ELECTRONICS Australia HIFI NEWS

JANUARY, 1977
AUST $1.00*
NZ $1.20

SIMPLE CB CONVERTER, VIDEO TERMINAL FOR MICROPROCESSORS

MODERN RADIO: FROM A PUSHBIKE TO MARS!

Now from Sony: the Definitive Direct Drives.

No one knows better than Sony how clearly superior the servo motor direct drive system is in turntable design — after all, we started it all more than ten years ago with the revolutionary TTS 3000. All the vast experience we've gained in producing direct drives in the decade since plus some remarkable new developments, are incorporated in this outstanding new range for 1977.

Turntables

PS8750 Photo-Electric, Direct Drive Turntable

Sony's finest turntable, ever. This is the ultimate precision instrument for reproducing sound from today's wide dynamic range recordings. Incorporates a great number of operating features developed exclusively by Sony. The performance is incredible with wow and flutter 0.025% (WRMS). Speed deviation within 0.003% , Signal/noise 70dB (DIN-B).

Features:

• Crystal-control, "X-tal Lock", system governs speed with superb accuracy compensating automatically for any variation in load/speed factors. • "Magnedisc-servo" system using magnetic auto monitor for precise speed, irrespective of voltage variations. • Direct drive servo motor provides exceptionally stable and accurate performance. • Photo-electric sensor for disc-end has no impact on cartridge or disc. • Feather-touch switch for stop/start and reject. • Entirely new moulding material SBMC minimises cabinet resonance. • Arm pipe and shell made of carbon fibre suppresses resonant feedback. • Dual supported jewel pivot. • Static insulated dust cover allows use of extremely light cartridges. • Oil-filled rubber damping mat absorbs disc vibration. • Remote viscous-damped cueing. • Tone-arm height adjustment for various cartridges.

PS4300 Photo-Electric Fully automatic Direct Drive Turntable

This is the feature-packed direct drive that audio experts have been waiting for. Total control convenience is achieved without compromise in performance. Wow and flutter a virtually unmeasurable 0.03% WRMS and Signal/noise 70dB (DIN-B).

Features:

• "Magnedisc-Servo" control automatically monitors and electronically compensates for voltage variations, giving precise speed. • Brushless and slotless direct drive motor for great accuracy of speed. • Fully automatic system for start, stop, cut and repeat. • Photo-electric sensor for disc-end eliminates mechanical impact. • Auto lowering in manual operation. • Plinth made of accoustically "dead" SBMC material eliminates feedback. • Highly sensitive tone-arm and Sony high performance cartridge XL-15 included. • Anti-skating device and lateral balancer. • Feather-touch controls.

PS3300 Automatic Direct Drive Turntable

Now you can obtain the superior performance of direct drive at the price of a belt-drive! And the performance is astonishingly good with wow and flutter only 0.04% WRMS and Signal to noise 65dB (DIN-B). Aesthetically, the PS3300 is most appealing with a slim and ultra-modern appearance that will enhance any HI-Fi System.

Features:

• Brushless and slotless direct drive motor for precise, even speed. • DC-servo control monitors and electronically compensates for any spurious influences on speed. • Automatic system for arm return. Cut and repeat. • Illuminated stroboscope and electronic pitch control adjustments. • Viscous damped cueing system for protection of cartridges and disc. • Highly sensitive "S" tone arm and Sony's magnetic cartridge VL-32G included. • Anti-skate device and lateral balancer.

SONY®

Research makes the difference.

GAC S 7902

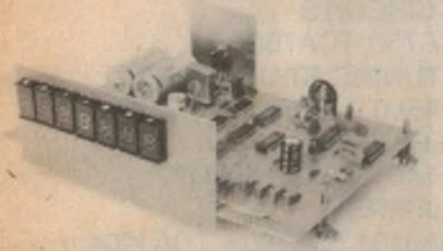
ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 38 No 10

This month, we commence desciption of our low-cost video data terminal design. Turn to p32 for the details.

Coming soon



Pictured is an advanced prototype of our new 200MHz frequency meter. It will have a seven digit readout, uses readily available parts and should cost about $100.

on the cover

When this attractive cyclist was snapped she was riding down the street listening to an Archer Road Patrol AM/FM bike radio. But we asked staff artist John Peterson to translate her onto the Martian landscape, as photographed from the Viking 1 spacecraft. It certainly improved the scenery but, more than that, the composite picture seemed to dramatise the spread of modern radio technology—from a battery set on a pushbike to a radio-controlled spacecraft transmitting colour pictures back from a distant planet. (Pictures from NASA and Tandy Corporation.)

CONTENTS—JANUARY, 1977

world of electronics and hi-fi

projects and technical

regular features

AUDIO ICs

Think
signetics
Think
PHILIPS

DESIGNER'S CHOICE

Here are the audio ICs you'll need to build up FM tuners, Pre-amps or Power amplifiers. Whether you are a manufacturer, serious hi-fi buff or simply a hobbyist you'll find the best of European and American designs in this range from Philips and Signetics.

- **FM AMPLIFIER/MIXER**
  SD6000
- **AM/FM CHANNEL RECEIVERS**
  TBA570, TBA700
- **AM RECEIVERS**
  NE546, TCA440*
- **FM DETECTOR/LIMITERS**
  ULN2111, TBA750A TCA420A, TCA770
- **FM GAIN BLOCKS**
  ULN2208, ULN2209
- **FM IF SYSTEM**
  CA3089
- **STEREO DECODERS (PLL)**
  TDA1005, UA758 (MC1310E)
- **DUAL LOW NOISE PREAMPS**
  LM381, LM382, LM387, NE542, PA239, TCA490 (UA739)
- **DC CONTROL CIRCUITS**
  TCA730, TCA750
- **ELECTRONIC TUNING STABILISERS**
  TAA550, TCA530, TCA750
- **POWER DRIVERS**
  NE540, SE540, NE541*
- **POWER AMPLIFIERS**
  TBA810,* TCA760B, TDA1004, TDA1010,* TDA2611*

When buying audio ICs from your local component supplier be adamant that you will only accept Philips/Signetics. You want the best. If he can't supply from stock ask him to order in for you. And if at the same time you need semi-conductors, ask for Philips transistors, Darlington transistors, diodes and rectifiers. They're Australian made – and by supporting the Australian industry you help them support you. Good business – good sense.

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Adelaide 2234022; **Brisbane** 2274822;
Perth 654199.

*(available soon)

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PHILIPS

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DEVALUATION

Most of the advertisements in this issue were already in the hands of the printer before November 28—the day on which the Federal Government devalued the Australian dollar by 17.5%. Some of the prices quoted in the advertisements may be affected by this decision.

Editorial Viewpoint

CB: "Why don't you tell us your policy?"

There has been quite a lot of pressure on us lately, here at EA, to make some sort of editorial policy statement regarding Citizens' Band radio. Not surprisingly most of the pressure has come from those with either committed views or vested interests: from the pro-CB lobbyists and equipment sellers on one side, and the anti-CB lobbyists and radio amateurs on the other.

Each side has produced reasoned arguments in favour of its position, and most of these are now fairly well known. We have tried to present them to our readers as objectively as possible, both in recent issues of the magazine itself and in the current 1976/77 Year Book.

What seems to us to have emerged from this is that in objective terms, neither side has produced arguments which are so convincing as to be worthy of our unqualified endorsement. There seems to be considerable validity in the pro-CB arguments that citizens have a right to be able to communicate via radio, and that CB radio can be used to advantage in many emergency situations. But countering these are the anti-CB arguments about interference to other services, the use of CB for anti-social and criminal activities, and the administrative costs and difficulties.

In short, the only way we as a magazine could come out with an unequivocal policy about CB would be by deliberately ignoring quite valid arguments from one side or the other. This would obviously be quite irresponsible, and would do no one any good.

On the other hand in a very real sense, all of the debate currently going on about CB is irrelevant. Due to lack of co-ordination between government departments, we already have a de-facto CB service, albeit a largely illegal one. And its future is going to be determined primarily by the actions and behaviour of the large number of people involved, rather than by our attitudes or even those of the authorities.

From a purely pragmatic point of view, it seems inevitable that sooner or later CB radio will have to be legalised in Australia—if only in a belated attempt to bring some order to the chaos. And it also seems inevitable that it will have to be approved on the established 27MHz band. Any attempt by the authorities to do otherwise would seem unrealistic and doomed to failure.

One thing is sure: CB radio is here, and pretending it isn't is unlikely to make it go away. Perhaps the only rational thing to do is find a way of adjusting to it.

—Jamieson Rowe

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The superb Luxor 'Music Centre' with record player, cassette deck, AM/FM radio.

Introducing the Luxor 'Swedish Sound'

Sweden's largest-selling range of high quality stereo systems is here to spread its superb sound around Australia

In 1923 at Motala in Sweden, Luxor first began mass production of radio sets. Today, Luxor are Sweden's largest selling, high quality stereo systems.

Record players of precision and reliability. Luxor features include a magnetic dynamic cartridge with adjustable stylus pressure. And a 16-pole synchronous motor and belt-drive for low wow and flutter.

The popular Luxor Record Player

Amplifiers with the quality of 'Ambiophonic sound'. Luxor have developed a 4-channel stereo system, called 'Ambiophonic sound', as a feature of the larger amplifiers. Other features include easily-operated slide controls, and switches for automatic frequency control, AM/FM radio, tape recorder, record player, headphones and loudness compensation.

Cassette decks for fast, smooth operation. With a Dynamic Noise Limiter or Dolby noise suppression. Automatic switching for chrome dioxide tapes. And, 90 second fast-forward and rewind on C-60 tapes.

The Luxor Cassette with Dolby noise suppression.

Speakers to suit all systems. From the Omni-directional Luxor loudspeaker with a 20 cm bass unit and four 5 cm treble units. To the 15 W speaker with a 13 cm drive unit and 6.5 cm treble unit.

The Omni-directional loudspeaker for floor standing adjacent to wall.

They look as good as they sound. Luxor stereo systems combine a careful attention to detail with an unmistakable touch of design flair. Elegant and sleek. In superb cabinets of walnut, teak and rosewood. And black or white lacquer.

The superb Swedish sound. As Sweden has developed in the world of music, so Luxor has developed in reproducing that sound.

The more you know about Luxor stereo systems, the more impressive they become.

The need for distributors and stockists to spread the sound. Distributors are required in Queensland, South and Western Australia and Tasmania. And stockists are required in all States. See the coupon below.

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LUX 148

ASSISTED RESONANCE

True, multi-purpose auditoria are now possible

A technique used for improving the acoustic qualities of London's Royal Festival Hall and which took ten years to perfect is now being applied in other big halls, and not only in Britain. Two multipurpose halls in the United States of America are being equipped with it.

"Assisted resonance", as the technique is called, is not just a means of improving acoustics of existing halls; it can also be used to give complete acoustic flexibility to new multipurpose buildings.

The musical quality of a hall depends heavily on the reverberation time (rt). Broadly, this is the time it takes for a moderately loud sound to die to inaudibility.

The "rt" depends, in turn, on the hall's volume and the amount of sound absorption in it. The bigger the volume, the longer the rt, in that it takes longer for sound waves to travel between the room surfaces; the more absorption in the room the shorter the rt, because more energy is absorbed each time a sound wave hits a surface. Much of the absorption is due to the audience and therefore on the number of seats.

The ideal reverberation time of a concert hall is put at about two seconds but, for speech, the optimum is nearer one second and this is what makes it difficult to design a truly satisfactory multipurpose hall.

When London's Royal Festival Hall was designed in 1948, the aim was an rt of 2.2 seconds. Costs later reduced this to 1.7 seconds because of changed seating capacity.

In 1964 the Greater London Council, when planning a modification of the hall, decided to upgrade the acoustics and called in Britain's Building Research Establishment (BRE).

Conventional remedies would have been to replace the ceiling—highly expensive and affecting only some frequencies—or to remove 1000 seats, turning it into a 2000 seat auditorium, which would have been unpopular with management and performers.

The BRE decided to seek other ways, but experiments took some time in a hall which was so busy that research workers could operate only for a few hours weekly. However, by the 1970s they had markedly improved the rt for the most important parts of the sound spectrum.

This was achieved by the assisted resonance method. Helmholz resonators were installed in the ceiling, each consisting of a microphone mounted on a backplate which is critically tunable so that it responds only to one chosen frequency. Its signals are amplified and fed back into the auditorium through a loudspeaker and this compensates to some extent for sound absorbed in the room and lengthens the rt time.

Since each resonator covers only one frequency, many channels—perhaps between 100-200 according to hall conditions—are needed adequately to cover the audio range most satisfying to the concertgoer's ear.

Since the success of the technique at the Royal Festival Hall two new multipurpose auditoria have been opened in the USA. Their good acoustics depend on BRE's electronic system.

The first installation—made under licence through Britain's National Research Development Corporation—is in a big pavilion in Concord, California. This has a semi-outdoor, bowl shaped auditorium seating 3500 people under a 200ft (60m) square roof and 4500 on the surrounding grassy slopes. Performances include circuses, rock and jazz, ballet, opera and orchestral concerts. Conferences are also held there.

The acoustic installation provides for a basically short reverberation time range of 1.4-1.7 seconds, capable of boost to 2.1-3.0 seconds by the assisted resonance system.

The second application is in the Scottsdale Centre for the Arts, Arizona, an 800-seat auditorium mainly used for exhibitions. By assisted resonance its characteristics can be varied to suit theatrical, chamber music or orchestra performances.

In Britain a further satisfactory installation has been made in York University Central Hall, which is primarily an examination and lecture hall, to improve it for musical concerts.

The valuable work of the BRE senior scientific officer responsible, Peter Parkin, and his colleague, Ken Morgan, was recognised this year by the award of the Rayleigh Gold Medal of the Institute of Acoustics.

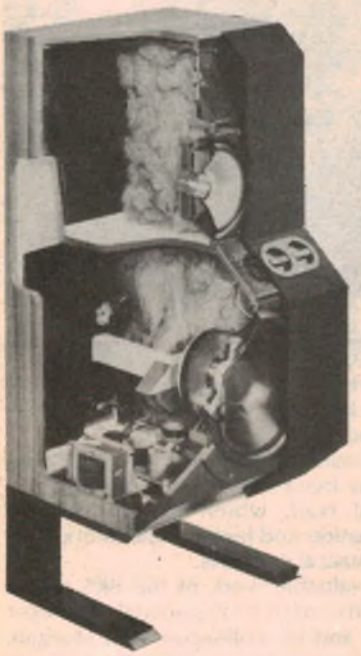
Problems of mixed use in public halls are much in the minds of Britain's local councils, who are eager to secure the best return on their investments in this area.

The London Borough of Hillingdon is just completing a 900-seat multi-purpose hall designed primarily for orchestral and operatic presentations, with occasional drama performances. Since it is on the threshold of London Airport, the hall has a potential for conferences and international business meetings, making good speech response important. Assisted resonance is being incorporated to balance all its needs.

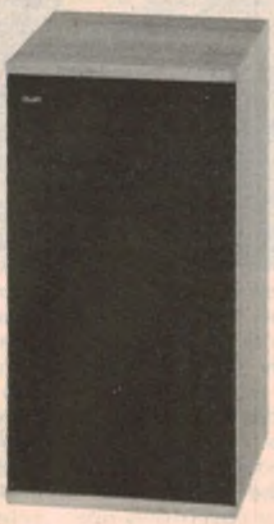
Another borough council, Reading, about 40 miles (60 km) west of London, is building a multipurpose hall in which similar care has been taken to ensure that acoustics match the usage. This hall, now nearing completion, seats 950 for theatrical presentation and 1500 for orchestral or choral concerts. Assisted resonance will ensure optimum response for a poetry reading or a symphony concert.

Each B & W speaker comes with its own written proof of superb performance:

B&W's reputation is based on producing clean natural sound without distortion, even at low volume. Each B&W speaker is tested in an Anechoic Chamber and issued with its own individual pen graph. You know exactly the performance of the speaker you are buying

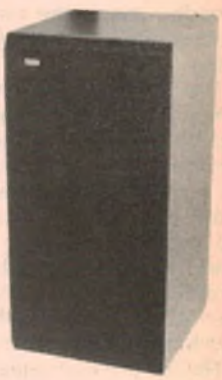


B&W DM6 Monitor
A brand new design. A high powered dynamic loud-speaker with low colouration and very high transient performance.



B&W DM2A Monitor
A more conventional design, utilising B&W research into acoustic line rear loading.. Brilliant clarity and lack of distortion.

B&W DM4 Monitor
A speaker with large B&W Monitor characteristics; its performance surpasses speakers of much greater size.



B&W DM5
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Australian breakthrough:

CUERAC AUTO PROGRAMS

Developed in Melbourne by Consolidated Electronic Industries Pty Ltd, the CUERAC "random access cartridge machine" provides a compelling new option for radio stations planning to automate. It can access and build a program around cartridges chosen in any sequence from a working library of 2500—all under computerised control.

In a never-ending battle against rising costs, more and more broadcasting stations are trying to get away from traditional operating procedures.

Initial steps toward automation involved the re-recording of most-used items on to broadcast type tape cartridges, complete with automatic cueing signals, the cartridges then being loaded into carousels for push-button or sequential playing.

Alternatively, or as well, complete musical programs may be pre-recorded on long tapes, with gaps in between into which announcements can be slotted (sometimes pre-recorded also), plus time calls (often derived automatically from a "talking clock"). At this level, automation provides a degree of labour saving, but its main benefit is to compress each 24 hours of programming into a more compact production effort, when staff are conveniently available. But, of course, time is still involved in pre-recording programs and, once done, it is a major job to vary the content.

The CUERAC system overcomes this problem in a very neat way. On the assumption that most stations build their programs from short selections or segments, it assumes that those most commonly used will be pre-recorded on to standard NAB "A" size broadcast cartridges, operating at 7½ips and each accommodating typically up to 6 or 7 minutes of program, plus auto cue tones. To this extent, it is based on standard practice.

However, in the CUERAC system, the cartridges are then loaded into a large dust-proof cupboard-size rack 2400mm high x 1690mm wide x 985mm deep. Specific slots are available for 500 cartridges arranged in 10 columns of 50, each slot being identified by a 3-letter code.

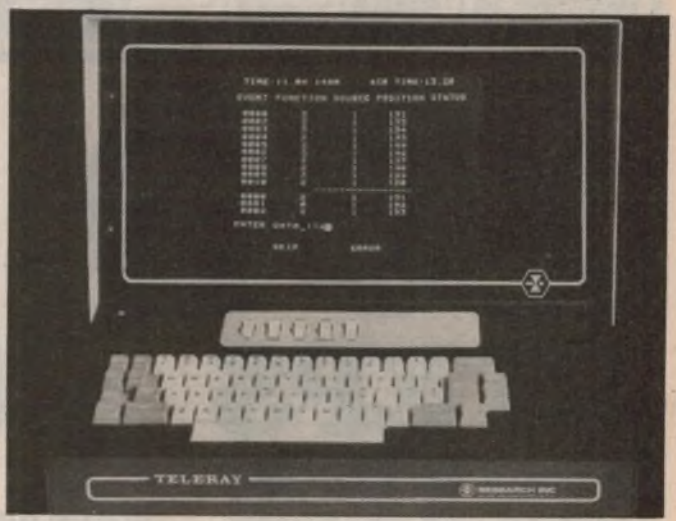
For many stations, the contents of 500 standard cartridges would provide an adequate library for current working, remembering that cartridges can be individually replaced or re-recorded on a progressive basis without otherwise disturbing the operation of the system. However, where a larger working store is considered necessary, up to 5 racks can be merged electrically into the one system.

The important thing, however, is that the racks are not just passive stores. A servo-controlled gripper mechanism can select any cartridge in the stack and transport it to an in-built playing deck, later restoring it to its proper place. This it can do under the direct command of an on-duty disc jockey or as part of a pre-programmed sequence.

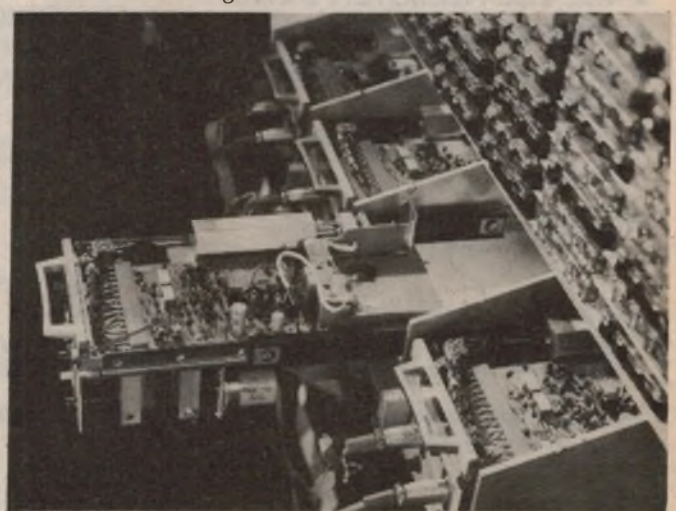
Programming and monitoring of the CUERAC system leans heavily on computer technology, with keyboard and punched tape access and a video terminal to display reference times, status, and the next 10 events. The associated computer has a ferrite memory core so that the program cannot be lost if power is interrupted.

For further information: Consolidated Electronics Industries Pty Ltd, 15a Anderson Rd, Thornbury, Vic 3071.

A close-up view of the CUERAC 500-slot cartridge library and the servo controlled "gripper" mechanism which transports selected cartridges to and from the playing decks. Adjustments permit cartridges to be positioned accurately within each slot.



The visual display terminal, with its ASCII keyboard and, on the screen, the display of a typical program format. While just figures to the casual observer, the readout gives a detailed rundown on events (and non-events!) to an operator accustomed to the coding.



A line-up of cartridge replay units in one of the 500-slot libraries. One unit is in the withdrawn position for head cleaning and servicing. The replay units are the standard CEI Cuemaster 900 series which have been widely used in the broadcast industry.

THIS CALCULATOR LEARNS!

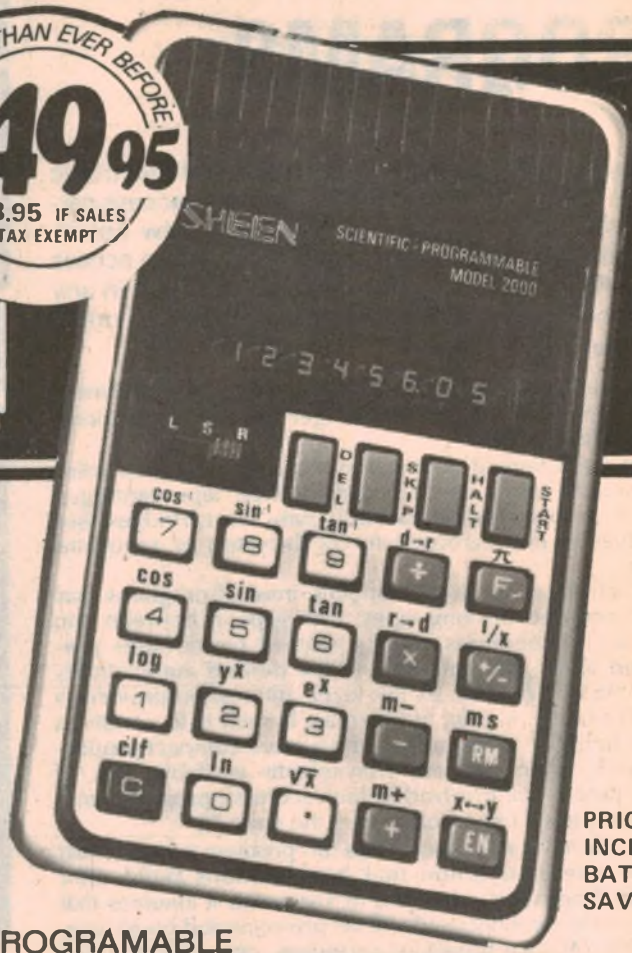
WHAT IT DOESN'T KNOW ABOUT FIGURES....YOU CAN TEACH IT!

FULLY PROGRAMABLE CALCULATOR From SHEEN

PAY LESS THAN EVER BEFORE

$49.95

$43.95 IF SALES TAX EXEMPT



100 STEPS

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- ★ 4-LEVEL REGISTER STACK
- ★ 12 MONTH GUARANTEE
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DO THIS WITH RE-ENTERING:

$$\frac{(5 \times x) + (x^2 - 8) \times (6 + Y)}{N\ (5 \times x)}$$

PROGRAMMING FUNCTION

The program is loaded by doing the problem with the calculator in the load mode and then switching to the run mode to to play back. Any number of halt points can be inserted in the programme to retrieve intermediate information.
The programme can be edited in the step mode and "de-bugged" 1 step at a time with the delete key. Multiple programmes can be stored and jumped to with skip key.

$49.95 ACT NOW! SEND THIS COUPON WITH PAYMENT INCLUDING $2 FOR POST & PACKING. DONT MISS OUT!

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MAIL NOW!

SHEEN ELECTRONICS AUST.
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MELBOURNE, VIC. 3043

Kef 103 Loudspeaker has steel baffle

The KEF 103 has a steel baffle which can be readily removed and rotated through 90 degrees. This provides optimum dispersion for vertical or horizontal mounting. Power rating is 100 watts on program material, and the woofer voice coil is claimed to withstand very high temperatures.

Outwardly, the KEF 103 is little different from many of its competitors on the market. It has a timber cabinet veneered on all sides and a black foam grille. Lifting the enclosure reveals the first difference — it is quite heavy for a relatively compact system.

The second difference lies in the acoustic foam. It adheres to the baffle not by the usual Velco strips, but by magnetic tape, the same as used in refrigerator doors. And the baffle is steel, not timber. Notice those four large chromed screws. They enable the baffle to be removed and rotated so that drivers can be optimally oriented for best dispersion with either vertical or horizontal mounting of the cabinet.

Dimensions of the enclosure are 500 x 330 x 245mm (W x H x D) and the internal volume is 25.4 litres. Mass is 19kg.

Apparently KEF decided on the steel baffle to enable it to be simply removable while still being adequately rigid. Thickness of the steel is 14G, and there are thick bracing strips down each side. The steel baffle would also appear to provide a more consistent seal around its periphery and around the drivers.

The cabinet is completely sealed and is lined with three layers of bitumen-loaded hardboard to deaden panel resonance. In addition, all internal panels are lined with thick foam plastic, and the woofer braces the rear panel via a rigid cardboard tube attached to its magnet structure.

The two-way system employs a 35mm diameter tweeter and a 150mm diameter woofer with a curvilinear Bextrene cone and PVC roll surround. It is unusual in having a short voice coil which is totally immersed in a strong magnetic field provided by a large ceramic magnetic. This technique is claimed to keep non-linear distortion to a very low level. One likely result of the short voice coil is that it would have a "soft" overload characteristic.

A total of nine components make up the crossover network, which is accommodated on a PC board and mounted on the baffle behind the tweeter.

A drawback common to many modern loudspeaker systems seems apparent on the KEF 103. That fragile tweeter dome is proud of the steel baffle, and quite vulnerable to damage. Nor is the foam grille likely to offer any protection. We are more in favour of speaker grilles which have acoustically transparent cloth stretched over a substantial perforated steel frame.

One could further argue that there is no reason for grilles to be so readily removable. While it may be of benefit to be able to view the drivers in the hifi showroom, easy access to loudspeakers in the listener's home may be a hazard, especially when there are young children on the loose.

Nominal impedance of the system is 8 ohms. We found it close to this figure over the whole range, apart from the system resonance at 55Hz which yielded a value of 25 ohms. Maximum power rating of the system is 100 watts on program and 80 watts continuous over the range 100 to 2.5kHz, reducing to 12 watts above 3kHz where the tweeter takes over. The woofer voice coil is claimed to safely withstand short term overload to at least 350°C and continuous operation at 250°C.

