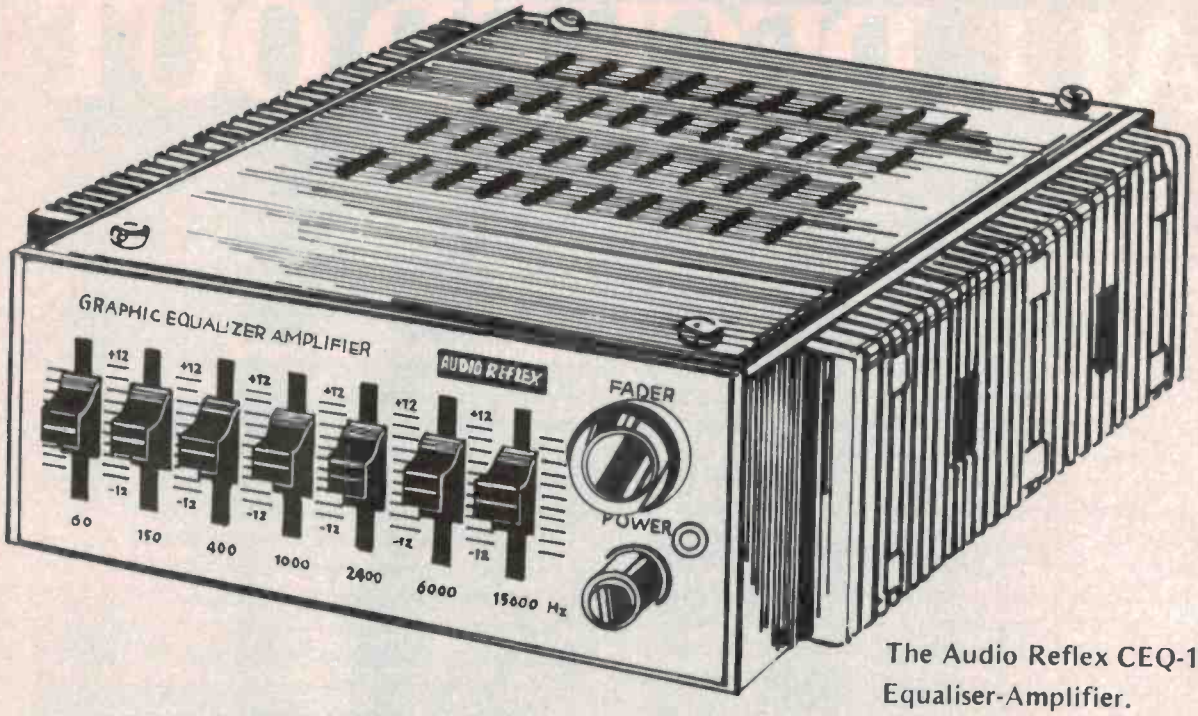
Or you can buy a Sony.

Which is the best place to start anyway.

SONY AUDIO

AP3254

Audio Reflex's remarkable CEQ-101, transforms your car into a capsule of beautifully encompassing sound.



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The CEQ-101 can "lift" music level to a thrilling degree of actual "performance presence".

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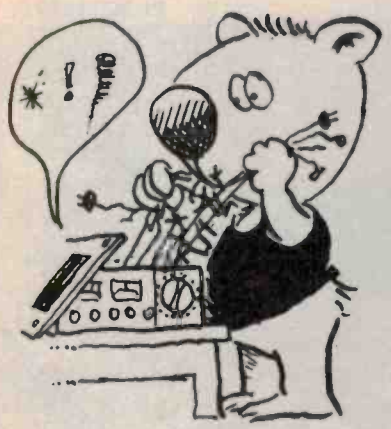
RF breakthrough — causes and cures

The evanescent nature of most forms of RF interference to hi-fi equipment is often sufficient to cause an otherwise methodical, logical-acting and patient person to erupt into behaviour characteristic of a clockwork orange. "It's those furshlugginer CBers again! . . . !!!!!!!" is not an uncommon cry. To suggest that the fault lies within the equipment is regarded as a treasonous canard! Here's how to delete those expletives.

IF YOU HAVE EVER been aggravated by the sound of the local taxi service's radio in the middle of your favourite record, or if the nearest TV transmitter imprints its sound track on tape every time you make a recording, you have been struck by that infuriating phenomenon known as RF breakthrough.

With the huge number of broadcasting stations, taxi radios and CB freaks — among many others — now operating, the problem of radio frequency interference is a major headache. And the problem is not restricted to those with hi-fi equipment; public address systems, hearing aids and even electronic musical instruments all suffer. (We won't delve into the case of the man who claimed to pick up transmissions through a filling in his tooth!)

The cause of radio breakthrough into audio equipment is almost invariably within the suffering audio equipment. It's rarely caused by a fault within the transmitter, or even by faulty operational procedures.



The phenomenon is generally known as 'audio rectification' because of the way the interference is picked up. In essence, the unwanted RF energy is picked up by some part of an audio system which acts as an antenna — speaker and interconnecting leads, or even an incorrectly earthed equipment casing.

The energy is passed on through the audio system until it strikes a component or suitable element which is operating non-linearly, which acts as a rectifier. This could be a valve, a transistor, an integrated circuit, or even a poorly soldered joint!

The rectified signal is then amplified by the remainder of the audio system. (In some cases the speaker leads may act as the antenna and a faulty connection on one of the speakers as the rectifier — as has happened with large and powerful PA systems.)

Of course there are other causes than transmissions by radio stations, television channels or CBers. Electrical machines and appliances often behave as transmitters of spurious radio frequencies, sending noise instead of the more coherent transmissions from radio stations.

Regardless of what form the breakthrough takes — noise or regular broadcasts — radio frequencies may be carried to the audio equipment along two paths, through the air, or through the mains power supply. The main methods of controlling these two forms are: shielding for airborne radio frequencies and filtering for line-carried interference.

The cure for one will have no effect on the other.

In most cases the causes of this type of interference are introduced into the early stages of a preamp, or are picked up and introduced by the power supply leads. To check that this is in fact so, just turn down the volume control when you notice the interference. If this does reduce the interference, it is being introduced before the volume controls, which are normally in the output stage of the preamp, or its equivalent in an integrated unit. ▶

Take the Pioneer to pieces to find what makes it unique.

On the surface, most turntables appear to be very much the same.

That's why we suggest you should look at the PL-560 in more depth.

First, take our arm.

Our tone arm moves smoothly and silently. Where other makes rely on as few as 3 ball bearings, Pioneer uses 40.

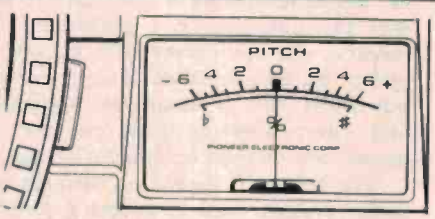
Some turntables mount their arms on cheap plastic and piano wire that vibrates. Ours floats on pivot bearings. This explains why we sound better.

Accuracy at every turn.

By using our own Quartz locked DC Hall motor just to power the platter, Pioneer give you accuracy and reliability for the life of the turntable.

The Hall motor assures the PL-560 turns silently. Any vibration or radiation is also eliminated.

Moreover, if you keep delving, every piece of Pioneer engineering you reveal will be backed by precision componentry.



A feature that's obvious.

While you're finding out how the PL-560 compares on the inside, look up for a minute. Note the Analogue Pitch display meter next to our strobe.

Use it expressly for tuning your music by 6% up or down.

A second motor. Just for moving our arm.

Many automatic turntables don't hesitate to put strain on one motor by asking it to perform extra functions.

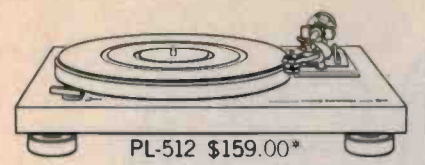
However, Pioneer prefer to use a Warren gear motor to move their tone arm, which in turn takes the load off the primary drive.

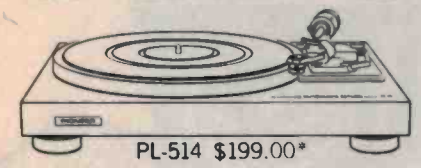
The extra power gained makes "Arm drag" on the PL-560 non-existent.

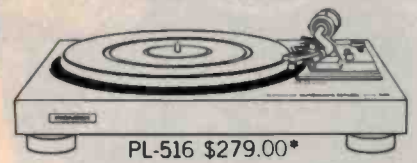
At this point, please continue the examination at your own speed. You'll find we're much more turntable than we appear to be.

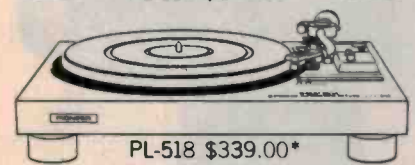
All the turntables illustrated offer the excellence synonymous with Pioneer.

PL-560 $559.00*

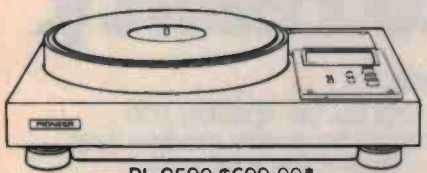

PL-512 $159.00*


PL-514 $199.00*


PL-516 $279.00*


PL-518 $339.00*


PL-520 $399.00*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If the level of the interference remains constant when the volume control is turned down, the interference is probably being picked up in some stage after the volume control.

Control-affected interference

If the volume control does affect the level of the interference, it is most likely that the signals are introduced in one of three places – via the mains cable, via the interconnecting leads between the main amp and the auxiliary equipment, or via the speaker leads themselves.

It may also be caused by a poor, or nonexistent earth connection – this should be checked thoroughly before looking further. To check this aspect, examine the continuuity of wiring at the input and output sockets on the equipment, and also check the earthing facilities in the interconnecting cables themselves.

Having checked out all the earth connections, it is advisable next to check the speaker leads. Although it is hard to see how a signal picked up here would be of sufficient level to produce an audible output, or even be affected by the volume control, signals picked up by the speaker cables may be routed in such a way as to show these symptoms. If the RF signal is picked up in the speaker leads, it is fed back into the amplifier's circuitry through the negative feedback loop. And while feedback is applied after the volume control, some of the radio frequencies may be conducted back into the earlier stages of the preamp.

Sometimes the speaker leads can be of such a length that they actually resonate at the interfering frequency, in which case an instant cure may be obtained by shortening or lengthening the cables. Unfortunately, this may merely substitute one cause of interference for another, and the taxi company may simply be replaced by a local TV channel. Twisting the cables, or using shielded cable may also be effective here.

Another possible cure is to connect a capacitor across the amplifier's output terminals, or from each terminal to earth. The high audio frequencies will not be degraded if a capacitance of about 100nF (0.1uF) is used as the impedance is very low at this point in the circuit.

A capacitance of about 10nF is generally sufficient to remove radio frequencies, although it is best to use the smallest value that gives relief from the problems (provided sufficient capacitors are on hand to allow a few experiments). *Always* use ceramic capacitors for this purpose.

Signal leads

If the checks already covered don't cure the problem, the next trouble spot to check is the signal leads. The quickest and easiest way to do this is to check all externally connected components, such as the turntable, tape deck or tuner. If the interference is eliminated when one of these leads is disconnected, then the cable connecting the component to the amplifier is not properly screened. The metallic shield or braid on the cable should be checked to see that it is complete, and that it makes a good earth contact at the component, and at the amp.

If none of these remedies has any result, check for line-carried interference by connecting a line filter in series with the incoming mains power line. These filters are available from some electronics suppliers, or a unit may be made as shown in Figure 1.

If you make this filter yourself, do not under any circumstances increase the values of the capacitors shown, and make absolutely certain that the capacitors are rated for at least 400 volts AC operation (preferably more for safety).

When the signal strength of the unwanted signal is very high, as it may be in areas close to transmitting antennas, the signal may find its way into the circuitry despite these precautions. This is most likely when the amplifier or the ancillary components do not have a metallic case, or when the metal cabinets are not correctly earthed. If a non-metallic case is thought to be the problem, the cure is an earthed shield – aluminium foil is suitable when securely earthed.

If the signal still finds its way into the system more drastic measures will be required. Firstly, check that there are no *dry joints* – joints where the solder has been incorrectly applied and has set ▶

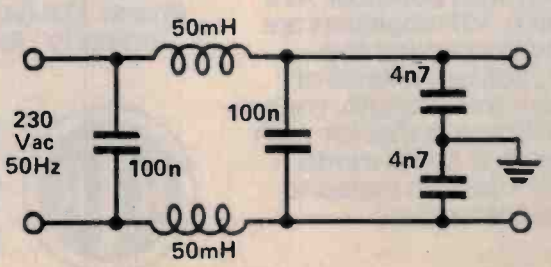
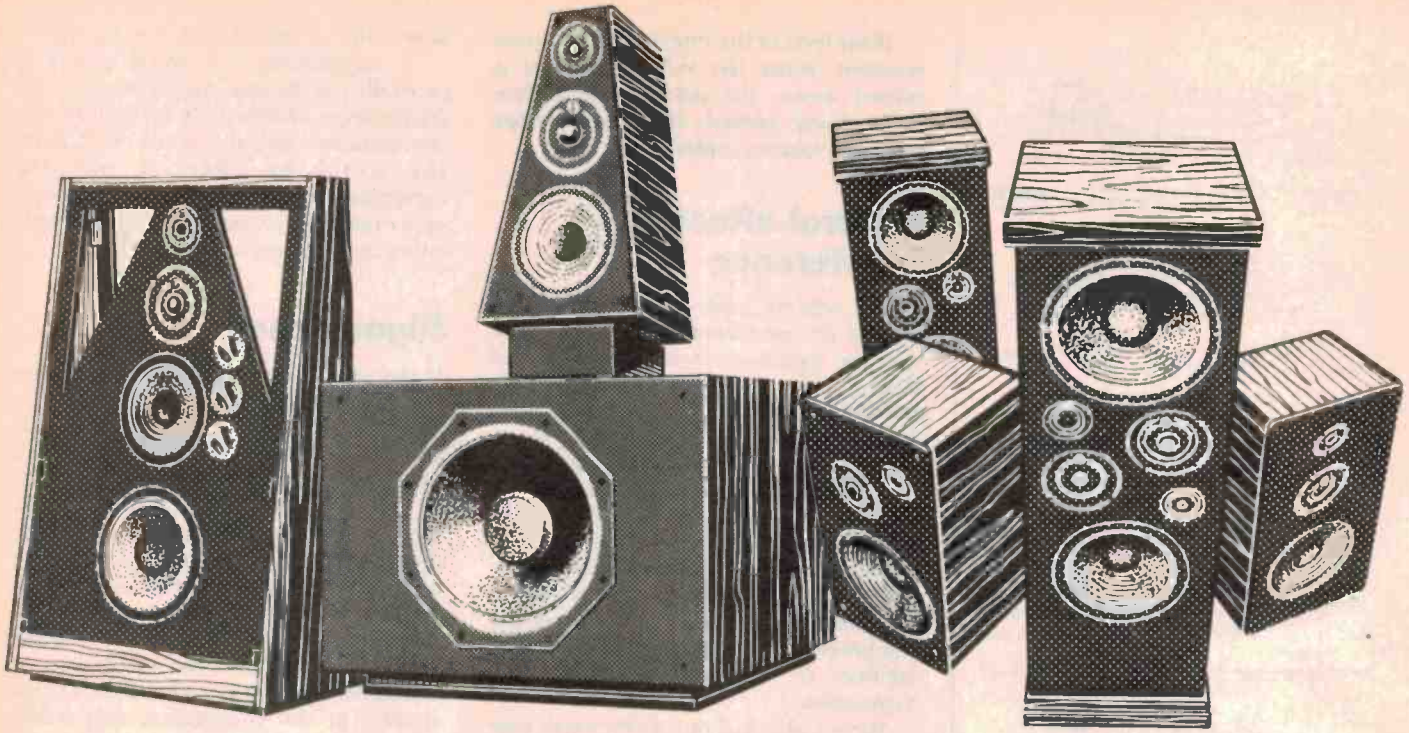


Figure 1. Circuit of a mains input filter which may be home made. If you do make it yourself it is essential to use capacitors rated for mains operation. Ceramic types rated at 400 Vac or, better still, 630 Vac, are recommended.



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around a conductor without making good electrical contact – for a dry joint can act as an almost perfect rectifier. If a visual examination shows any doubtful joints – if they look crystalline or grey – resolder them by giving them a touch with a hot soldering iron.

Electrolytic capacitors may cause problems because they tend to have high inductive reactance at radio frequencies, which may prevent them passing the unwanted radio frequencies to ground. Suspicious capacitors may be checked by temporarily wiring a 10nF (0.01 μF) capacitor in parallel. Permanent wiring of the additional capacitor may follow if this is found to cure the breakthrough problem.