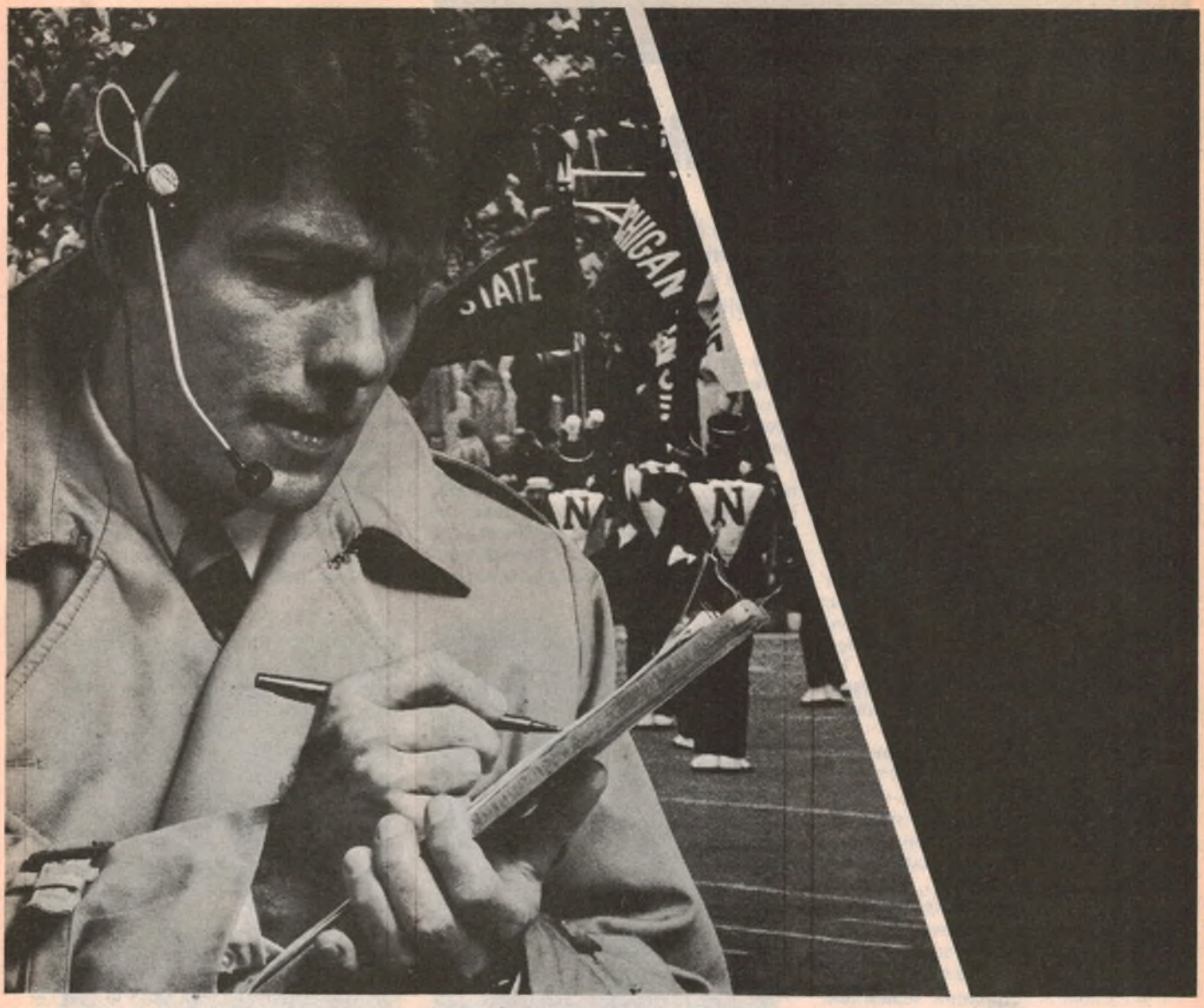
Listening tests reveal that the KEF has a very smooth response over the whole audio bandwidth, with usable bass down to below 40Hz. It performs equally well on orchestral, pipe organ or hard rock. Overall sound quality is neutral and the bass is very well damped and controlled.

But these admirable results have been achieved at the cost of efficiency. We found that a 100 watt per channel amplifier was a minimum requirement if moderately loud sound levels are desired in medium size rooms. And the loudspeaker ratings suggest that the woofer, at least, could handle considerably more power on music programs.

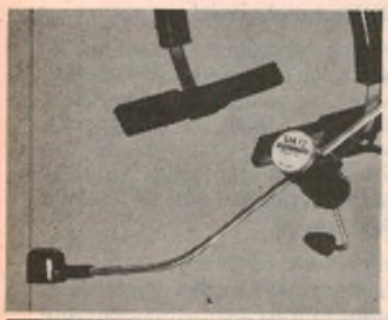
But this apparent drawback could be an advantage for people who want a fine loudspeaker system to match one of the very high quality high power amplifiers currently on the market. This would enable the best overall system signal-to-noise ratio to be obtained.

It seems a paradox that the best quality amplifiers which have a very high power output must be matched to inefficient loudspeakers to obtain the best results. This is particularly the case when the listening room is none too large. For these situations, the compact KEF 103 would be an ideal choice.

Recommended retail price of the KEF 103 is $558 per pair. Further information and demonstration can be obtained from high fidelity retailers. Australian distributors are Audioson International Pty Ltd, 64 Winbourne Road, Brookvale, NSW 2100. (L.D.S.)



Next best thing
to a sound proof booth.



Shure's new headset microphones are coming through loud and clear. With their unique miniature dynamic element placed right at the end of the boom, Shure's broadcast team eliminates the harsh "telephone" sound and standing waves generated by hollow-tube microphones. The SM10 microphone and the SM12 microphone/receiver have a unidirectional pickup pattern that rejects unwanted background noise, too. In fact, this is the first practical headset microphone that offers a high quality frequency response, effective noise rejection, unobstructed vision design, *and* unobtrusive size.

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AE104/FP

Tandy BD-1000 belt-drive turntable

Tandy Electronics have recently released a low-priced belt-drive turntable, type BD-1000. It is manually controlled and has a balanced arm, damped lowering device and adjustable anti-skating. A magnetic cartridge with conical diamond stylus is included.

When the operating convenience and high performance of good quality automatic turntables is considered, the popularity of manually controlled turntables is surprising. Perhaps it can be explained in terms of their lower price and mechanical simplicity.

Certainly the appearance of the BD-1000 is one of simplicity. There are only two control levers and a minimum of bright metalwork. Dimensions of the complete unit in base and cover are 442 x 134 x 372mm (W x H x D) and mass is 5kg.

That very light mass of 5kg points up one of the interesting features of the BD-1000. The plinth is made not of timber, but plastic. It is a single injection moulding finished in metallic grey. This reviewer is not enthusiastic about the plinth—it does not seem adequately rigid, although this does not seem to have an undue effect on performance.

Similar doubts can be expressed about the platter. It is a very light aluminium injection moulding which only weighs 500 grams. Here there is a more direct correlation between mass and performance so we must express a preference for a heavier turntable.

Spring-loaded hinges are fitted to the tinted perspex cover which can be easily unclipped if desired. About 60mm clearance is required at the rear of the plinth to allow the cover to open fully.

A 4-pole synchronous motor with a stepped pulley drives the platter via the usual flat belt. The speed change lever acts to move the belt up or down the spindle to select 33 or 45 rpm operation. The matching lever on the right-hand side of the baseplate combines power switch and control of the cueing device. The cueing device is hydraulically damped on both lowering and lifting.

An unbranded magnetic cartridge is fitted to the removable headshell, which has 12.7mm mounting centres, standard EIA locking collar and lead colour code.

The Tandy BD-1000 has attractive styling and simple operating controls. A magnetic cartridge is included in the low overall price.

The cartridge stylus assembly is removable and the recommended playing weight is 2 grams.

Balancing of the tonearm with the rotatable counterweight tended to be a little critical. This appeared to be because the range of playing weight provided by one rotation of the counterweight is fairly large at 4 grams.

We also found the instructions on the antiskating adjustment ambiguous. This is a small matter but can easily be improved with a better diagram and text in the owner's manual.

Suspension of the turntable renders it reasonably proof against heavy floor vibrations but the unit does tend to dance around a little when the control levers are operated. Provided this is done carefully, the arm is not disturbed.

While we approve of the fitted three-core mains cord and three-pin mains plug, we found a problem with the turntable earth wiring. Because the arm is earthed via the three core flex rather than via the signal leads, all manner of mains borne interference and broadcast station pick-up was being fed into the signal leads. It is but a moment's task with a soldering iron to correct the arm earth wiring and produce interference-free operation.

In other respects the Tandy BD-1000 is hassle-free in operation. It is possible to hear some belt noise when close to the unit, but this would only apply in a very quiet environment.

Performance of the magnetic cartridge is quite respectable. At 2 grams it gave very slight mistracking of the +12dB drum test track on the W&G 24/2434 test disc. Frequency response was within 2db from 20Hz to 16Hz and 9dB down at 20kHz. Channel balance was within 1dB. Separation between channels was much better in one direction than the other, but not inadequate at about 18dB at 1kHz in the worse channel.

Sound quality of the cartridge is quite pleasant and free of vices, although the arm is capable of accepting a much better cartridge if desired.

Wow and flutter performance of the BD-1000 is not marvellous. It gave a peak reading of between 0.1 and 0.3% (DIN 45507), which is audible on constant tones. Rumble performance was good. We achieved an unweighted measurement of 45dB with respect to 5cm/sec.

Accessories provided with the unit are 45 RPM spindle adaptor, small screwdriver, phial of oil, rubber bush, spare belt, owner's manual, and earth wire.

Our summary of the BD-1000 will appear ambivalent. There are a number of compromises in its design which are probably inevitable in a low price unit. But at $109.95 for the complete unit, including base, perspex cover and magnetic cartridge, it will have considerable appeal to those on a tight budget.

The Tandy BD-1000 turntable is available from Tandy stores throughout Australia. (L.D.S.)

Tape: still plenty to argue about!

When magnetic recording tape first appeared over the hifi horizon, it was heralded by its champions as the beginning of a new era—one that would be free from all the dreadful things that had come to characterise other systems and, in particular, the disc. But, as the years roll by, one thing is certain: tape, too, has its problems and its areas of contention.

by NEVILLE WILLIAMS

In certain important ways, the "new era" part of the claim is justified. As one who struggled to make an occasional indifferent disc record on an amateur basis, I can never quite get over the ease with which one can now make excellent tape recordings, almost any time, anywhere.

And, of course, the modern disc scene relies very heavily on tape as the mastering source. How much dearer—and rarer—LP records would be, if they had to be recorded as uninterrupted performances on disc, or assembled from other disc masters.

But what the tape champions so often used to rave about was much nearer to the domestic scene: tape would get rid of all the old problems that had traditionally bugged sound reproduction in the home. For example:

- **No more problems with stylus wear.** True: the tape system offers head wear, instead!
- **No more clicks and pops due to dust on the surface of the disc.** True: tape gives you a smooth persistent hiss instead, depending on the nature of the tape and the recording, and whether or not the heads, guides and tape have become permanently magnetised!
- **No more mis-tracking due to the accumulation of fluff around the stylus, or gunk in the groove.** True: tape mistracks because of the build-up of loose oxide "gum" around the gap in the playing heads!

One could go on, of course, but the point should be clear enough: both disc and tape can fill a vital role for the hifi enthusiast, both have their intrinsic advantages and disadvantages, and both can suffer when things go wrong.

This last observation is illustrated by a couple of stories related to the writer in recent days.

One concerned a recording engineer who found his efforts being frustrated by dropouts and oxide shedding with a highly reputed brand of mastering tape. Having encountered the problem on several occasions, he swore off the particular tape and changed to an opposition brand.

There the matter might have rested had he not encountered an American engineer representing the company, who naturally insisted that the complaint was quite uncharacteristic of the product. It transpired, in due course, that the tape in question had come from a batch which had, indeed, been found faulty in the USA a couple of years back and had been withdrawn from sale. No one had thought to alert the Australian outlet, with the result that spools from the batch had filtered randomly into supplier's and user's stocks throughout the nation, to be picked up and used, also at random.

A rather similar story came to light involving a well known brand of blank cassettes. In this case, the user noted a tendency for the level to vary randomly on either or both stereo tracks—not complete dropouts but marked long-term variations in level. The transport and heads were checked and cleaned, and different decks compared, all to no avail.

Again, the problem turned out to be oxide shedding—not as loose particles but "gummy" enough to build a tiny land sufficient to lift the tape microscopically away from one or the other of the head gaps. The land would build up and then as mysteriously be rubbed away again.

It seemed almost certainly to be another instance of a faulty batch with the difference that it was picked up in Australia first—and then only because the person concerned was working on a critical project which necessitated close and fairly constant awareness of the level meters.

Curiously, when I happened to relate the circumstances to a member of our own staff, he professed to have encountered precisely the same problem. There

CASSETTE SOUND IN YOUR CAR OR VAN

Claimed by Pioneer to be the smallest cassette deck in the world, the Modular 55 (right) measures 5in wide by 6in long by 2in deep, and can therefore be installed by a handyman in-dash, under-dash, in a glove box or even under a seat. Yet, for all its small size, the Modular 55 has volume, bass, treble, loudness and balance controls. It is intended for use with a Modular 10 amplifier (left) at 5W per channel (System 1, $173) or with a Modular 30 amplifier (rear) at 15W per channel (making up System 2, $208). A range of speakers is available from Pioneer, not included in the above prices. (Pioneer Electronics Pty Ltd, 178-184 Boundary Rd, Braeside, Vic 3195).

was just one point of difference: he nominated as the culprit an entirely different brand of cassette!

There is no particular moral to the two stories except that they emphasise how utterly critical quality control must be for the manufacturer who aspires to produce a recording tape that will be consistent in its mechanical and electrical properties, from batch to batch, and from month to month. It would be interesting to know how many dogmatic positions have been taken up by recordists, relative to the quality of different brands on the basis of their experience with dubious batches.

Along a more general line, the manufacturers of Memorex tape have recently "stirred the pot" with a published statement about the relative head wear caused by three general classes of tape: iron oxide, cobalt-modified iron oxide, and chromium dioxide. Reflecting work done in Dupont's Wilmington, DE laboratories, the information was passed to us by Leroya Industries Pty Ltd, of 156 Railway Parade, Leederville, W.A. 6007.

Argument about the different tape formulations has been going on for a long time—much of it to do with head wear—and much of it summed up by a debate in the US magazine "Stereo Review" for March '76. The case for ferric oxide was put by Tor Silverstsen of Tandberg of America, while that for chromium dioxide and other special formulations was put by Andrew G. Petite of the Advent Corporation.

Tor Silvertsen claimed that chromium dioxide posed a wear problem, which had caused manufacturers to turn to ferrite heads; however, ferrite heads tended to saturate before the tape coating, often cancelling any advantage which it might offer. Therefore, to obtain the full benefit, it had been necessary to go back to magnetically adequate (and softer) head materials, thereby retreating again to a head wear situation.

To which Mr Petite replied "Balderdash"!

His company's tests, he claimed, suggested that chromium dioxide was no more abrasive than the average ferric coating and was, in fact, less abrasive than the coating on some premium ferric tapes.

Which must surely leave the non-expert non-plussed!

But it serves to focus attention on the work by the Dupont Labs, which would seem to demonstrate that chromium dioxide isn't the hazard to heads that it is often claimed to be.

One series of Dupont tests involved running tapes over a dummy head with a contact surface composed entirely of highly permeable mu-metal. The loss by wear was then measured and showed the following results:

TAPE	WEAR (u/100 hours)
All Cr02 tapes	17
All iron tapes	10
TDK-SA	12

(Cr02 tapes included Sony, BASF, Dupont. Iron tapes included Maxell, Scotch, Ampex and Fuji).

Curiously, quite different results were found when the tests were repeated using high quality permalloy heads, as found in top-line cassette tape decks:

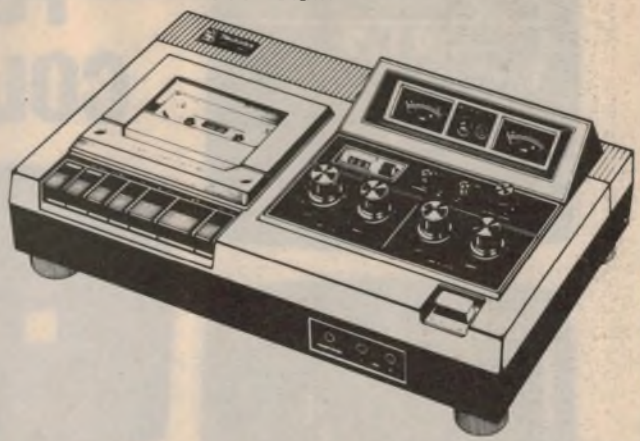
TAPE	WEAR (u/100 hours)
All Cr02	5
All iron tapes	2
TDK-SA	20

No similar tabulation is given from ferrite heads but a graph of wear after 25 hours suggests that TDK-SA is unkind to this material, tending to wear it faster and more unevenly than Cr02 tape, particularly near the edges and equivalent to the left hand track of the stereo pair. After 300 hours, response from the TDK-SA set-up was down 1.5dB at 10kHz, while that from an equivalent Cr02 set-up was still at reference.

From the wording of the report, one gathers the impression that abrasiveness varies markedly from one brand of tape to another, and in its effect from one type of head material to another. In fact,

CASSETTE SOUND IN THE HOME . . .

Haco Distributing Agencies Pty Ltd have just announced the release of two new Technics hifi stereo cassette decks, a top loading model RS-620 at a recommended retail price of $239.45 and the front loading model RS-630 at $229 recommended retail.



The RS-620 on the right seeks to present the most-wanted features and performance in an economical price bracket. Play and stop buttons are enlarged for ease of operation and the twin meters may be used either in average or peak reading mode to make possible most accurate use of the tape headroom. Another welcome feature is provision for microphone mixing.

Dolby-B facilities are incorporated, along with provision for both normal and chromium dioxide tape. The head is claimed to be "super-hard permalloy". Wow and flutter is rated at 0.12% RMS, S/N ratio 49dB (higher with Dolby) and frequency response 30-11,000 (DIN) with normal tape or 30-12,000 (DIN) with Cr02 tape.

In the front loading deck RS-630 (lower left) special care has been taken to ensure that the cassette can be seen in operation, and also to provide access to the heads for easy cleaning. Like the RS-620, it has wider play and stop buttons, peak and average level meters and it can accommodate any popular tape currently on the market. It has provision for mic input, although without mixing, and its electrical specifications are somewhat higher than the RS-620.

Technics claim that the head life should be very long—up to as much as 10 years.

(Further information: Haco Distributing Agencies Pty Ltd, 57 Anzac Pde, Kensington, NSW.)

From Toshiba, this PC 4020 cassette deck, is fitted for Dolby, and with automatic compensation change for normal or Cr02 tape. Performance specifications are excellent. For economy installations Toshiba offer the PC3001. (From Toshiba-EMI Aust Pty Ltd, 301 Castlereagh St, Sydney.)

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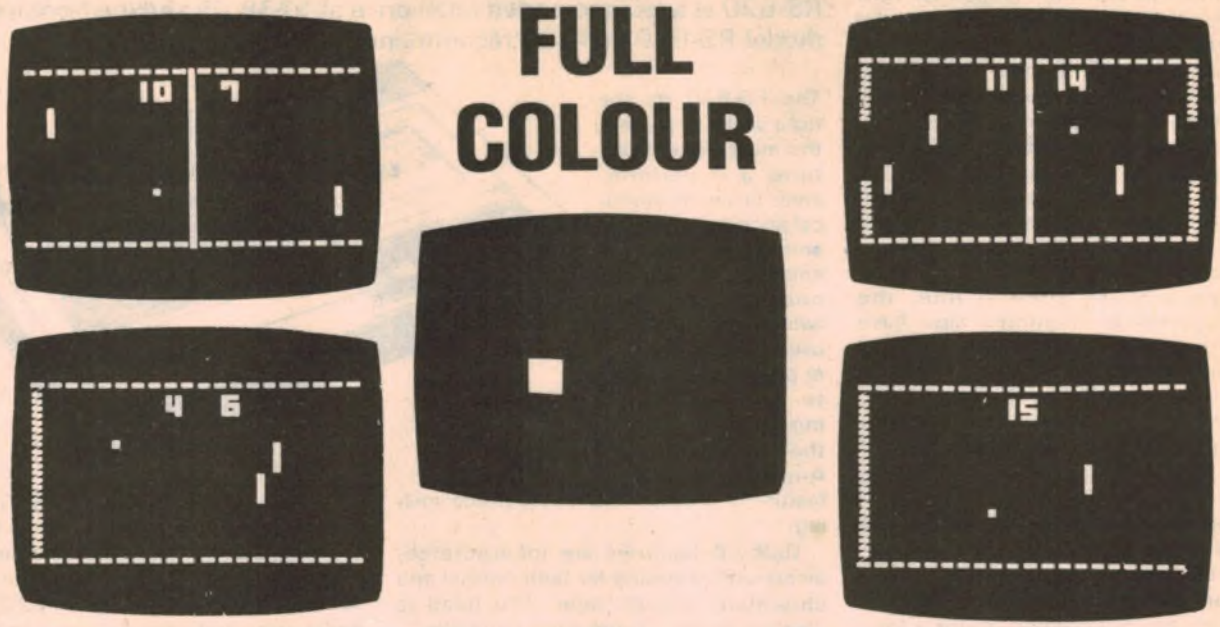

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HIFI NEWS

Tape—but in the big league!

A well known firm in the professional recording field, Leevers-Rich are now represented in Australia by Unison Productions, of 118 Terry St, Rozelle, NSW 2039.

Pictured at right is the Leevers-Rich E200 ¼-in professional recorder, featuring modular construction for versatility and ease of servicing. Plug-in modules adapt for mono, twin or stereo, a choice of speed combinations, appropriate compensation and alternative recording characteristics. Specifications and facilities are to full professional standards. A new console model, BE1000, due in Australia shortly, is expected to sell at a lower price than the E200, although its specifications also make impressive reading. Unison Productions advise that they are able to supply equipment in rack mounted form, complete duplicating systems and such ancillaries as Leevers-Rich bulk erasers.

Dupont researchers have yet to prove that the particles are totally to blame for head wear; it could have a lot to do with the binder. Certainly, Cr02 does not emerge as the villain of the piece.

We quote:

"Audio head wear has always received considerable attention. There seems to be as many theories, pseudo-facts, and accusations as there are consumers.

"Dupont's extensive work on head wear has uncovered several interesting facts:

1. In general, chromium dioxide tapes are similar in head wear to iron oxide tapes.
2. The consumer can expect a head life in excess of 1500 hours if he uses only Cr02.
3. The cobalt-modified iron oxides, like

JVC super portable

JVC's new 3050AUL "Super Portable" must be one of the most impressive offerings, thus far, for people on the move. It combines a minature TV receiver with 3-inch diagonal screen, and a radio covering the AM broadcast band, FM and short waves from 6 to 18MHz. It can operate from internal batteries, a rechargeable Ni-Cd battery pack, mains supply unit, and 12V car battery, drain being 10W on mains, 4.5W on other sources. Recommended retail price is $269. (Hagemeyer (Australasia) B.V. 59 Anzac Pde, Kensington, NSW 2033).

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TAPE HEADS BY THE HUNDRED

Among the seemingly more hopeless tasks that one could dream up might well be that of providing replacement heads for a significant number of the tape recorders which have found their way on to the world's markets during the last couple of decades. Yet it is precisely that task which has been tackled head-on by Nortronics, of Nth Minneapolis, USA.

The 50-page quarto-size catalog, illustated on the right, dramatises the magnitude of the task. Four pages near the front, in close and detailed tabulation, are necessary to summarise the Nortronics range of heads, showing mechanical details, inductance, impedance, resistance, gap, crosstalk, bias current and voltage, record current, output, response, etc.

Then follow 24 pages of close tabulation relating the Nortronics range of replacement heads to the needs of commercial recorders and this reads like a who's-who of brands—from Admiral, Aircastle, Airline and Aiwa, through Hammond, Heath and Hitachi, to Yashica, York and Zenith!

Then follow sections covering professional requirements, in particular broadcast cartridge recorders.

And, it is sobering to note, on page 43, a summary of the track configurations that has had to be covered: 4 for 0.15in cassette tape; 7 for 0.25in tape; 2 for 0.5in; 2 for 1.0in; 1 for 2.0in tape—the latter 16-track.

The last few pages are devoted to tape hardware and gadgetry likely to be needed by those involved in tape machine service.

Nortronics is represented in Australia by Emac Industries Pty Ltd, of 9 Audesly St, Clayton Sth, Vic 3169. (Tel Melb 544 5157.)

According to Emac Manager Ian McNally, there are sufficient stocks of the catalog on hand to meet the needs of professional audio engineers, maintenance and service personnel; the cost is $5.00 each, posted.

Alternatively, a short form catalog is available free, again to those professionally involved in tape recorder maintenance and service.

Not surprisingly, Emac do not carry in Australia the full catalog range of Nortronics heads, but they do have in stock a representative range of those most frequently required for the local market.

However, where particular heads are not available ex-stock, most can be obtained within about 3 weeks.

HIFI NEWS—continued

TDK-SA, show a range of head wear patterns. Some are fully the equal to iron oxide, while others show 2 to 3 times the wear of Cr02".

Elsewhere in the same report, one paragraph suggests that the makers of Memorex tape are particularly sensitive to other claims being made for TDK-SA tape:

"Claims have been made that TDK-SA exhibits a significant signal-to-noise advantage over Cr02 tapes. Our measurements indicate that, in fact, the best S/N performance measured for a TDK-SA tape is the same as the performance of the best Cr02 tapes. While the output of the TDK tape was higher this was offset by their higher bias noise level."

And on another aspect: "Chromium dioxide tapes, in the C-90 form, have an average print-through of −49.5dB. TDK-SA averages −46dB. This implies, in non-technical terms, that a given signal will produce a 3.5dB greater "echo" in TDK-SA than in Cr02 tape."

By this time, the reader should just about have the message that Dupont is trying to get across: You can use Cr02 tape (particularly our Cr02 tape) with confidence; but if you like TDK-SA, you should like our Cr02 tape even better!

How the makers of TDK tape view this report, we're not sure. They might be annoyed. But then again, they might be flattered by the tribute to their publicity efforts and the near-implication that Super-Avilyin is the tape to beat!

FOOTNOTE: I completed the above on a Friday afternoon, convinced that I'd argued enough about arguments. But the Sunday papers carried two full-page advertisements for Hitachi cassettes. The "technical" page made these points, among others:

1."Among the new tape coatings available from other tape manufacturers are chromium dioxide and ferri-chrome ...

While you listen to the music you can dance around our room.

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HIFI NEWS—continued

The simple fact is that chromium coated tapes are abrasive. Not really good news for tape recorder heads." And not really good news, either, for those who are trying to disprove this idea!

2. After explaining their choice of cobalt ferrite particles, Hitachi describe their coating as an "alloy or combination of metals, with none of the abrasive characteristics of chrome". A rather startling claim, when read immediately after Dupont's criticism of TDK-SA, which uses a similar formulation.

3. "The cassette shell is important to your listening pleasure. Hitachi tapes are precision screwed constructions, rather than moulded." Yet it was only last month that we repeated Decca's statement that they had chosen welded rather than screwed construction because of torsional effects introduced by screws!

When faced with this kind of conflict, it's rather difficult to escape the conviction that, maybe, it's less a matter of the approach than it is of quality control. Iron, cobalt or chrome; glue, screw or weld; rollers, guides or fingers—they can all be good, bad or indifferent, depending on precision and quality control.

The trouble with that sentiment is that it's devilish hard to work it up into good publicity copy!

IREE AUDIO GROUP

One of the success stories of the Institution of Radio and Electronics Engineers, NSW Division, was the creation of the special interest audio group in late 1972. Since then it has organised a continuing and well supported lecture program, approximately one per month, covering a range of subjects of interest to audio engineers and enthusiasts.

The Group was formed to promote and serve the special interests of both IREE members and others in the areas of audio-frequency engineering and technology. Membership is open to any person with a particular interest in audio, and at a special rate to members of the IREE and students.

The principal activity of the Audio Group is its lecture/meeting program. Generally the Group meets 10-12 times a year, on week day evenings from February to November. Both the day of the week (usually Tuesday or Wednesday) and the location, (usually Macquarie, N.S.W. or Sydney University) are rotated for the convenience of members.

Regular meetings include not only lectures and/or demonstrations on traditional audio topics (amplifiers, loudspeakers, tapes, etc.) but also technical tours and visits. A special effort is made to arrange lectures from visiting overseas experts. Meetings are frequently held in co-operation with other groups and organizations having a common interest, e.g., IREE Sydney Division, Australian Acoustical Society, Music Broadcasting Society.

The Audio Group supports professional activities in the audio field and is represented on subcommittees of the Standards Association of Australia which are currently active in establishing measurement standards and minimum performance standards for high fidelity reproducing systems.

The Audio Group is administered (under a set of Rules approved by IREE Council) by a voluntary committee which is elected annually.

Annual subscriptions to the Audio Group (paid directly to IREE) are currently $10 per year. Financial members of IREE (any grade) and bona fide students may join at a special rate of $3 per year.

Applications for membership in the Audio Group may be obtained at Audio Group meetings, or from the Honorary Secretary of the Audio Group. Completed application forms should be forwarded to the Honorary Secretary: P. Garde, Hon. Secretary, School of Electrical Engineering, The University of New South Wales, P.O. Box 1, Kensington, N.S.W. 2033. Telephone: 662 2829

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PLATO: instruction via a computer terminal

An important revolution, based on advanced electronic technology, is quietly gathering momentum in our educational institutions. Computer-based teaching systems can now offer the student the opportunity to teach himself at his own rate, and can serve to make the learning process an interesting and stimulating experience. Perhaps the most successful and technically advanced of these systems is the PLATO system, a joint development of Control Data Corporation (CDC) and the University of Illinois.

by GREG SWAIN

The CDC PLATO system is officially described in company literature as a system "specifically designed for individualised and distributive education in a computer-based environment." In simpler terms, PLATO is a computer-based instruction system using the resources of a large, modern computer (CDC CYBER 70 or 170 Series) and numerous visual display terminals. Students interact with the computer by means of the terminal keyboard.

For educationalists, computer-based systems such as PLATO represent a new approach to the learning process—a process that traditionally has been rather an inefficient and tedious business. Usually, a group of students have been put together in a large room, seated at an array of uncomfortable desks, and then had knowledge hurled at them either verbally by the teacher or visually by means of a blackboard or slide projector. Test and examinations were then used to find out if the required proportion of this knowledge had been absorbed.

By its very nature, this process has tended to obstruct true learning. The teacher is forced to treat the students as a group, with the material presented pitched to suit the mythical "average" student. There was little opportunity for individual tuition, either to allow brighter students to forge ahead, or to help the less bright students to keep up. And this, together with the passive nature of the process, tended to produce boredom, frustration and a widespread lack of enthusiasm and motivation.

Students using the CDC PLATO computer-based education system. The system distributes instructional materials in the form of text, numbers, animated drawings and other graphics for individualised, self-paced learning.

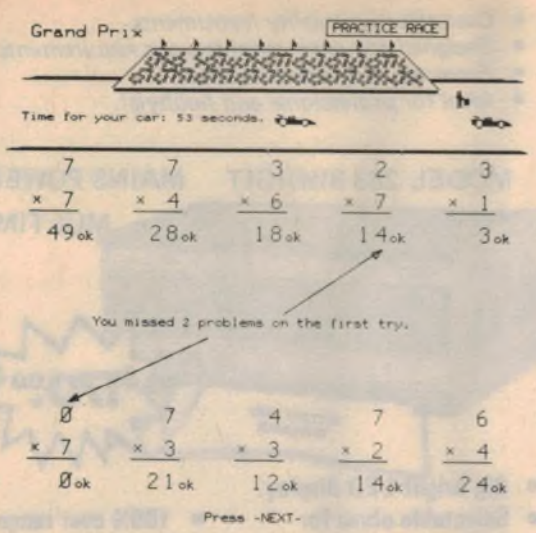
A computer-based teaching system such as PLATO can overcome these objections. Thanks to time-sharing techniques, the computer program can give highly individualised attention to a great number of students simultaneously. Not only this, but it allows the teacher to monitor each student's progress and can make the learning process more efficient by ensuring continuing enthusiasm and motivation on the part of the student.

The PLATO system has been under continuous development since 1960 by a dedicated staff of educators and scientists at the Computer-based Education Research Laboratory (CERL), University of Illinois. This research and development effort has been lead by Dr Donald Bitzer, director of CERL and inventor of the PLATO system.

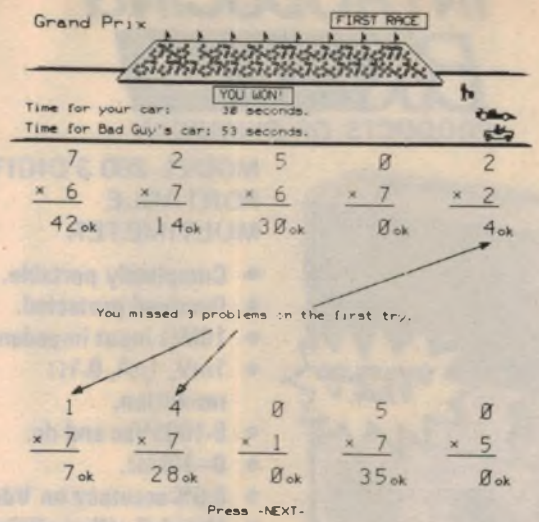
Research started in the Coordinated Science Laboratory at the University. The first PLATO system used a high-speed digital computer as the central control element for teaching a number of students simultaneously. In the first seven years of PLATO's existence, the system evolved from one terminal to 71, utilised two different computers (ILLIAC 1 and CDC 1604), and employed four programming languages. Additionally, about 180 teaching lessons were written for the system to demonstrate its flexibility for teaching and for research.

Then, in 1967, the University of Illinois organised the Computer-based Education Research Laboratory. The PLATO project moved into the new laboratory, with direction continuing under Dr Bitzer.

From 1967 to 1972, in cooperation with Control Data Corporation (CDC) of Minnesota, the first economical, large scale, computer-based educational system—the current PLATO system—was evolved. Improvements to the computer system, to the design and construction of peripherals, and to the range of lesson



This game of mathematical drill and practice for a grade-school student first establishes skill-level in a practice race. Lesson indicates errors.



The end of the first race, and the student is encouraged by winning. In this manner, the student is positively reinforced while solving problems.

material have been the subsequent development pattern. The result is the current CDC PLATO system, now available on a commercial basis.

The CDC PLATO terminal consists of a plasma-display screen, an electronic keyboard and associated electronics. Optional features include a touch panel, a microfiche projector, and auxiliary connectors for attaching external data-collection devices. The terminal can write at 180 characters per second, and up to 32 lines with 64 characters per line can be displayed.

The instructional materials use a variety of display techniques to increase and maintain student motivation levels. Materials can appear as text, numerics, graphics or animated figures. Students work through the materials at their own pace, on their own terminals, making errors and receiving corrections in private.

Because the student must interact with the computer through a terminal, lessons are automatically tailored to meet his learning style and pace. The system responds to the student in just two-tenths of a second, advises if he has given the correct answer and, depending on guide lines established by the teacher, either displays the next lesson or provides additional practice until a particular skill is mastered.

The PLATO system goes further than the usual drill and practice philosophy, however. The software is particularly oriented towards the student developing an understanding of the subject matter. Thus, lessons may include tutorial material, inquiry, dialogue, simulation, computer games, and problem solving.

Perhaps one of the greatest advantages of a computer-based teaching system like PLATO is that each student's progress can be monitored by an analysis of ongoing test results. Records of student achievement are maintained by the system, and are used for evaluating both student progress and the effectiveness of the lesson material.

Teachers may review student performance and change or update the instructional materials in the computer through the same terminals used by the students. The system offers the author effective lesson-creation/editing facilities for writing and positioning text, and for drawing pictures on the screen (by moving a cursor and marking points). The PLATO system then automatically creates the corresponding author language statements which produce the text and the picture.

A valuable feature of the PLATO system here is that two users can communicate directly with each other from their respective display terminals. This facility is typically used by a lesson author who may wish to discuss a lesson problem with a PLATO consultant who is well versed in the author language. The consultant's screen reflects the same display as the author's screen, and both can "talk" to each other by typing and erasing messages.

The PLATO author language is, however, a relatively simple language to learn. In spite of this, it is still a powerful language for controlling a complex computer system and has more than 200 commands in its repertoire. It permits a person with minimum training and no previous computer experience to prepare, maintain and improve software.

At present, there are about 1,000 terminals connected to PLATO computer systems at more than 150 sites around the world. Many of these are in the United States where the system has proved highly successful, both in education and in business. As the system has spread there has been a proliferation of lesson material and hundreds of teachers are now programming lesson material on a continuous basis. Program contributors in the United States are paid royalties similar to those received by book authors.

Lesson material has now been created for more than 150 different subjects ranging from biology, chemistry, physics and mathematics to such areas as music, library science, political science, psychology and medicine. Many subjects, of course, account for hundreds of individual lessons. The system is equally applicable to primary, high school, and tertiary teaching situations, and is well-suited to adult-training programs.

The system, for example, is finding increasing application in industrial training enviroments. In this context, the system is well capable of presenting many manual skill training programs, e.g., pilot training for an instrument rating.

Again, the system is also highly suited for information storage and retrieval, for data processing, for problem solving and for administration—these in addition to its educational uses.

In the words of Dr Bitzer, who visited Australia recently to demonstrate PLATO, the system is "limited only by the imagination of the user—that is of the teacher or the student. It is not limited by the hardware".

The aim, says Dr Bitzer, is to put a terminal into every home!

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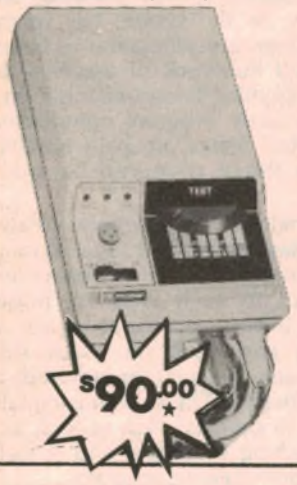

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Simple anti-wobble device will cut satellite losses

A British space engineer, Mr Steve Tonkin of the British Aircraft Corporation's Electronics and Space Group, England, has invented a device which stops the "wobble" that can affect orbiting satellites. The device is quite simple yet can prevent a satellite from straying from its planned orbit, thus saving millions of dollars worth of equipment and effort.

by LOUISE KEHOE*

One of the problems that have confronted space engineers over the years is that of satellite wobble or "nutation". The problem is that when a satellite is launched, instead of spinning smoothly into orbit, it may nutate, or spin unevenly, so that it falls into an irregular path and may even be lost in space. Such a loss is expensive since a great deal of sophisticated communications equipment is often loaded on to the spacecraft.

It is well known that some spinning objects, whether it be a child's top or a space satellite, are more stable than others; a flat, disc shaped spinner is less inclined to wobble than a long cylindrical object.

But the long thin shape of a spacecraft launch rocket means that the satellite must also be in the form of a long cylinder if the best possible use is to be made of the space available. The inherently lower stability of this shape must then be compensated for by some form of control of the wobbling, and this is known as nutation damping.

In the past, methods of controlling nutation have been complex and energy consuming, increasing the weight and cost of the satellite. Steve Tonkin's proposed new style of nutation damper is small and light, uses very little power and is also inexpensive.

The inventor describes the device as a "compliant flywheel". This is a canister of fluid mounted on a ballbearing so that it spins freely on any axis. The flywheel is driven at high speen by a small electric motor and spins in the direction opposite to the spin of the spacecraft.

The function of the device is to absorb the irregular vibrations of the vessel, just as a car suspension system absorbs the bouncing of the vehicle. The flywheel device prevents wobble building up to an unacceptable degree and perhaps causing the spacecraft to fall out of its orbit.

Experts from many of the world's space organisations are impressed. At a recent conference of the International Federation for Automatic Control, held in West Germany, Mr Tonkin caused quite a stir when he described the device. Representatives of the European Space Agency, and the United States, Chinese and Soviet organisations showed keen interest in what could prove to be an important step in space satellite design.

Like many a good invention, Steve Tonkin's satellite stabliser is simple in concept and design. So simple, in fact, that it is almost surprising that it has not been done before. But according to Mr Tonkin, when he first raised the idea several years ago it met with scepticism. Only when he was able to build a prototype and demonstrate his theory could he persuade the experts of its great potential.

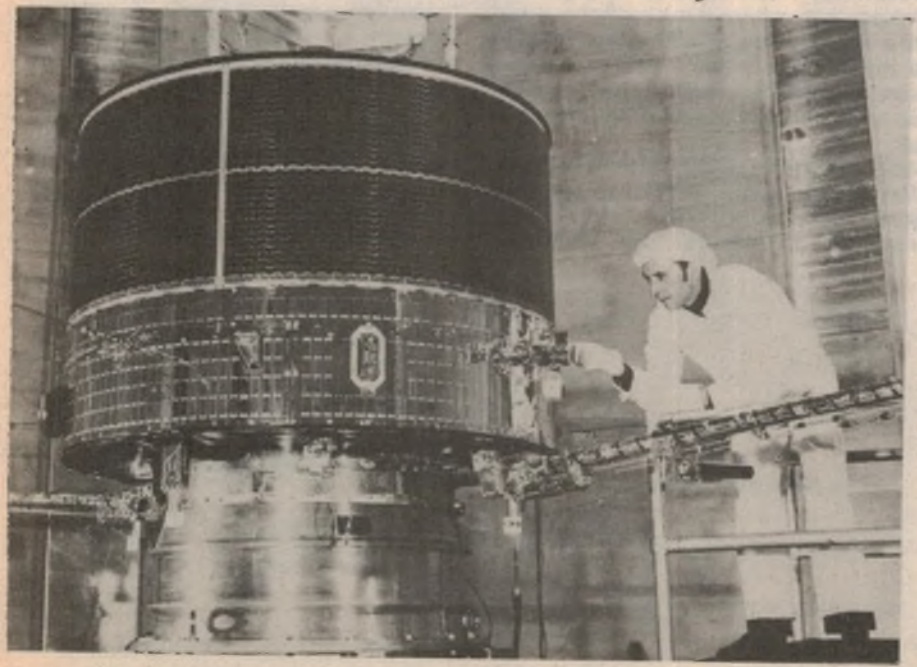
The next step, to design a real system, has already begun. At BAC work has started on designing a system suitable for use in a satellite launched from a Skylark rocket. This is the rocket which is currently used to launch most European spacecraft.

There is currently a plan to set up a European communications network which will rely on a number of satellites to provide a broad range of services throughout Europe in the 1980s. Services will include regional communications—for television, radio or radiotelephone—and maritime and aeronautical communications. The development of this network is being co-ordinated by the European Space Agency.

It now seems that the satellite stability system designed at BAC may play a vital part, since it is likely that it will be incorporated in the satellites that link up the new network. As the first stage towards setting up this network a test satellite, called OTS for Orbital Test Satellite, will be launched next year.

OTS could well be the first satellite, to benefit from the new stability system. And since it is a model upon which future European satellites will be based, this may be an important test for the flywheel device.

*"Electronics Weekly", London.



A geostationary orbiting satellite undergoing test at the British Aircraft Corporation's facility at Bristol. This type of satellite could be the first to be fitted with the new anti-wobble device.

MICROPHONES

Part 4: Microphone overload; plugs and connections.

Reproduced by courtesy of Sennheiser Electronics, this series of articles is intended to assist sub-professionals and amateurs who need to use microphones, but without the advantage of formal acoustic training. This article discusses microphone overload and the problem of microphone plug and connection standards.

by G. PRAETZEL and E. F. WARNKE*

SOUND PRESSURE DISTORTION: When the input of a tape recorder or an amplifier is overloaded, harmonic distortion occurs. Can microphones be overloaded in the same way? This question cannot be answered generally, as there are differences between moving coil microphones and capacitor microphones.

During tests of dynamic microphone type MD 421 test persons with a powerful voice were asked to shout at the microphone from the closest possible talking distance. The highest sound pressure produced was 500 bar, and the voltage delivered by the microphone was about 100mV. This corresponds to a loudness just on the threshold of pain for the human ear. However, the harmonic distortion remained below 0.5%; below the threshold of perception.

Some capacitor microphones, however, can show audible overload at such extremely high sound volumes. Fortunately, levels of this order are not normally encountered in everyday microphone applications. If, however, such conditions do occur, eg, when the microphone is placed near a loud brass instrument, then it should be ascertained that the capacitor microphone is designed for the expected high sound pressure. In a doubtful case, it is better to use a dynamic microphone.

CONNECTION PROBLEMS: It would be nice to have a world-wide standard microphone connector plug with a mating socket. Unfortunately, the abundant ideas on the design of plug connectors and the scope of contact combinations by equipment manufacturers make the universal solution well nigh impossible. During the first attempts at standardisation on a national scale, so many solutions were offered that, in spite of recognising generally the necessity for standard connections, great difficulty was experienced in working out standard specifications which would not inflict considerable economic losses on users of existing types.

DIN STANDARD MICROPHONE PLUG CONNECTIONS: Fortunately, in West Germany and those European countries which it supplies with tape recorders and sound equipment, the microphone plugs and sockets conform to DIN 41524. DIN 41594 is so manifold, however, that a microphone with the above mentioned plug (Fig. 14) may not match electrically every socket into which that plug fits mechanically.

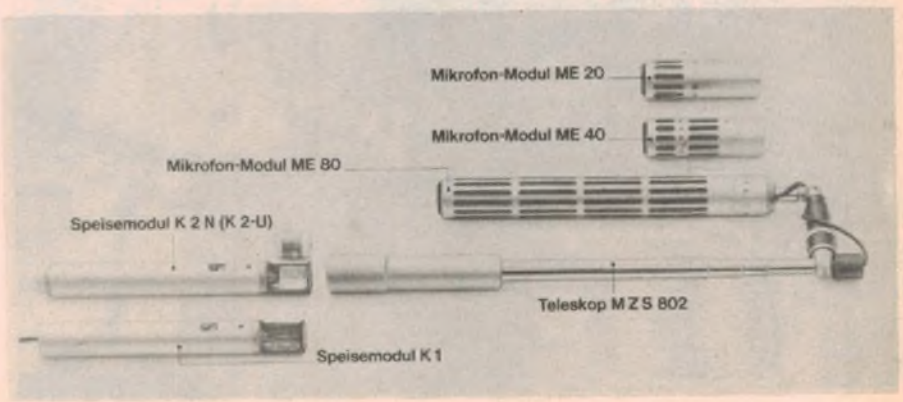
Granted, one can assume that today a great majority of the tape recorders on the European market are fitted with these connecting sockets wired to one of the six (!) diagrams shown in Fig. 15. However, none of these six different wirings is necessarily interchangeable with another one. This results in a retalively high number of possible mispairings, where a microphone wired to a standard specification, connected to a microphone input wired to another variant of this standard will either provide an unsatisfactory result or no result at all.

ALTERNATIVE MICROPHONE PLUGS: Besides the above mentioned standard plug and connections there are, especially in overseas tape recorders, various alternative plugs, such as Cinch plugs, and several types of jack connectors. With the exception of the stereo jack connector with a 6.3mm diameter. (Fig. 16) which provides for both channels of a stereo recording, other plug connectors are only two-pole; the "live" pole and the screen. This facilitates considerably the manufacture of suitable adaptor-cables.

MICROPHONE CONNECTION MANUAL: There are, on the European market, DIN standard plugs with various standard wiring arrangements, as well as various alternative plugs, all adding up to a somewhat chaotic situation.

This moved Sennheiser to investigate all tape recorders on the European market and catalogue them according to their microphone input sockets and wiring. The result of this extensive work is a manual published every year called "Mikrofon-AnschluB-Fibel". It contains diagrams for the connections between microphone plugs and corresponding sockets of tape recorders.

(Copies of the latest "Microfon-AnschuB-Fibel" are available on request from the Australian Sennheiser agents; R. H. Cunningham Pty Ltd, 493 Victoria St, West Melbourne, Vic. 3003, or 4 Waters Rd, Neutral Bay, NSW 2089.)

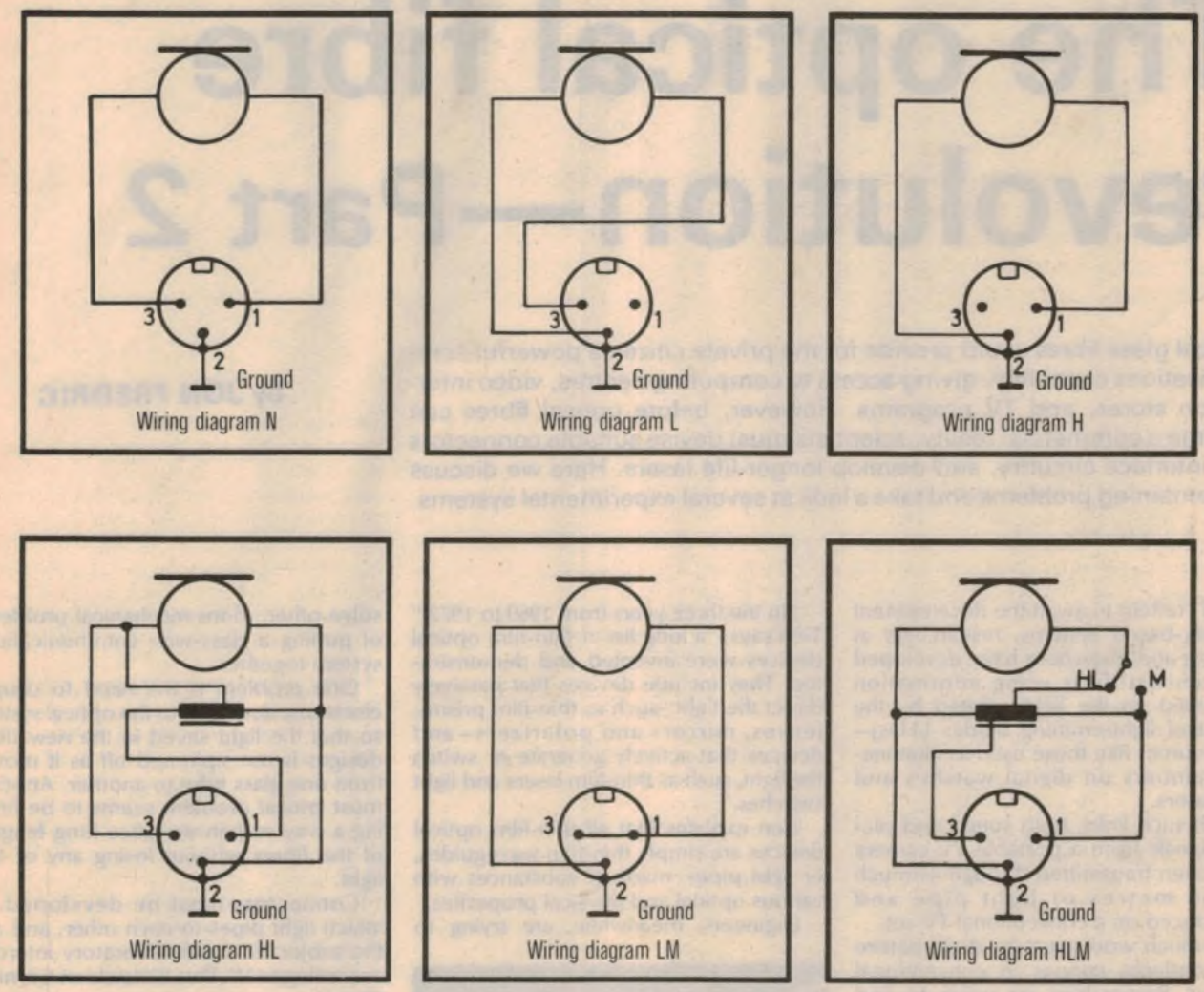


Typical of modern microphones is this multiple head system by Sennheiser. The ME20 head gives a spherical response, the ME40 a super cardioid, and the ME80 a super cardioid below 1000Hz and a sharp frontal lobe above this.

*Reproduced by arrangement with Sennheiser Electronics. Translated by T. M. Jaskolski and adapted for magazine publication by W. N. Williams.

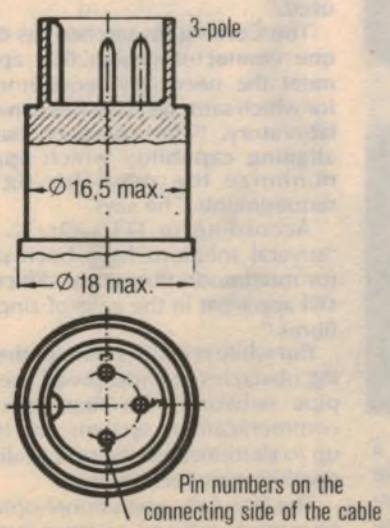
Standard DIN-Microphone Connections

Fig. 15



Plugs for microphones to DIN 41524

Fig. 14



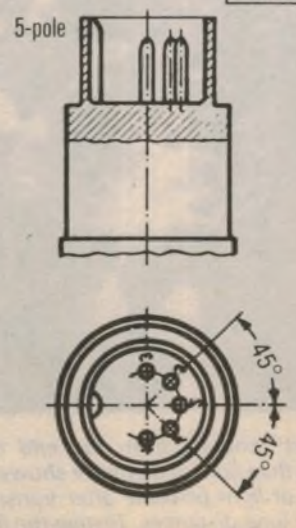
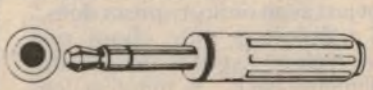


Fig. 16

The non-standardized jack plug with a 6.3 mm Ø used for microphones as well as for headsets.



Light beam communications in the 1980s

The optical fibre revolution—Part 2

Optical glass fibres could provide for the private citizen a powerful communications capability, giving access to computing centres, video information stores, and TV programs. However, before optical fibres can become a commercial reality, scientists must devise suitable connectors and interface circuitry, and develop longer-life lasers. Here we discuss the remaining problems and take a look at several experimental systems.

by JON FREDRIC

Not content to await the development of laser-based systems, researchers at Corning and elsewhere have developed experimental links using information impressed on the light created by the output of light-emitting diodes LEDs)—light sources like those used as illuminated numbers on digital watches and calculators.

With such links, both sound and picture signals from a portable TV camera have been transmitted through as much as 330 metres of light pipe and reproduced on a conventional TV set.

But much work must be done before glass replaces copper in conventional systems. Researchers are trying to find more efficient ways to join the threadlike fibres. Engineers must increase the lifetime of lasers; those now in experimental use will operate for 100,000 hours, but for practical use a one-million-hour laser is needed.

Scientists also are developing optical integrated circuits—the optical equivalent of the little chips operating digital watches and calculators. Engineers at Bell Labs plan to use the circuits to boost or amplify the light beams, or to switch them from one fibre to another.

According to P. K. Tien of Bell Labs, integrated circuits for optical systems can be made from "thin films"—flat miniature circuits—just as integrated electronic circuits are.

"The thin films, however, form miniature lasers, lenses, prisms, light switches and light modulators," says Tien.

"A thin-film prism refracts a beam of laser light just as an ordinary prism does," he says. "But it is only about one millimetre high and several thousandths of a millimetre thick." A thin-film lens brings three laser beams to a focus as does an ordinary lens.

"In the three years from 1969 to 1972," Tien says, "a long list of thin-film optical devices were invented and demonstrated. They include devices that passively direct the light—such as thin-film prisms, lenses, mirrors and polarizers—and devices that actively generate or switch the light, such as thin-film lasers and light switches."

Tien explains that all thin-film optical devices are simply thin-film waveguides, or light pipes, made of substances with various optical and physical properties.

Engineers, meanwhile, are trying to solve other, more mechanical problems of putting a glass-wire communications system together.

"Starburst" coming from the end of a fibre less than 5um in diameter shows the intensity of light possible after transmission over long distances. Testing the fibre is Corning scientist Dr Donald B. Keck.

One problem is the need to couple electronic devices into the optical system so that the light saved in the new fibre designs is not siphoned off as it moves from one glass tube to another. Another most critical problem seems to be finding a way to join or splice long lengths of the fibres without losing any of the light.

Connectors must be developed to attach light pipes to each other, and are the subject of much laboratory interest, according to W. Bart Bielawki of Corning Glass.

"Simple connectors have been used in early experimental systems," he says. "But in links where several interconnections are required, signal losses build up and these early connectors cannot be used."

The Corning researcher has described one connector design that appears to meet the necessary requirements, and for which samples have been made in the laboratory. "The approach has a self-aligning capability which appears to minimize the need for tight fibre requirements," he says.

According to ITT's Dr. K. C. Kao, "several solutions have been proposed for multimode fibres, but difficulties are still apparent in the case of single-mode fibres."

But while scientists ponder the remaining obstacles to widespread use of light-pipe networks, the first basic optical communications systems are being set up to demonstrate the practicality of this revolutionary technology.

The first fully operational optical fibre communications system went into operation recently in Dorset, England.

Built by the British unit of International Telephone and Telegraph Corporation, the new laser link was set up for the Dorset police to connect the video display units of their main control room at Bournemouth with their central computer several hundred yards away. The system carries 10 million bits of information per second by means of light rays sent through a glass fibre conduit.

The new laser link was installed in Dorset because optical fibers have been shown to be immune to electromagnetic interference and surges. In 1975 these had caused serious damage to the police department's computer control installation, following a severe lightning storm. (The fibre network, incidentally, is also immune to wiretapping.)

Within a very short time, Bell Laboratories will begin testing an experimental optical communications system at its research facility in Atlanta, Georgia, according to George C. Dacey, Bell Labs' vice president for transmission. A 600-metre cable containing over 100 fibres will be used to test optical transmission lines many kilometres long.