If the problem remains after all these checks, it may be necessary to modify the amplifier as outlined below – not a job for the inexperienced.

Unaffected by volume control

Sometimes the unwanted radio frequency breakthrough will be heard at a constant level, which is not affected by settings of the volume control. When this happens (or when all other attempted remedies have failed) it will be necessary to use some form of filtering at the input to the power amplifier. This is a job for those experienced in electronic matters as it involves knowledge of the input circuitry of the amp, and it should not be attempted by the hi-fi (or electronics) novice.

One way of providing this filtering, which has proved successful, is shown in the diagram. Unfortunately it is impossible to quote exact component values as these will be determined by the circuitry of the individual amplifier. However, it is important that the component values be chosen so that there is no audible change in the frequency response as a result of the modifications. Only in really severe cases which have withstood all possible solutions will it be necessary to trade off frequency response against interference removal. The capacitors used should be ceramics (not paper or polyester types) and inductor L1 may be a ferrite bead.

Breakthrough in FM tuners

Electricity, the very thing that makes radio transmissions possible, also interferes with those transmissions. Although FM broadcasting has considerably reduced the problems, it is not totally immune, and breakthrough still occurs. As with stray noise picked up within the other components of the audio system, FM interference is also either airborne or line-carried.

Sometimes the same cures as are used in the rest of the system will be sufficient to remove unwanted breakthrough, but it is also possible to remove the offending source in many cases, since a majority of the problems arise from household appliances.

Identifying the source may be the most baffling problem of all, as the cause may be as diverse as a car's ignition system, or a faulty fluorescent light fitting.

A car ignition system gives rise to a fast and steady popping type of interference. Most cars should be fitted with suitable suppressors, but older cars, or cars with faulty suppressors, may still cause serious problems for FM users near main roads.

A number of household appliances which are operated by electric switches cause irregular clicking – the switching of fridge thermostats is well known, and others like electric typewriters, adding machines or even relays in the lifts in high rise apartment buildings can contribute.

Whining, or a steady level of scratchy noise often arises from electric motors which produce sparks in operation, and from electric generators. And a simple faulty fluorescent light fitting can give rise to a buzzing hum.

Obviously with devices such as these, the easiest cure may be the source – if you can find it.

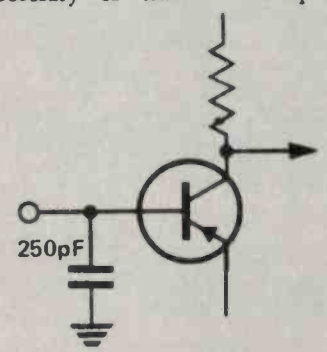


Figure 2. A simple filter which, connected at the preamp input, will prove effective in many cases.

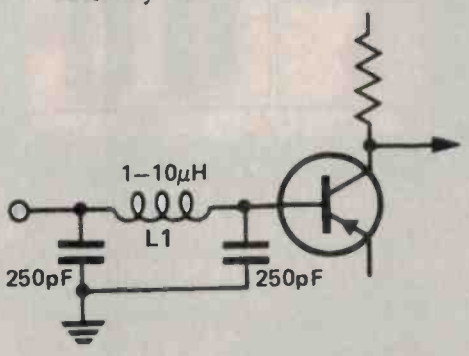
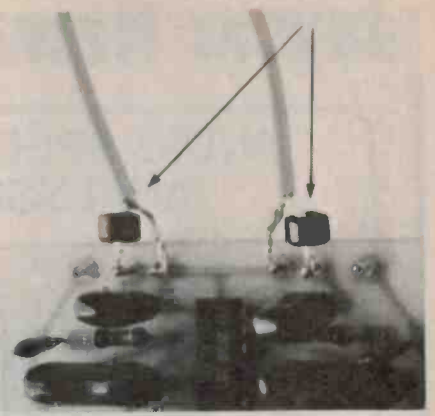


Figure 3. Another simple filter, similar to that shown in Figure 2, but generally more effective in stubborn cases.



Ferrite beads, slipped over the active input leads at the preamp, are often effective in blocking RF interference.

Where does noise come from?

It may seem strange that these useful and apparently harmless devices should cause problems by generating radio frequencies, but there are many ways in which they can develop such frequencies.

Any sharp pulse from switching, or somehow interrupting, an electric circuit contains some radio frequency energy. Thus switches, thermostats and some motors cause problems. And any machine which causes sparks in operation is a likely candidate. After all, the very first radio transmissions were made with the aid of a spark transmitter, in which capacitors were allowed to discharge across a spark gap. Spark transmitters produce so much radio frequency energy that they can affect very wide areas of the RF spectrum and cause widespread interference to most receiving devices. Some electric motors are not so very different, and almost every electric switch in an ac circuit produces sparks in operation. An arc lamp is virtually an enormous spark generator.

When trying to eliminate RF noise in the FM tuner, it is necessary to find where the noise is coming from – power lines or through the air. A simple means of doing this is to disconnect the antenna and link the tuner's terminals to ground. If the noise persists, it is carried through the power lines; if it has disappeared, it is airborne.

If the noise is found to be airborne, and you have a directional outdoor antenna with a run of 300 ohm balanced feeder, it is possible that the noise is being picked up in the feeder cable. In this case a shielded feeder is essential – in spite of its extra cost – and this may reduce or completely eliminate the problem. ▶

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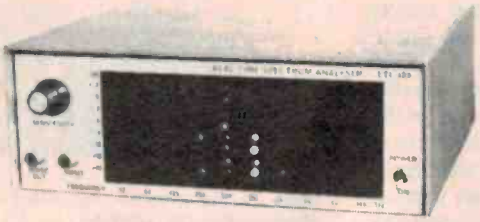

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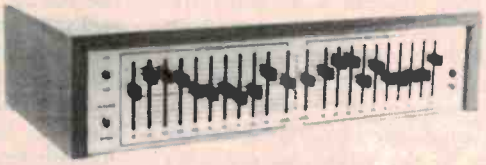

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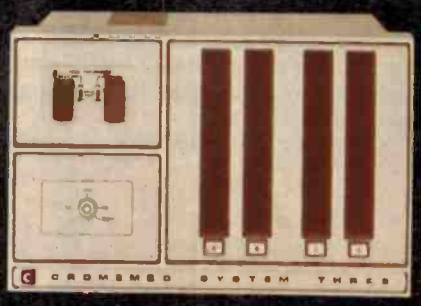

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— from page 129.

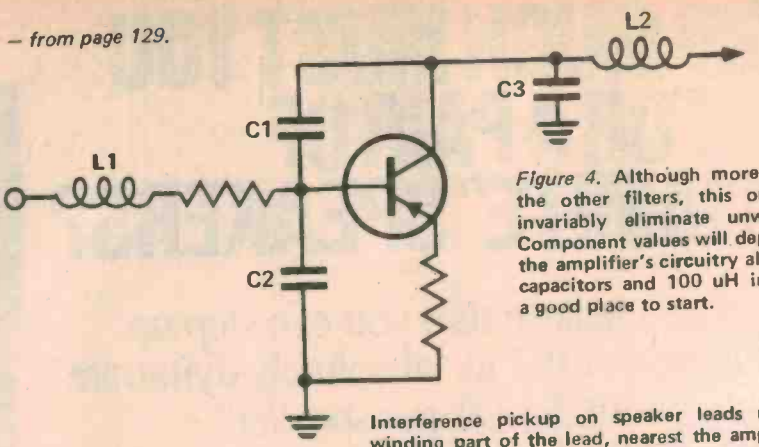
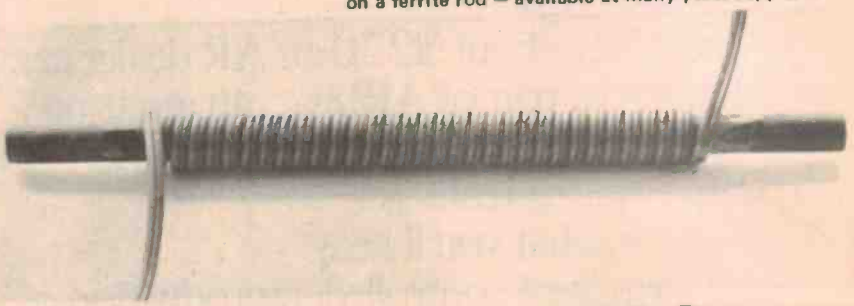


Figure 4. Although more complex than the other filters, this one will almost invariably eliminate unwanted signals. Component values will depend largely on the amplifier's circuitry although 100 pF capacitors and 100 uH inductors seems a good place to start.

Interference pickup on speaker leads may be cut by winding part of the lead, nearest the amplifier terminals, on a ferrite rod — available at many parts suppliers.



Line carried noise

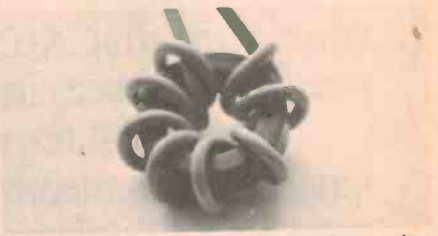
If the noise is carried through the power lines, it is worth looking for a generating source within the home. When a machine or appliance is suspected, it can be verified by having somebody turn the machine on and off while you listen to the noise on the audio system with the FM as source.

If you do manage to identify a source within your home, it is worth checking with the manufacturer of the appliance or machine to see whether radio frequency suppression is normally fitted, or is available. Unless the manufacturer has some simply-fitted device, it is best to consult an expert, as there are many different methods of applying the suppression.

Generally the method will depend on a bypass of the RF to ground via a capacitor. If you know the details of the machine's operation and have electronics experience, you may be able to decide where the capacitor should go and what value should be used. If you have any doubts at all, however, consult an expert.

Small permanently fixed devices which are giving rise to an airborne interference may sometimes be shielded by a metallic cover securely bonded to earth. To totally shield a device, it must be completely enclosed in a well earthed metal case, but this may not be necessary (or possible) in every case.

When constructing a shield, make certain that it is well bonded at all joints and that the earth connection is firm.



To prevent RF pickup in signal-carrying cables, wrap them around the core of a small ferrite toroid.

RF pickup on speaker leads may be stopped by wrapping them around a ferrite toroid of a convenient size.

If you cannot locate the noise source, it will be necessary to run through the same procedures as were used for eliminating breakthrough from the system as a whole.

If after taking every humanly possible measure you still suffer from radio frequency interference, you have only three options left: You can sell your equipment, you can sell your house, or you can bomb the offending source.

We cannot really recommend any of these. ●

(See 'Shoparound', page 63, for details on where to obtain beads and toroids)

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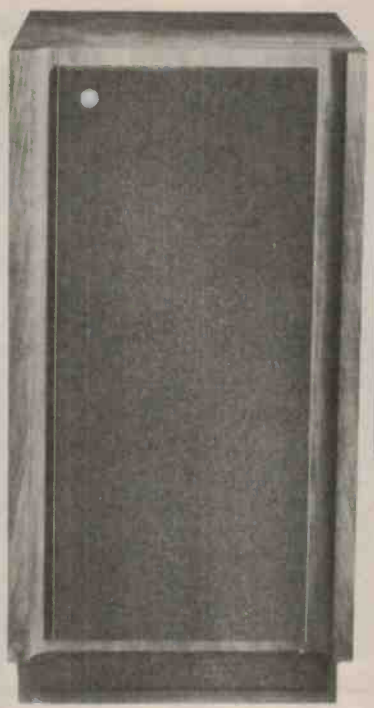

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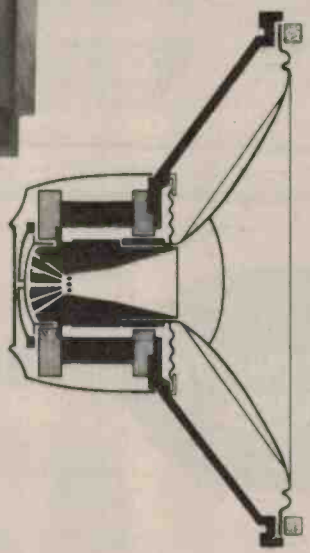
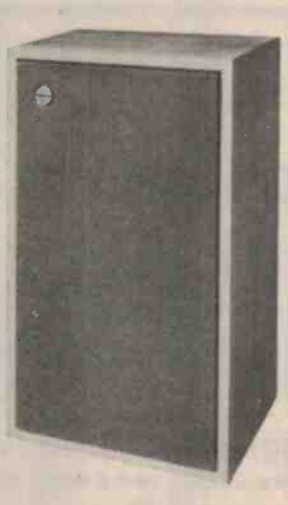
T225
DORSET



Profile of Tannoy's unique dual concentric loudspeaker.

TANNOY

T125
OXFORD



For over half a century, Tannoy has been engaged in the continuous research and production of high quality loudspeakers and components.

Tannoy's research led to the development of the unique dual concentric driver, which, from the outset, was adopted as a listening standard by broadcasting and recording companies all over the world. This system produced outstanding results when applied to hi-fi loudspeakers. However, modest facilities and painstaking standards of production permitted only limited distribution in Australia. Now ... new techniques and materials, as well as expanded facilities have made Tannoy systems available to many more listeners.

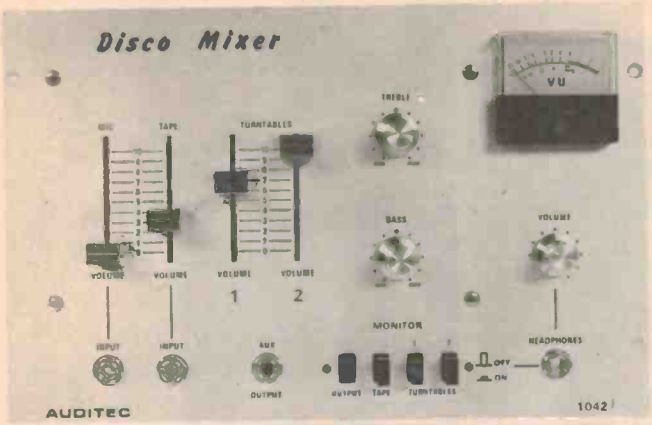
The Tannoy integrated speaker system is the crowning achievement of generations of acoustic consultants, researchers, designers and sound engineers, and is produced in the best traditions of British craftsmanship.

This truly magnificent new range of "T" series loudspeakers is now available through selected dealers. Contact your nearest specialist for a demonstration of the new generation of Tannoy loudspeakers.

Distributed by:—
HARMAN AUSTRALIA PTY. LTD., P.O. Box 6, BROOKVALE, N.S.W. 2100 Telephone: (02) 939 2922

HA135/78

THE AUDITEC DISCO MIXER



A MONO DISCO MIXER FEATURING:

- 4 input channels — tape, mic, t/table 1, t/table 2
- Inputs for magnetic cartridges
- 4-position push-button monitoring
- Pre-fade cueing
- 1 volt output to drive power amplifier
- Sockets for mic, tape, headphones and aux output on front panel
- AC or DC power supply

Major Stockists:
Melbourne, ZEPHYR PRODUCTS, (03) 568-2922; Brisbane, DELSOUND PTY. LTD, (07) 229-6155; Adelaide, NEIL MULLER P/L, (08) 272-8011; Perth, WILLIS TRADING CO. P/L, (092) 321-7609; Canberra, MUSIQUE BOTIQUE, (062) 81-5255; Darwin, DARWIN COMMUNICATIONS SYSTEMS, (089) 85-3184; Alice Springs, FARMER & DAVIES ELECTRONICS, 52-2967.

Other Agents:

NSW: Tamworth, HI-FI GALLERY, (067) 66-2525; Albury, RAY WALSH SOUND SYSTEMS, (060) 21-1502; Wentworthville, PRESIDENT SOUND, (02) 631-6689; Glenfield, WMR ELECTRONICS, (02) 605-1203; Blaxland, DAWES SOUND SYSTEMS, (047) 39-4421; Woollahra, JAI SOUND, (02) 389-8277; Dee Why, DR HI-FI & ELECTRONICS, (02) 982-7500; Orange, LANDERS MUSIC CENTRE, (063) 62-6515.

QLD: Bundaberg, BUNDABERG HI-FI, (071) 71-3176; Maryborough, KELLER ELECTRONICS, (071) 21-4559; Mermaid Beach, R.A.V.E., (075) 38-3331.

SA: Adelaide, PROTRONICS P/L, (08) 212-3111.