The purpose of the experimental system, says Dacey, is to evaluate, under actual conditions, pulsed-light transmission for ultimate use between Bell Telephone's switching offices in metropolitan areas. Bell will use the system to study the transmission of light beams at two different speeds: 1.544 and 44.7 million bits per second (Mbs), respectively.

The pulses of light will be created by light-emitting diodes (LEDs) and by miniature lasers. These miniature lasers are modulated by interrupting the electric current that drives the devices, just like Morse code is transmitted.

Although the system in Atlanta is in the exploratory development stage, and is not ready for actual use by operating telephone companies, it represents a significant step forward from the laboratory to an approximation of field conditions.

One important feature is the packaging of the system's components, Bell Labs says. They have been designed to be compatible with conventional electronics used in AT&T's central office equipment.

The extremely transparent glass fibres used in the experimental cables were provided by Western Electric, AT&T's manufacturing arm. The process for making the fibres was discovered and developed by Bell Labs, the company says. In related experiments, glass fibres provided by Corning Glass Works also will be used in a Bell Labs cable.

Bell Labs has designed a cable structure that cushions and protects the glass fibre waveguides so that they can withstand the rigors of field handling. It also aligns them so that they can be spliced more easily.

The cable's more than 100 glass fibres would have the capacity to handle tens of thousands of telephone conversations

WHEN THE FLASH FLOOD STRUCK, ALVIN KNEW HE WAS IN TROUBLE ....THEN HE DISCOVERED

Alvin's an electronics buff from way back when . . . he can talk for days on the subject, almost as though he had invented electronics himself . . . an impressive array of electronics gadgets and equipment in his "pad" is living proof of his keen devotion. No wonder he was sure everything "went down the drain" when a sudden flash flood saturated all before him. THEN he discovered the CRC procedure for restoring flood-damaged electronics equipment. To remove the residue he flushed everything with fresh water, then applied CRC Lectra Clean to remove the grime. After that, CRC 2-26 was applied to remove all remaining moisture, leaving a thin protective film to prevent water re-entry, at the same time giving added protection against rust and coorosion of all metal surfaces. Today Alvin's "pad" contains handy cans of protective CRC for any future emergencies. If you're a buff like Alvin and want to know more about CRC electrical products write CRC Chemicals Australia Pty Ltd, Centre Court, Paul St., N. Ryde 2113.

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FURTHER EDUCATION COURSES IN ELECTRONICS FOR TECHNICAL OFFICERS

The Electronics Technology Division proposes to run the following special purpose courses in 1977. These courses are designed to update technical officers, engineers and technicians in those specialized areas which are becoming increasingly in demand today. This will enable personnel to keep abreast of the rapid technological changes being made in the electronics field.

The courses will run on a part-time basis for three hours per week for sixteen weeks. Applications and enquiries should be directed to the Division's office on (03) 347-7611 ext. 347/348.

INTEGRATED ELECTRONIC LOGIC TECHNIQUES

This course will contain basic logic introduction e.g. Logic Gates, NOR's, NANDS, Flip Flops, Registers, Boolean Algebra, Karnaugh Map, Combinational Logic and Sequential Logic.

COMPUTER AIDED DESIGN

Course will involve the use of a computer to solve network and/or electronic design problems. The student will be introduced to the fundamentals of a high level language BASIC or FORTRAN IV and the procedures required to run programs on interactive terminals. Program de-bugging will also be covered.

MICRO PROCESSORS I

Serves as an introduction to the construction and operation of the micro-processor. This course will enable the student to understand and evaluate a micro-processor and to obtain a basic working knowledge of programming at the machine code level.

MICRO PROCESSORS II

Will be a more advanced study of micro-processors following on from the previous course. Will include more advanced programming techniques and practical applications with existing hardware technology.

INTEGRATED ANALOG TECHNIQUES (PROPOSED)

An introduction to intergrated amplifiers An explanation of the terminology involved in their specifications. Construction techniques. Operational amplifiers — their configuration, characteristics and limitations. Applications of Voltage Regulator IC's, pre-amp IC's, Buffers, Arrays, Comparators and other specialized IC's.

PRINTED CIRCUIT TECHNOLOGY (PROPOSED)

Design of printed circuit Boards from the drafting stage to the actual manufacturing techniques. Will include silk screening, hard and soft gold plating and photographic techniques.

Optical fibre revolution

when used at the faster transmission rate of 44.7Mbs (million bits per second).

Methods are being developed for splicing these glass fibres in the field. The objective is a connector to make possible the simultaneous joining of all cable fibres, without handling individual fibres.

The light source and detector devices have been packaged for everyday use. The transmitter, including the laser and its associated circuits, consists of packaged circuit boards which contain the signal processing, or repeater, electronics

Because the laser in the higher-capacity 44.7Mbs transmitter is affected by temperature changes, a special control circuit is included on the circuit board. This compensates for the effects of normal temperature variations likely to be encountered in central offices.

The laser itself, a chip of aluminium gallium arsenide no larger than a grain of salt, is compatible in size with the dimensions of the fibre. Light from the tiny laser source travels over the glass fibre waveguide, and is converted into an electrical signal by a highly sensitive silicon detector.

The second set of experiments, using light emitting diodes as light sources and simpler detectors, is designed to evaluate simpler systems that would operate at the lower speed of 1.544Mbs to carry 24 one-way, simultaneous telephone conversations per fibre light guide.

Corning Glass Works, which provided 25 kilometres of optical waveguide for the Bell Labs experimental system in Atlanta, now is selling its Corguide glass fibre cables commercially.

The company has delivered several optical cables to the Navy's Electronics Laboratory Center in San Diego for systems being developed there to test long-distance, high-bandwidth transmissions.

As the first experimental systems prove practical, components to implement optical communications systems are rapidly becoming commercially available. On the heels of Corning's entry last year, a Sturbridge, Massachusetts based firm, Galileo Electro-Optics Corporation, recently announced the commercial availability of five different types of its Galite optical communications fibres for communications and other uses.

Corning's W. Bart Bielawski agrees that "commercially, the most important application for optical waveguides is their substitution for electrical conductors used by the telephone industry." Beyond this, says Bielawski, "optical waveguides promise true two-way video systems in broadband networks.

Shown are laser transmitter and receiver packages manufactured by Bell Labs for lightwave communications. The two packages making up the transmitter are at top. The package being held contains a laser, a chip no larger than a grain of salt, which is used to create the tiny pulses of light that carry information through the hair-thin optical glass fibres.

"Computers for general electronic data processing and computer-based process control and instrumentation systems represent the most likely, first large-scale usage of optical waveguides."

Military applications include wiring of weapons systems such as aircraft, helicopters, ships and submarines, Bielawski says. "Headquarters, field and base communications are of specical importance to the Army," he says, "while surveillance systems operated from shore, ship or submarine may make a substantial impact on the Navy's capabilities to detect, identify and evaluate underwater threats."

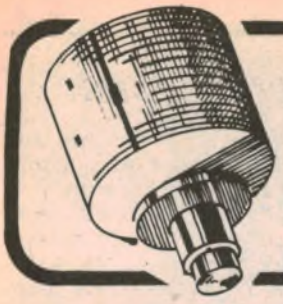
The sheer capacity of optical fibres is what fascinates scientists, engineers and business managers alike.

The striking new capabilities have startling implications. In addition to drastically reducing communications costs, the new cables could provide opportunities to inaugurate innovative new services that, until now, may only have been considered science fiction.

Consider the "wired city," where homes and businesses in both urban and rural areas could be interconnected by an optical fibre network. You could see special educational programming on TV, talk by Picturephone, shop by TV and receive business data transmission, special entertainment and virtually any other type of telecommunications services conceivable.

In this day of constant shortages, it's also reassuring to know that, while there's a growing scarcity of copper (which today is used most heavily in communications cables), glass—the basic material of optical fibres—is both abundant and relatively inexpensive.

As we move towards the 1980s, the communications promises of optical glass fibres will become reality.



News Highlights

Space cities could solve Earth population problems

Is the Earth really doomed in as few as 50 years?

From a study financed by the Club of Rome, a Massachusetts Institute of Technology computer answered "yes" after looking at this planet's expanding population and diminished resources.

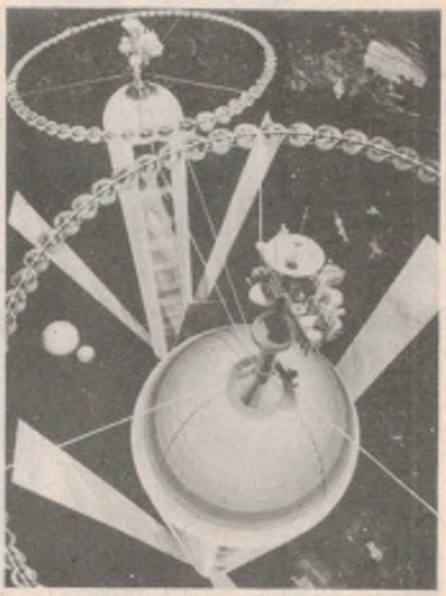
Walter Hurd Jr. disagrees, however, for some very surprising reasons.

Hurd, a product assurance expert at Lockheed Missiles & Space Company in Sunnyvale, California, was keynote speaker recently at the annual conference of the European Organisation for Quality Control, Copenhagen, Denmark.

In that talk, entitled "Space Resources and the Human Race," he explained why he believes the Earth's salvation lies in such futuristic concepts as building solar power plants in space and transplanting huge chunks of the world's population to self-contained cities in the sky.

He reported in detail on pioneering research into space colonization done by Professor Gerard K. O' Neill of Princeton University, and on work by Dr Peter Glaser of Arthur D. Little, Inc., to put solar power plants in space.

With existing technology developed for the Apollo, Skylab and Space Shuttle programs, O'Neill believes it is now possible to create communities in outer



space where humans could live in conditions better than on Earth.

Materials used to build these communities would come mainly from the Moon. Low lunar gravity and the absence of an atmosphere would make it easy to catapult containers of raw ore into space from the Moon's surface. These containers would then float in bucket-brigade fashion to a collection platform in lunar orbit where raw materials would be processed unto usable form, and construction of a space community could begin.

O'Neill's first community, Hurd said, could be more than a mile in circumference, house 10,000 people, and be completed in the early 1990's if work were started by 1978.

Each space community would rotate fast enough to let centrifugal force substitute for gravity. Its large size would permit construction of hills, streams and lakes, creating an environment similar to Earth's today.

Hurd believes these communities, in the next 100 years, could build Dr. Glaser's power plants in space to supply energy for those left behind on the mother planet.

O'Neill cites construction of these plants as a major economic justification for space colonization.

Hurd warned that only 50 to 100 years may remain in which to plan and begin expansion of the human race into space. After that, he fears all the Earth's resources will be needed just to keep mankind alive in an increasingly overcrowded and polluted world.

"By then," he said, "the option of moving into space may no longer be open to us."

Aust. government backs Interscan bid

The Commonwealth Government will provide assistance this financial year to enable added scientific weight to be given to Australia's entry in the world quest for a new aircraft landing guidance system.

The money—$800,000 from the Department of Transport and $300,000 from CSIRO—will be spent on data preparation and further technical tests, evaluation, and design studies of the Australian concept, Interscan.

These results would be used to demonstrate to the International Civil Aviation Organization (ICAO) that Interscan, a joint Department of Transport-CSIRO development, was more than an experimental scientific model and could readily be produced by industry.

The ICAO, the world body of government agencies concerned with aviation, is seeking an all-weather landing guidance system to take aviation into the 21st-century. An ICAO committee is expected to make its recommendation early this year on the system to be used at world airports from the 1980s. The Australian Interscan system already has the support of the United States and the Soviet Union.

Interscan comprises several stationary ground antennas which beam microwave signals to aircraft. The antennas are completely electronic in operation, having no moving parts. It is relatively simple, inexpensive and very flexible.

The present aircraft landing system has a single, straight pathway extending 10 kilometres out at a fixed angle of three degrees, down which aircraft approach and land. But by the 1980s, airports will need greater flexibility in choosing the path of aircraft during approach and landing to deal with different types of aircraft and increased traffic, and also to have more scope for noise abatement.

Interscan provides dozens of "highways in the sky" from 50 kilometres out. These are either straight or curved and at a variety of angles of descent, up to 30 degrees from the horizontal. Aircraft will be able to approach and land in bad visibility with the same operational flexibility they have in clear weather.

Also, Interscan microwave signals to the aircraft—compared with the signals from the present system—are much less affected by reflections from taxi-ing aircraft, ground vehicles or buildings.

The Department of Transport and the CSIRO are confident that the time reference scanning beam technique employed by Interscan is superior to the other techniques being considered by ICAO.

GIM has ambitious expansion program

General Instrument Microelectronics, recently announced plans to increase the total installed diffusion capacity at its Glenrothes, Scotland, production unit by over 50 percent. The expansion involves the installation of a new diffusion line alongside two existing n- and p-channel lines at a cost of £500,000. New clean room facilities for "front end" masking and diffusion have already been completed.

Recent products developed by GIM include a new stand-alone microcomputer in a single DIL package. Designated type number 1650, this device is designed for use in microwave ovens, washing machines, weighing machines, cookers, timers, central heating controls, and a host of other applications. The device incorporates a CPU controlled by 512 x 12 bits of ROM microprogram, with 32 by 8 bits of RAM, three 8 bit wide input-output lines and a self or externally driven clock on a single chip. Power supply requirements are a single +5V rail, and inputs and outputs are TTL compatible.

GIM has an on-going development program with the Massachusetts Institute of Technology to perfect an X-ray photolithographic method which will allow the density of integrated circuits to be raised by a factor of ten. This could mean in the near future 100,000 interconnected transistors on a single IC chip instead of the 10,000 or so now possible with existing techniques.

Microprocessor-based data system for cars

Dedicated microprocessors promise significant improvements in automobile performance and driveability in the next few years. From RCA's laboratories in Princeton, New Jersey, comes the news that the company is developing a microprocessor-controlled information system that will monitor the operating conditions of an automobile and even brake the car in an emergency.

The system, based on the commercially available RCA Cosmac microprocessor, is used to process information from sensors mounted throughout the vehicle. Data, such as rate of fuel consumption and engine rpm, will be presented on the dashboard in luminescent orange alphanumerics.

For the anti-collison braking system, the system considers return signals derived from an RCA-developed microwave radar which shows the vehicle's speed and direction, as well as obstacles and the location, speed and direction of other vehicles. Poor driving conditions can be taken into consideration by sensing whether the windshield wipers or the headlights are on.

British govt. backs wavepower research

The British government will spend $1,313,000 over the next two years to support research into deriving energy from sea waves. The scheme will make the country the world's premier centre for wavepower research.

The idea is to develop mechanical contrivances for mooring out to sea, riding the waves to bleed them of their energy. The initial problem is to find the most efficient and cheapest practical means of acquiring the energy in the waves. Devices will need to be built which are not going to be battered to pieces in storms and will continue to work, day in day out, for decades.

Four systems were selected as the most promising; the money is being divided between them, so that 1/100 scale models of each can be built and tested for performance in wave tanks. One, or possibly two schemes will later be chosen as the bases for working prototypes to test in genuine sea trials.

Announcing its plan the Government said that in theory up to half of Britain's present total requirement for electricity could be met by a chain of devices straddling a stretch of ocean 1000km long. The best sites, where the waves are most energetic, are off the northwest coast of England and Scotland, and off the west coast of Cornwall, southwest England.

It is hoped that large prototypes moored off the coast will be put through their paces in ten years' time. It would probably take a further ten years to get the first production model afloat and working. The system is not expected to make substantial contributions to the national electricity supply until early next century.

"Big Ben" sick — crock clock sees Doc.

"Big Ben"—the famous clock on the Houses of Parliament in London—has been suffering poor health. According to its "Doctors"—scientists from Britain's Non-Destructive Test Centre at Harwell in southern England—minute cracks have been discovered in two vital gear wheels in the striking mechanism.

Using techniques developed for the nuclear power industry, the scientists X-rayed various parts of the clock to establish the full extent of the damage caused by the failure of the mechanism earlier this year.

The name Big Ben actually refers to the 14 tonne bell which strikes the hours and was so named as a compliment to Sir Benjamin Hall, the first Commissioner of Works at the time the bell was cast in 1858. The 316ft (96.3m) high clock is still one of the most accurate time-pieces in the world—a recent survey revealed that

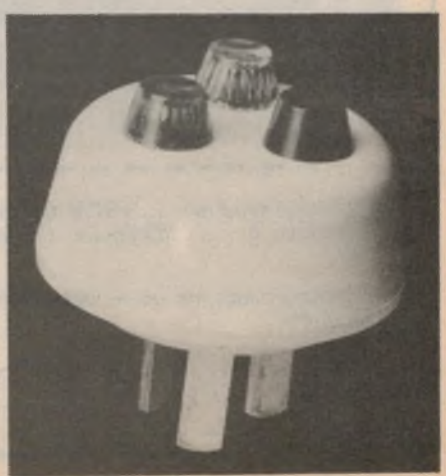
it had less than a half second error per year. It has been made famous throughout the world by the BBC's radio broadcasts of its chimes.

Power point tester checks wiring safety

This simple power point safety tester is capable of instantly diagnosing faulty power point wiring, thus minimising the risk of electric shock and damage to appliances. The unit is an ideal service tool for electricians.

In use, the safety tester is simply plugged into a power point to see if the outlet is correctly wired. This will be indicated by a red-green illumination pattern. Other illumination patterns indicate that the wiring is faulty as follows: red-amber = active and neutral reversed; red-green-amber = no earth; green-amber = active and earth reversed; green = no neutral.

Reader enquiries should be directed to Swann Electronics Pty Ltd, PO Box 350, Mt Waverley 3149.

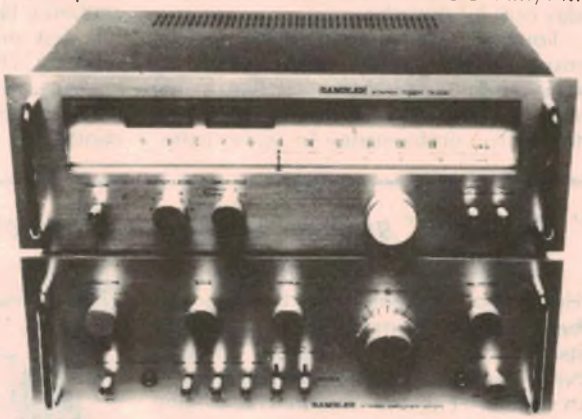


A lot of Hi-Fi's are just heartless stereotypes.

Sure they can look like a million dollars. And could cost the manufacturers close to it — for design, facia dyes, knurled knobs, toggle switches and two tone timber.
But what's really missing is the timbre.
At Rambler, we know what counts, when it comes to sound performance. It's heart.
Not that our equipment is wanting for clean functional design either . . .
It's just that we have our priorities right, to give you good sound.
Without wasting money on gauche gadgetry. Which means you save money. Lend an ear to this Rambler Integrated Amplifier model AK635 with the Rambler AM/FM Stereo Tuner Model TK600.

TK600
This tuner is brushed silver finish, to match the AK635 Amp, features rack style handles, variable output control, 75 ohm coaxial cable terminal, PLL-MPX demodulator, FET front end High blend switch

AK635
This amplifier features 40w x 40w (8 ohms), Multi-Speaker switching, Bass and Treble dual control, separate volume and balance controls, stereo head-phone output, mike input and mike mixing, 2 tape system for dubbing, separate pre and main Amp operation, rack style handles, subsonic filter



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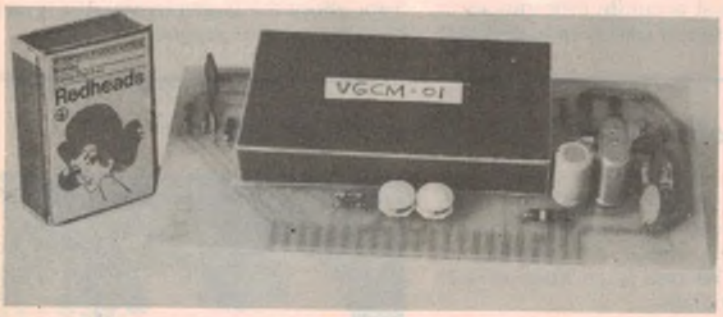

This is the chromatec VGCM-01 colourizing module that can be added to the majority of B/W games. (Chromatec has sole rights to TV game colour conversion process—Pat Pending.)

It gives you a blue and a red bat, an orange ball, white boundaries and a selection of a background colours—eg. green (tennis), brown (squash), etc.—it's up to you!

If your TV game provides positive 9V. signals for bat ball scoring and boundaries, negative 9V. sync. and 2:1 or non-interlaced scan, then this module is for you. (Suits most CMOS IC games and directly interfaces with AY-3-8500 LSI chip.)

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Box 274, Springvale, Vic. 3171.
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NEWS HIGHLIGHTS

Now buses can beat the traffic lights

Although fuel prices have risen very considerably over the last few years, the increases in rail and bus fares have not provided any lasting incentive for car users to change their mode of transport. In order to speed up public transport, and by inference make it more attractive to more people, Plessey, England, has designed a controller, known as "Ident-a-bus," which can give a bus the right-of-way in busy city centres. The controller operates in response to the approach of buses fitted with a special unit which activates inductive loops.

Another priority detector has been developed by Sarasota Engineering, England. This system has been tested by Britain's Department of the Environment. It has been shown that in certain circumstances the application of selective vehicle detectors is beneficial.

The new detector utilises a two-channel vehicle-borne frequency-modulated transmitter which operates a special receiver. Each transmitter and receiver is a two-channel unit so that a driver can select instruction to the roadside equipment.

Other developments include the fitting of radar detection units to portable traffic lights.

While portable traffic-lights offer a simple solution when temporary traffic signals are required—at roadworks for example – disadvantages become apparent when the flow is biased more in one direction than in the other. Also, if the flow is intermittent, the arrival of a vehicle at the light may result in a long waiting period when no vehicles are travelling in the opposite direction.

Portable traffic-lights fitted with radar detection units which change the light sequence in favour of an approaching vehicle can solve this problem. The design uses the Doppler principle where an approaching vehicle causes a frequency change to occur. The Staffordshire Public Works Company fits microwave radar detector units to its portable lights for this purpose.

Electronic stock ordering—contract to Plessey

Plessey Australia, Electronic Systems, has won a contract for supply of an electronic stock ordering system from leading Victorian hardware retailer, James McEwan and Company Pty Ltd.

Following a careful evaluation, McEwan's chose the Plessey 1450 Portable Data Capture System for installation throughout Victoria in the McEwan and Magnet chains of hardware stores. When the system is installed the ordering book in each McEwan's store will be replaced by a Plessey portable data capture unit.

To replenish shelf stocks the store operator will "read" bar coded shelf labels with a light pen and key-in the quantity required. The data is recorded immediately on cassette tape ready for batch processing.

For McEwan's, the system will provide for more efficient stock ordering and tighter control over stock levels both at the warehouse and in individual stores. McEwan's also expect substantial benefits to flow on to customers. The new ordering procedures will ensure that shelves are better stocked with the products in high demand and allow store staff to devote more time to assisting customers.

New underwater connector developed by STC

'Big Jim', an atmospheric diving suit came in handy recently when a new electrical connector underwent a series of proving trials at an Admiralty testing station in southern England.

Manufactured by STC, England, the new electrical connector can be plugged and unplugged underwater while live and has been tested and proved for use at depths of 460 metres.

The diving suits, which are basically pressure vessels with articulated arms and legs, have completed strain gauge testing to the equivalent of a 610 metre dive. The suits can be fitted with various types of manipulators and can be used for attaching hydraulic connections,

removing debris and many other similar tasks associated with offshore drilling.

Pipe and cable locator to 3 metres

This British hand-held location instrument can find and fix the position of any underground pipe, cable, sewer or drain to within 50mm in depths up to 3 metres—saving time, cost and even possible accidents.

The instrument operates by any one of three methods. In the first, low frequency waves are "bounced" into the ground and back to the instrument in the manner of a radar. In the second, a connection is made to the buried pipe at an access point—like a manhole—and another lead is placed on the ground, completing a circuit rather like the connections when a bulb is held against two terminals of a battery. Thirdly, where there is a pipe or sewer, a small radio transmitter is sent floating down it sending out signals. The system will not only locate the service but can also identify what type of service it is.

Readers should direct their enquiries to Electrolocation Ltd, 129 South Liberty Lane, Bristol, BS3 2SZ, England.

Microprocessor courses

To provide for the rapid development and applications opening up in Australia, Sontron Instruments has opened a training centre in Melbourne where courses will be held on microprocessor technology and related products.

The courses are directed to any interested party, preferably with a good understanding of digital electronics, and will cover microprocessors available from National, Signetics, Motorola and Intel. The duration of each course will be 10 weeks of three hours per week at a cost of $200.00.

Sontron Instruments is also interested in starting a computer club, where members can exchange applications and software.

For further information concerning classes or the club, write to Sontron Instruments, PO Box 156, Carnegie, Vic. 3163; or telephone Brian Baldie after 6pm on (03) 772 6562.

Video data terminal for microcomputers

Low in cost yet loaded with features, this video terminal design is ideal for use with microcomputer systems. It uses any standard TV receiver or video monitor as the display, has an internal refresh memory capacity of 1,024 characters, and can communicate at any of nine crystal-locked data rates. It may also be used as a "TV typewriter" for titling and text generation in video systems.

by JAMIESON ROWE

Most of the small microcomputer systems which are currently arousing so much interest are designed to communicate with the user in ASCII code, via an asynchronous serial terminal such as a Teletype model ASR-33 teleprinter. The problem is that one of these teleprinters can cost you anything from $400 to $1500—rather more than many of the small microcomputers themselves!

To provide one lower-cost alternative, the author developed the ASCII-Baudot translator unit which was described in the October 1976 issue of this magazine. The translator was based on a dedicated microprocessor, and allowed a low-cost surplus Baudot teleprinter machine to communicate with a microcomputer system.

While the translator has allowed quite a few people to get their microcomputer systems "up and talking", we realised even when we were developing it that it was by no means the complete answer for everyone. Teleprinters are fairly complex mechanical devices, and surplus Baudot machines in particular can be noisy in operation and critical to adjust.

Because of the disadvantages of teleprinter machines, many people have expressed interest in a fully electronic terminal, in particular a video terminal.

Commercial video terminals have been available for some time, although until recently their cost has tended to be even higher than teleprinter machines. However, in the last year or so, low cost video terminals for microcomputers have been described in some of the US electronics and computer hobby magazines. These all used a conventional TV receiver or video monitor as the display, in order to lower costs.

Virtually all of these designs were based on particular microcomputer systems, and were intended to interface directly with the system via its parallel address and data bus lines. This generally made them unsuitable for use with other systems, particularly most of the newer microprocessor evaluation systems.

Nethertheless, they showed the way, suggesting that it should be possible to produce a similarly low-cost terminal designed for standard asynchronous serial interfacing. Accordingly, as soon as the ASCII-Baudot translator project had been completed, the author set about developing a terminal along these lines.

As luck would have it, I hadn't gone very far with a design when I received a fateful telephone call. It was from Mr Ed Monsour, a local electronics engineer who has specialised for some years now in the design of video terminals and associated equipment. He had rung to

Here is the complete terminal, with a 21-cm portable TV receiver used as the display device. The low-profile case was kindly provided by Cowper Sheetmetal & Engineering, of 11 Cowper St, Granville, NSW.

SPECIFICATION

A low-cost video data terminal designed to use any standard TV receiver or monitor as the display device. Interfaces to any microcomputer or other computer system via standard asynchronous 20mA input and output lines, at any one of nine standard data communication rates. Will also operate as a "TV typewriter". The keyboard circuitry has a 90-key ASCII encoder designed for use with low-cost surplus keyboards.

Main features are:

- Displays full 6-bit ASCII character set of 64 characters.
- Refresh memory capacity 1,024 characters, which may be organised as either 32 x 32-character lines or 16 x 64-character lines. Double-height characters possible in former mode.
- All critical timing derived from 2MHz crystal, including TV sync frequencies.
- Nine crystal-locked communication rates: 75, 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud.
- Full duplex or half duplex operation.
- Display roll-up and roll-down facility.
- Inbuilt audio alarm driver.
- Both video and modulated RF outputs.
- No critical setting-up.
- Low power consumption—approximately 5 watts.

ask if I thought we and our readers would be interested in a new low-cost video display module he had just developed, and was preparing to sell as a kit via his company E & M Electronics Pty Ltd.

We didn't talk for long before I realised that Ed's video module kit sounded as if it would make an excellent basis for our project terminal. And this was confirmed a couple of days later, when I visited Ed at his premises in Marrickville. His module proved to be a very impressive design, based on modern CMOS and low-power Schottky TTL integrated circuits, and with many worthwhile features.

For example the refresh memory has a capacity of 1,024 characters, many times that of earlier low-cost designs. Not only this, but Ed has given the module various display options, so that the memory may be displayed in a number of ways. You can have 32 lines of 32 single-height characters, for example, with 23 lines typically being visible on the screen at any one time. Or you can have the same number of lines and characters, but the characters displayed in double height mode—with about 11 visible at any one time. Or as a third option, you can have the memory displayed as 16 lines of 64 characters—with 15 lines visible at once.

Apart from this, one of the things which impressed me about the module was its lack of setting-up adjustments. Unlike many of the earlier designs, which had numerous preset adjustments to make (often using a CRO or a frequency counter), Ed's module has only two—both of which can be adjusted without instruments and when the module is finally operating.

Virtually all of the critical timing is derived from a single quartz crystal, including all of the video sync signals and the clock signals used to set the baud rates for communicating with the main computer system. This makes for very easy setting up, and for reliable operation as well.

The other features which Ed has provided on the module include both video and modulated RF outputs, optional roll-up and roll-down facilities for the display, a driver for a low-voltage sound generator (pulsed in response to the ASCII "bell" character code), and a range of nine standard communication rates from 75 to 9,600 baud, together with facilities for varying the serial data format as required.

In addition there is a switchable facility for half-duplex operation in place of the usual full-duplex mode, so that the display may be used to echo directly the characters from its associated input keyboard. This allows the terminal to be used away from computer systems as a "TV typewriter", for displaying text on TV receivers and video monitors.

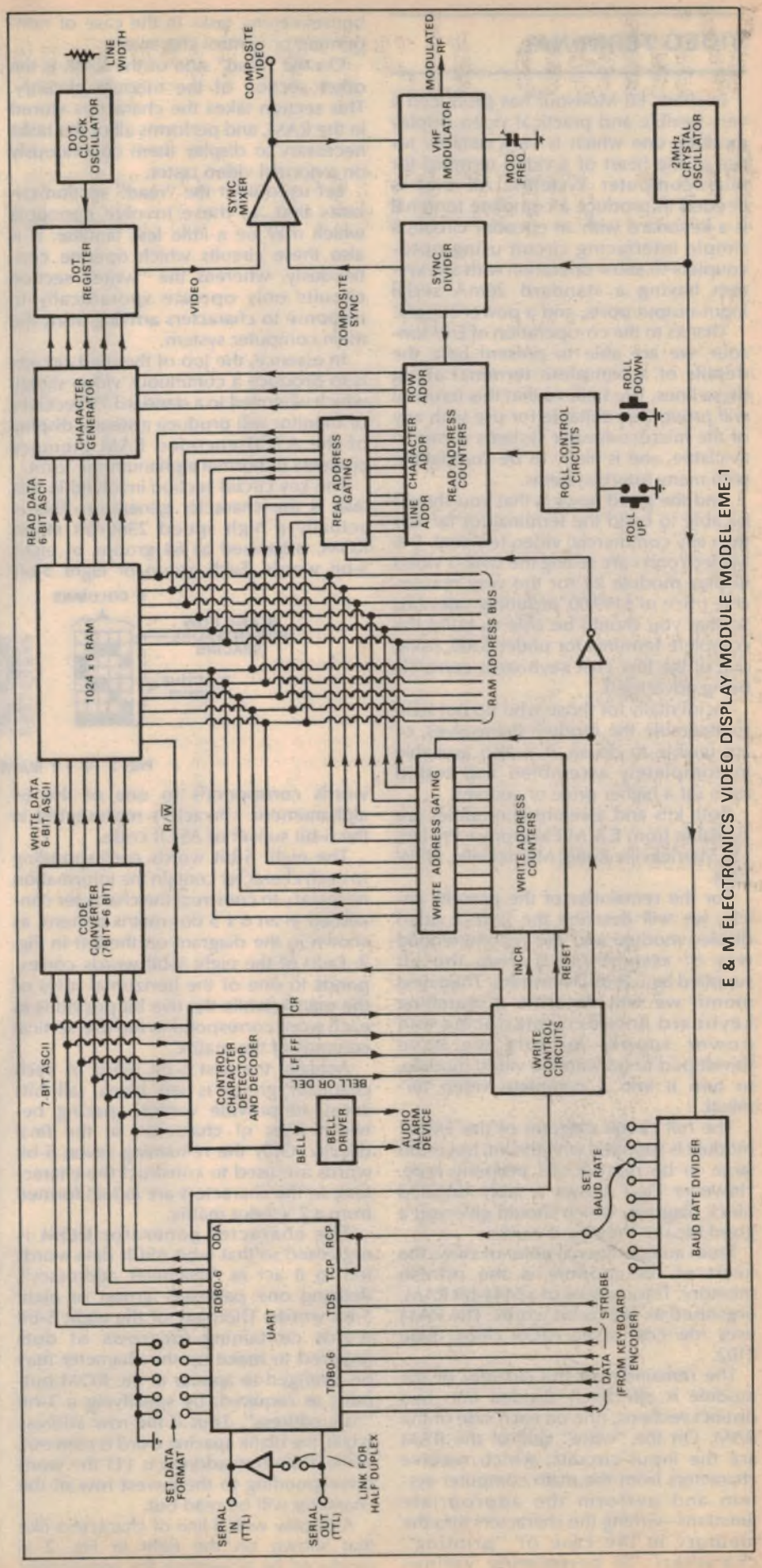


Fig. 1: Block diagram for the EME-1 video display module, heart of our terminal.

VIDEO TERMINAL

In short, Ed Monsour has produced a very flexible and practical video display module, one which is very suitable for use as the heart of a video terminal for microcomputer systems. All that is needed to produce a complete terminal is a keyboard with an encoder circuit, a simple interfacing circuit using opto-couplers to allow operation with any system having a standard 20mA serial input-output ports, and a power supply.

Thanks to the co-operation of Ed Monsour, we are able to present here the details of a complete terminal along these lines. We believe that this terminal will prove very suitable for use with any of the microcomputer systems currently available. and is likely to be compatible with many future systems.

And the good news is that you should be able to build the terminal for far less than any commercial video terminal. E & M Electronics are selling the EME-1 video display module kit for the very reasonable price of $199.00, including sales tax. So that you should be able to build the complete terminal for under $300, using one of the low-cost keyboards currently being advertised.

Incidentally for those who do not wish to assemble the module themselves, or are unable to do so, it is also available in completely assembled and tested form (at a higher price of course).

Both kits and assembled modules are available from E & M Electronics Pty Ltd, 136 Marrickville Road, Marrickville, NSW 2204.

For the remainder of the present article, we will describe the EME-1 video display module and the recommended way of assembling if from the kit supplied by E & M Electronics. Then next month we will describe a matching keyboard encoder, interfacing and power supply module we have developed to go with the video module, to turn it into a complete video terminal.

The full circuit diagram of the EME-1 module is supplied with the kit, but is too large to be reproduced properly here. However Fig.1 shows a fairly detailed block diagram, which should give you a good idea of the way it works.

From an operational point of view, the heart of the module is the refresh memory. This consists of a 6144-bit RAM, organised as 1024 6-bit words. The RAM uses low-cost static MOS chips, type 2102.

The remainder of the circuitry of the module is effectively divided into two distinct sections, one on each side of the RAM. On the "write" side of the RAM are the input circuits, which receive characters from the main computer system and perform the appropriate functions—writing the characters into the memory in the case of "printing" characters, or performing various housekeeping tasks in the case of non-printing or control characters.

On the "read" side of the RAM is the other section of the module circuitry. This section takes the characters stored in the RAM, and performs all of the tasks necessary to display them continuously on a normal video raster.

Let us look at the "read" section circuits first, as these involve concepts which may be a little less familiar. It is also these circuits which operate continuously, whereas the "write" section circuits only operate sporadically in response to characters arriving from the main computer system.

In essence, the job of the read circuits is to produce a continuous video signal, which when fed to a standard TV receiver or monitor will produce a steady display of the ASCII-encoded RAM memory contents in normal alphanumeric form.

The key circuit section involved in this task is the character generator. This is actually a high speed 2560-bit static ROM, organised as 64 groups of eight 5-bit words. Each group of eight 5-bit words corresponds to one of the 64 alphanumeric characters represented in the 6-bit subset of ASCII code.

FIG. 2 : 5 x 7 MATRIX CHARACTER GENERATION

The eight 5-bit words corresponding to each character contain the information necessary to construct the character concerned in an 8 x 5 dot matrix pattern, as shown in the diagram on the left in Fig. 2. Each of the eight 5-bit words corresponds to one of the horizontal rows of the matrix, while the five bit positions in each word correspond to the five vertical columns of the matrix.

Actually the first 5-bit word of each character group is left blank (all bits zero), to provide vertical spacing between lines of characters in the final display. Only the remaining seven 5-bit words are used to construct the characters, so the characters are in fact formed from a 7 x 5 dot matrix.

The character generator ROM is organised so that 6-bit ASCII data words fed to it act as "character addresses", defining one particular group of eight 5-bit words. Then any of the eight 5-bit words containing the rows of dots required to make up the character may be arranged to appear at the ROM outputs, as required, by specifying a 3-bit "row address". Thus if the row address is 000, the blank spacing word is read out, while if the row address is 111 the word corresponding to the lowest row of the character will be read out.

A display with a line of characters like that shown on the right in Fig. 2 is produced by presenting the appropriate sequence of 6-bit ASCII code words repetitively to the character generator, for eight successive TV scanning lines. For the duration of each scanning line the character generator row address is kept static, but the address is incremented between lines.

As a result the character generator produces for each successive scanning line a sequence of the 5-bit words corresponding to the appropriate horizontal row of the line of characters. First a sequence of blanks is produced, then during the next line a sequence of the uppermost active rows for the line of characters. The third scanning line produces the sequence of "second active row" words, and so on down to the eighth scanning line which produces a sequence of words which correspond to the bottom row of the line of characters.

The sequence of 5-bit words produced during each line is turned into a serial video signal by the dot register, shown in Fig. 1 immediately to the right of the character generator. The dot register is basically a shift register, used here as a parallel-to-serial converter. The 5-bit row data words produced by the character generator are parallel loaded into the register, and then shifted out in serial fashion by feeding high speed clock pulses to the register.

The clock signals fed to the dot register are produced by the "dot clock oscillator". In the EME-1 the frequency of this oscillator is adjustable by means of a variable resistor (RV1), and this allows the width of the displayed lines of characters to be adjusted.

The serial output of the dot register is raw video information, and lacks the usual sync pulses. It is therefore fed to a mixer, where a composite vertical and horizontal sync signal is mixed with it to produce a normal composite video signal suitable for being fed to a standard TV monitor. The composite video signal is also applied to a VHF modulator circuit to produce modulated RF, suitable for feeding to the aerial terminals of a standard TV receiver.

The RF output frequency of the modulator may be adjusted by means of a trimmer capacitor, over a range which covers a number of the high-band Australian VHF TV channels. This allows the signal from the module to be placed on a blank channel, to prevent interference from local TV stations.

Note that the dot clock oscillator frequency adjustment and the VHF modulator frequency adjustment are the only two setting-up adjustments required on

the module, and neither requires instruments.

The horizontal and vertical sync frequencies produced by the module are derived via a 2MHz quartz crystal oscillator, via the sync divider circuits. As a result both sync signals are locked to within 0.2% of the standard TV frequencies of 15,625Hz and 50Hz.

In order that the character generator and its following circuits may produce the desired video display of characters, according to the description just given, the character codes stored in the RAM must be presented to the character generator in the appropriate sequences. This task is performed by the circuits represented in Fig. 1 by the block labelled "read address counters".

There are basically three counters in this section, one being a 6-bit counter which keeps track of the characters within the horizontal display lines. This is associated with a 5-bit counter which keeps track of the display lines themselves. Finally there is a 3-bit counter which provides the row address information for the character generator.

The outputs of the character and line address counters are fed to the address bus lines of the RAM via a set of gates. Normally these gates are enabled, so that the read address counters are able to cycle the RAM addresses over and over through the correct sequences for generating a continuous video display of the characters stored in the RAM.

There are actually two line address counters in the read address counter circuits, one an up-down counter and the other a normal up counter. It is the latter whose outputs are fed to the RAM address bus, and which increments once for each displayed line of characters. But at the start of each TV field, this counter is preset to a particular line address by parallel loading it from the up-down counter. Thus the count of the up-down counter determines on which line of the characters stored in the RAM the display begins.

By changing the count of the up-down counter, the display may thus be arranged to start on any desired line. This is the function of the roll control circuits, and the "roll up" and "roll down" push-buttons. One button increments the counter, the other decrements it.

Hopefully you can see from the foregoing that the RAM is normally under the control of the read circuits, and being used to produce the video display. The only time this state of affairs is interrupted is when a new character arrives from the computer system, causing the "write" circuits to spring into action.

As shown in Fig. 1, a UART is used to receive the asynchronous serial characters arriving from the main computer system, and convert them into parallel form. The transmitter section of the UART is made available for use by a keyboard encoder, to transmit asynchronously back to the system.

The UART receiver and transmitter clock signals are provided by a divider connected to the 2MHz crystal oscillator. The divider provides nine alternative output frequencies, corresponding to the standard asynchronous communication rates of 75, 110, 150, 300, 600, 1200, 2400, 4800 and 9600 baud.

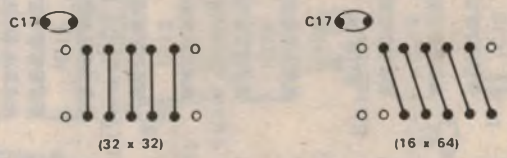
The data format used by the UART may be set in the usual way, by means

LINKS ON THE EME-1 VIDEO DISPLAY MODULE

A. DISPLAY FORMAT

Link	32 x 32 format	16 x 64 format
LK1	Join C-A	Join C-B
LK3	Join C-A	Join C-B
LK5	Join C-A	Join C-B
LK7	Leave open	Close
LK10	Join C-A	Join C-B

ADDRESS SWITCH LINKS:



B. CHARACTER SIZE

Link	Single height chars	Double height chars
LK4	Open	Close
LK8	Join C-A	Join C-B

(Note: double height characters available only in 32 x 32 format)

C. CHARACTER SPACING

To have display characters closely spaced, leave LK2 open.
To increase horizontal spacing between characters, close LK2.

D. LINE FEED OPTIONS

For instantaneous rack-up action on LF character (normal operation) join C-A of LK6 and leave LK9 open. Alternatively, display may be made to roll-up on LF by leaving LK6 open and closing LK9.

E. COMMUNICATION RATE

Speed	LK13	LK11	LK12
75 baud	Join L-A	Open	Open
110 baud	Join L-A	Close	Close
150 baud	Join L-B	Open	Open
300 baud	Join L-C	Open	Open
600 baud	Join L-D	Open	Open
1200 baud	Join L-E	Open	Open
2400 baud	Join L-F	Open	Open
4800 baud	Join L-G	Open	Open
9600 baud	Join L-H	Open	Open

F. DATA FORMAT

The links of LK14 set the usual serial data format:
A: No parity bit (NPB). Close to enable parity.
B: Number of stop bits (NSB). Close for 1, open for 1.5 or 2.
C,D: Number of data bits (NDB1 & 2). Both closed for 5 bits,
C only closed for 6 bits, D only closed for 7 bits, both open for 8 bits.
E: Parity odd/even (POE). Close for odd, open for even parity.
(Note: For normal teleprinter format used in most 110-baud interfaces, close links A and D only.)

G. FULL/HALF DUPLEX OPTION

LK15 controls this option. leave open for full duplex as required for interfacing with most computer systems employing automatic echoing of characters from keyboard. Close for half duplex, as required for systems not providing auto-echo, or for using the terminal as a "TV typewriter".

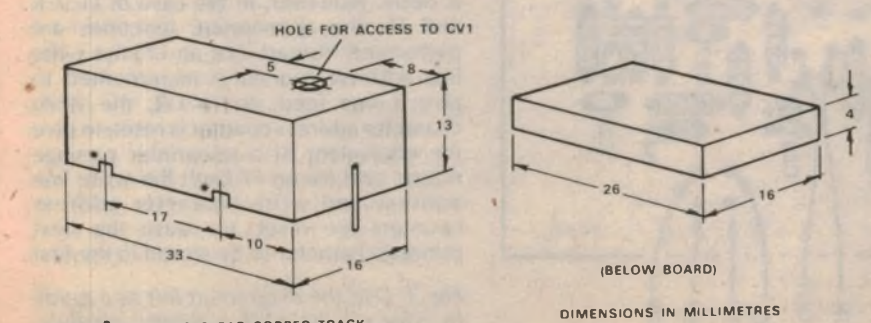
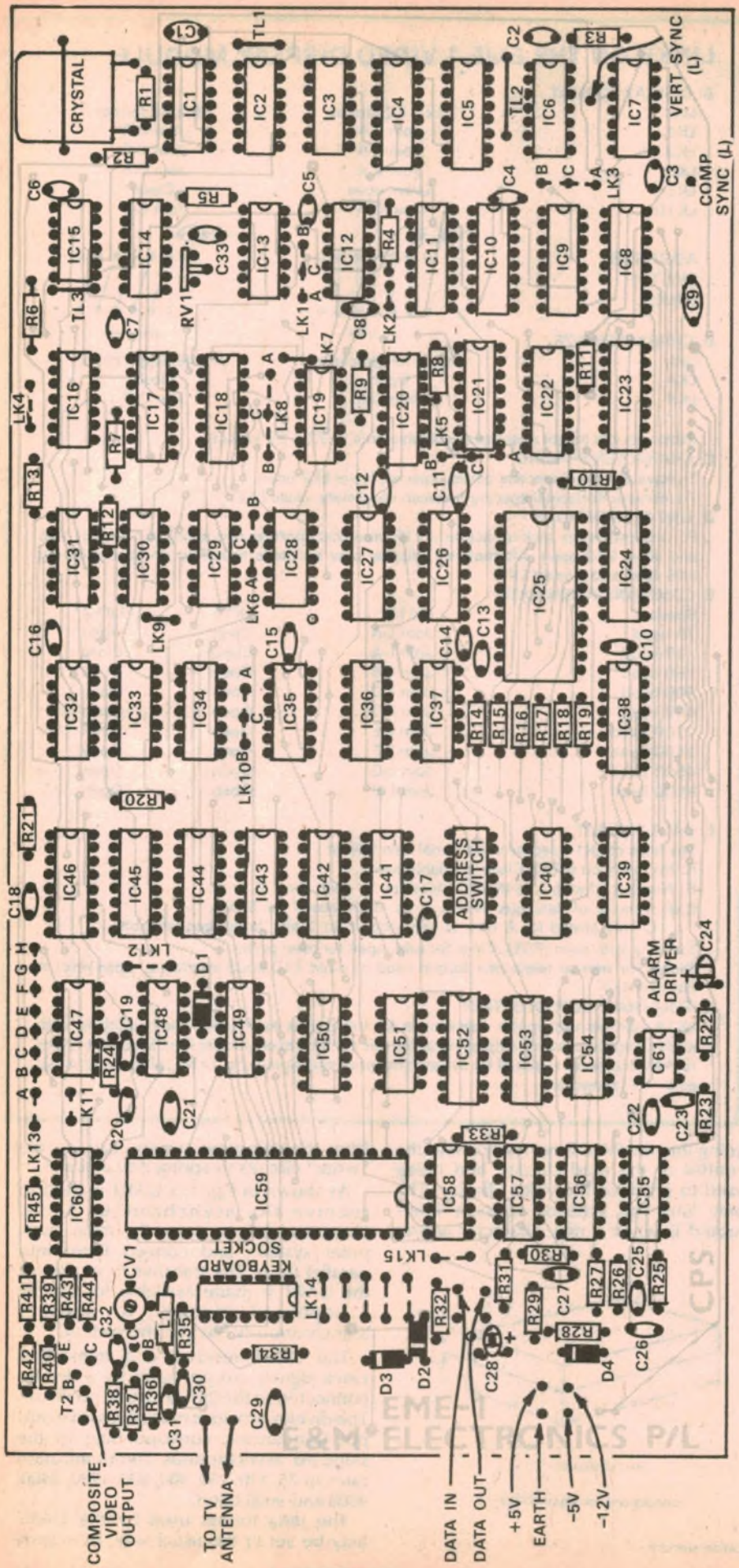


FIG. 4 : VHF MODULATOR SHIELDS



of links. A link may also be used to feed the output from the UART transmitter back to the receiver input, to provide half-duplex operation. Normally with this link open, the keyboard and UART transmitter operate quite independently of the UART receiver and the rest of the display module, giving full duplex operation.

The 7-bit ASCII data produced at the UART receiver outputs is fed to the RAM data inputs via a code converter circuit, whose function is to convert codes for the lower-case alphabetic characters into their equivalent upper-case character codes.

As well as being presented to the RAM via the code converter, the output data from the UART receiver is also fed to circuitry which detects and decodes the various non-printing control characters. The control characters which are detected and decoded are "bell", "line feed" (LF), "carriage return" (CR) and "form feed" (FF). The circuits also detect the "null" or "delete" character.

The decoded "bell" character is fed to an audio alarm driver circuit which is capable of pulsing one of the audio sound generators such as a Sonalert or Audiolarm. The remaining control characters and the delete character are fed to the write control circuits, where they are used to control various functions in response to the "output data available" (ODA) strobe signal from the UART.

For example if none of the control characters is decoded, nor a delete character, this is taken to imply that the received character must be a printing character. Accordingly the write control circuits increment the write address counter, and generate a control signal which disables the read address gates from the RAM address bus, and simultaneously enables the write address gates. This sets the RAM address bus to the next available RAM location, as specified by the write address counter. The write control circuits then send a WRITE (L) pulse to the RAM, causing the character to be written into that location.

If any of the control characters or the delete character is detected and decoded, the write control circuits inhibit this writing cycle. In the case of the delete and bell characters, nothing else is done. However, in the case of LF, CR and FF, the appropriate functions are performed instead. For an LF, the write line address counter is incremented to give a line feed; for a CR, the write character address counter is reset, to give the equivalent of a teleprinter carriage return; and for an FF both the write line address and write character address counters are reset, to cause the next printing character to be stored in the first

Fig. 3: Use the diagram at left as a guide to wire up the EME-1 display module. The parts are identified on the facing page.

RAM location—producing the equivalent of a form feed.

All of the circuitry of the EME-1 video display module is provided on a single PC board which measures 267 x 132mm (10.5 x 5.2 inches). The board is double-sided (etched conductors on both sides), and has plated-through holes. There are a total of 61 integrated circuits on the board, 14 of which are TTL (mostly low-power Schottky), one a 555 timer for the audio driver, and the remaining 46 are MOS devices.

The main reason for the relatively large number of devices is that designer Ed Monsour has used widely available and low cost SSI-MSI devices in preference to more costly and harder-to-obtain LSI types.

As the PCB pattern has many closely-spaced conductors, I suggest that you use a low-power soldering iron with a fine bit. I myself use a Mico 6V/10W "Mini" iron, with a bit having a tip diameter of about 1.2mm. This makes it somewhat easier to solder IC pins and components pigtails to the PCB pads without adding unintentional solder bridges.

I would also suggest that you use fine-gauge resin-cored solder, rather than the normal type, again to assist in avoiding bridges. For this type of work I myself use 0.7mm solder, which seems to be stocked by at least some suppliers.

To assist in wiring up the module from the E & M Electronics kit, we have prepared an overlay wiring diagram (Fig. 3). This shows all of the ICs and other components, listed numerically. The parts list gives the IC type numbers and component values, to enable each part to be identified. The wiring diagram also shows the various input and output points on the PCB, and the programming links. These are wired according to the information in the table.

In assembling the module, I suggest that you wire it up in the following sequence. First, fit the wire links, making sure that if bare tinned copper wire is used, the links are mounted proud of the PCB so that they don't short the etched pattern.

Note that there are three "test links" (TL1, 2 and 3) which must be fitted, as well as those described in the table.

Then fit all of the resistors, proceeding in numerical order according to the parts list and checking them off as you go.

Then fit the capacitors, following the same methodical routine. Don't forget to observe polarity with the two tantalum electrolytics, C24 and C28.

Now fit the four diodes D1-D4, making sure that each is orientated correctly. Also fit transistors T1 and T2, also making sure that they are correctly orientated. And fit inductor L1, mounting it slightly proud of the PCB.

Note that if you are sure that you will never be using the modulated RF output of the module, the VHF modulator components may be omitted. This includes R35-38 inclusive, C31 and C32, CV1, L1 and T1.

If you will be using the modulator, however, now would be the best time to fit the tin plate shields for it above and below the PCB. Details of the shields are given in the small diagram of Fig. 4.

Then fit the TTL integrated circuits, comprising ICs 7, 8, 9-15, 26-28, 57 and 58. Also the 555 device, IC61.

At this point you should pause to make sure that you are prepared for the MOS devices. Make sure that the soldering iron is earthed, and that the earth of the PCB is connected reliably to the barrel and bit of the iron via a cliplead. It is also a good idea to earth yourself, if there is any risk of you acquiring a static charge due to the action of plastic or rubber shoes on nylon carpet, etc.

Now fit the remaining MOS integrated circuits, working methodically from the parts list as before. When soldering in each one, it is a good idea to solder the supply pins first (usually pins 7 and 14); this makes sure the remaining pins are protected by the internal clamping diodes.

This completes the assembly of the video display module, and you should now be ready to add to it the remaining circuitry required to produce a complete video terminal. This will be described next month, in the second of these articles.

PARTS LIST FOR VIDEO DISPLAY BOARD

INTEGRATED CIRCUITS

IC1	4011	IC2	4024
IC3	4013	IC4,5	40163
IC6	4023	IC7	74LS00
IC8	DM8097	IC9-11	74LS161
IC12,13	74LS74	IC14	7400
IC15	74LS00	IC16	4001
IC17	4029	IC18	40163
IC19	4023	IC20	4029
IC21	40163	IC22	4029
IC23	40097	IC24	40163
IC25	2513-CM2140	IC26,27	74LS195
IC28	74LS08	IC29	4013
IC30	4011	IC31	4071
IC32,33	4013	IC34	4023
IC35	4001	IC36	4081
IC37	4024	IC38	40097
IC39	4024	IC40	40097
IC41-46	2102	IC47	4024
IC48	4023	IC49,50	4081
IC51	74C30	IC52,53	4028
IC54	4011	IC55	4071
IC56	4011	IC57	74LS04
IC58	74LS08	IC59	S1883
IC60	40163	IC61	NE555

TRANSISTORS

T1	2N706	T2	2N3643

DIODES

D1-D4	1N914

RESISTORS

R1	1M	R2	2.2k
R3	10 ohms	R4	10k
R5	2.2k	R6-10	10k
R11	2.2k	R12,13	10k
R14-19	2.2k	R20-22	10k
R23	33k	R24	10k
R25	1M	R26	100k
R27	10k	R28,29	22k
R30	2.7k	R31	10k
R32	470	R33	220
R34	470	R35	2.7k
R36,37	1k	R38	3.9k
R39	47ohms	R40	75 ohms
R41	2.2k	R42	1k
R43	3.9k	R44,45	22k
RV1	2.2k miniature variable		

CAPACITORS

C1-18	.01uF ceramic
C19	100pF ceramic
C20	.01uF ceramic
C21	.047uF
C22,23	.01uF ceramic
C24	6.8uF tantalum
C25,26	220pF ceramic
C27	680pF ceramic
C28	6.8uF tantalum
C29-31	.01uF ceramic
C32,33	10pF ceramic
CV1	3.5-13pF variable

MISCELLANEOUS

1	PC board, code EME-1 (See note below)
1	Inductor, L1
1	2MHz crystal

NOTE: All of the above components are sold as a complete kit for the EME-1 video display module by E & M Electronics Pty Ltd, 136 Marrickville Rd, Marrickville, NSW 2204. The proprietary PCB is not sold separately.

PHILIPS MONITOR ASSEMBLIES AVAILABLE

This is the video monitor assembly from a Philips model C3 30-cm monochrome TV receiver. Although it does not include a sync separator, it will interface to our video data terminal quite easily. Cost of the assembly is $125, and stocks are available from Cema (Distributors) Pty Ltd, who have offices in Sydney and Melbourne.

Follow the CB action at home with our

Powermate for transceivers

By the time you read this Citizens' Band radio could well be legal in Australia, in which case CB activity will increase markedly. You can follow the action at home by powering your transceiver from our CB Powermate.

CB Powermate puts out 13.6VDC at 1.5A

by LEO SIMPSON

While most CB activity is likely to be mainly from cars, many operators will want to carry on the conversation while at home. The easy way to do this is to remove the transceiver from the car and operate it from a suitable mains power supply.