For descriptive leaflets, call, phone or write to:

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10 Waltara Ave, Waitara. NSW. 2077. Phone (02) 48-4116.
(Pacific Highway side opp. Waltara Station)

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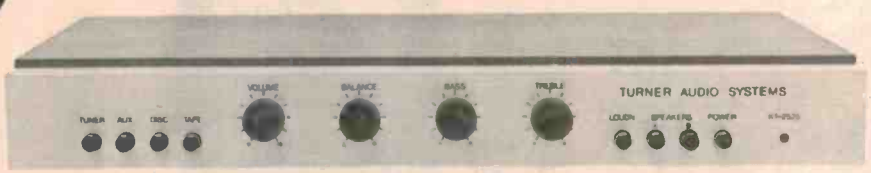


Integrated Stereo Amplifier Model KT-2525

(Read the review in "HI-FI & Music" March 1979)

Why an Australian Amplifier? Particularly when the competition is so keen. The simple answer is that the first priority of the Turner KT-2525 amplifier is engineering for quality sound reproduction. Arrange a demonstration today by calling **N.V. Dale Electronics** of 274 Victoria St, Brunswick, Victoria: **(03) 387-6170** who will advise you of your nearest Turner Audio Stockist.

n.v. dale electronics

274 Victoria Street, Brunswick, 3056. Ph. (03) 387-6170

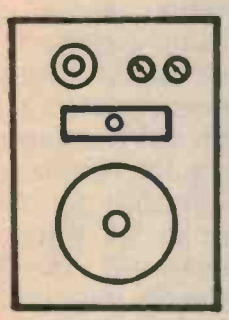
Fisonic Audio

121 BATH RD, KIRRAWEE,
NSW. 2232. Ph: (02) 521-1688

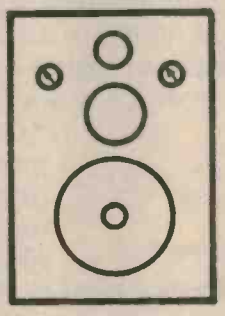
New Speaker Kits!

Kits Contain: All necessary screws, Screwdriver, Glue, Innerbond, Cloth baffle (with cloth already on), All necessary wire and crossovers, Push terminal plate, Full set of instructions, All speakers, Fully machined woodwork.

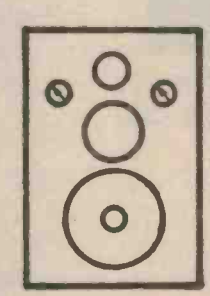
GENERAL INFORMATION:
1. The kits are designed to be assembled with no previous experience.
2. The kits come complete with all materials and tools required.
3. All kits are made from 3/4" timber (not 5/8" as most kits)
4. Prices are for pairs and includes sales tax, freight and insurance anywhere in Australia.
5. Kits are shipped within 48 hours of receipt or order.
6. Kits are fully operational 3 hours after assembly and require no polishing or finishing apart from wiping over with damp cloth.
7. Send cheque or money order only.



12HKF
Size 620 x 455 x 290
Max Input 70W RMS
20 HZ — 20 KHz
Infinite baffle design
12" Woofer
Midrange Exp. Horn.
4" Dome tweeter
Twin attenuators
Price: $320.00

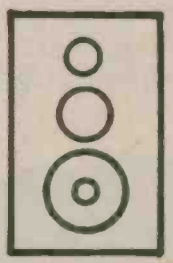


12KF
Size 620 x 455 x 290
Max Input 50W RMS
20 Hz — 20 KHz
Infinite baffle design
12" woofer
5" midrange
4" tweeter
Twin attenuators
Price: $220.00

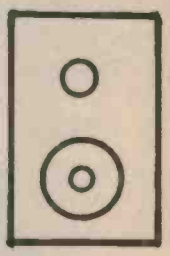


103HKF
Size 600 x 396 x 270
Max Input 50W RMS
20 Hz — 20 KHz
Reflex design
10" woofer
4" midrange
2" dome tweeter
Twin attenuators
Price: $200.00

103KF
Size 600 x 396 x 270
Max input 25W RMS
25 Hz — 18 KHz
Infinite baffle design
10" woofer
4" midrange
3" tweeter
Price: $175.00



83KF
Size 515 x 300 x 225
Max Input 25W RMS
28 Hz — 18 KHz
Infinite baffle design
8" woofer
4" midrange
3" tweeter
1 attenuator
Price: $130.00



82KF
Size 515 x 270 x 225
Max input 18W RMS
30 Hz — 15 KHz
Infinite baffle design
8" woofer
3" tweeter
Price: $105.00

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Realistic® STA-240. Unique features, high power and very clean sound make this receiver a *real* standout! There's a big 5-digit frequency readout for both FM and AM so you always know what station you're on, plus a conventional tuning dial, and the 5-level signal strength LED's can be seen from across the room. The sophisticated tuner's Auto-Magic system fine-tunes and locks in FM stations, automatically, for lowest total harmonic distortion. And there's automatic wideband /narrowband switching on AM for optimum reception from all stations, weak or strong. You also get two tape monitors for duplicating or recording on two decks at once, phase-locked loop multiplex for the best in FM stereo, genuine walnut veneer case, all this for just **$599.95**

Frequency Counter

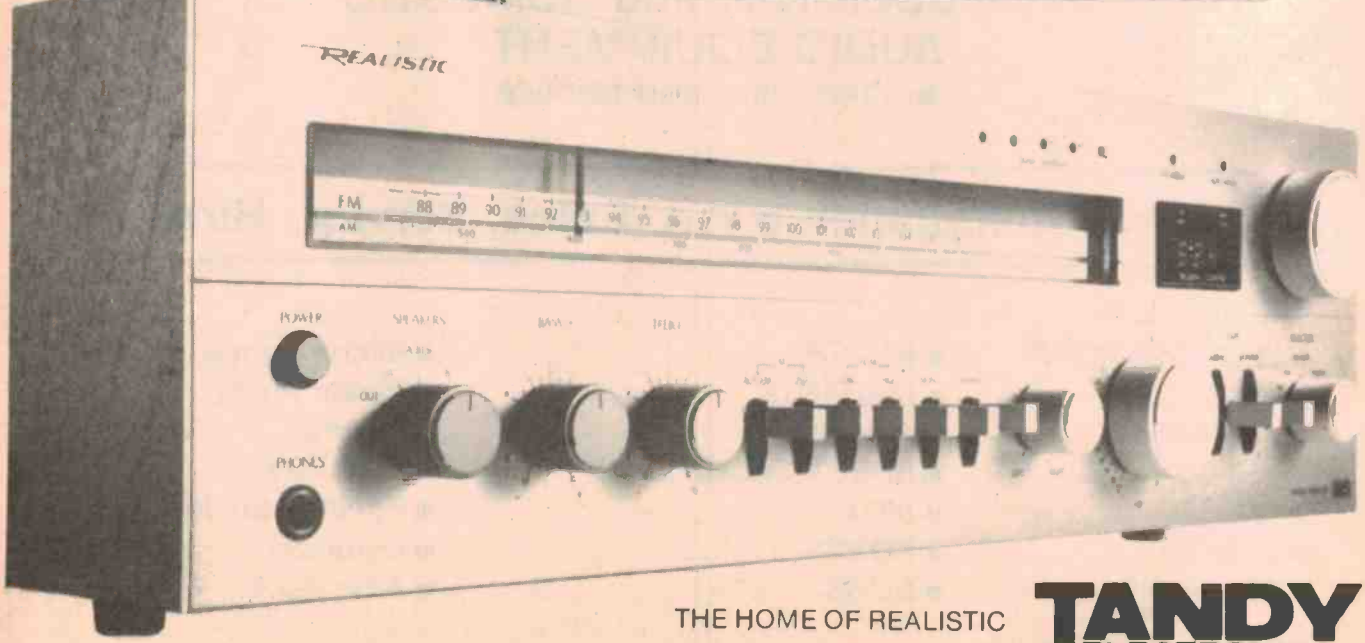

Auto-Magic


Signal Strength

31-2083

KING OF THE HI-FI JUNGLE

60 watts per channel minimum RMS at 8 ohms from 20-20,000 Hz, with no more than 0.05% total harmonic distortion



THE HOME OF REALISTIC **TANDY ELECTRONICS**

Independent Tandy Electronics Dealers may not be participating

sound business

with Richard Timmins

NOW DIGITAL techniques seem poised to take over the future of hi-fi., there's a trend towards reassessment of most aspects of quality sound reproduction. Before looking at this, in forthcoming issues, I should say some words about the digital revolution in the short term.

For a number of years, the BBC and some other broadcasting institutions have used high quality PCM (pulse code modulated) digital land line links for transmission of audio signals over long distances. Benefits to FM radio audiences have been considerable, with better dynamics thanks to improved signal-to-noise ratios, and lower levels of harmonic and intermodulation distortion. A number of manufacturers have developed digital tape recording systems – Denon was one of the first and using vast quantities of tape (!) together with very expensive and complex-engineered equipment, are producing recordings which, even in their analogue form for commercial release, display welcome reductions of noise and distortion.

There is no doubt that digital processing is the future way for hi-fi; one can envisage before too long a fully electronic system (including storage) in which the digital-to-analogue conversion will be right at the end of the chain at the amplifier/loudspeaker interface.

This is, perhaps, one of the two main factors delaying an immediate major swing to digital processing; it would seem pretty pointless to go to an interim system based, say, on various exisiting disc systems intended originally for the purpose of video reproduction. The other factor is simply the economics of the whole thing. For a result not necessarily any better (yet!) than can be obtained using conventional methods – and here I am referring to the results one may get at home – digital systems cost quite a lot more.

Even if the consumer were prepared to pay extra at this stage, the industry probably wouldn't; cost of overall re-equipment, establishment of suitable standards and specifications and a host of secondary factors would be colossal. Entirely new systems would in any event take some considerable time to introduce, so even though we might see a few commerical digital systems during the next few years, they will most likely go the same way as four-channel sound and fail to gain overall acceptance.

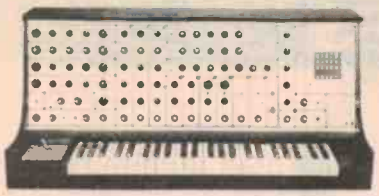
The obvious short-term trend will be development of self-contained analogue-to-digital-to-analogue components, such as Sony's audio-fied videotape recorder, and the class 'D' SWAMP and other types of digital amplifier – that is, if the RF interference problems raised by some of these components can be overcome at reasonable cost.

Reassessment of current analogue methods seems to be the particular province of British, European, American and local specialist equipment manufacturers, and the results being achieved are no doubt adding their own effect on the delay of the digital takeover.

The vast south-east Asian mass-production industry has responded very quickly to much of the 'new philosophy' especially in the area of amplifiers; surprisingly, what one might term as the 'semi-specialist' sector – predominantly traditional, once-specialist concerns now catering for a mid-level mass market, to which the status-symbol of a respected name is an important part of a sound system – seems content to lag behind offering at best well-made performance mediocrity. ●

The most sophisticated of the professional digital recording systems is this piece of equipment from 3M. Designed for studio use, it was developed jointly with the BBC and can record 32 tracks of 16-bit information on a 25 mm tape running at 1143 mm per second. Sampling of the input is at a rate of 50 kHz (i.e: 50 000 samples per second). Frequency response is within 0.3 dB between 30 Hz and 15 kHz, signal to noise ratio is claimed to be not less than 90 dB while distortion is said to be better than 0.03%.

Jaycar Keyboard Kits



INTERNATIONAL 4600 SYNTHESIZER

This superb studio quality synthesizer offers unlimited flexibility. It utilises a 484 point patchboard for rapid programming. Also features the 'Fairlight' digital keyboard.

COMPLETE KIT **$916.50** tax free

$1054 tax paid

Also available in sections.

For more information on the above kits please send two 20c stamps.

'Clef' String Ensemble

The new 'Clef' Ensemble offers features and performance normally only found on much more expensive units.

- Split keyboard facility.
- 4 voices on upper keyboard.
- 3 pre-sets on lower keyboard.
- Variable attack and delay.
- Foot controlled swell pedal.

COMPLETE KIT **$344** TAX FREE

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GRADO Laboratory Series Cartridges have earned an enviable reputation for their open, uncoloured music reproduction.

Reviewers and listeners alike have agreed that **GRADO** cartridges do sound cleaner and more realistic, offering full definition, tight bass and extended top end.

All **GRADO** cartridges feature the unique 'Flux Bridger' principle, which allows improved tracking through a lower tip mass — making **GRADO** cartridges suitable for the majority of current tone arms.

The full range of these highly acclaimed and very reasonably priced cartridges is now available from selected dealers from as low as $20.

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AMAZING MICROCOMPUTER TECHNOLOGY

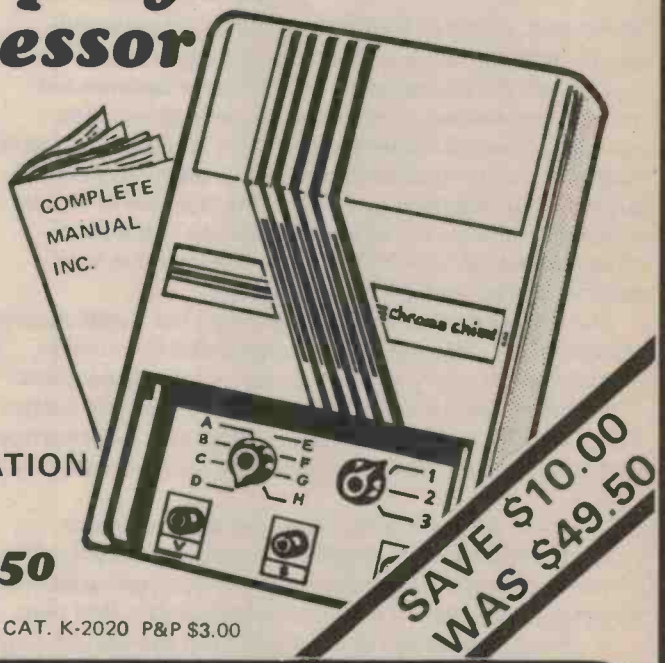
Dick Smith brings the electronics enthusiast of Australia the state-of-the-art in electronics. Yes! You can become a part of this electronic breakthrough. Products not dreamed possible just a few short years ago are yours to enjoy NOW - from Dick Smith Electronics.

24 different tunes played by this microprocessor door chime

- The world's first electronic door chime kit!
- Uses pre-programmed micro computer chip (containing thousands of transistors) to generate tunes.

Instead of boring old buzzes, dings or dongs, the Chroma-Chime will play one of its 24 well known tunes from its memory using its tiny 'brain' to do all of the music synthesizing!

As electronic enthusiasts you will appreciate the superb electronic technology of the Chroma-Chime. Be one step ahead in micro computer technology with a door chime that will amaze your friends and delight your visitors.



CHOOSE YOUR TUNE FOR THE DAY FROM THE 24 LISTED HERE:-

Westminster Chimes - Greensleeves - Maryland - Oranges and Lemons - Twinkle twinkle little star - Mendelssohn's Wedding March - Sailor's Hornpipe - Cookhouse Door - Colonel Bogie - Beethoven's 9th - William Tell Overture - Soldier's Chorus - Fate Knocking - Bach - Mozart - Lorelei - Great Gate of Kiev - Oh Come all ye faithful - God save the Queen - Rule Britannia - Land of Hope and Glory - Stars and Stripes - Marseillaise - Deutschland uber Alles.

7 DAY NO OBLIGATION OFFER

$39.50

CAT. K-2020 P&P $3.00

SAVE $10.00
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FANTASTIC DOOR GUARD ALARM

Incredible! 2730 different codes - and you can pre-program any one of them.

Modern computer electronics brings you home protection in a novel and ingenious package that not only protects you from intruders, it welcomes guests with a pleasant 'ding dong' chime.

Ready to attach to your door - all you need do is select your personal code, program the unit and it is ready to use.

Features: 5 second entry delay - enough time to feed in your 3-digit code.

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CAT. L-5100 P&P $3.00

- Activated by closing the door as you go out.
- Operates from a single 9v transistor battery.
- Your choice: as a shrieking intruder alarm or a pleasant visitors welcome. (Switch selectable on front panel).
- Size: 72(w) x 171(h) x 33(d)mm.

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DSE588

AMPEX 360 Professional Series Cassettes

Low noise/high output
Wide dynamic range
Ferrosheen ™ polished oxide surface
Superior quality shell and components

HERE IS A UNIQUE OPPORTUNITY to obtain world-famous AMPEX tape cassettes at truly bargain prices.

The AMPEX 360 series are standard tape cassettes but made to professional standards using professional grade materials. They are made specifically for applications in which consistent and reliable performance is as essential as top quality electromagnetic properties. The tapes are of course completely suitable for all general purposes – the main difference between AMPEX 360's and many other tape cassettes is that these are made properly!

The Ampex Professional Series cassette has a wide dynamic range due to its low noise/high output oxide formulation, providing clean, well defined response across the spectrum.

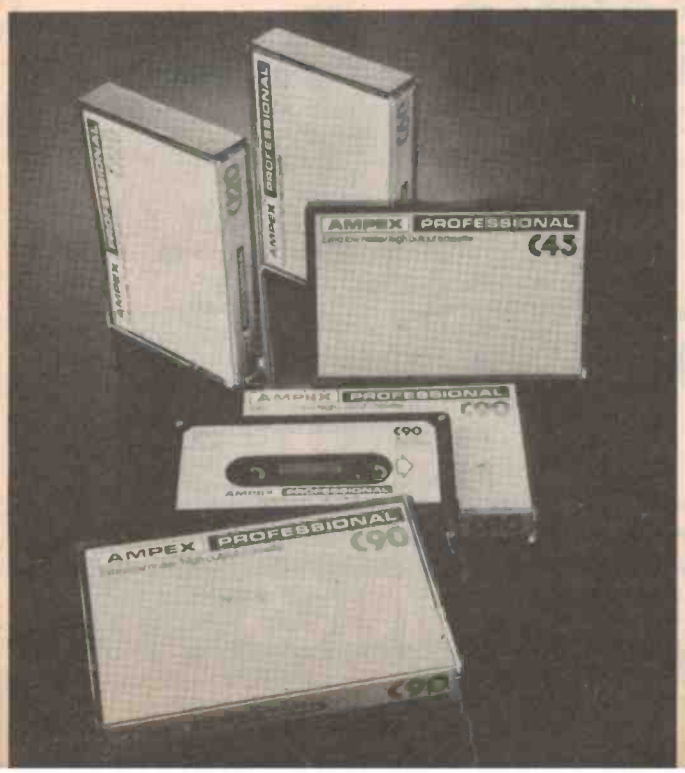
The recording surface is polished by the exclusive Ampex Ferrosheen ™ process to produce a glass-slick oxide surface that achieves close tape-to-head contact, maintaining sound fidelity.

The shell, and its internal components, are precision products designed for the highest mechanical reliability. The pressure pad system is a felt/beryllium copper spring assembly. Rotating guide rollers run on lubricated stainless steel pins.

A special formulation in the interior top and bottom liners reduces tape edge friction and minimises possible wow and flutter. The cushioning effect created by the liners helps to reduce mechanical noise to a practically inaudible level. The convex shape of the liners causes a spring-like action which controls tape torque and tape alignment and helps in forming a uniform tape pack for smooth, jam-free operation.

The cassette shells are assembled with five screws to maintain precise internal dimensional uniformity. The shell may be dis-assembled for editing or splicing if required.

Windows, which allow visual inspection of the tape packs, are made of solid transparent polystyrene to protect the tape from dust.



CHARACTERISTICS	SPECIFICATION
CASSETTE TAPE SYSTEM	
PLASTIC SHELL	
Dimensions:	Manufactured in conformance to Philips Dimensional Standards.
Materials of Construction:	High heat, medium impact polystyrene.
Torque Control Liners:	Graphite coated, preotensioned polyester.
Pressure Pad Assembly:	Felt/Beryllium copper spring.
Magnetic Shielding:	Full-width steel.
Closure Method:	5-screw assembly.
Tape position Windows:	Rigid polystyrene. Welded.
Tape Guide System:	Rotating guide rollers operating on lubricating stainless steel pins.
SYSTEM PERFORMANCE	
Rotating Torque:	Less than 25gm/cm without hold-back.
Wow and Flutter:	Less than 0.10% DIN weighted.

INTRINSIC MAGENTIC OXIDE PROPERTIES		
Coercivity (Hci) in oersteds	290	290
Retentivity (Brs) in gauss	1100	1100
Erasure (1000 oersted field) in db	–60	–60
PHYSICAL PROPERTIES		
Base film thickness in mils	0.50	0.30
Base film type	Tensilized polyester	Tensilized polyester
Oxide coating thickness in mils	0.20	0.17
Total thickness in mils	0.70	0.47

AMPEX CASSETTES
SPECIAL READER OFFER!

Offer extended *to Sept 15*

Each cassette is packaged in a transparent "Norelco" container. The insert label is reversible, providing space for programme contents and title to be written or typed.

Dindy Marketing has arranged with Ampex for Dindy to offer these tapes to our readers for a limited period of time, and at genuinely bargain prices. Electronics Today International has tested these tapes and supports Ampex's claims for performance and quality.

NOTE: Dindy has available ex-stock – 10,000 C45's; 40,000 C60's and 10,000 C90's. If demand exceeds Dindy's stock, Ampex has agreed to make further supplies available to Dindy within two weeks notice.

Due to the extreme care taken in manufacture, it is extremely unlikely that any faulty cassettes will be found – in the improbable event that you receive a faulty cassette, Dindy guarantee to replace it (at their discretion) within 30 days.

Organisations able to purchase at sales-tax free prices should enclose a valid sales-tax certificate and deduct C45 (10c); C60 (11c); C90 (12c) for each cassette.

This offer is made by Dindy Marketing and this magazine is acting as a clearing house for orders only. Cheques should be made out to 'Ampex Offer' and sent together with the order form to 'Dindy Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process the orders and pass them on to Dindy who will send out the goods by IPEC or certified mail. Please allow approximately four weeks for delivery.

SPECIAL BARGAIN PRICES

Quantity	1 – 50	51 – 100	101 – 200	201 +
C45	$1.25	$1.20	$1.15	$1.10
C60	$1.35	$1.30	$1.25	$1.20
C90	$1.45	$1.40	$1.35	$1.30

Plus postage – $2.00 (any quantity).
If valid sales tax certificate enclosed deduct 10 cents – C45's, 11 cents – C60's, 12 cents – C90's.

AMPEX OFFER

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Rushcutters Bay, NSW 2011

Please supply:

Quantity

.....C45 .....$ .....

.....C60 .....$ .....

.....C90 .....$ .....

Postage (any quantity) $2.00

TOTAL:

Name .....

Address .....

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Please make cheques/postal notes payable to 'Ampex Offer' and send together with the order to 'Ampex Offer', Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. Offer extended to 15 September.

Due to public demand!

Melbourne's HOME COMPUTER SHOW will now be expanded to include not only the latest gadgetry and wizardry of the new microprocessor technology but also a comprehensive range of low cost ($500 - $20,000) small business and professional systems marketed by the large computer companies.

HOME & SMALL BUSINESS COMPUTER SHOW

SOMETHING FOR EVERYONE!

* Microprocessor based consumer products and games
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* Intensive, practical, nuts-and-bolts seminars for small businessmen, professionals, educators and hobbyists
* Australia's 2nd computer Chess Championship
* Special discounts for school excursions
* Free raffle tickets for a valuable prize.

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Friday	28th Sept	10am - 8pm	(TRADE & SCHOOLS)
Saturday	29th Sept	10am - 10pm	(PUBLIC)
Sunday	30th Sept	10am - 8pm	(PUBLIC)

Look for further details in the next issue!

ADMISSION

Adults	$2.00
Children	$1.00 (School
Students	$1.00 excursions 60c)

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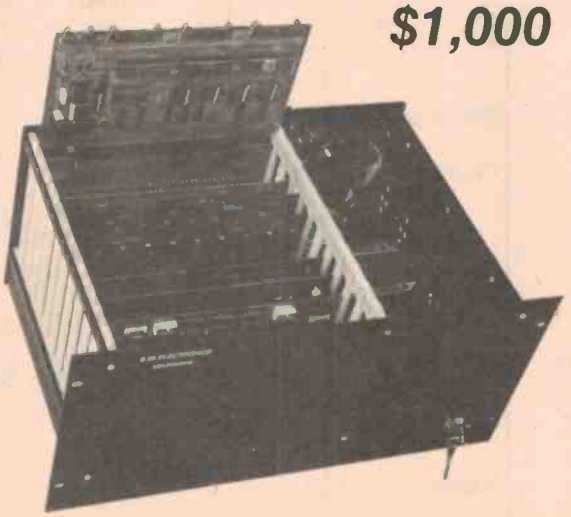
SME MICROCOMPUTER SYSTEMS *UNDER $1,000*



HARDWARE

CPU BOARD
Z80 at 4MHz with power on jump, wait states on all cycles, Z80 or 8080 I/O addressing mode, provision for on board 2708 eprom, DMA grant tri-states all signals from board.

RAM BOARD
16K, 2114's, low power, 450nS that will work at 4MHz with no wait states, 4K addressing with write protect.

PROM BOARD
16K, 2708, wait states, 8K or 16K boundary addressing.

I/O PORT BOARD
9 parallel and 1 serial, link select for TTY, CRT or TTL outputs, Xtal controlled baud rate generator, 9600 to 75 baud, patch area to flat cable connectors.

FLOPPY DISK CONTROLLER BOARD
Can control up to 4 8" or 4 mini drives single or double sided, IBM 3740 soft sectored, 34 & 50 way edge connector on top of board for direct interface to full or mini drives, suits Shugart, Persci, MFE & CDC drives plus others.

CARD CAGE
11 slot mother board, 15 amp power supply, cooling fan 90 CFM, key switch for power on, bench mount and rack mount (illus), all anodised aluminium.

SOFTWARE

Monitor Prom 2708 Z80 16 functions,
Disk Bios Prom for CP/M boot up;
Disk Test Prom with random read/write, format, read & write to sectors etc;

ETI 640 Driver Prom (Z80). All proms supplied with listings and instructions, Std. versions $25 ea. Customised versions $30 ea.

DISK SOFTWARE
Customised CP/M disk operating system, E-Basic, Microsoft 16K Basic, Fortran, Cobol, CP/M users group, text editor, assemblers, symbolic instruction debugger, disassemblers, general ledger, disk copy, ram test.

PRICE
Of typical system with 16K Ram, Prom Board, Port Board, Z80 CPU, Card Cage, Assembled & Tested $1250.00, Kit Price $993.00.

Disk System: with 2 x 8" drives and controller $1319. With 1 x 8" drive and controller $739.

NOTE: Card Cage is available in 6800 version with 10 amp reg. supply.

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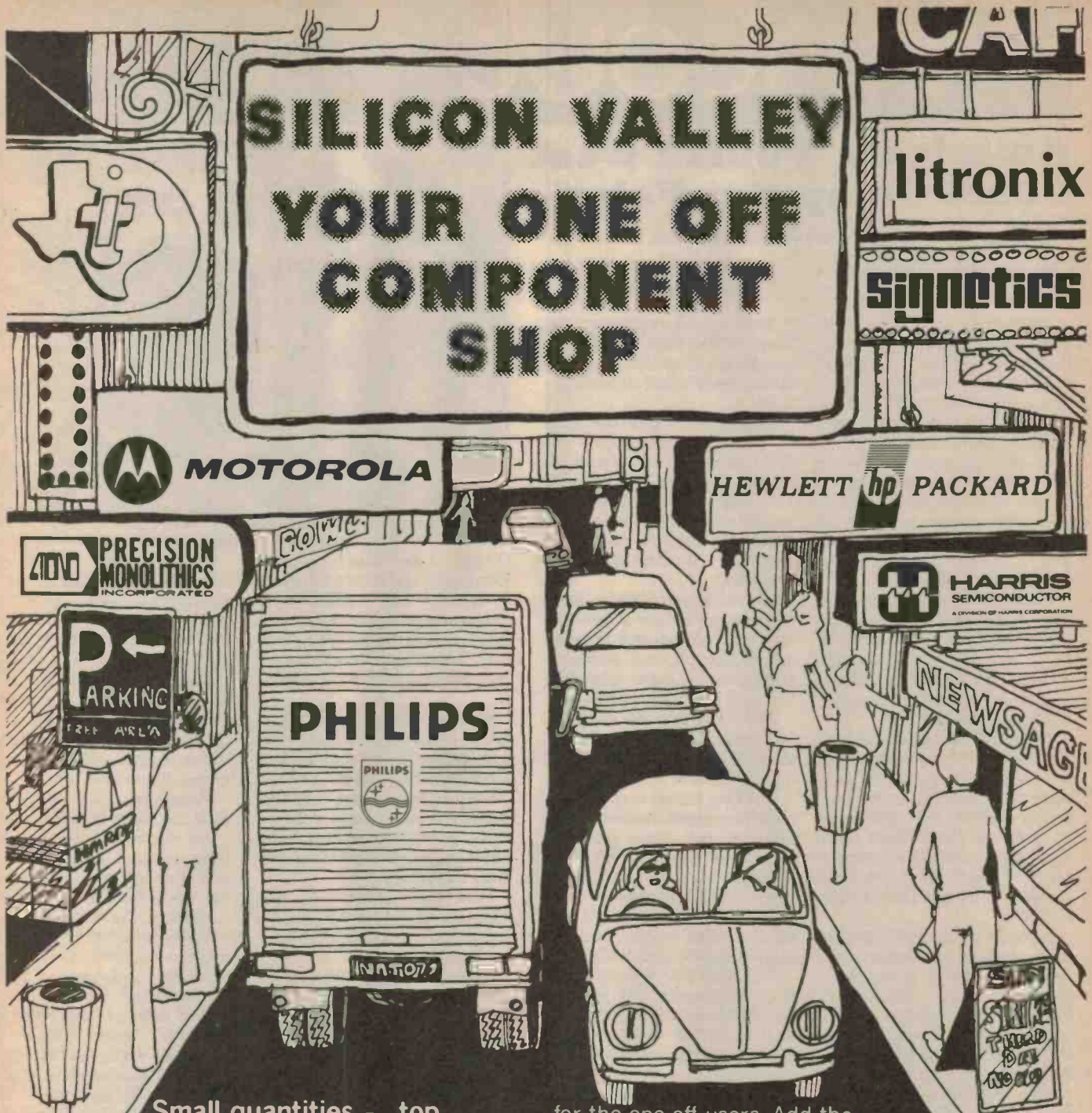

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MELBOURNE: 308 Whitehorse Road, Blackburn. Telephone: (03) 877 5311

308 Bridge Road, Richmond. Telephone: (03) 429 4780

ADELAIDE: 170 Sturt Street, Adelaide Telephone: (08) 51 4080

AUCKLAND: 7-9 Kirk Street, Grey Lynn. Telephone: 76 1169

Print-out

America's 'Fourth West Coast Computer Faire'

*Held May 11-13 1979, in San Francisco, California USA.

Clearly, 1979 is the year of software.

Portia Isaacson

Although I couldn't count them, I came away from the Fourth West Coast Computer Faire with the strong impression that every other exhibit was a software company with a tabletop display reminiscent of the little garage-shop hardware companies of two years ago.

The software distribution companies were typified by Kilobaud's 'Instant Software' and Creative Computing's 'Sensational Software'.

Kilobaud and Creative are both distributing programs for the Apple II, the Commodore PET, and the Radio Shack TRS-80 on audio cassettes. Programmers are paid a royalty based on sales volume.

'WHATSIT' is one of the better known program packages — a very nice personal data base management suite. The author of WHATSIT, easily recognized by his beanie with propeller on top, is becoming a familiar sight at computer shows. (No it's **not** Dick Smith! — Ed).

A good example of small business system innovation was Datamaster which is based on the Radio Shack TRS-80 with Micropolis disks. Datamaster is a program that provides record keeping, payroll, electronic mail and word processing.

The big hardware news was Atari's release of two new computer systems.

Their exhibit dominated the lower exhibit floor entrance. It was always crowded, especially during the periodic demonstrations.

It appears that Atari learned a lot from Apple since the Atari 800 has Apple II's best features with significant innovations. This machine may be a very important entry in the home computer market, as Atari is a Warner Communications Company.

Warner is a 1.3 billion dollar combine with major activities in music recording and publishing, motion pictures, television entertainment, cable television, toys and electronic games.

The Atari computer comes in two versions: the Atari 400 for US $549.99 and the Atari 800 for US $999.99.

Both are based on the 6502 microprocessor, contain a custom chip for colour graphics, have 8192 bytes of RAM (random access memory) and 8192 bytes of ROM (read only memory), connect to colour TV sets for the video display and are programmable in BASIC.

The Atari 800 is expandable to 49 152 bytes of RAM and has two ROM cartridge slots for a total of 32 768 bytes of ROM. Both computers can use audio cassettes.

Software is available for both computers. Among the software on ROM cartridges is BASIC, Life, Chess, Music Composer and Home Finance.

Among the educational software available on audio cassettes is US History, World History, Sociology, Basic Psychology, Spelling, and Basic Algebra.

Radio Shack was also there in force, although with a smaller exhibit than I have seen at other shows. (Radio Shack has sold one-half the personal computers sold to date primarily because of their massive retail distribution capability.)

And then there was the Orange, a computer being exhibited by Advanced Computer Products.

At first I thought the Orange was a pun on the Apple II computer. However, the exhibit personnel tried very hard to convince me that the Orange was a real US $500 computer.

I wanted to read more about it, but when I looked in the manual it was in Japanese.

As you know, we have been waiting two years for Texas Instruments to introduce their home computer. I have tired of waiting so at the 'banquet' — the high point of the show — I gave a short talk with slides describing TI's home computer.