Just about any 12V DC power source with a current rating of about 1.5 amps or more could probably be pressed into service. But few transceivers will give the best performance when operated in this way, because the power output ratings of transceivers are quoted for a DC input voltage of 13.6 or 13.8V.

There is a dual reason for this. First, it enables the manufacturer to quote higher ratings than would be possible for a 12V input. Second, which the manufacturers would no doubt hasten to point out, the normal voltage available from a car's electrical system, with the motor running, hovers just below the 14V mark.

The above remarks equally apply to radios and stereo tape players designed for use in cars. This situation has existed for at least fifteen years.

It follows then, that the way to obtain the best performance from a CB transceiver is to operate at 13.6V DC. The CB Powermate puts out 13.6V at up to 1.5 amps, which should be adequate for most models.

Powermate can also be used to power other 12V appliances such as tape players, provided their current drain is 1.5 amps or less.

The circuit is simple and uses readily available parts. Cost should be around $16 to $18.

Refer now to the circuit diagram. The power transformer has a centre-tapped 30V secondary winding which is coupled to a full-wave rectifier and 4700uF filter capacitor to develop about 21 to 23 volts DC at no load. The output of the 4700uF is coupled to a simple series regulator consisting of a Darlington transistor pair and a 15V zener diode reference.

The Darlington pair merely acts like an emitter-follower. The reference voltage at the base of T1 determines the voltage at the emitter of T2. Because each transistor has a base-emitter voltage drop of approximately 0.7V, the resulting output voltage at emitter of T2 is 15–1.4 = 13.6V.

Low hum output is a feature of the circuit. This is because any ripple voltage (hum) applied to the input of the regulator is considerably attenuated by the voltage divider consisting of the 560 ohm resistor and the dynamic impedance of the zener reference (typically about 10 ohms).

Regulation of the circuit is about 5%. Put another way, the change in voltage from no load to full load at 1.5 amps is typically 14.2V to 13.6V. Ripple ranges from less than 10mV peak-to-peak at no load to about 40mV peak-to-peak at full load.

Powermate is easy to build and layout is not critical, although internal wiring should be kept reasonably short and compact to avoid instability.

Instability in a simple circuit like this? Yes, it is entirely possible in a series regulator circuit. It can happen because of long leads to the collector of T2. These can act as an inductance and the circuit oscillates at several Megahertz.

Fortunately, the remedy is usually simple. A 0.1uF capacitor can be connected across the output terminals or from collector of T2 to the chassis.

We built our Powermate into a compact box measuring 134 x 76 x 150mm (W x H x D) available from Dick Smith Electronics. The cases have a sturdy steel lid and a flimsy aluminium base but they are adequate for the job. Rubber feet are fitted to the case.

The transformer was also supplied by Dick Smith, type DSE 6672. This is equivalent to the A&R 6672. The Ferguson PF 3559 or PL30/40VA would also be suitable. We accommodated the few circuit components on a 12-lug length of

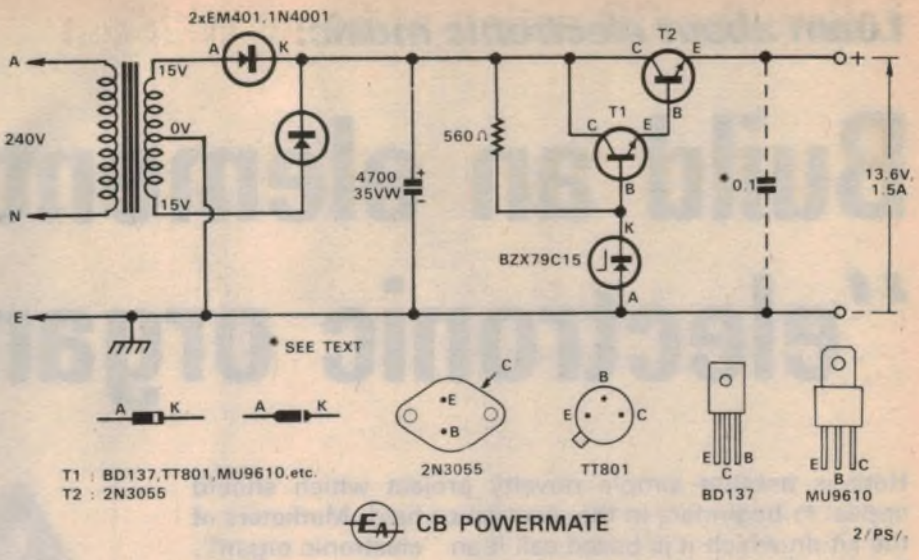
Powermate will run most CB transceivers with a maximum output rating of 5W.

miniature tagboard, but a large tagstrip would have done just as well.

Make sure that the zener diode and transistors are correctly wired otherwise damage is certain to result.

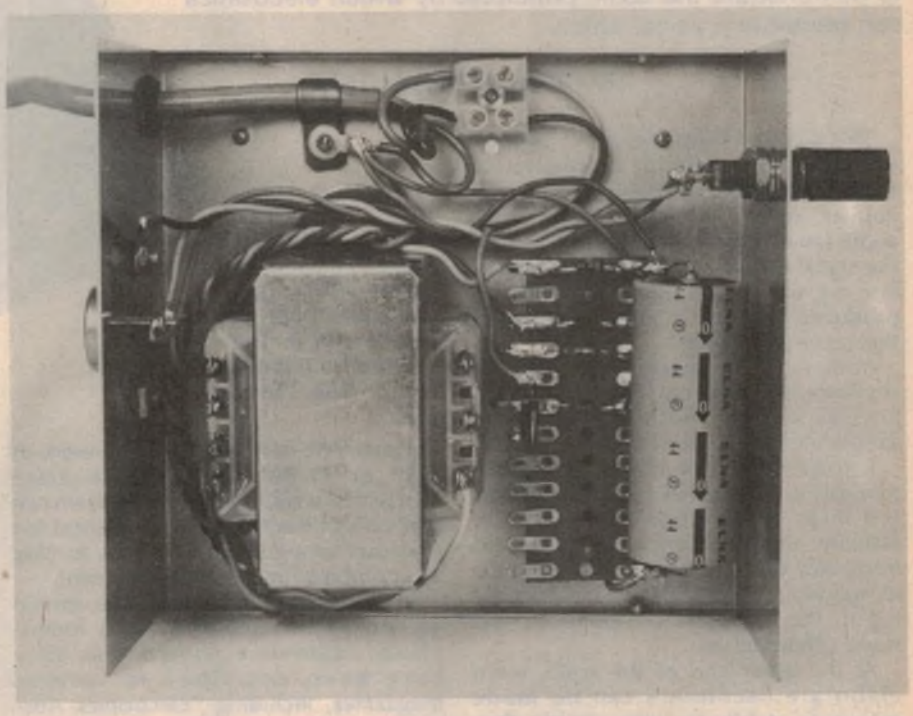
Follow this procedure for wiring the three-core mains cord: Pass the cord through a grommet in the rear of the case and anchor it with a cord clamp. The active and neutral wires are terminated in an insulated terminal block. The earth wire is soldered to a lug which is bolted or riveted to the chassis. Leave a loop of slack in the earth wire so that if the mains cord is pulled out, the earth wire will be the last to break.

The 2N3055 transistor T2 is mounted in the following way: Drill the mounting holes if not already provided. Make sure tha the contact area is free of burrs and swarf. Smear the contact surface and the underside of the transistor with silicone grease or heatsink compound. A mica

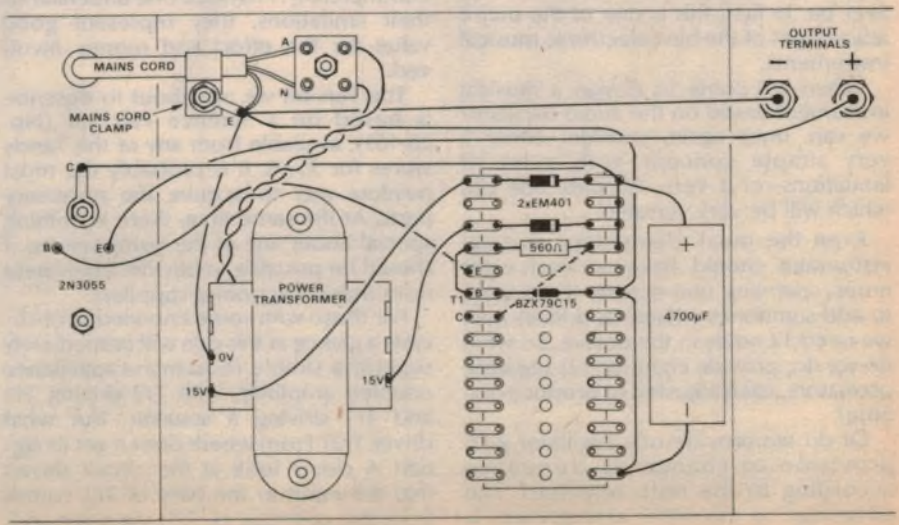


PARTS LIST

1 metal box, 134 x 76 x 150mm
1 transformer with 30V centre-tapped secondary, A&R 6672, DSE 6672, Ferguson PF 3559 or PL30/40VA
1 2N3055 silicon NPN power transistor
1 BD137, TT801, MU9610 silicon NPN transistor
1 BZX79/C15 or similar 15V 400mW zener diode
2 EM401, 1N4001 silicon rectifier diodes
1 4700uF/35VW electrolytic capacitor
1 560 ohm ½W resistor
1 12-lug tagboard
1 2-way insulated terminal block
2 solder lugs
1 grommet
2 4mm banana socket/binding posts, one black, one red
Mains cord and three-pin plug, screws, nuts, hookup wire, solder, common sense.



This photo and diagram below show the easy assembly of Powermate.



washer and insulating bushes must be used to isolate the transistor from the chassis. Attach a solder lug to one of the mounting screws to terminate the collector lead.

When assembly is complete, check the circuit for errors. Use the wiring and circuit diagrams for comparison with your work. Now switch on and check the voltage output. It should be close to 14V.

The Powermate is not proof against damage from severe overload or short-circuit. When making connections to the output terminals, make sure the unit is not energised. We have not included fuse protection since CB transceivers usually have at least one fuse in their supply leads.

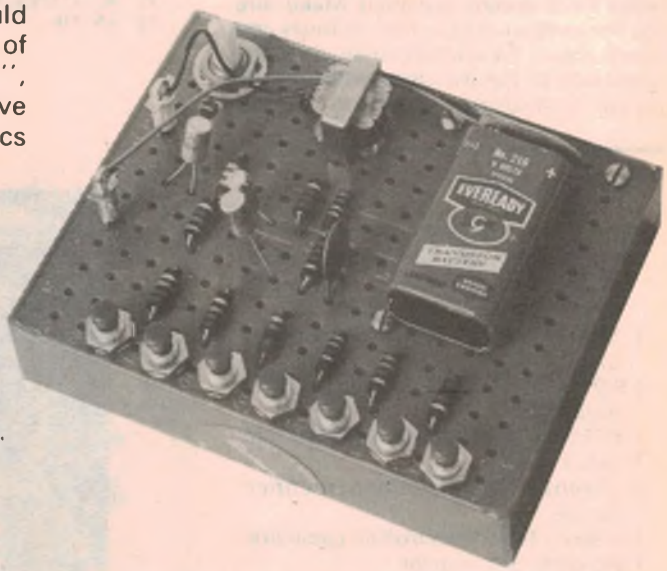
Optional extra features on the unit could be an on/off switch and a pilot light. We think most constructors will do without these though, as they are usually provided on the CB transceiver itself.

Learn about electronic music:

Build an elementary "electronic organ"

Here is another simple novelty project which should appeal to beginners in the electronics field. Marketers of the kit on which it is based call it an "electronic organ", but this flatters it too highly. Nevertheless, it does serve to demonstrate the basic principles by which electronics can generate musical notes.

by WALTER NEVILLE



The finished "organ". The pot, R12, is in the top left corner with the output transformer to the right of it. The seven push buttons are on the lower edge.

The basis of most electronic musical intruments is a circuit configuration known as an audio oscillator. As the term implies, such a circuit oscillates at an audio (audible) frequency and, if we feed the signal into an amplifier/speaker system we will hear a note similar to that produced by, say, a string vibrating at that same frequency.

In its most elementary form, such an oscillator is a relatively simple device. As a result, it is not hard to design a very simple electronic musical instrument.

Of course there has to be a catch. Such a simple oscillator has many limitations, the most serious one being lack of stability, or a tendency to change its frequency of oscillation according to the temperature, the state of the battery driving it, the aging of components, and many other factors.

At the other end of the scale, more elaborate oscillators can be made extremely stable—far more stable than any conventional musical instrument can ever be. In fact, this is one of the major advantages of the best electronic musical instruments.

When we come to design a musical instrument based on the audio oscillator we can, once again, consider either a very simple concept—with a lot of limitations—or a very complex one but which will be very versatile.

Even the most elementary musical instrument should have at least eight notes. spanning one octave. If we want to add semitones (sharps and flats) then we need 12 notes in the octave. So what do we do; provide eight (or 12) separate oscillators, each adjusted to produce one note?

Or do we provide one oscillator with provision to change its frequency according to the note selected? The advantage of this latter arrangement is obvious; one oscillator does the work of eight (or 12). But there is a disadvantage too; with this simple arrangement we can play only one note at a time, whereas the previous arrangement allows us to play any combination of notes we desire.

In spite of its limitations, the simple version—often referred to as a monophonic organ—is a popular one. They have been described in various magazines, including "Electronics Australia", and have even been marketed commercially. Provided one understands their limitations, they represent good value for the effort and money involved.

The version we are about to describe is based on a Science Fair Kit (No. 28-101), available from any of the Tandy stores for $5.95. It is probably the most painless way to acquire the necessary parts. At the same time, there is nothing special about any of the components; it should be possible to buy the equivalent from many electronics suppliers.

For those with some knowledge of circuits a glance at this one will immediately suggest a simple resistance-capacitance coupled amplifier, with Tr2 driving Tr1 and Tr1 driving a speaker. But what drives Tr2? From where does it get its signal? A closer look at the circuit shows that the input to the base of Tr2 comes from the collector of Tr1, via a network of switches, resistors, and a capacitor.

If we ignore the multiplicity of resistors for the moment, and the switches, we can assume that this network consists of a single resistor and capacitor. Regardless of the actual components used, any network which connects the output of an amplifier back to its own input is called a feedback network—for fairly obvious reasons.

Feedback may be designated as either "positive" or "negative" (according to the phase) but this is really too complex a subject to discuss here. Suffice it to say that the feedback in this case is positive. An important effect of positive feedback in any amplifier is to make it less stable and, if sufficient feedback is provided, the amplifier will go into oscillation.

And this, as we explained at the beginning, is just what we require of an audio oscillator. Equally important is the fact that the frequency at which this arrangement oscillates is determined by, among other things, the values of resistance and/or capacitance in the feedback network.

Another interesting aspect of this circuit is that, if it is redrawn according to popular convention, it suddenly looks very like another circuit configuration with which you may already be familiar; the so-called "multivibrator".

But whether you think of it in terms of

a multivibrator or simply as an amplifier with positive feedback, really doesn't matter; either definition can be justified in this case. The important thing is that the circuit functions as an audio oscillator.

By now you probably can appreciate the reason for the various resistors and switches in the feedback network. The switches, which take the place of the keys on a musical keyboard, will bring into circuit individual resistors which have been selected to produce a particular note. If all the resistors have just the right value each note will fit exactly into its correct place in the musical octave.

The circuit, as shown, has a number of limitations, even for a simple device. The first point that struck us is that it provides for only seven notes, rather than the eight normally regarded as a full octave.

Another is the use of a variable resistor (R12) for the S1 position, and which also remains in circuit in series with each of the other resistors, R1 to R6, as it is selected. The manual in the kit explains that this can be used to move the whole scale up or down. While this is true, we questioned whether it would retain the proper frequency ratio between notes at all settings.

We also queried the values of R1 to R6 on the basis that the ratios seem unlikely to provide the normal ratios between musical notes. And it is significant that the manual suggests that other value resistors may be substituted if desired.

We were also intrigued by the attempt in the manual to explain the relationship between resistor-capacitor combinations and frequency, in terms of the resistance-capacitance time constant. Even putting aside an obvious error in mathematics, the explanation can only be described as "quaint" and not to be taken too seriously.

All these suspicions were confirmed when we built the unit. In addition, it produces one of the most raucous sounds we have ever heard; so much so that the accuracy of the frequency, or "pitch" in the musical sense, becomes quite hard to determine. "Squawk" is the word that best describes the sound and one staff member suggested that the device should be called a "squawgon"!

All of which adds up to a device with seven keys which produce seven squawks progressing up the scale by random increments. Its ability to produce even a simple melody would be doubtful.

Fortunately, these limitations are not insurmountable and would provide a challenge for the experimenter. The reason for the raucous note is simply that the system has far too much feedback for the gain of the amplifier section so that all stages—and also the speaker we suspect—are being grossly overloaded.

There are various ways in which the gain can be controlled but an easy one to try was to connect a resistor in series with one connection to the 4.75uF coupling capacitor, C1. We tried various values up to about 22k and these did make the note somewhat less raucous.

It also had a second beneficial effect; it reduced battery drain significantly. In its original form the standing current, before a button was pressed, was about 3.5mA and when a button was pressed rose to between 22.5 and 25mA, depending on the individual note. With a 10k resistor in series with C1 the standing current drops to 1mA and the operating current to a maximum of 15mA.

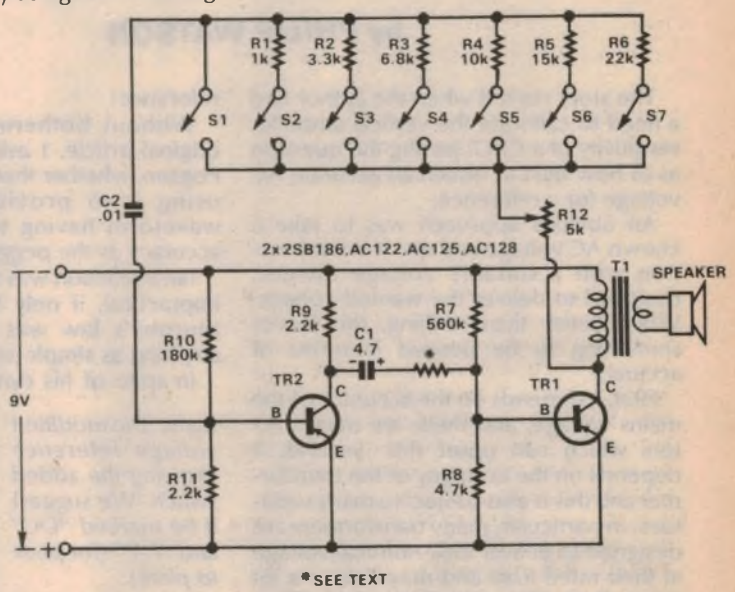
In our prototype a much closer approach to a correct note sequence could be obtained by using the following resistors in order: The 22k is retained for the lowest note, followed by 15k, 12k, 10k, 6.8k, 4.7k, and 3.9k. If the octave is to be completed, by fitting another button, the next value would be 2.7k.

But even with the 7-note arrangement it should be possible to pick out a "white notes only" melody, by playing the lowest note in place of its missing counterpart, one octave higher.

As with all these kits, assembly should present no problem. A perforated plastic box in which the components are packaged becomes a simple chassis. The rows of perforations are coded with letters and numbers which permits any individual hole to be nominated. The instructions make frequent use of this system establish the position of components.

In addition, there are drawings showing how to mount particular components, a layout diagram, and a circuit. Even a beginner should have no problems. As with the previous kits, we elected to make the various soldered connections without trimming the component pigtails. This preserves the components for use in other projects if, as is most likely, this project will be used only as an exercise and ultimately stripped down.

If you want to exercise some initiative, you could contrive something that looked like a keyboard, with a contact under each key. You could add sharps and flats by including extra resistors in the sequence where the semitones (or black notes) fit in the octave. If you could pick up a handful of oddment 20k potentiometers, the notes could be made tuneable. The whole pitch of the octave could be changed by selecting another value of capacitor instead of the .01uF in the feedback network. The loudness of the sound in the speaker could be reduced by wiring a low value resistor—less than 100 ohms—in series with one lead to the voice coil. None of these measures will result in a good "organ" but you'll be learning while you experiment!



The circuit, as shown, looks very like an amplifier, except that there is a positive feedback path from the output to the input. By varying the resistance in the feedback path the note can be varied.

As we mentioned earlier, the project need not involve the Science Fair kit. All the components should be readily available from electronics stores, even though a little more effort may be involved in collecting them.

The only components worthy of special mention are the transistors and the speaker transformer. The original transistors are 2SB186s; general purpose PNP types. There are a number of substitutes available and these are shown on the circuit.

The output transformer appears to be a standard push-pull type with primary impedance of about 500 ohms and a secondary of 8 ohms. There are several versions available locally.

There is nothing critical about the speaker and almost any 8 ohm unit should suit. The original was a nominal 50mm diameter type but any size would do.

And that is about all there is to it. We don't suggest that this device, or any tune that is played on it, will make musical history, but building it can be a lot of fun and you will have learned something. And when you tire of it, the bits will always come in handy for another project.

Add a P-P feature to voltage reference

Necessity is the mother of invention, according to the popular adage, and the development of the feature to be described certainly falls into this category. It tells how a very simple modification can significantly increase the value of an already useful device.

by PHILIP WATSON

The story started when the author had a need to calibrate the vertical amplifier sensitivity of a CRO; posing the question as to how best to obtain an accurate AC voltage for a reference.

An obvious approach was to take a known AC voltage and use it in conjunction with a suitable voltage divider, designed to deliver the wanted voltage. While better than nothing, this leaves something to be desired in terms of accuracy.

First, it depends on the accuracy of the mains voltage, and there are many factors which can upset this. Second, it depends on the accuracy of the transformer and this is also subject to many variables. In particular, many transformers are designed to deliver their nominal voltage at their rated load and may deliver a lot more than this unloaded. And, third, there is the accuracy of the resistors making up the divider network.

All of which adds up to a rather indeterminate reference at best. The desire for something better turned my mind to the DC Voltage Reference described in our June 1976 issue, which could provide an accuracy of 0.1%. Was there some way in which it could be used as an AC reference?

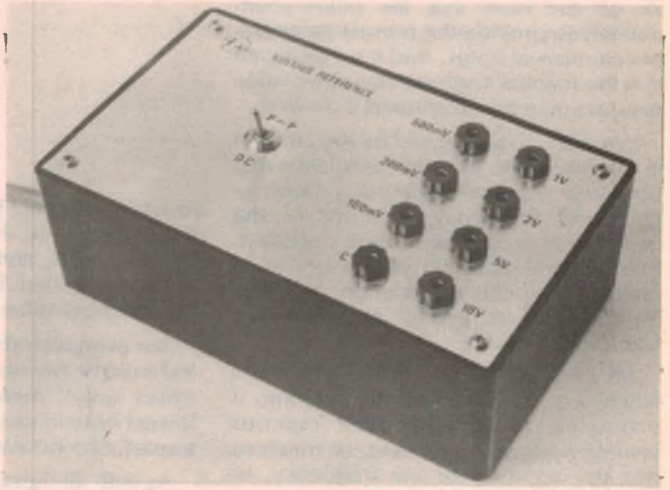
Without bothering to refer to the original article, I asked the author, Ian Pogson, whether there was some way of using it to provide a clipped AC waveform having the same order of accuracy as the pegged DC.

Ian's reaction was that it probably was impractical, if only for the reason that Murphy's law was unlikely to allow anything as simple as that to work!

In spite of his cynicism, however, he fished out the circuit and we studied it jointly. The idea of feeding AC to the device was ruled out almost as soon as it occurred, since it was obviously designed to operate at one polarity only. But what would happen if we fed it with DC pulses?

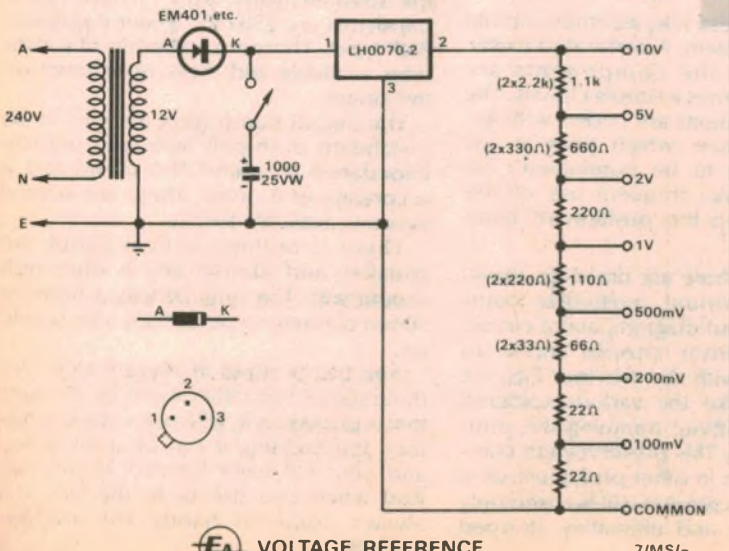
My first reaction was to suggest the output from a full-wave rectifier, but Ian countered this by suggesting a half-wave rectifier, pointing out that the period of non-conduction should provide a clearly defined base line while the zener action should clip the positive going pulses and, hopefully, produce something approaching a square wave whose amplitude was just as accurate as the DC reference.

At which point we both looked at the circuit and realised that all that was needed to achieve this was to remove the 1000uF filter capacitor. It seemed too good to be true but, if it worked, Murphy's law would certainly have taken a bashing this time!



Right: The modified voltage reference showing the added switch. We suggest it be marked "DC" and "P-P" (for peak to peak).

Below: The modified circuit showing the switch in series with the filter capacitor. A spare lug on the terminal strip simplified the actual wiring changes.



VOLTAGE REFERENCE 7/MS/-

Well, to cut the story short, we tried it—and it worked, delivering a waveform exactly as predicted. All we had to do was add a switch to the front panel, and make the appropriate connections.

The wiring changes were simple. We lifted the positive lead of the 1000uF capacitor from its existing tag and moved it to an adjacent blank tag. Then we wired the switch to bridge these two tags.

It must be realised that the signal is useful only for calibrating a CRO. It cannot be used, at least directly, to calibrate an AC meter, since the angular waveform is far removed from the sinewave on which AC meter calibrations are based.

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Per Disk	109.4 Kbytes	
Per Track	3125 bytes	
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Per Disk	80.6 Kbytes	89.6 Kbytes
Per Track	2304 bytes	2560 bytes
Per Sector	128 bytes	256 bytes
Sectors/track	18	10
Transfer Rate	125 kilobits/sec	
Latency (avg)	100 ms	
Access Time		
Track to Track	40 ms	
Average	463 ms	
Settling Time	10 ms	
Head Load Time	75 ms	

Functional Specifications

Rotational Speed	300 rpm
Recording Density (inside track)	2581 bpi (103 bp mm)
Flux Density	5162 fci (206 fcp mm)
Track Density	48 tpi (1.89 tp mm)
Tracks	35
Index	1
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Media Requirements	
SA104	(soft sectored)
SA105	(16 sectors hard sectored)

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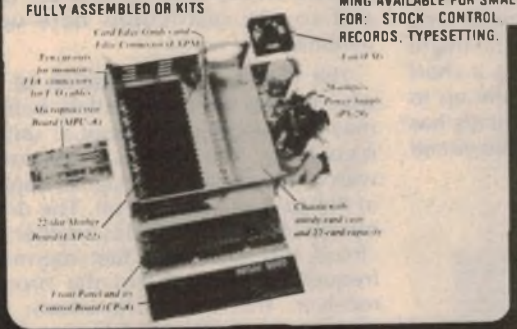

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848 9133 AH654 1127

Short-wave converter for the 27MHz band

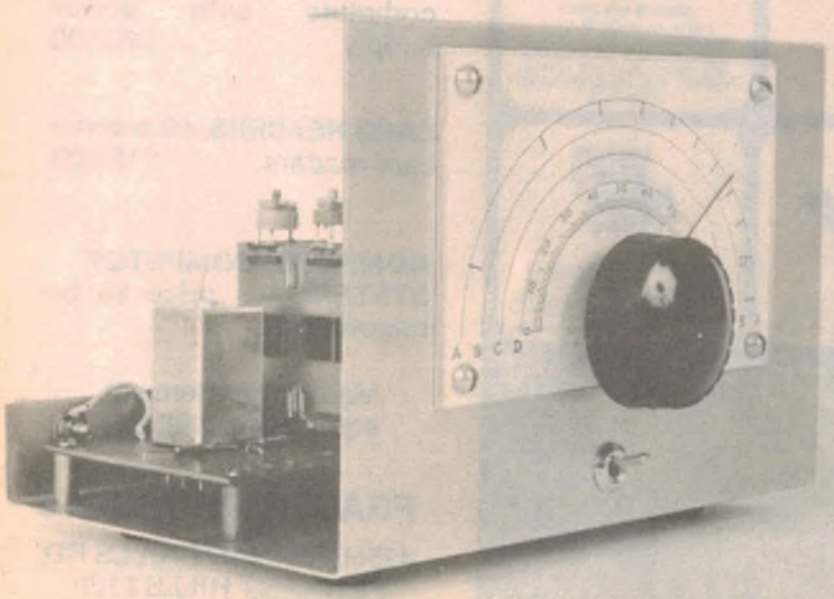
. . . simple project for listening to amateurs and "CBers"

Here is a timely addition to our line of converters, designed to let you listen in to the increasing activity on the 27MHz band. It should be particularly handy if "CB" operation becomes legal, as now seems likely. The converter is simple, effective and suitable for use even with personal portable receivers.

by IAN POGSON

Beginning in April, 1973, the author described a series of simple converters covering various tuning ranges. Since then, interest has grown considerably in the 27MHz band. With more Novices being added to the ranks in the near future and the possibility of legislation being enacted to permit greater use of the 27MHz band, one can only guess at the amount of activity that these factors will generate. Even now, listening around on the band any night or at week-ends, there is quite a lot to be heard. With all this in mind, I was prompted to add a converter to the series to specifically tune the 27MHz band.