It was entirely in jest, of course, and judging from the uproarious laughter from the crowd, it was very timely.

Perhaps now TI will announce their computer in self defence?

An extensive offering of lectures all three days were very well attended, many times with the rooms filled to overflowing.

Among the lectures were several on energy management, computers in education, the Forth language and Digital Broadcasting.

Jim Warren, the Faire organizer, can chalk up another successful show with impressive statistics of 14,104 attendees, 100 speakers, and 230 exhibiting companies.

Software companies dominated the Fourth West Coast Computer Faire. Above are some examples of the packages provided by Instant Software.

Atarai's exhibit at the West Coast Computer Faire was well attended.

The Datamaster System consists of a union of the Radio Shack TRS-80 plus Micropolis disks and a software package.

Transdata – new printer

Transdata have added an 80 column printer to their range of computer peripherals.

The model 8300 promises to be one of the 'workhorse' printers for small business applications. It has the capability to print up to three copies onto pre-printed forms.

Printing speed is 125 characters per second with the standard 7 x 5 dot matrix format (or 7 x 9 as an option) capable of software modification for double-width printing.

The printer, which comes with either eight bit parallel or RS-232 input, is available ex stock for $1095 (or $1130 with RS-232).

Transdata P/L, Clement St., Gloucester, NSW. (tel: 065 5711).

Second Melbourne Home Computer Show

Following the success of the Sydney Home Computer Show, Australian Seminar Services are to run another show in Melbourne, the second to be held in that city.

The show will be held in the Exhibition Buildings from 27 — 30 September and will have a greater emphasis on small business and professional computer systems.

An added feature of the Melbourne show will be a series of seminars covering the nuts-and-bolts details of computerisation.

Also featured will be the second Computer Chess Championships (the first having been staged at the Sydney show).

Special discounts for school parties are available.

For further information on booths still vacant and any other enquiries, contact Alan Schwartz on (03) 267 4311 or at 10th floor, 14 Queens Rd., Melbourne, Vic 3004.

Sorcerer's apprentice

Winner of Dick Smith's "Win a Computer" competition at the recent Sydney Home Computer Show was Kevin Reville of French's Forest. Receiving his prize, an Exidy Sorcerer, Kevin — a computer consultant — and part time lecturer in commercial data processing — said he will use the Sorcerer to assist in classroom demonstrations at Sydney Technical College.

COMPUTER CLUB DIRECTORY

Section 1 – arranged by districts

ADELAIDE	– ACS Microprocessor Group, c/- Doug Cruikshank, School of Mathematics and Computer Studies, South Australian Institute of Technology, Box 1, Ingle Farm, SA 5098.
ADELAIDE	– Wireless Institute Microprocessor Group, c/- Clive Pearson, Wireless Institute of Australia, P.O. Box 1234K, Adelaide 5001 (or Box 207, Gawler, SA).
ARMIDALE	– New England Computer Hobbyists Club, c/- Union University of New England, Armidale NSW 2351.
BRISBANE	– IREE Microcomputer Interest Group, P.O. Box 81, Albion QLD 4010 (Tel. 356 6176)
CANBERRA	– MICSIG, P.O. Box 118, Mawson ACT 2607 (Tel. 72 2237)
GEELONG	– Geelong Computer Club c/o Ian Stacey (052) 22 1455 (bus. hours). Meets 2nd Thursday each month at Tybar Engineering, Hampton St., Newtown, Geelong 3220.
HOBART	– Tasmanian Amateur Computer Society, meets first and third Tuesdays of the month in the Computer Studies Area of the Rosny Matriculation College, at 7.30 pm. (Tel. Clive Myers, 65 2252)
MELBOURNE	– Microcomputer Club of Melbourne (MICOM), P.O. Box 60, Canterbury, VIC 3126. Meets on third Saturday of every month at AMRA Hall, Willis St, Glen Iris, opposite Glen Iris Railway Station, at 2 pm.
MELBOURNE	– Monash Personal Computer Club, c/- Union Building, Monash University, Clayton VIC 3168.
NEWCASTLE	– Newcastle Microcomputer Club, c/- Dr. Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, Newcastle NSW 2308 (Tel. (049) 68 5256 (office), (049) 52 3267 (home)).
ORANGE	– Bruce Carroll, Orange 62 8703 or Neville Wilde, Bathurst 31 5809 or write c/- Box 1117, Orange 2800.
PERTH	– Western Australian Computer Enthusiasts Group, c/- R. Langlois, Memrex Pty. Ltd, 49 Hay St, Aubiaco WA 6008. Meets last Monday of each month at 7.30 pm at Taimac Video Corporation, 1st floor, cnr. Newcastle and William Streets, Perth.
SYDNEY	– Microcomputer Enthusiasts' Group, P.O. Box 3, St. Leonards, NSW 2065. Meets at WIA Hall, 14 Atchison St., St. Leonards on the first and third Mondays of the month at 8pm.
SYDNEY	– IREE Microprocessor Group, c/- Dr. Barry Madden, School of Chemical Technology, University of NSW, P.O. Box 1, Kensington NSW 2033. (Tel 662 2423)
SYDNEY	– Marrickville Microcomputer Society, c/- 26 Malakoff St, Marrickville 2204. (Tel. 569 5689)
WAGGA WAGGA	– c/o D Aleksic, PO Box 186, Wagga Wagga NSW 2650.
WOLLONGONG	– Wollongong Computer Club, c/o Gary Nelson, 220 Farmborough Rd., Farmborough Heights 2526. Tel: (042) 71 4054.
NEW ZEALAND	
AUCKLAND	– The N.Z. Microcomputer Club, P.O. Box 6210, Auckland 1, NZ.
CHRISTCHURCH	– c/- Paul Campbell, 50 Francis Ave. Christchurch, NZ.
WELLINGTON	– Wellington Microcomputer Club, P.O. Box 1581, Wellington, NZ.

Section 2 – arranged by processor or computer

APPLE II	– Apple II Users Club, c/- Computerland Australia Pty. Ltd, 55 Clarence St, Sydney 2000.
EXIDY SORCERER	– Exidy Sorcerer Users Group, c/- Frank Schuffelen, 66 Porter St, Templestone, VIC 3106.
EXIDY SORCERER	– Sorcerer User's Group. Meets at WIA Hall, 14 Atchison St., Crows Nest. PO Box 43 Peakhurst 2211. 4th Monday every month. Workshops 1st Friday of odd months, 2nd Friday even months.
TI59	– TI59 User Exchange Service, c/o Serge Petelin, 95 Gerler St., Bardon QLD. Tel: (07) 450 2066.
TMS9900	– TMS9900 User Group, c/o Les Kinch VK2BBD, 128A Booralie Rd., Duffys Forest NSW 2084, Tel: (02) 450 2026.
TRS-80	– TRS-80 Users Group, c/o G F Stevenson, 34—36 Sturt St., Adelaide. Tel: 515241. Meetings 1st Thursday of month at address available from the above.
TRS-80	– TRS-80 Users Group, c/o Les Kinch VK2BBD, 128A Booralie Rd., Duffy Forest, NSW 2084. Tel: (02) 450 2026.
2650	– Australian 2650 Users Group, c/o Applied Technology, 1A Patterson Ave., Waitara 2077.

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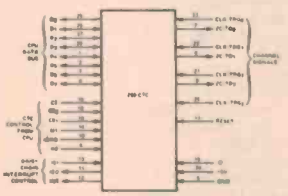

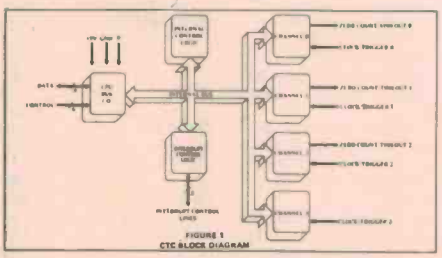

FIGURE 1
CTC BLOCK DIAGRAM

The Z80-Counter Timer Circuit (CTC) is a programmable, four channel device that provides counting and timing functions for the Z80-CPU. The Z80-CPU configures the Z80-CTC's four independent channels to operate under various modes and conditions as required.

The Zilog Z80 product line is a complete set of microcomputer components, development systems and support software. The Z80 microcomputer component set includes all of the circuits necessary to build high-performance microcomputer systems with virtually no other logic and a minimum number of low cost standard memory elements.

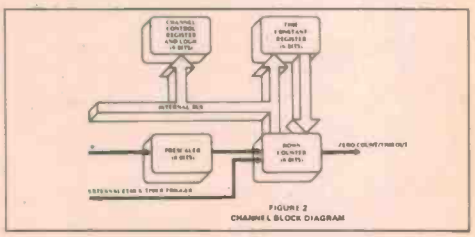

FIGURE 2
CHANNEL BLOCK DIAGRAM

Other peripherals available from Zilog:
Z80/A CPU — S10 — P10 — CTC — DMA — RAM.
The Z80 Family of Components & Technical Manuals are now available at:
SILICON VALLEY and **COMPUTERLAND** stores throughout Australia;
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SYSTEM B

The Vector Graphic SYSTEM B is a complete video terminal based microcomputer system. The SYSTEM B consists of the MZ dual floppy disk based microcomputer and the MT video terminal. The SYSTEM B is a professional quality computer system specifically designed for business and engineering problem solving. The SYSTEM B has enough computing power for serious applications yet costs far less than traditional minicomputer systems. As an example the all semiconductor main memory costs only 1.5c per byte and each standard floppy disk drive can store more characters than an IBM compatible std. 8 inch diskette. The result is real computing power within the budget of any small business or professional office.
A computer is only as powerful as the operating systems that it can support. The standard operating system is MICROPOLIS BASIC, an interpreter which includes MDOS, a Z80 assembler, editor and debugger. CP/M disk operating system is also supplied standard. The MZ microcomputer can store 49,152 characters in Random Access Memory (RAM) and 630,000 characters on 2 quad density floppy disk drives. The Vector MT video terminal is designed to interface directly to the MZ. The 12" screen has a display of 24 lines by 80 characters. When combined with the Flashwriter II video board it offers instantaneous positioning of the cursor anywhere and uses "memory mapping" techniques to display characters on the screen. The SYSTEM B retails for **$5,795** plus $587 sales tax. ***Dealer inqulries invited.***

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BOOK REVIEW

Practical Microcomputer Programming: the Z80

Written by W.J. Weller

published by Northern Technology Books, Box 62, Evanston, Il 60204, USA.

Price — US $29.95

Reviewed by Dr. Tim Hendtlass, Applied Physics Department, Royal Melbourne Institute of Technology.

IT HAS BEEN this reviewer's experience that by far the best way to learn machine language programming is to first learn from examples, secondly, and most important, try one's ideas out in practice.

The author of the book reviewed here has provided information and tools to enable you to do just this. In the 475 pages he not only gives a description of any Z-80 instruction and over 100 worked and documented examples, but he also gives the full source code listing of two useful software development aids. This package of hard data, examples and programmes form a very impressive aid to machine language programming for the Z-80.

One basic feature of the book which may not meet with universal approval is the fact that the author does not use Zilog 'standard' mnemonics. There are several different sets of mnemonics used for the Z-80 and this set is based on the original 8080 mnemonics for the 8080 subset of the total Z-80 instruction set with what are claimed to be clear and logical extensions to cover the special Z-80 instructions.

For example, the 8080 can Store the contents of the H and L registers Directly in a pair of memory locations, for which the 8080 mnemonic is SHLD. The Z-80 can also store the contents of the B and C registers directly and the mnemonic used in the book for this is SBCD. Other new mnemonics chosen show a similarity to MOS Technology and Motorola, for example using 'branch' rather than 'jump relative'.

How comfortable one will feel with the mnemonics used in this book is a personal matter and will probably depend on previous experience in this field. One of the points the author makes is that Zilog mnemonics take about *one third as many* key strokes again to enter as this book's set.

The author has also invented some new convenience mnemonics. The Z-80 does not have an instruction called 'clear carry bit', although there is one which does do this. ORing the accumulator with itself (ORA A) does not alter its contents but changes the flags and, in particular, clears the carry bit. This book includes a new mnemonic RSC (reset carry) which of course has the same binary value as ORA A.

For another instance, comparing two 8-bit quantities on the Z-80 has the results (equal, greater, etc.) reported in the zero and carry flags. Doing a conditional jump or call after such a comparison requires one to remember which combination of these flags refers to which result. To assist new mnemonics (CEQ — call if equal, CGE — call if greater or equal, etc.) have been added. There are also ones to handle comparisons between signed 8-bit quantities. These additional mnemonics are non-standard but a very good idea. A total of 289 mnemonics are used in the book.

The special mnemonics used in this book would be of no great value unless you had an assembler which accepts and can correctly handle them. One of the software aids referred to above is a combined editor/assembler which does just this. Object tapes of both the software aids are supplied without further charge when a coupon which comes with the book is returned.

The text editor/assembler is approximately 10K bytes long and can work either with all source code in memory or with any set of peripherals that can be made to transmit on a single character basis. Thus it can assemble vast programs. The 2-pass assembler is written in a straightforward way and not optimised for either speed or size. According to the author this is to allow the source to be another example to study. All the mnemonics, including the convenience ones are allowed but only a basic range of pseudo-ops (no conditional assembly or macros for example). It would appear adequate for all but the most complex assembly language programs.

The text editor is a line oriented editor, lines can be added, inserted, deleted, listed and punched. But, if an error is made in a line, it is necessary to delete that line totally and re-enter it. Lack of string search and substitute capabilities would make working on a very large program tedious.

Having a combined assembler/text editor has some non-obvious advantages. For example, lines may be entered in almost entirely free format. The assembler part knows which instructions require parameters and how many and thus the program is able to format everything very neatly into columns for you. This program, by the way, is written in pure 8080 code and may be used on an 8080 or 8085-based machine.

Among the options you may specify at assembly time is one which causes any lines containing Z-80 special instructions to be printed out along with the error lines. The program you are told to load the tape with, however, is written in Z-80 code.

The second piece of software is a debug monitor which must be run in RAM. This is written in Z-80 code and takes 2157 bytes excluding I/O routines. It contains less than other 2K monitors (eg. ZAPPLE). Still again, it is adequate.

Memory locations and CPU registers can be inspected and altered — a good point here, the flags are shown separated and identified and may be individually altered by name. The contents of blocks of memory locations can be output to, or read from, tape. Programs can be started at any point but only one breakpoint can be set. This is a disadvantage as it means you have to always correctly guess the path a program will take or the breakpoint will be missed and control over the program lost. Memory fills and searches may be carried out, inputs ports read and data sent to output ports. Both these programs require you to provide input and output subroutines to suit your peripherals.

Some considerable detail on just what these routines must do is provided, as are examples for you to study. Probably quite a few of the subroutine linkage points will not be used in a given system, they are there to allow almost anything to be interfaced.

Turning to the main part of the book. There are 18 chapters; in order: The Nature of the Programming Task,

Binary Operations, Logical Organization of the Z-80 Computer, Machine and Assembly Language Programming, Using the Assembly Program, Moving Data with Z-80 Instructions, Arithmetic and Logical Operations on the Z-80, Software Multiplication and Division, Using the Stack Pointer, Handling Arrays and Tables, Decimal Arithmetic, Communication with Terminals, Number Base Conversion, Floating Point Arithmetic, Graphic Output, Programming with Interrupts, Program Debugging Techniques, Functional Description of the Assembly Program. Then there are 150 pages of appendices.

Except for a few minor blemishes, the text is clear and the examples well chosen. These vary from the basic (how to swap the contents of two registers for example) to the quite complex (quadruple precision division, 40 by 40 X-Y plot subroutines for example). The examples really do something practical and just plead to be tried out in practice.

There are a few faults. For instance, a table listing the hexadecimal values of the printing ASCII characters show them all as having their most significant bit (bit 7) set to one. This could be quite misleading. Again, at the end of the book is a cross reference list between the author's and Zilog's mnemonics (very good) which also has a reference page number by each entry so as to permit one to get more information easily. For some reason these are the page references in the Zilog manual! Use the main index for references to this book.

This book is neither perfect nor cheap, I would rate it as very good and inexpensive. The package it provides is one of the best I have seen for teaching how to program the Z-80.

The text is far superior to almost all others, especially some of the lower price paperbacks. The programs that come as well are a unique feature for a book of this type and, as long as you have a system with 16K of memory, will really let you get your teeth into the subject. The matter of non-standard mnemonics is a personal matter but if you are into, or wish to get into, Z-80 programming at the machine language level I recommend you give very serious consideration indeed to adding a copy of this book to your library. ●

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The S-64K-LPS can deliver regulated power at, simultaneously, + 5V, - 5V, + 12V, - 12V and + 15V, and combinations of these (e.g., combining - 12V and + 15V gives you 27V, for EPROM programming).

Total price for this neat, compact unit is only $175.

This is the ideal unit for powering the TECHNICO T-9900-SS 16-BIT MICROCOMPUTER: T-1.5K-SS, assembled: $575. T-6K-SS, assembled: $795.

From **I.M.P.A.C.T. LTD.,** P.O. Box 177, PETERSHAM, NSW 2049.

☐ Please send me details of the S-64K-LPS power supply and the T-9900-SS microcomputer. 17

Name:.....

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Two great computers from Calculator Supermarket...

PeCos I
$1700

Specifications

Main Unit: CRT (monitor), keyboard, MPU, I/O, 2 cassette decks, power supply, memory, RS 232-C (output only). **Options:** 2 additional cassette decks, high speed printer. **Microprocessor:** 6502. **Dimensions:** 18½" x 19½" x 8½". **Keyboard:** 60 keys, durable, typewriter-style construction. **CRT:** 9-inch, black and white, 40 characters per line, 16 lines total. Upper and lower case. **Language:** PeCos, derived from JOSS by Rand Corporation. **Power:** 240 Volt, 50 Hz. **Cassette:** Standard audio cassette drives with motor control by computer. Manual rewind and fast forward. **Cassette Files:** Up to 4 tapes addressable. Semi-automatic control makes files on tape addressable by tape number. Search can begin at any position on tape. Files also accessed by name. **Baud Rate:** 800 (speed-tolerant recording) selectable. **Rom Memory:** 24K, PeCos Interpreter and operating system. **Ram Memory:** 16K. **Math Capabilities** Number dissection, string concatenation, transcendental, trigonometry and function definition in 9-digit floating decimal arithmetic with number range of (1 x 10-99) to (1 x 10 99).

Compucolor II

Specifications

Keyboard: Separate keyboard with Standard ASCII 4 level, coded with 192 codes. Includes 71 gold crossbar commercial key switches. CPU Reset and Automatic disk loading (AUTO) keys are included. Optional: 101 keys with color and numeric clusters or 117 keys with 16 additional function keys. **Microcomputer:** Central Processing Unit: 8080A, 2 microsecond cycle time with total memory expandable to 64K bytes. Read Only Memory (ROM): 16K bytes of nondestructive read only. Memory sockets included for 8K bytes of additional EPROM/MROM memory. Includes DISK BASIC, File Control System, and Terminal Software. Random Access Memory (RAM): 4K bytes for screen refresh. 8K bytes for user workspace. (Optional 16K and 32K — Models 4 and 5). Input/Output Ports: system is designed for 478 ports, with 30 ports implemented in standard unit. Including one RS-232C Serial Asynchronous Channel for a printer of modem. 50 pin bus: provides all addresses, data, clocks, etc., to allow the Compucolor II to be expanded with additional peripherals in the future. CRT Terminal Commands: Page/Roll Mode; Erase Line; Erase Page; Tab; Two Character Sizes; Blink; Cursor Home, Left, Right, Up and Down; Cursor XY Addressing; Caps Lock; CPU Reset; Foreground/Background Color Selection; 15 Plot Modes; Blind Cursor Mode; Local, Full and Half Duplex Modes; Write Vertical Mode; and Transmit Cursor and Page Modes.

Language: DISK BASIC 8001 interpreter in ROM memory includes: 29 statement types: CLEAR DATA, DEF, DIM, END, FILE, FOR, GET, GOSUB, GOTO, IF, INPUT, LOAD, NEXT, ON, OUT, PLOT, POKE, PRINT, PUT, READ, REM, RESTORE, RETURN, SAVE, STEP, THEN, TO, and WAIT. 3 command types: CONT, LIST, and RUN. 19 mathematical functions: ABS(x), ATN(x), CALL(x), COS(x), EXP(x), FNx (y), FRE(x), INT(x), INP(x), LOG(x), PEEK(x), POS(x), RND(x), SGN(x), SIN(x), SPC(x), SQR(x), TAB(x), and TAN(x). 9 string functions: ASC(xS), CHR$(x), FRE(xS), LEFT$(xS,I), LEN(xS), MID$(xS,I,J), RIGHT$(xS,I), STR$(x) and VAL(xS). 12 Disk File commands: COPY, DELETE, DEVICE, DIRECTORY, DUPLICATE, INITIALIZE, LOAD, READ, RENAME, RUN, SAVE, and WRITE. Baud Rate: Independent Baud rate generators for one of 7 Baud rates from 110 Baud to 9.6K Baud.

Mini Disk Drive: Uses 5¼" square Compucolor II diskettes. Tracks: 40. Track Density: 48 tpi. Power on Delay: 1 second. Access Time: (average 20 tracks) 200ms. Average Latency: 200 ms. Transfer rate: 76.8 Kilobits/sec. Performance specifications: Capacity formatted 51.2K Bytes/Side. Both sides usable by flipping diskette over. **CRT Display:** Eight color display with 32 lines of 64 characters (2048 characters). Two different character sizes. Plotting graphics of 128 x 128, including vector generating software. 64 standard ASCII characters and 64 additional special graphic characters. Includes a Standard RS232C Terminal Mode for time sharing use. 60Hz refresh. Usable screen area 9" wide x 6¾" high.

Programmed Sof-Disk Albums Available for the Compucolor II: Sampler (Includes: 1. Demo Program of Sample Displays and CCII Features; 2. Game of Concentration; 3. One-Armed Bandit; 4. Biorhythms; 5. Loan and Repayment Schedule; 6. Memory Diagnostics for the CCII; 7. Engineering Application). **Math Tutor:** Math Tutor, Checkbook, Recipe Program, Math Dice, Biorhythms. **Star Trek:** Star Trek, Lunar Lander, Shoot, Tic-Tac-Toe. **Hangman:** Hangman, Math Tutor, Two to Ten. **Chess:** Chess, Acey Deucey, Line Five, Biorhythms. **Othello:** Othello, Math Dice, Concentration (Numbers), Concentration (Letters). **Text Editor/Assembler for the 8080.** Some programs may require additional RAM memory. **Prices:** Model 3 — 8K user RAM — $1795 Retail. Model 4 — 16K user RAM — $1995 Retail. Model 5 — 32K user RAM — $2395 Retail. Inc. Sales Tax. Warranty 90 days. **Available options:** Second Compucolor II Micro-Floppy disk drive. Expanded Keyboard: 101 keys with color and numeric clusters. Deluxe Keyboard: 117 keys, including 16 additional function keys. Additional 16K RAM Module (only for Model 3 and 4).

P.O Box 464C GPO Melb. – 261 Elizabeth St. (03) 67-6412

Trade enquiries welcome

A review of Texas Instruments' University Module, TM 990-189

THE 990/189 is a single board, truly self-contained microcomputer system based on one of TI's 9900 family of 16 bit microcomputers. We say 'truly', as the one pcb holds:

(1) 45 key alphanumeric keyboard,
(2) 10 digit alphanumeric display (if 7-segment),
(3) Visual indicator LEDs and acoustic beeper,
(4) 1K bytes RAM,
(5) 4K ROM with monitor and assembler as standard,
(6) Audio interface,
(7) Three ports,
(8) Room for expansion including EPROM.

It came with a power lead (needs +12, +5, -12), a connector for the audio interface and two big manuals – more on each later. This will cost you only $299 plus tax.

Before proceeding to a detailed discussion of each facility, it should be noted that we think this is the best piece of microcomputer evaluation hardware we have yet seen; given the ICs it has, it is a magnificent piece of design.

As can be seen in the accompanying photograph, the keyboard/display unit resembles a TI59 case – no doubt this is a cost saver.

Each key has two functions, the shift being equivalent to a control key which gives each other key its control function. The keys are only labelled with non-control functions, which at first seems to be an oversight. However, there results a clear keyboard and those few required shift functions are soon memorised. The display is also TI-calculator standard, and hence 7-segment. We thought that this would give rise to a terribly ugly character set, but this is not so – a few minutes of use of the display familiariser (the monitor has this function!) and you hardly notice the weird letters at all. The display shows only 10 characters, but this is usually adequate. In any case, long strings can be rotated left and right six characters at a time – another excellent design feature.

Four user-addressable LEDs and a bell are provided. The bell consists of a piezo-transducer giving 'clicks' or 'beeps'. These are used as signals during certain operations and as simple prompts for initial programming of the unit. We found these most useful as we learnt about the interface chips.

RAM and ROM

Here, the first consequential design feature of the processor becomes evident – it is organised for an 8-bit wide memory. This has one advantage in that standard, readily available 8-bit wide memory ICs can immediately be used; i.e: one 2708 EPROM gives 500 instruction lines. However, this halves the maximum number of words of memory that can be accessed, as each one requires two addresses. The device is clearly not destined for large memory applications as we shall see later.

There is 4K of ROM on board. This contains an excellent monitor with an easy breakpoint control facility, as well as single stepping. In addition, there is a full symbolic assembler. This is both a beautiful feature and a necessity for efficient programming. It operates line by line and, by keeping a symbol table, can support most forward symbolic references.

The assembler is fully able to detect an invalid assembly code or format and will permit an exit to monitor at any time while maintaining the symbol table and informing the programmer of the remaining unresolved references.

Input-output

The usual audio (cassette) interface is provided. It is not fast, but it is reliable and easy to use.

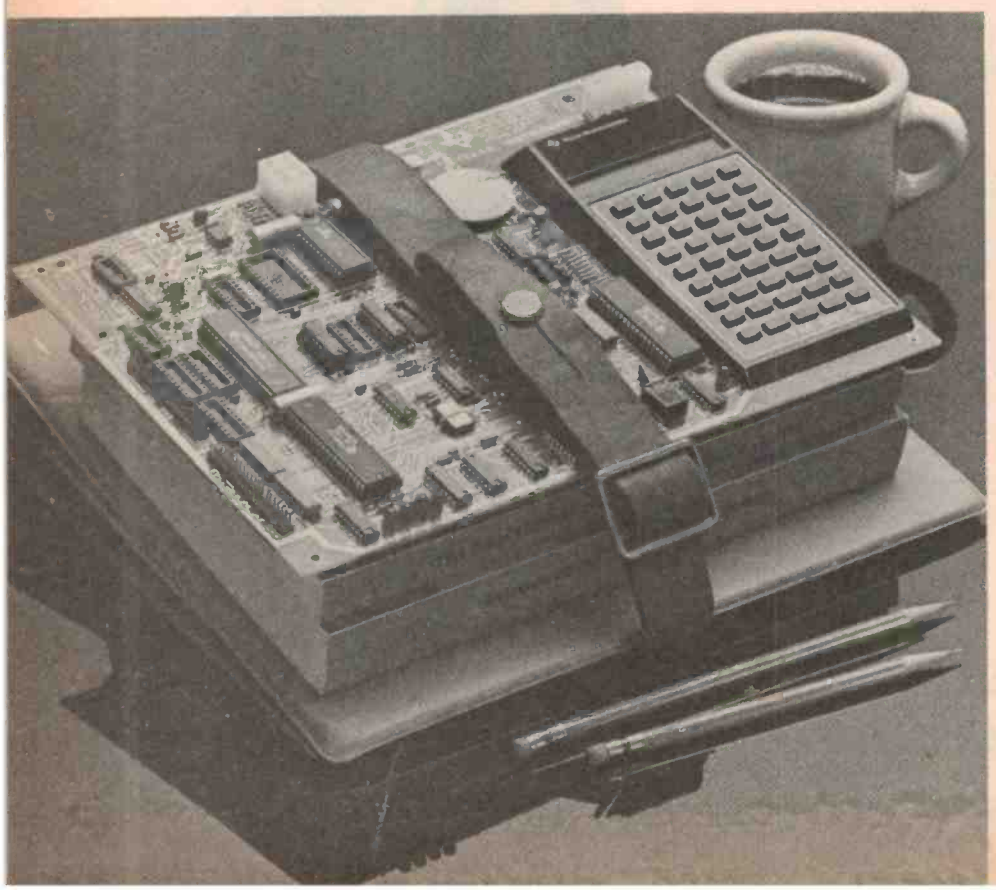
To record a program on tape, you enter starting and finishing addresses as well as an entry address (PC) and the program name; then push return. Upon a 'go' command following, the motor drive output is sent active, and a 'FWD' LED illuminates. The cassette drive is turned off and a beep sequence used to indicate that storage is complete.

Reloading a program is even easier; just push 'L' and start the replay. Synchronisation is automatic and a string of beeps indicates completion, the program name being left in the display. There is also provision on the board for a relay to operate the cassette motor.

The input/output ports on the board are for bus expansion, serial interfacing and parallel interfacing. Only the parallel port had ICs in the sockets of the board which we received. The parallel IC is a 9901 Programmable Systems Interface (PSI). This is a complex chip designed to provide input/output lines and allow the generation of interrupts. It is architectured specifically for the 9900 series.

Here we must again note a special feature of 9900 system organisation. All communication from the microprocessor to peripherals is done via a circuit in the μP serially, to the peripheral whose address lies in a particular register of the workspace (R12).

We have no idea why TI have chosen to use a CRU. It seems to us that it would be better to treat peripherals as memory locations. The CRU allows convenient control of the address of the peripheral under immediate consideration and the number of bits it is to receive. It also removes the need to set aside large blocks of memory for interfaces. Yet, its general clumsiness



outweighs the advantages we could find.

There is one further serious disadvantage to the 9980 CPU used on this board. It has only 14 address lines. This limits directly accessible memory to 16K, or 8K of 16-bit words. This could be a problem if you are looking for a big-memory number-crunching processor. We found this very incongruous in a chip that sports hardware multiply and divide! We must point out though, that this is not a serious drawback when in the application of educational device rather than system centre. Also the 9900 range has 16 address bit processors if you so require, with their appropriate evaluation boards. For our money, 14 bits is quite adequate here, even if unconventionally limiting.

Manuals

The biggest complaint from an enthusiasts point of view is undoubtedly the manuals supplied with the board. The first consists of a teaching course which is an excellent work to familiarise one with 9900's at the rate of three hrs/week for two years! – hopeless as a reference manual or 'converter' for someone familiar with other micros already.

We also received the User's Guide, which is inadequate in our opinion. It is too verbose in places, lacking in others. For instance, there is nowhere in either book a complete listing of the instruction set with a concise description of the effect of each instruction. Only a 9900 Family System Design Manual has such a listing and there, one whole page is devoted to each instruction! We suspect that one of these should have been supplied with the unit. In any case you will need one.

Overall view

Having discussed the features in detail, let us give an overall picture of the beast. It programs with typical 16-bit powerfulness, much like a PDP-11.

The assembler and monitor are both clear and effective so the thing is not confusing or frustrating in itself. Once the PSI chip is mastered you are really away, and can turn out programs for doing simple jobs at once. The assembler takes all the pain out of machine level programming.

The board is an ideal 16-bit learning device and in our opinion is the best micro-educational thing yet – especially at the price asked. Don't buy one of these if you want a big number-crunching high level system – get one of its big brothers.

If you want a really fun, self contained unit that leaves you able to come to grips with a computer of the order of a PDP-11, here is the answer.

–Jonathan Scott.

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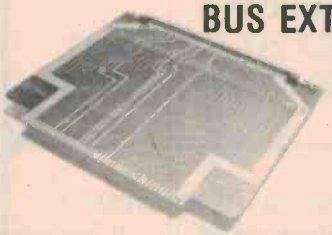

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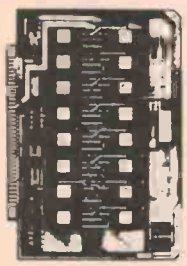

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EPROM'S to suit: 1 to 8 $13.50, 9 to 16 $12.50

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- Displays up to 32x2k pages simply by changing contents of 8 bit page register
- Hardware scrolling controlled by scroll register
- Displays full 128 ASCII character set (Control characters optional)
- Inverse video (may be mixed with normal video)
- Coarse graphics
- Link programmable character/line (48, 64, 80)
- Link programmable lines/page (20,22,24)
- Additional line at bottom of page for status information — unaffected by scrolling
- Dot rate controlled by phase locked loop — automatically adjusts to different formats.