After some thought, it was decided that the original concept should be followed, using the original "universal" PC board. Also, many beginners (and others) would wish to feed such a converter into a personal portable or perhaps a larger transistor domestic type radio, as well as those readers who might want to feed the converter into a short wave receiver which did not tune up to 27MHz. Each of these requirements has been considered and although the circuit as shown is designed to feed into a receiver tuning the broadcast band, details will be given later on showing how it can be fed into a short wave receiver at about 3.5MHz.



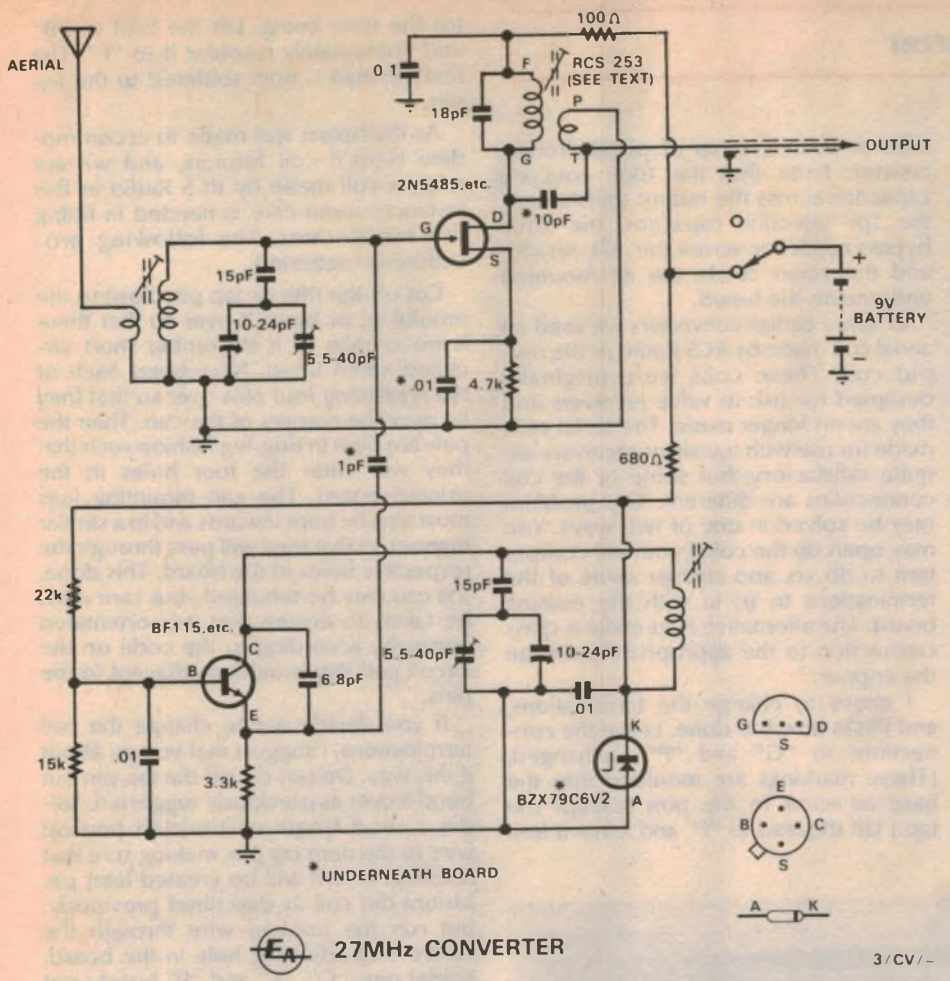
Frontal view of the completed converter, with the aerial coil and tuning gang both visible behind the front panel. A simple, folded aluminium chassis is used.

Perhaps at this early stage it should be pointed out that there are some limitations to feeding the converter into an ordinary broadcast receiver. It means, of course, that you are limited to the amount of selectivity available in the receiver, although generally this should be sufficient. Also, the normal receiver is designed to resolve AM transmissions and will not respond satisfactorily to other modes such as FM and SSB. Fortunately, most of the transmissions at present on the 27MHz band are on AM and so any restrictions here will be minimal.

The circuit is an adaptation of those which have been presented before. It may be seen that it is about as simple as it could be. The mixer is a junction FET, with a tuned circuit at signal frequency in the gate or input circuit. The drain or output of the FET includes another tuned circuit, this time at the first intermediate frequency, to feed into the broadcast receiver. There is a 4.7k resistor in the source of the FET, which may appear to be a rather high value, one which would bias the FET well back into the "knee' or non-linear part of the characteristic curve. This is so, in fact, and is a requirement for efficient mixing of the incoming signal with that from the local oscillator.

The local oscillator itself uses a bipolar transistor, and the circuit is an adaptation of that used for our Solid State Dip Oscillator and many other more recent projects. This oscillator can be made to operate satisfactorily over a very wide frequency range. The tuned circuit consists of a coil winding similar to that used for the signal frequencies, together with the other section of a 2-gang variable capacitor.

It may be seen that there is a 15pF capacitor connected in series with each section of the gang. These are added to restrict the tuning range provided by the



27MHz CONVERTER

3/CV/-

available size of gang. There is also a variable trimmer across each section of the gang. These, together with the slugs in each of the coils, provide for correct alignment and band coverage. Output from the oscillator is taken from the emitter via a 1pF capacitor to provide injection into the gate of the FET mixer.

The components used in the converter are normally stocked items and no trouble should be experienced in obtaining a complete kit. The types of capacitors required are shown in the parts list.

For the mixer transistor, there are at least four different type numbers which we know to be suitable. These are 2N5485, FE5485, MPF106 and BFW11, all having substantially the same characteristics. The oscillator transistor is a bipolar and such types as BF115, TT1002, SE1002, or similar should be satisfactory in this position.

The prototype printed circuit board was made by RCS Radio Pty Ltd, but there are quite a few manufacturers of printed circuit boards and suitable boards may be also available from other makers. As mentioned in previous articles on converters, we have attempted to make this a multi-purpose board and during assembly, you will notice that there are many unused holes. To avoid any possible errors due to the extra holes, I suggest that extra care be taken during assembly.

The output transformer is an RCS type 253 broadcast aerial coil connected in reverse. Possibly other brands could be used, provided they can be made to fit the space on the printed board.

The dial assembly calls for special comment, particularly as the "Jabel" dial used on the prototype is no longer available in this form, having since been modified. The actual mounting centres have been retained but the height has been increased by about 12mm. This means that the front panel has to be increased in height. This has been taken care of in the dimensions given in the parts list, and the metalwork drawing has also been altered to suit.

A good place to start construction is to wind the aerial and oscillator coils. The aerial coil consists of a primary and a secondary, with the secondary wound first. The start of the winding is anchored by soldering it to the lug of the former, according to the drawing. The finish of the winding may be temporarily held in place with a small piece of adhesive tape. Leave this end free while the primary of two turns is wound over the bottom end of the secondary. The start is anchored by soldering it to the appropriate former lug and the finish may also be held in place by drawing it tightly and soldering it to its lug. The finish of the secondary is now soldered to its lug.

The oscillator coil is treated in much the same way, except that it only has one winding. Keep it in mind that the frequency stability of the oscillator largely depends on this coil. It should therefore be wound firmly and finished in a workmanlike manner. The start and finish must be soldered to the lugs as shown in the drawing, so that the connections suit the pattern on the printed circuit board. To ensure that the windings of both coils stay firmly intact, they should now be given a coat of cellulose lacquer or other suitable material.

Before the 2-gang variable capacitor

PARTS LIST

1 Chassis-panel, 165mm long x 127mm high x 127mm deep
1 Cabinet to suit
1 Dial assembly, Jabel 6/36N
1 Flexible coupling, ¼in x ¼in, Jabel
1 Miniature toggle switch, SPDT
2 Terminals, 1 red, 1 black
2 Large 3-tag strips (battery supports)
4 Rubber feet
1 Grommet for coax cable
6 Spacers, 12½mm long, tapped ⅛in Whitworth
1 Printed board, 152mm x 76mm, 73/3C
1 Aerial Coil, RCS type 253
2 Neosid coil formers, 7.6mm x 35mm, with grade 900 slug and can
1 Zener diode, BZX79C6V2
1 Transistor, 2N5485 or similar
1 Transistor, BF115 or similar
1 9V battery, No. 2362

RESISTORS (½W)
1 100 ohms
1 680 ohms
1 3.3k
1 4.7k
1 15k
1 22k

CAPACITORS
1 1pF NPO ceramic
1 6.8pF NPO ceramic
1 10pF NPO ceramic
2 15pF NPO ceramic
1 18pF NPO ceramic
1 10-24pF Roblan 2-gang variable
2 5.5-40pF Philips trimmers
3 .01uF 200V greencaps
1 0.1uF 100V greencap

MISCELLANEOUS
Hookup wire, coax cable, solder, screw, nuts

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

can be fitted to the board, leads must be soldered to the two bottom lugs of the fixed plates. About 50 mm of 20 gauge tinned copper wire should be used, with a loop wound firmly around each lug before soldering. This will prevent the soldered joint from coming adrift when the other end of the lead is soldered to the board. A trimmer must also be soldered to each section of the gang and as may be seen from the picture, we used the newer solid dielectric type. If you have the old "beehive" trimmers, then use them by all means.

Care should be taken when soldering the gang trimmers in place. Make sure that good soldered joints are made, without damaging the trimmers by burning or overheating.

Possibly the most interesting part of the construction is assembly of the printed board. Although this is a straightforward job, it is advisable to approach it in a systematic manner. A good place to start is with the resistors, followed by capacitors and other small items, including the transistors. Do not forget the link, which may be a piece of tinned copper wire or even a scrap of pigtail from a resistor. Note that the 10pF coupling capacitor across the output transformer, the 1pF injection capacitor, the .01uF bypass capacitor across the 4.7k resistor and the zener diode are all mounted underneath the board.

In some earlier converters we used an aerial coil made by RCS Radio as the output coil. These coils were originally designed for use in valve receivers and they are no longer made. The aerial coils made for use with transistor receivers are quite satisfactory, but some of the coil connections are different. This problem may be solved in one of two ways. You may open up the coil if you feel competent to do so, and change some of the terminations to fit in with the existing board. The alternative is to make a cross connection to the appropriate point on the copper.

I chose to change the terminations, and this is how it is done. Leave the connections to "G" and "P" unchanged. (These markings are moulded into the base adjacent to the pins, except the tap.) Lift the lead to "F" and leave it free for the time being. Lift the lead to "B" and immediately resolder it to "F". The floating lead is now soldered to the tap pin.

As the board was made to accommodate Neosid coil formers, and we are using a coil made by RCS Radio in this instance, some care is needed in fitting this transformer. The following procedure is suggested.

Cut off the fifth or tap pin close to the moulding, or bend it over so that there is no chance of it becoming short circuited when fitted. Now bend each of the remaining four pins over so that they lie over the corners of the can. Then the pins are bent in dog-leg fashion such that they will enter the four holes in the printed board. The can mounting lugs must also be bent inwards and in a similar manner so that they will pass through the respective holes in the board. This done, the can may be mounted—but care must be taken to ensure that it is orientated correctly, according to the code on the circuit and that moulded adjacent to the pins.

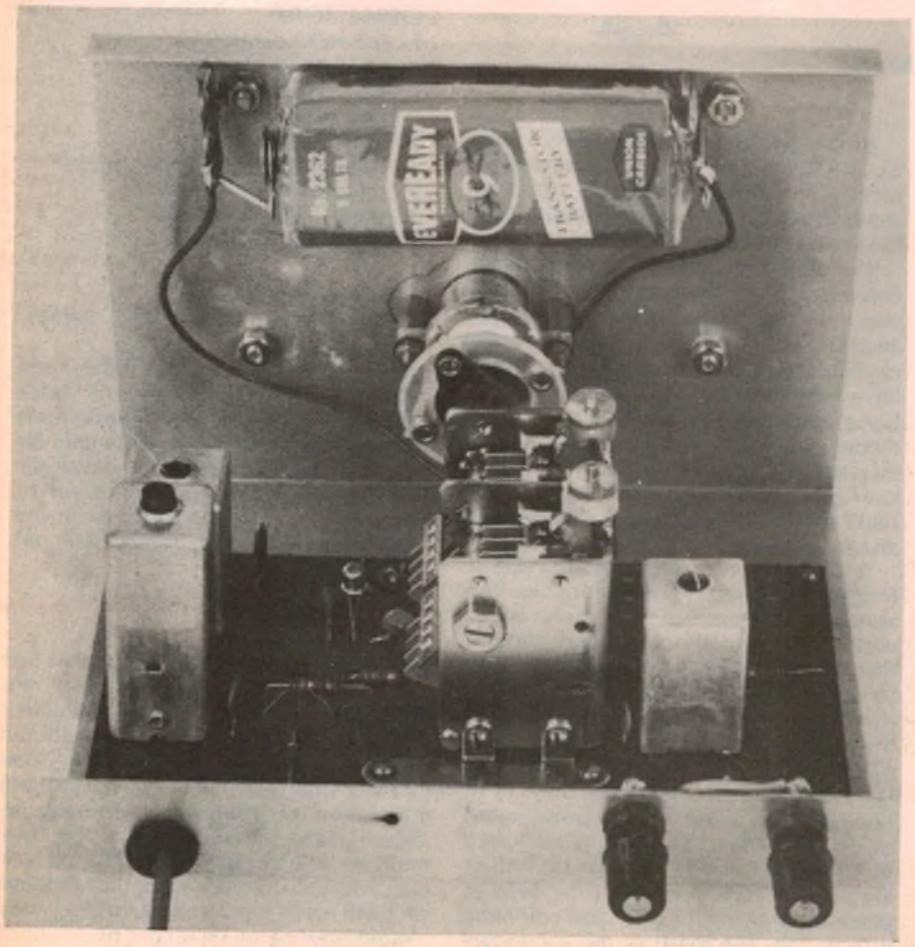
If you decide not to change the coil terminations, I suggest that you go about it this way. Do not cut off the tap pin but bend it over as previously suggested. Solder a short length of insulated hookup wire to the bent tap pin, making sure that no short circuit will be created later on. Mount the coil as described previously, but run the hookup wire through the centre slug adjusting hole in the board. Solder pins "G", "F" and "P" but do not solder "B" to the copper pads. Instead, run the lead of hookup wire to the pad adjacent to "B".

Fit the aerial and oscillator coils into their cans and bend the lugs over so that when the screws are used for mounting, they will contact the side of each hole. This is to ensure that the can is connected to the earthed copper. Each coil is fixed to the board with two 6BA screws. If 6BA screws are not readily available, the alternative is to re-tap the holes to ⅛in Whitworth.

The 2-gang capacitor is fixed to the board with four screws. An option is to add two extra PCB mounting spacers under the board, to two of the screws, one nearest the front panel and adjacent to the oscillator circuitry, with the other diagonally opposite. The other four spacers are fitted at each corner of the board.

This completes the assembly of the board, except for some leads which must be provided to go to external points. Leads of sufficient length are soldered to the earth point near the earth terminal on the back skirt of the chassis, the aerial point of the coil to the aerial terminal, the +9V point to the switch and a lead from the copper earth for the negative terminal of the battery. The coax cable is connected with the inner conductor to the output point and the braid is soldered to the earth copper nearby.

The two terminals, rubber grommet,



This rear view shows the main disposition of components, including the flexible dial drive coupling. The oscillator coil is at left, nearest the front panel.

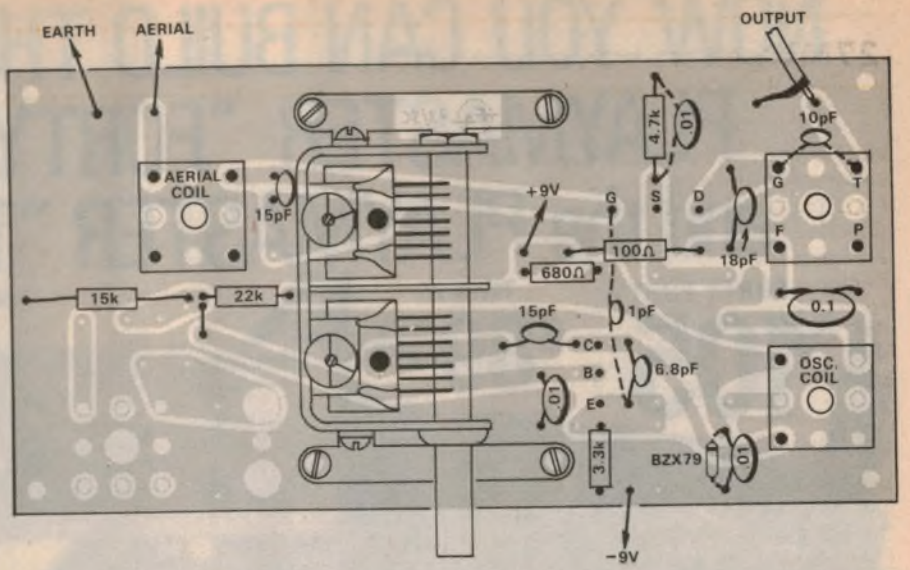
switch, dial assembly and battery may now be fixed to the chassis-panel. As we mentioned earlier, the dial we used is no longer made but if you have one, then it may be used, as the mounting holes remain the same. Alternatively, the new dial may be used as suggested, or you may make your own arrangements as you see fit, possibly by still making use of the dual ratio dial drive by Jackson Bros. This drive is available as a separate item from Messrs Watkin Wynne, 32 Falcon Street, Crows Nest, NSW 2065.

The complete dial assembly is supplied with a scale, having in addition to a 0-100 logging scale, four blank ranges, which may be calibrated according to actual needs. However, calibration of this may present problems to those readers who do not have any instruments for calibrating. To help with this problem, we are printing a full size scale so that you may cut it out and use it directly, or you may take the information and mark it on the scale provided on the dial assembly.

When mounting the dial assembly, we suggest that you make provision for the battery by adding a large 3-tag strip under each of the two top screws. The battery may then be strung across these strips as may be seen in the picture.

At this stage, a careful check should be made to ensure that no errors have been made on the board assembly and elsewhere. Satisfied that all is well, the board may now be screwed to the chassis, not forgetting the flexible coupling between the gang and the dial drive. A short spindle is required between the drive and the coupling and this may be obtained from an offcut of a potentiometer spindle.

All interconnecting leads are now terminated to the respective points. The negative battery connection may be tied to the earthed lug on the appropriate tag strip, whereas an insulated lug will be used for the positive connection at the other end. If you use heavy gauge tinned copper wire for these connections, it should be sufficient to hold the battery in place. However, if you wish, an extra bracket may be fitted according to your own ideas.



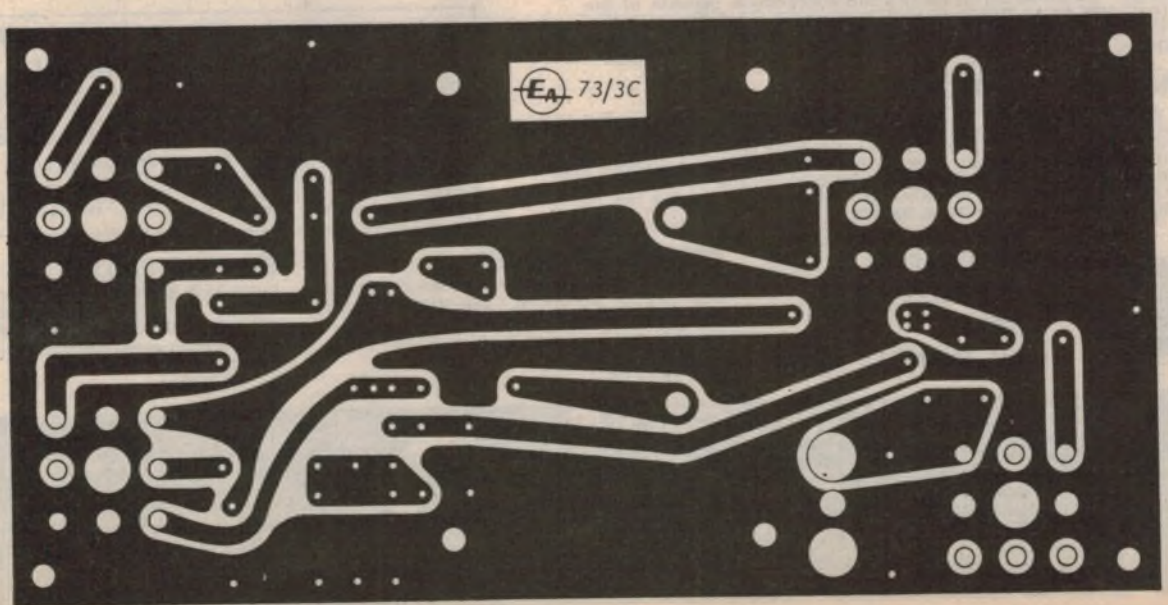
The component layout shows the PC board as viewed from the component side. Pay particular attention when inserting polarity conscious components.

Having completed the mechanical work, the converter is ready to be put into operation. Quite a number of items must be considered here. We will assume that you have a suitable broadcast receiver into which to feed the converter. We will also assume that you have an aerial which is efficient at 27MHz. Hopefully, you will also have access to a signal generator or modulated oscillator which you may use to align and adjust the calibrations against the dial scale. If not, then you will have to use whatever information you can relating to the frequency of received signals and try to adjust the dial calibrations accordingly.

If you have an ordinary broadcast receiver with aerial and earth terminals and without a ferrite rod aerial, then you may feed the output coax cable directly into the aerial and earth terminals. On the other hand, if you have a small transistor personal portable receiver, or a larger receiver with a ferrite rod aerial fitted, then you may use this instead. However, some preparation is necessary before you can use this type of receiver.

The simplest way is to get a few yards of insulated hookup wire. After determining which way the ferrite rod aerial runs inside the receiver, wind from six to ten turns of hookup wire around the receiver so that the ferrite rod is parallel with the axis of your winding. The winding may just be bunch wound and the

Below is an actual size reproduction of the PCB pattern.



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Dealer prices may be higher due to transport costs.

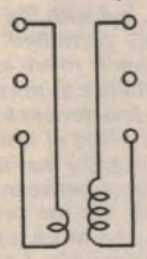
two insulated ends twisted together to hold the winding in place. Now bare the two ends and solder them to the two connections of the coax cable from the converter.

The above method is quite a rough looking job but works very well. However, if you wish, then it is up to you to devise a more neat way of winding and arranging the turns around the receiver. On the other hand, if you wish you may be able to open up the set and if space permits, wind six turns or so directly around the ferrite rod, again using insulated hookup wire and terminating it to the cable from the converter.

Switch on the receiver and tune right down to the high frequency end of the dial, so that you have just tuned past station 3NE, or 1600kHz. This will ensure a clear spot as your first intermediate frequency. The receiver should be left tuned to this position. Switch on the converter and with the volume control on the receiver set to a suitable level, adjust the slug in the converter output coil for maximum noise or hiss. You may find that the slug will protrude somewhat above the top of the can. If this is excessive, then the 18pF capacitor should be reduced to 15pF.

As an alternative to setting the receiver tuning just outside the broadcast band, you may wish to choose a lower frequency. However, this has problems of broadcast stations breaking through, particularly at night. To reduce this possibility, you may be able to rotate the receiver to null out the interfering station, or perhaps even stand the receiver on end to reduce pickup of the ferrite rod.

Coil Winding Details

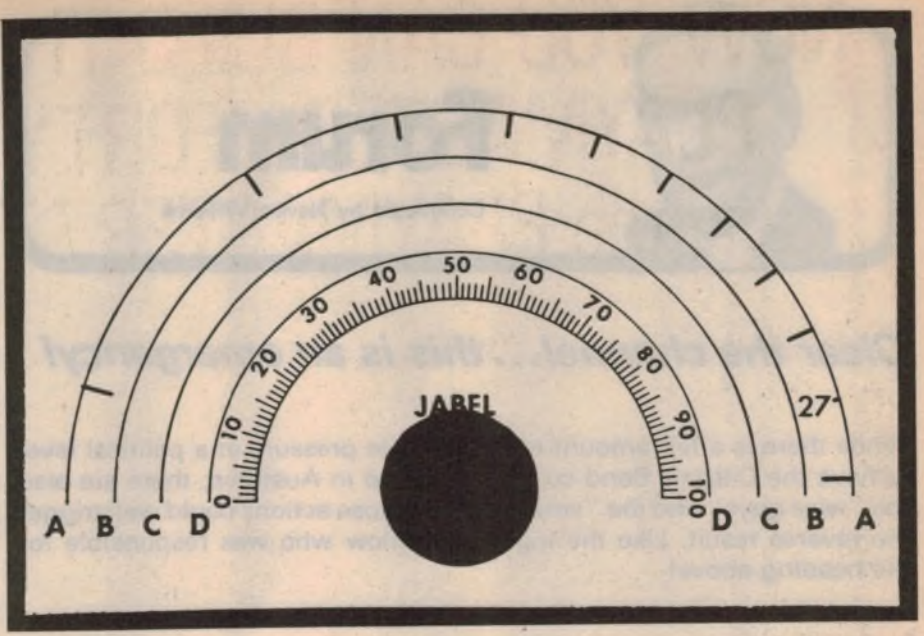


COIL CONNECTIONS VIEWED FROM ABOVE

COIL DETAILS

Aerial coil: Tuned winding, 15 turns 30B&S enamel wire on Neosid 7.6mm former. Coupling winding, 2 turns 30B&S enamel wire wound over earthy end of tuned winding. Use grade 900 slug and mount in can.

Oscillator coil: One winding, 15 turns 30B&S enamel wire. Other details as above.



This full size reproduction of the dial scale may be either copied or used direct. The blank ranges may be calibrated according to requirements.

Assuming that you have a calibrated signal generator available, set it to 27MHz and feed it into the aerial of the converter. Set the converter dial pointer to 27MHz. Adjust the slug in the oscillator coil until the generator signal is heard. Also adjust the slug in the aerial coil for maximum response. Keep the signal generator level such that only sufficient signal is fed in to make effective adjustments to the slugs and trimmers.

Now set the signal generator to 27.9MHz and set the converter dial pointer to 27.9MHz, which is the last point towards the other end of the dial. Adjust the oscillator trimmer until the signal is heard and then adjust the aerial coil trimmer for maximum response. As always, when aligning a superhet receiving system, this process must be repeated several times until the calibrations are set at the correct points near each end of the dial respectively.

Each time the oscillator coil slug or trimmer is adjusted, the slug or trimmer on the aerial coil should also be adjusted.

If you are unable to obtain the use of a signal generator for calibration and alignment, then it will be a matter of making use of whatever facilities may be available. If you do not have any means of generating a signal yourself, then a friend may be able to help. It should not be very difficult to identify a signal of known frequency around 27MHz and so calibrate that end, but it may be more difficult to get a calibration for the other end.

Although about as simple as it could be, this little converter can give a very good account of itself given a broadcast receiver of reasonable sensitivity and a good aerial system. I have tried the prototype, using an aerial for amateur bands from 3.5MHz to 28MHz and feeding it into a portable transistor receiver with a ferrite rod and I was more than surprised at the performance. At nights and at weekends, many signals may be tuned in with good reception.