32K STATIC RAM: $569 KIT

- Page mode operation — allows system expansion to 1 Megabyte
- Quality PCB with solder resist
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- 300nS access
- Fully static operation
- Buffered address, data and control lines
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- 4 x 8K blocks — individually addressable — each write protectable — may be removed from address space if not required
- Multi-phase operation — the module allows access during phase one and phase two — ideal for multiprocessing or DMA channels

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32K	$569	$599
24K	469	499
16K	359	389
8K	249	275

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Add 15 percent tax where applicable. P&P: $2.50 Sydney Area. $3.50 elsewhere

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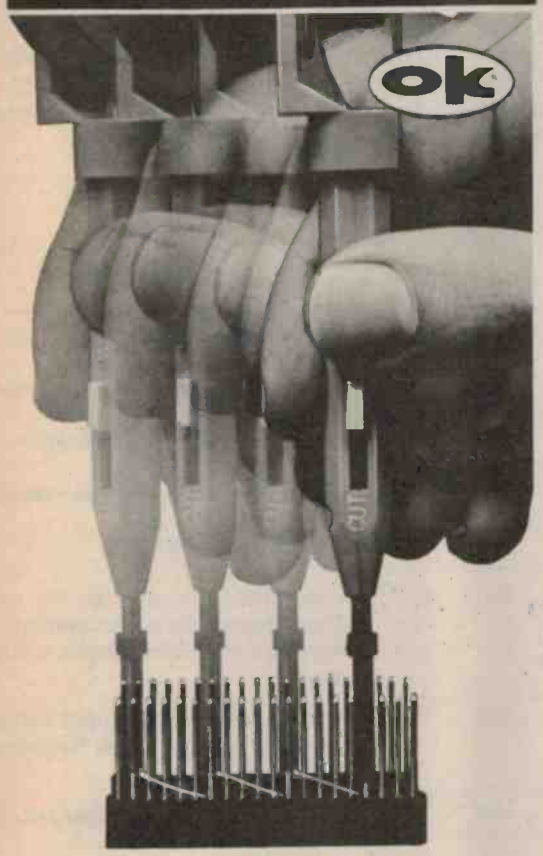

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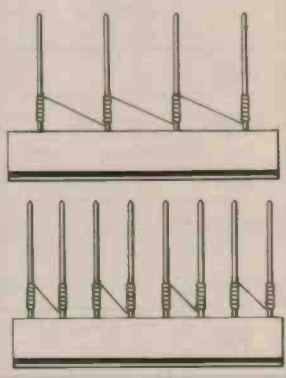

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	YELLOW	R-JW-Y
	RED	R-JW-R

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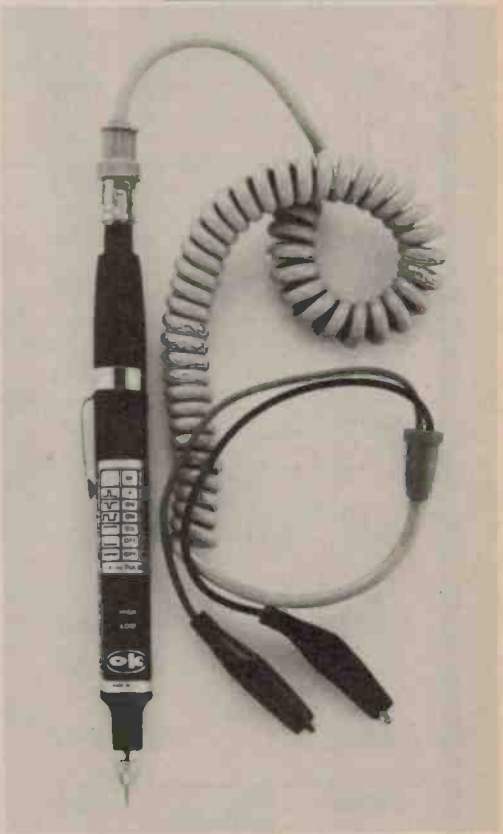

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eti data sheet

There are so many different operational amplifiers on the market that we thought it was about time that we did a mini-survey of what's available.

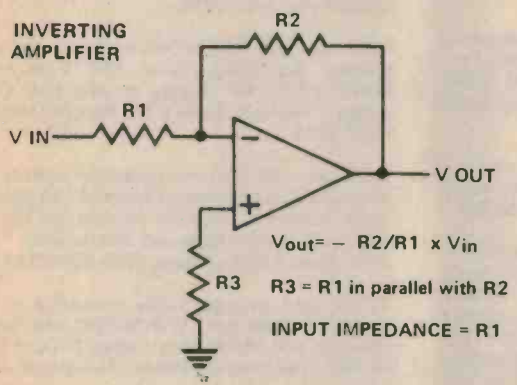
The headings on the table should be fairly self-explanatory, except perhaps for the second-last column, which gives the number of devices in a package — S single, D dual and Q quad.

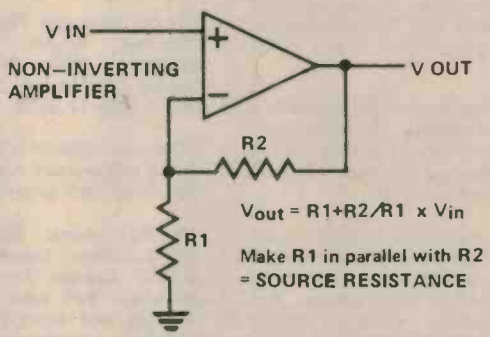
CMRR is short for common-mode rejection ratio. This means that, if both the inverting and the non-inverting inputs of the device are tied together and a signal applied, the CMRR gives you the ratio between the applied signal and the output. Of course, in an ideal op amp, there would be no output and the CMRR would be infinite.

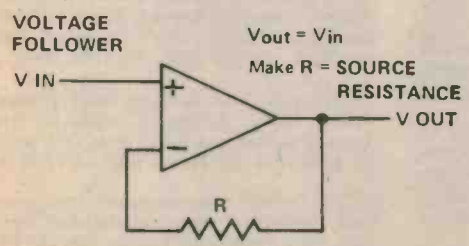
Op amp types	Input offset voltage mV	Input bias current nA	Type of input structure	Band-width MHz	Slew rate V/ns	Voltage gain dB	Maximum supply voltage V	CMRR dB	Qty	COMMENTS
709	2	300	NPN	1	0.25	90	± 18	90	S	Needs frequency compensation
307	2	70	NPN	1	0.25	100	± 18	90	S	Internal frequency compensation
301	2	70	NPN	10	0.5	100	± 18	90	S	Needs frequency compensation
741	2	80	NPN	1	0.5	106	± 18	90	S	Internal frequency compensation
748	1	120	NPN	10	0.5	103	± 22	90	S	A decompensated 741
308	2	1.5	NPN	3	0.5	110	± 18	100	S	Low supply current drain 0.3 mA Needs frequency compensation Very low differential input voltage range
318	4	150	NPN	15	50	106	± 20	100	S	Very low differential input voltage range. Sometimes needs frequency compensation
747	2	80	NPN	1	0.5	106	± 18	90	D	Internal frequency compensation
1458	1	80	NPN	1	0.8	103	± 18	90	D	Internal frequency compensation
4136	0.5	40	PNP	3	1.0	110	± 18	100	D	Low noise
3900 3401	Current inputs	30	Current sinks	2.5	0.5 20	70	± 18	—	Q	Current balancing amplifier
324	2	45	PNP	1	0.5	100	± 30	70	Q	Ground sensing inputs Output voltage can go to ground Low power. 0.8 mA drain per IC
3403	2	150	PNP	1	1.2	100	± 36	90	Q	Ground sensing inputs Class AB output Output voltage can go to ground Low power 3 mA drain per IC
348	1	30	NPN	1	0.5	103	± 18	90	Q	Low power 2.4 mA drain per IC Class AB output
RC4739	2	40	PNP	3	1	110	± 18	100	D	Raytheon device only Low noise audio amplifier
uA739	1	300	NPN	10	1	86	± 18	90	D	Fairchild device only Low noise audio amplifier Needs frequency compensation
LM381	Not applicable		NPN	15	—	112	± 20	—	D	Low noise amplifier Internally compensated
CA3130	8	0.005	MOSFET	15	10	110	+16	90	S	Ground sensing inputs Very high input impedance Needs frequency compensation

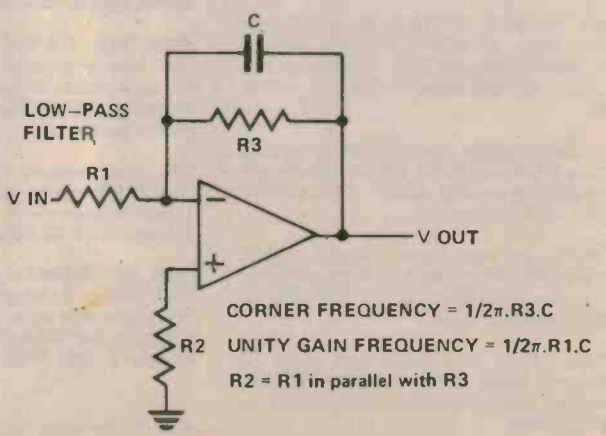
Op amp survey

Op amp types	Input offset voltage mV	Input bias current nA	Type of input structure	Band-width MHz	Slew rate V/ns	Voltage gain dB	Maximum supply voltage V	CMRR dB	Qty	COMMENTS
CA3140	8	0.010	MOSFET	4.5	9	100	+36	90	S	Ground sensing inputs Very high input impedance
CA3160	6	0.005	MOSFET	4	10	110	+15	90	S	Ground sensing inputs Very high input impedance
NE531 RC4531	2	400	NPN	10	35	96	± 22	100	S	Very fast op amp Needs frequency compensation
TL080	15	0.4	JFET	3	13	83	± 18	70	S	Pin for pin replacement for 748
TL081	15	0.4	JFET	3	13	83	± 18	70	S	JFET input op amps, with fast slew rate and wide bandwidth [Texas] 741
TL082	15	0.4	JFET	3	13	83	± 18	70	D	1458
TL083	15	0.4	JFET	3	13	83	± 18	70	D	747
TL084	15	0.4	JFET	3	13	83	± 18	70	Q	324









MINI-MART

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WE'LL PUBLISH up to 24 words (maximum) totally free of charge for you, or your club or association. Copy must be with us by the 1st of the month preceding the month of issue. Please, please write or preferably type your adverts clearly — otherwise it may not turn out as you intended! If we can't understand it, relatively few readers will (no insult intended). Every effort will be made to publish all adverts received — however, no responsibility for so doing is accepted or implied.

Conditions

Name and address plus phone number (if required) must be included within the 24 words allowed. Reasonable abbreviations, such as 25 Wrms or 240 Vac, count as one word. **Private adverts only** will be accepted. Please let us know if you find a commercial enterprise using this service. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.

Send your ad to:- ETI Mini-Mart, Modern Magazines 15 Boundary St RUSHCUTTERS BAY NSW 2011

2650 mini computer, VDU encoder, CPU 4K RAM. Cassette interface, keyboard all mounted in single console $550. Phone Bert (after hours) 758.4086.

Yamaha CT1010 AM/FM tuner $300 ONO. Also Karinna 18 ch SSB radio with antenna, power mike and SWR meter $140. Phone Peter (08) 43.3026 — Adelaide.

NOVICE Ham self study kit — theory, morse, texts, tapes and exam questions. Only $15 posted. T Wilson, WIA Education Service, PO Box 109, Toongabbie NSW 2146.

WANTED microcomputer system, will exchange for Kawasaki 350 CC Motorcycle. Phone Paul, Wollongong, after 5 pm (042) 61.5451.

TEKTRONIX Oscilloscope for sale model 454 portable, excellent condition, 150 MHz, 5mV dual trace, 50 ns/div delayed sweep, P6010 divided by 10 probes and manual. $2500. Dr A M Downing (03) 489.9770.

MELBOURNE Hifi and Tape Friends — the Recording Society of Australia meets monthly for demonstrations, lectures and live-recordings. You are invited to come along. For syllabus and information write or phone Don Patrick, 36 Argyle St, MacLeod 3085, phone AH (03) 459.1717.

FOR sale Heathkit HD-1416 Code Practice Oscillator and ER-3701 Novice License Course. Almost unused $25. D Morton, 26 Myrtle St, Murwillumbah 2484. (066) 72.3335.

SELL: Multimeters, Avo 8 Mk5 little use $175. Avo DA116 LCD digital meter still under makers warranty $245. Phone (03) 288.9536, Mt Waverley, Vic.

SELL SME III arm, new, boxed, $195. Soundcraftsman 1020 graphic equaliser $225 ONO. J A Coulson, Dilston, Tas 7252. Phone (003) 28.1237 after 5 p.m.

WANTED: Kind of printer that could be converted for home computer use (TRS80). Jim Spazzal (049) 63.2558, PO Box 114, Merewether 2291.

HP-25 programmable calculator includes charger, manual and applications book. $75 M Ryan, 12 Watt St, Gympie, Qld 4570.

MAKE friends with your tape recorder — join ATRA the Australian Tapespondance Club, members in all states and overseas. SAE to ATRA Box 970, GPO, Adelaide, 5001.

PHONOGRAPH and Early Record Collectors — join The Phonograph Society of Australia. Branches in both NSW and Vic. Information available — Vic: 27 Doveton Ave, Doveton 3177. NSW: PO Box 36, Fairy Meadow 2519.

SELL: MEK 6800 D2 assembled. ½ K RAM. Full buffering, manuals; extra books, software. $275 ONO. Ring (03) 749.2627 after 7 pm, ask for Mark.

SELL: National Panasonic Communications Receiver, Model DR48-MW/FM/SW/1.6—31 MHz. SSB. New 4 month old $450. Zagora, 10 Norfolk St, Moonee Ponds 3039. Phone (03) 37.3690.

FOR sale: 100 watt guitar head, new preamp, driver and output stages. Ex cond. must sell $90 ONO. AF or w/ends only (02) 529.5997.

TRS-80 owners: RS 232 Serial Interface — (no expansion interface required!) — run a printer straight from your 16 K level 2 machine. $65 with documentation. Circuit diagram and basic program for LLIST and LPRINT functions $15. Also programs available on an exchange basis. PO Box 122, Bondi Beach, NSW 2026.

WANTED: RS 232 Serial or Parallel printer, dot matrix printout, e.g. Teletype 43, etc. Please write to R Gareb, 17/37 O'Donnell St, Bondi, NSW 2026 or ring (02) 30.8261 with details and price.

PHILIPS speakers: Pair dome midrange AD 0210/SQ8 (new) and ETI 439 crossovers (heavy copper - wire coils on air formers) $75. Phone: ACT 82.4682.

PHILIPS PM5324 AM/FM sig gen 100 kHz to 110 MHz. Bandspread and wobbulator for Australian FM band crystal calibration. $350. Essential for FM servicing. J Aylmar, 6 Patriot St, Darra (07) 375.5075.

SELL: Semcon 8K static RAM. Parity error detection. 350 ns low power. Motorola D2 bus. IC sockets throughout. As new. $200 Steve Ceprow. BH (03) 726.6455, AH (03) 859.6691.

SELL transceiver AWA-SS220 6-channel 2-freq simplex 2—15 MHz SSB/AM 100 watt PEP 240 volt supply manual spare parts. Suitable for marine or mobile $560. Phone: (02) 48.2424.

PROGRAMS: HP25/TI57 golf, blackjack, hi-lo (HP), golf, hi-lo (TI). $4 ea or 3/$10. Write to J Lavett, Scotch College (ARH), 491 Glenferrie Rd, Hawthorn, Vic 3122.

TRS-80 program swap. Send us your favourites on cassette (CLOAD or system) and we'll return ours. B Koziol, 36 Osburn Drive, MacGregor, ACT 2615.

FOR sale: EA 3 MHz frequency counter with probes. $80 ONO. Also, FET VOM multimeter 10 Mohm input, as new $60 ONO. Apply: Michael Blowes, PO Box 28, Molong, NSW 2866.

FOR sale: 16 bit mini computer with circuit diagrams and instruction manual. 16 Kb core store memory. System housed in 19 inch rack and is complete and operational. Best offer over $100. Phone (02) 938.2333 BH.

TI 52 card programmable calculator — 224 steps, 20 memories. With BASIC and finance libraries and instruction books $100. Tony McGee, 107 Church Street, Gloucester 2422.

MEMOREX 1280 cassette communication terminal RS 232, tractor feed, numeric pad, $1800. John, 17 Victoria St, Roseville NSW 412.2409.

VTR colour Shibaden SV-700 as converted by Xenon, virtually unused, EC, cost $680, desperate, sell $300. 3.5" TV tubes and yokes new $20. Russell (054) 95.1899 (BH).

SELL, complete working 2650 system. 4K RAM, VDU, keyboard, cassette interface. Lots of software, BASIC, Star Trek on cassettes. $400 (ONO). Phone (08) 44.1765 (home).

SELL Tarbell microcomputer cassette interface assembled with manual and test tape. 189, 540 bytes/s or Kansas City $115. Joe (03) 570.7680.

FOR sale. Chess Champion MK1 computer. As new condition $100 ONO. Ideal for learner to average player. Ring Ray MacFadyen (058) 21.4444 AH (058) 21.2776.

WANTED: Micro MA202, or 202L tone arm, with lever operated height adjustment in base collar. Please reply to L Nelson, 307 Bambra Rd, Sth Caufield, Vic 3162. Phone: (priv) 578.1582, (bus) 689.4411.

LICENCED. Midland 18 Channel SSB. Plus 3/4 wave home base antenna, 40 foot 58 coax, power supply and extension speaker, all as new. Price $200 cash. Write: Marilyn Neilsen, PO Box 351, Yenda 2681.

SELL Philips N1500 video cassette recorder in carton $750. 28 Beauford Ave, Caringbah (02) 524.4062.

LARGE C core power transformers 240V primary 2 x 32V secondaries. Ideal for power amplifiers $10 each. Earlwood NSW 78.6249.

SELL: EA cassette interface working with transformer $30 or swap for Baudot teleprinter with cash adjust. A Partridge "Glen Ard Mohr", Exeter, Tas 7251 (003) 94.4524.

WANTED: TI-59 calculator in exchange for year 1885 "Bausch 2 Lomb" Microscope, complete with objectives and eye pieces. Excellent condition and collectors item. W Lelyveld, 36 Napier St, Parramatta, NSW 2150. Phone 635.6308.

FR-1 MK2 cartridge plus FRT-3 transformer $110. Soundcraftsmen RP2212 frequency equaliser $240. Both items have had little use – K J Nesbit, 39 Lantana Ave, Launceston, Tas 7250. Phone (003) 44.5973.

SELL: Realistic DX-160 communications receiver. Only 1 yr old, as new. Phone Paul Colley, Ade (08) 272.6329. Sell for $110.

WANTED: Please, I need a circuit diagram for the "Timbra A40" stereo amp. Will pay. Can anyone help? Paul (03) 846.2036, 20 Little Valley Rd, Templestowe 3106. Thanks.

SELL: Telegame ETI 810. Good condition, hardly used, instructions and plans included, price $25. For details phone Maryborough (054) 61.3065 AH or WE (ask for Greg).

FOR sale: Uher stereo cassette recorder model 124. AC/DC portable with some accessories $200. Contact George Meldrum, 309 Princes Highway, Bulli, NSW. Phone (042) 84.3153.

CORVUS 500 scientific calculator, nine memories RPN, twelve digit display. $55. Also HP33E programmable calculator, eight memories, 49 steps, $95. D Shanahan (02) 977.3765 (home).

MICROCOMPUTER ICs. New. 6800 $9; 6820 $5.50; 6821 $6.50; 6852 $5.50; 8080A $9; 8255 $8. Graham, 4 Pryton Court, Balwyn 3103. Phone 89.6918 AH.

FOR sale ETI 641 S100 printer complete. Less additional PROMS and PROM circuitry. Printer. Suitably housed cost $175 sell $150 ONO. Phone Mark (03) 870.4017 AH.

SELL Central Data 2650 motherboard, S100 extender board, P/S keyboard, VDU, software and documentation. Worth over $1000, yours for $600. M Stracke, 6A Knutsford St, Balwyn Vic 3103.

CRO Telequipment 3" 6 MHz 100 mV/ch $60. Intermodulation distortion analyser, power and milivoltmeter in one instrument – Heathkit $60. B Bloom (051) 49.4111 ext 4629 (after hours).

SELL: Trio shortwave receiver model 9R59 DS. Very little used. $150 ONO. Tom Klinkenberg (065) 83.5362, Port Macquarie.

WANTED: Old telephones, complete or parts any type or age. A Willett, 69 GL Sect RAAF Fairbairn, ACT 2600, (062) 70.6270.

QUAD Series 2 valve amplifiers, overhauled, in good condition, preamp operational $150. P Stein, PO Box 245, Narrabeen, NSW 2101.

AUSTRALIAN Radio DX Club, for shortwave and mediumwave DXers. Monthly magazine published. Write for details with 30 cent stamp to PO Box 67, Highett, Vic or PO Box 79, Narrabeen, NSW.

QUAD 33/303 pre-amplifier and power amplifier for sale. Unmarked, perfect condition. In original packing $400. Melbourne (03) 509.8551.

BACK issues ETI, EA, EE, PE, 140 altogether. 30 cents to 60 cents per issue or lot for $55 including bonus. Balgowlah, NSW Phone (02) 949.3499.

TRS-80 Hard Copy Casino Package. Tattslotto, One Arm Bandit, Russian Roulette, Brain Teaser, Flip Flop, Roulette, Mini Dice. $5 or $25 the lot. Box 283, Lorton 5333.

OSCILLOSCOPE for sale. Trio C01303.A. Excellent condition, vert amp 20 mV/ch to 50V/ch. Hor amp 10 Hz to 100 kHz. $150 or best offer. R Medson, Kilsyth, Vic. Phone 725.4415.

ROTEL turntable RP2500 Servo Belt Drive, variable speed, two years old $100. Contact Mr Jenkins, Berowra, NSW 47.0319 BH, 456.2075 (home).

US made, 28-30 MHz high gain low noise Oscar pre-amplifier 12 VDC. Complete with circuit diagram. New. $35. W H R Treloar. Phone (02) 239.5267. Office hours.

TANDY TRS-80 Computer Level 2 with 16K Memory, Video Monitor, cassette recorder, power supply with all manuals. $1,100 ONO. Adrian Smith (02) 47.0319 BH.

WANTED: Oscilloscope in working order. Cheap. Ring Sydney 438.2135 after hours.

2650 micro computer - ETI 632 VDU, 11K RAM, P/S, ASCII Kbd and encoder, RECI cassette interface, 4K BASIC, documentation, users group, software. $600 ONO. Bill, Box 781, Shepparton, Vic (058) 23.1258.

URGENT sale. ISE, AM-SSB power supply. Dick Smith TVI, Phone Adelaide 295.1270.

MEK6800 D2, Minibug III monitor, VDU interface, extra RAM. $200. EA low cost VDU, In case; working $200. D Johnson 2/13A Aberfeldy Ave, Edwardstown 5039.

ICs 3 off 6800 CPU's $9.50 ea; 4 off 8212 I/O $2 ea; Ken Herbst, 73 Eric St, Goodna 4300. Phone (07) 288.2757.

Morrow microcomputer front panel/CPU board, S100 assembled and fully socketed $180. R Pfotenhauer, PO Box 81, Lyneham 2602.

8" floppy disk drive BR803, $375, Tarbell FDI $150, CP/M operating system $70 docum extra, all three $550. R Pfotenhauer, PO Box 81, Lyneham 2602.

SWAP disassembled source listing of SWTPC 8K BASIC V2.0 or V2.3 for cassette of same, specify your version. R Pfotenhauer, PO Box 81, Lyneham 2602.

PHILIPS FM 320 UHF CB for sale. This unit in A1 condition with proven reliability and operation. $250. Call Mike (08) 356.5010.

S-100 edge connectors, gold-plated, solder-tail, $4.50 ea. Wire-wrap IC sockets, gold. 14 pin-55 cents, 16 pin-65 cents. All new. Graham (03) 89.6918 AH.

WANTED: Thorens TD-124 turntable, good price paid. J Webb, 6 Ilford Rd, French's Forest, 2086. Phone (02) 452.1712.

SELL cross-assembler written in PDPII BASIC – plus to assemble 8X300 machine language programs $40. J Churchill, 11 Terence St, Adamstown Hts, NSW 2289.

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At Hanimex, we believe that everyone should benefit from the latest technological advances.

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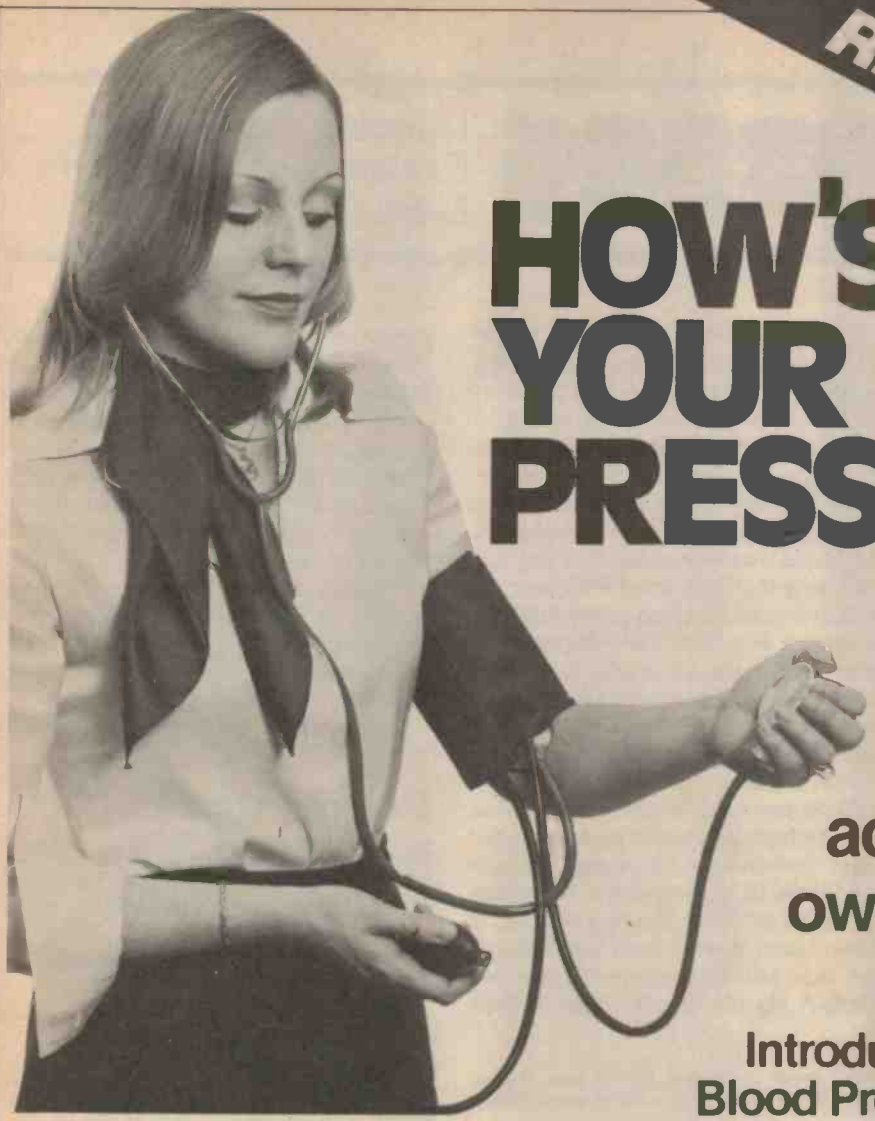

Take your own blood pressure quickly and accurately in your own home or office

Introducing the Unitrex Home Blood Pressure Monitoring Kits!

A SPHYGMOMANOMETER can help protect you and your family against one of the most dreaded human killers in the world – heart disease and other illnesses associated with abnormal blood. It is not surprising then that hundreds of thousands of people world-wide are buying their own personal blood pressure monitoring devices – NOT as replacements for regular medical checks. But simply as an extra precaution for peace of mind.

One of the best known home units is the Home Blood Pressure Monitoring Kit from Unitrex. A substantial quantity of these were imported by Australia's Caldor Corporation and sold extensively via chemists – they were also offered via mail order. These units were generally sold at $29.95.

Caldor have a number of these units still available which they are offering to our readers for the very low price of $19.95 – plus $2.50 post and packing. The kit includes the professional blood pressure unit itself, a nurse's stethoscope, a complete instruction book and three month's supply of blood pressure recording forms.

Please note: This offer is made by the Caldor Corporation, 12 Terra Cotta Drive, Blackburn, Vic., 3130. This magazine is acting as a clearing house for orders only. Cheques should be made out to 'Caldor Offer' and sent together with order to 'Caldor Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process orders and pass them on to Caldor who will then send out the units by certified mail. Please allow approximately four weeks for delivery. Offer closes July 31st 1979.

Caldor Offer

Please send me:

.....Quantity – Unitrex blood pressure monitoring kit/s at $19.95 each	$ .....
plus postage at $2.50 each	$ .....
TOTAL	$

Name .....

Address .....

.....Postcode ...

Please make cheques/postal notes payable to 'Caldor Offer' and send C/- Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011.

DREGS

Doodles, Ramblings, Exclamations, Gee-whiz & Stuff like that

Another item from our 'ideas which never quite made it off the ground' department.

Rather fed up with drilling holes in printed circuit boards, one of our staff used part of his brain to think about easier ways of producing holes, while the other part actually operated the drill.

Naturally, the best way would be some sort of photographic process. His first thought was to put a pattern of dots of fluorescent paint onto the board, and then let a microprocessor-controlled drill find all the holes and drill them. This idea was quickly discarded when he realised that that would only cope with one size of hole — unless you used different 'colours' of paint . . . but no, that was getting messy.

The next thought was to do it chemically. This was much more promising. Say, for example, that the blank copper-coated board was treated in such a way that the application of UV light to the glassfibre side caused the glassfibre to harden. The 'soft' parts — where the holes were to be — could then be etched away in much the same way as the copper. The only problem with the system was that the thickness of the glassfibre, and it's optical 'roughness', would mean that any UV which was incident on the surface of the board would end up pretty fuzzy by the time it reached the copper. The answer must be to produce a clear perspex-like material with UV hardening properties which had the electrical characteristics of glassfibre.

Given such a material, the copper could be pre-coated with photo-resist and the whole thing sold as a package. All the constructor (or manufacturer) would have to do would be to expose the copper side with the required track pattern, etch it and then expose the other side with the pattern of holes required. A couple of pilot holes drilled from the copper side would facilitate lining up. The holes could then be etched away and the board would be ready to use. This system would have the additional advantage that any shape or size of hole could be produced easily and quickly — strangely-shaped boards could be produced in the same way.

Having struck this idea, it's only natural to extend it to the other area where the drilling of holes is a problem — front panels. We'll let you ponder that one for youselves.

Any budding polymer engineers out there?

This month's gem is from Tandy, advertising their TRS-80 home computer. By the way, if any of you find a suitable photograph on an advertiser's leaflet (must be printed — not photocopied), then send it in — the more, the merrier.

Pot plants

Pursuers of the nouveau-trendy lifestyle in seedy, but fashionable, inner city suburbs in Australia's two largest cities seemed to have taken, en-masse, to **growing indoor plants** as a hallmark of their lifestyle.

The potted palm is passe, ferns are farout but . . . wonder of wonders . . . weeds are the winner this year! If you're successful in growing a particularly trendy variety, then you gain almost as much kudos — certainly more popularity — than if you acquired a Morgan classic sports car or similar.

Many tropical and sub-tropical weeds thrive in alkaline soil, regular watering and about 15 hours of sunlight per day. Now, we're getting enquiries from readers about designing a suitable artificial light with a timer. Fair go! this isn't Botany Today — still we did get into aquarium lights a couple of issues ago, perhaps . . .

Paperless office

We recently heard that 'the World's first paperless office' had been opened in the US. Incoming mail is immediately microfilmed, voice equipment is used to record dictation, which is then typed directly into a computer. One would think that the risk of the system breaking down would worry the management — all that information being lost. Not at all — the office is situated in the Watergate Complex, Washington.

REAL HI-FI

AND IT'S ALL IN OUR COLOUR CATALOGUE

The truth is, JVC have always produced real hi-fi components and we believe this current range represents JVC's finest range ever. Here are some real innovations and performance features to whet your appetite:— Quartz locked turntables with uncanny accuracy; Receivers/Amplifiers, some with built-in SEA Graphic Equaliser and DC, class A/B amplification; Cassette deck with JVC automatic computerised tape tuning; Computer designed speaker systems; Separate but matching JVC components designed to compliment one another, perfectly. And all this real hi-fi know-how is yours ...merely for the asking.

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A MORE COMPLETE CASSETTE DECK WOULD BE HARD TO IMAGINE.

Technics Model RS-641

Technics has gone to great lengths to bring you the RS-641 cassette deck. And it shows.

A glance at the front panel reveals such sophisticated features as a long life, highly accurate FL (fluorescent) bar graph peak/VU meter which makes conventional needle-type meters obsolete.

The distinct advantage of the FL meter is that there is no moving parts, as control is electronic so response time is instantaneous. Also there is no overshoot, a characteristic of the needle-type meter. The FL meter itself emits light, so there is no difficulty in reading and the left and right channel displays are aligned in parallel for easy viewing and comparison.

The RS-641 employs a vertical hold front-loading system with the cassette compartment boasting an indicator for tape left to run and a back projected light. There's also a music selector switch which allows you to locate the beginning of your favourite track . . . automatically.

What you can't see will impress you just as much. As with any quality deck today the Technics RS-641 has Dolby* noise reduction. Heart of the tape transport system is an IC-controlled FG servo DC motor which maintains unwavering speed accuracy. The result is low wow and flutter rating of 0.05% WRMS.

The impressive wide frequency response is due to the exclusive Technics HPF recording and playback head. So durable that it carries a limited 10-year warranty.

Technics cassette decks offer a lot more than you would expect. See for yourself at your Technics dealer.

For a National Technics catalogue, please write to:
National Technics Advisory Service, P.O. Box 278, Kensington, N.S.W. 2033

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National Technics hi-fi

T78.20