If you would rather feed the converter into a short wave receiver which will tune around 3.5MHz but does not tune right up to 27MHz, then this may be done by substituting for the RCS aerial coil with one of your own winding. Use a Neosid former 7.6mm diameter and 60mm long, with two grade 900 slugs and a can. Wind a primary with 120 turns of 28B&S enamel wire and terminate to suit the tuned winding on the board. The output or secondary winding consists of 12 turns of the same wire wound over the earthy end of the primary. It is terminated to suit the output on the board. The tuned winding is shunted with an 82pF NPO ceramic or a polystyrene type.

Having done this, it will be necessary to set it to frequency by whatever means you have available and align and calibrate the rest of the unit. There is one point however. It is not likely that the calibrated dial scale which we used on the prototype will be accurate for this application. No doubt readers wishing to do this will have facilities to do their own calibrating.

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FROM YOUR NEWSAGENT

Forum

Conducted by Neville Williams

Clear the channel... this is an emergency!

While there is a fair amount of responsible pressure at a political level to have the Citizens Band concept adopted in Australia, there are also the "wise guys" and the "smart alecs" whose actions could well trigger the reverse result. Like the ingenious fellow who was responsible for the heading above!

The case for legalised CB was spelt out in our "Year Book" currently on sale. At this level, it makes reasonable sense. If private citizens can be given the opportunity to communicate spontaneously, by dedicating a small segment of the frequency spectrum for that purpose, why not make it available to them?

It can be argued, of course, that CB channels will become highly congested on some occasions in some areas—a prospect that is anathema to the average orderly administrative mind, accustomed to thinking in terms of dedicated channels and services.

But, although it's often mentioned, it's hardly a valid argument against the CB concept. If the participants can get by, notwithstanding the congestion, that's what matters most—provided they keep their "chaos" to themselves and inside the allotted band.

This "provided" condition is very much at stake and is currently causing the FCC a good deal of concern in the USA—despite the "sweetness and light" picture that CB proponents like to paint.

Not all CB emission stays inside the allotted bandspace, because not all CB transceivers are properly designed or properly adjusted. They radiate harmonics and they radiate splatter, causing interference in neighbouring radio and TV receivers. And when the CB population is as high as it is in the United States—and still climbing—there aren't too many neighbourhoods without their share of potential splatterers.

No less a hazard are the deliberate high power merchants who boost their power way beyond the intended limit and blast their signal into neighbourhood receivers, amplifiers and tape recorders by splatter, harmonics and sheer front-end overload.

Maybe receivers and audio systems should be more proof against RF signal penetration, but neither the manufacturers nor the purchasers would have been aware of the magnitude of the impending problem at the time the equipment was designed and sold. The proliferation of CB transceivers, operated by just about anyone able to push a button, is a hazard of a quite different order.

It is one thing to have a sprinkling of commercial and amateur transmitters, normally operated by technically involved people, who are normally willing to help when interference occurs.

It is quite another thing to have a high concentration of transmitters, in neighbourhood areas, generally less sophisticated in design and operated by people generally less skilled and generally less concerned about their licence (if any).

It is now all too easy for a number of citizens to be having a whale of a time chattering, DXing and working mobile, while their neighbours suffer the consequences!

It shouldn't be this way and it wouldn't be this way if prospective CBers could be relied upon to buy well designed equipment and to operate it as intended and envisaged. But some of the local 27MHz fraternity are already making it quite clear that they have no intention of so doing.

At a recent pirates-and-others meeting in Sydney, one group of those present was counselling a moderate approach to the authorities, based on good equipment, limited power and aerial configuration and objectives generally in line with official practice in the USA.

But there were those present to whom this was clearly "sissy stuff". They were aiming at big fat linears, big fat beams and walls plastered with DX cards. When challenged that they should be thinking in terms of an amateur rather a CB rig, their reaction was rather sobering: there was no way they wanted to become amateurs because there would be too many restrictions!

And responsibilities?

I wasn't at the meeting, but I know someone who was—a man who has been really keen to push CB radio and to see a sensible set of regulations evolved to cover its operation in Australia.

He went to the meeting optimistic that CB supporters were being so helpful and constructive that the Authorities could hardly fail to listen to them.

He came away with the very real apprehension that he might be contribu-

Microprocessors: a problem of adjustment

Dear Sir,

The sudden appearance of microprocessors and other such devices has been heralded by some as an explosion of knowledge.

I wonder whether it is not more of an implosion because, to many individuals, the more important effect is not on the outside world of technology, but within themselves, on their own thoughts and attitudes.

Has the microprocessor heralded the advent of future shock?

In the face of any new technology, one tends to find some refuge and security in the familiar past and, for some involved in electronics, "the past" has all happened in our lifetime.

From the age of hand-made components, crystals and catswhiskers, we entered the thermionic valve era, with its still personal evidence that equipment was operating—the hum of a transformer, the glow of a filament, the warmth of an output valve.

But, with the solid-state era, a certain coldness developed, somehow epitomised by the cold luminescence of a light emitting diode. Still, we had the comfort of capacitors and resistors, with their gaily coloured markings.

Then followed integrated circuits, dull and black, but with the compensation that they permitted the construction of much more elaborate projects. And thence to microprocessors, a further detachment from components, and a world of systems.

The microprocessor may indeed be a better transducer between man and his environment but the problem of satisfaction may be more urgent than that of ultimate precision. Lest we pursue change for the sake of change, we should not lose sight of the inner completeness of man and his integration, in a harmonious manner, with nature.

Perhaps electronic magazines and the industry in general have a responsibility to be concerned with psychological adjustments to changing technology, as distinct from the mere dissemination of technological information. *L.M. (Nundah, Qld.)*

ting instead to the evolution of a new anti-social breed of communicators!

And if the irresponsible element has that effect on a champion of the cause, how are the authorities going to react?

By coincidence, it was within a few hours of listening to this disillusioned lament that I happened to be tuning around the 27MHz band, while checking out a general-coverage receiver. I noticed two or three young amateurs doing their normal thing, involving their names, callsigns and "ham" jargon. Elsewhere two or three non-licensed nets were in progress, evident from their studied efforts to hide their real identity and location.

And then suddenly up came an agitated plea to: "Clear the channel, please clear the channel. This is an emergency . . . this is not an exercise . . . repeat, this is not an exercise. Calling Mascot control, Mascot control . . . I have lost power . . . I am going down . . ."

So it went on, a complete Mayday procedure for an aircraft in distress.

In other circumstances, the performer might have qualified for some kind of an Oscar—right sounding phases, just the right amount of agitation in his voice, with the signal disappearing by accident or design at about the time it might have disappeared in real life (or real death).

The one incongruous feature was the effort to contact Mascot Control Tower on 27MHz.

But, hearing it, I was in no mood to grant an Oscar. I felt very angry indeed.

Perhaps I shouldn't have been. Perhaps I should have realised that irresponsibles are likely to show up in any group of people. Why not on 27MHz?

Perhaps it was in the fact that radiating a fake emergency call is something that even an irresponsible person doesn't normally do!

But where does it leave the pro-CB lobbyists who are emphasising the potential of CB radio in real emergency situations? How credible is their case when an ostensible CB user has just radiated a carefully phrased aircraft mayday for all to hear? And, from what I gather, there were plenty of others who heard the transmission.

On second thoughts, the perpetrator probably should get an Oscar: for the best piece of anti public relations to date; transcending even the efforts of his mates at the Pirates & Others meeting referred to earlier!

THOSE PCB DRAWINGS

To change the subject completely, our July issue carried a letter from a reader K.N.S. of Artarmon, NSW criticising certain of our printed wiring patterns. One in particular was described as "a congested mess". And that being so, if the board pattern was so badly executed, could readers possibly have any confidence in other aspects of the design?

K.N.S. ended his letter with the sentence: "Please let's have artworks that

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As for Harman Kardon receivers, it is perhaps sufficient to point out that their design is inherited from our Citation series of components.

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Of course you're looking at high fidelity products. But the attitudes with which they were conceived and built are their very essence. We can tell you much more about each or all of them — without circled numbers or coupons. Write to us. We'll respond promptly. Harman Kardon, P.O. Box 6, Brookvale, N.S.W. 2100.

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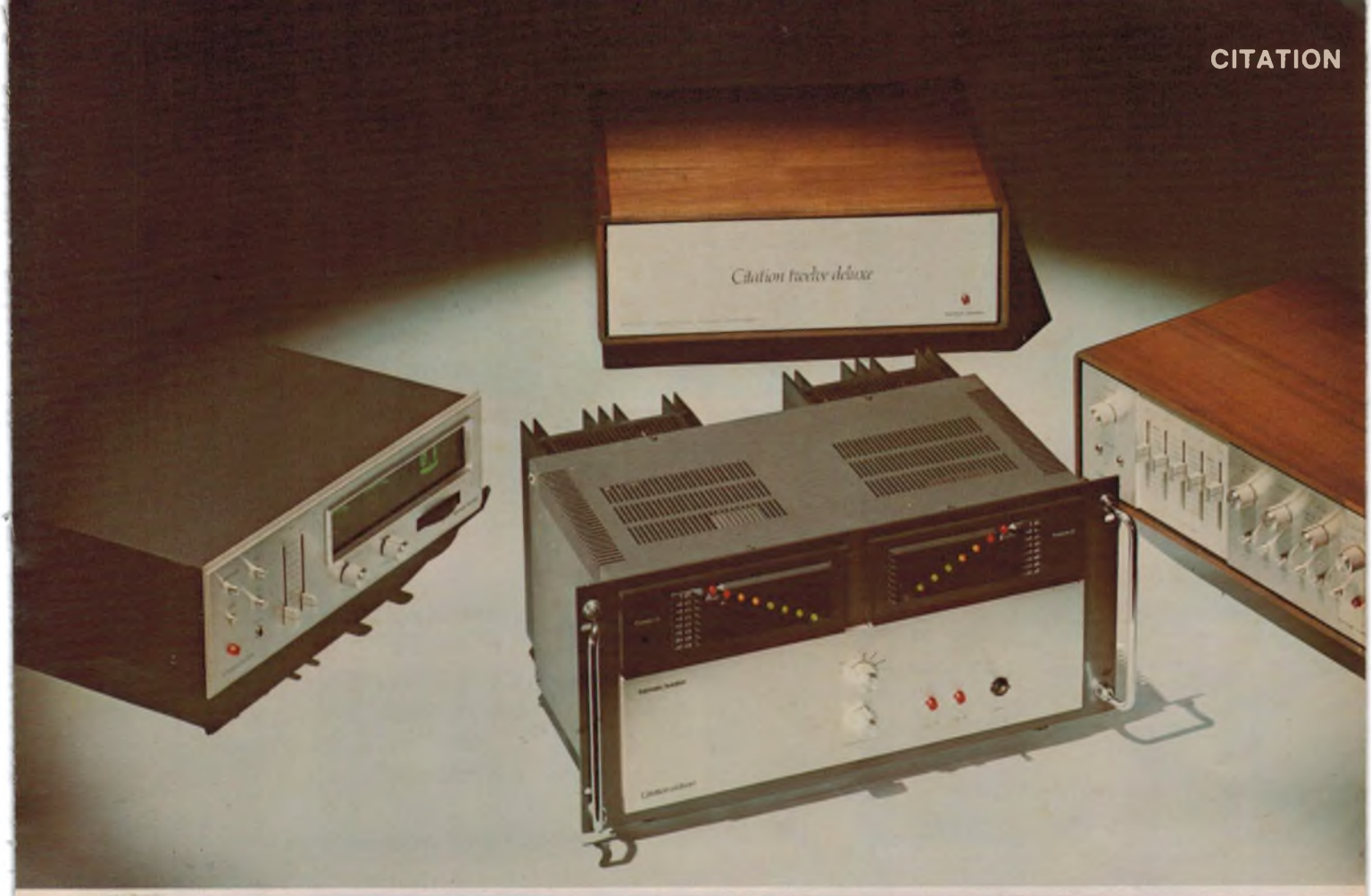
CITATION



330C 430 730

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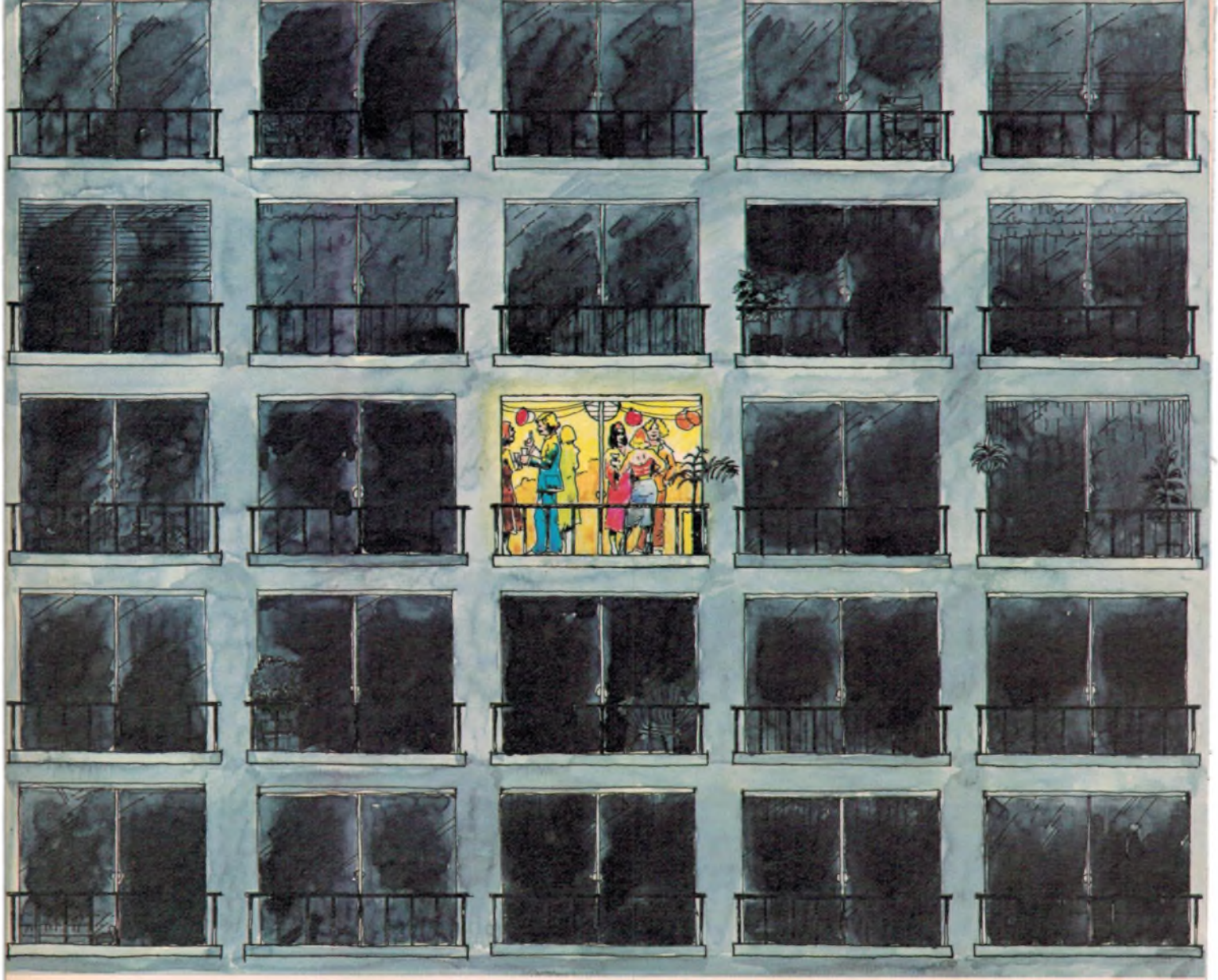
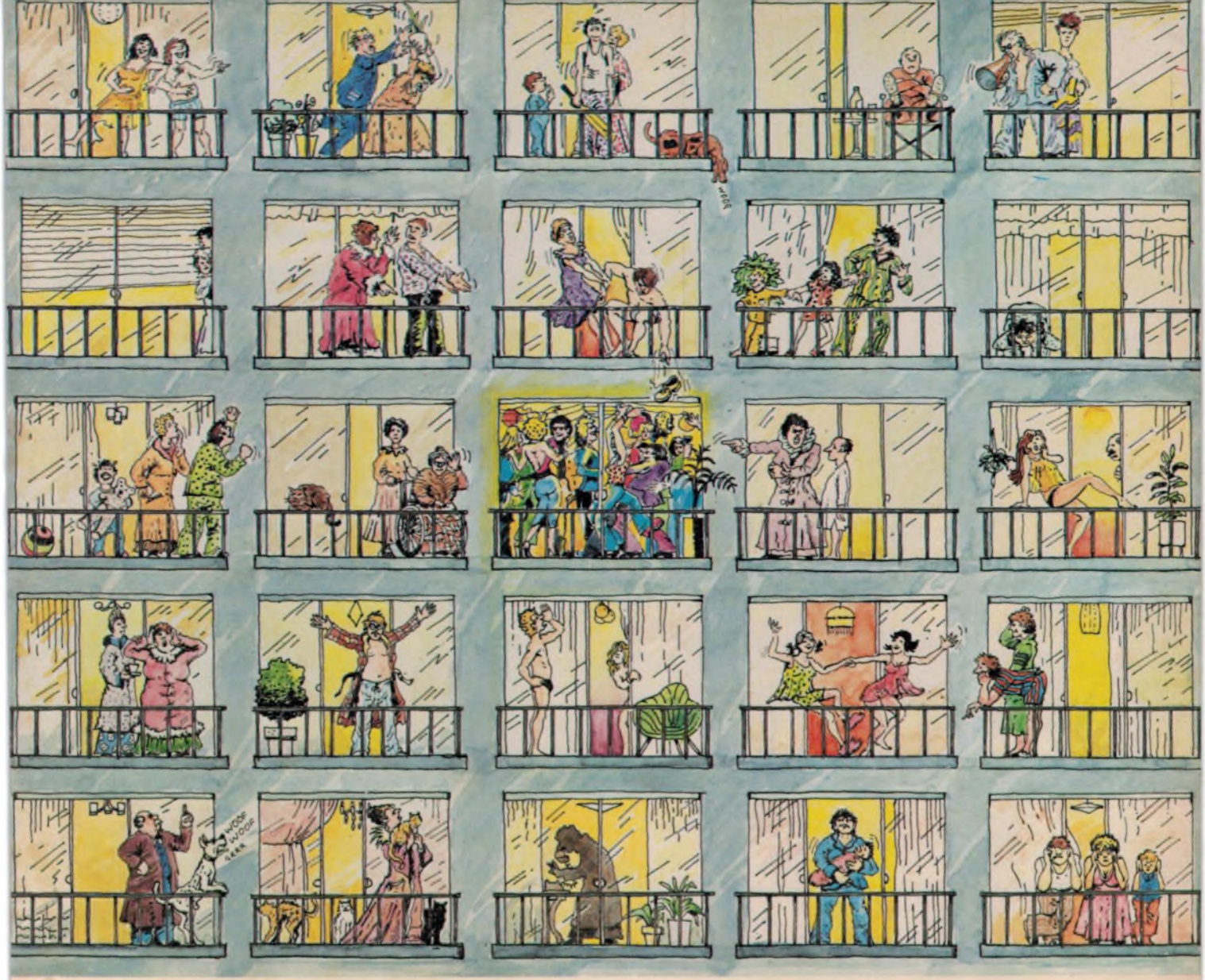


With La Scala speakers and a 35 watt amp you can entertain your friends

AUR20



or your neighbours.

At some stage in their hi-fi lives most buffs invariably want to upgrade their equipment for something with a little more oomph.

And this, we readily admit, more often than not turns into a rather expensive exercise.

So with that very thought in mind we suggest you have a very good listen to our Klipsch La Scala speakers.

They're designed to give you all the sound you need from a very minimum input. (In fact thirty-five watts per channel gives you more than enough oomph with La Scala's.) So saving you on having to spend up on highly expensive amplification equipment at the same time.

And the reason why La Scala's give such a big sound is simple.

They're horn loaded. And work on a similar principle to that of a megaphone or trumpet. So not only do you get a much purer sound. But the sound gets much louder, as well as getting louder faster.

La Scala's can also sustain a higher impulse such as a cymbal much longer, and yet still maintain an excellent quality at low levels.

As well as giving you low distortion over a wide range of frequencies.

In fact over thirty-five years of continual thinking and making have gone into the perfecting of La Scala's. And yet even with today's high technical standards few have been able to come near us in such terms of power excellence. So as you can see they're not an overnight pop phenomenon.

(We also think so much of our speakers that under normal usage we even give a lifetime guarantee.)

No doubt the only way to really appreciate just how good La Scala's are is to pay a visit to one of our dealers listed overleaf and purchase a pair.

If you're still not totally convinced once having installed them, we have one other sure fire way of testing them.

Turn up your amplifier and ask your neighbours.

Klipsch

Why the cannon on your 1812 Overture sounds more like a popgun.

A rather unfortunate situation occurs during a recording session.

Because the dynamic range of most recording equipment doesn't equal the dynamic range of live performances, the loudest sounds end up being very much compressed, while the softer sounds have to be lifted above tape noise.

So no matter how good your equipment is, it will never ever give a true performance.

Introducing dbx.

Fortunately for the home hi-fi buff there's now an extremely effective solution available.

The dbx 117.

Basically it's a dynamic range enhancer that works on the signal's voltage level without changing the frequency response. (Unlike other systems that are designed merely to filter out high frequencies.)

And attached to any good system it will noticeably increase the entire dynamic range of any signal put into it. While at the same time reducing surface noise.

So now your softs become even softer. While your louds, especially your crescendo's, become much more dramatic when they finally reach the top.

Consequently giving the recorded performance both more body and definition.

dbx will also improve the sound of your older records. So there's less need for you to have to replace them. (The dbx 117 will also help reduce hiss from FM broadcasts as well as your tapes.)

In fact should you desire to test the dbx before purchase, we then suggest you contact one of our dealers listed opposite and politely ask him to play you a copy of the 1812 Overture.

Should you still have a few reservations then all we have to say is that perhaps the 1812 Overture was recorded featuring a popgun.

Or your ears aren't as good as you thought they were.

dbx

AUR19

FORUM—continued

look as their name implies—a work of art."

In our reply, we pointed out that the term "artwork" was a carryover from the days of woodcuts and engravings but that it now refers to virtually anything that is put under the camera in preparation for printing. It was therefore quite inappropriate to infer any parallel between artwork for printing and "works of art".

But, beyond that, a wiring pattern needed to be functional first of all. If it was also neat, that was to the good, but there was a practical limit to the man-hours one could spend in re-working prototype boards merely for cosmetic purposes. As it was, we could find no justification whatever for his extravagant condemnation of the particular pattern.

It was with interest, therefore, that we received the following comment from a reader who is involved, full time, in the production of printed wiring patterns.

Dear Sir,

Having several thousand hours' experience of designing printed circuit board layouts. I read your July issue 'Forum' with interest.

This may be a case where beauty is largely in the eye of the beholder. A well-designed layout has considerable visual appeal to an expert, simply because the elegance of its solution is more apparent to him than to the less experienced. Similar differences of opinion between expert and layman are commonplace in art, sculpture, cat shows, pop music and thousands of other examples.

I am in general agreement with your comments on KNS's letter. There is actually little in the layout of the board 76vg5 that can be criticised; only a few components could have been re-positioned to make conductor runs shorter, and the overall improvement would be quite minor.

My firm makes considerable numbers of boards from EA patterns and we experience very few problems. For a good end-product, the critical features are:

- *Are pads sufficiently large?*
- *Is spacing between conductors sufficient?*
- *Are conductors wide enough for the current they carry?*
- *Have high voltage, high current, high impedance and high frequency conductors been planned to allow for these properties?*

If all four answers are in the affirmative, trouble is very unlikely.

I am surprised to learn that your patterns are drawn full size, as it is much more difficult to achieve neat results than with a twice size drawing. You are to be congratulated that your standard remains higher than90% of our commercial customers who do full size drawings—or perhaps they are to be chided because as professionals they really ought to do better?

A.G.A. (Auckland N.Z.)

"Without exactly resorting to easel and palette, our staff . . .

Thanks A.G.A. for your reassuring remarks but in the meantime, as we observed in the July issue, the "broadside" from K.N.S. will doubtless have had some effect. Without exactly resorting to easel and palette, our technical staff has probably been made just that more conscious of board pattern niceties.

Incidentally, there are very practical reasons for our technique of producing board patterns, same size, using adhesive tapes and symbols on a transparent base. Components can be observed directly instead of having to visualise objects twice the size in spaces twice the size.

And, when the pattern is finished, it can be contact printed directly onto photographic paper or film, without having to rely on a camera and operator to produce a precise order of reduction.

MICROPROCESSORS

In a letter on the first page of Forum, L.M. expresses a concern which is shared by many who have grown up with electronics. Although always a mystery to many, wireless-radio-electronics was mechanical enough and physical enough in its early days to ensure a sensory appeal to those who worked with it. But that is largely gone; whether it's working or not working, doing its thing in its own complex little brain, a piece of modern gear looks inscrutably the same.

L.M. could be accused of merely baulking at progress. Perhaps he is. But he's also wondering aloud whether the price of progress is being measured in terms of human commitment and involvement. How curious that microprocessor chips should, in such short order, have spawned a new race of dedicated devotees!

Where you can hear Klipsch La Scalas and entertain our neighbours.

N.S.W.

SYDNEY CITY:
Instrol Hi Fi. Kent Hi Fi.

EASTERN SUBURBS:
Woolloomooloo—Convoy Sound.

NORTH SHORE:
Crows Nest—Allied Hi Fi.
Brookvale—Riverina Hi Fi.

WESTERN SUBURBS:
Concord—Sonata Music
Summer Hill—Fidela Sound.
Fairfield—Bing Lee Electronics.
Parramatta—Grammophone Shop.

SOUTH:
Miranda Fair—Miranda Hi Fi.

WOLLONGONG: Sonata Hi Fi.

NEWCASTLE: Ron Chapman Hi Fi.

TAREE: Godwins Hi Fi.

LISMORE: Lismore Hi Fi.

A.C.T.: Pacific Stereo.

VICTORIA

MELBOURNE CITY:
Allans Music. Southern Sound.
Instrol Hi Fi.

MELBOURNE SUBURBS:
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Dandenong—G. W. Williams.
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BRISBANE CITY:
Reg Mills Stereo. Audio Labs.

BRISBANE SUBURBS:
Redcliffe—Hi Fi Sales (Q'ld.) Pty. Ltd.
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SOUTH AUSTRALIA

ADELAIDE CITY:
Allans Music.

ADELAIDE SUBURBS:
St. Peters—Sound Dynamics.
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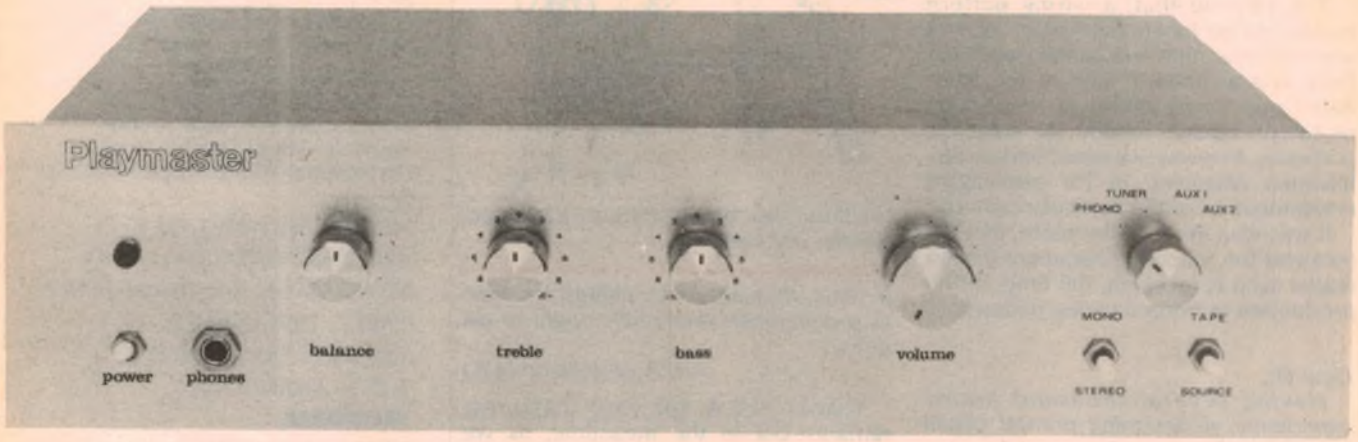
AUR 20

Playmaster Forty/Forty stereo amplifier



second article completes the construction details

In this second article on the Playmaster Forty/Forty we complete our description of the assembly details, and describe the setting-up procedure. A detailed trouble-shooting procedure is also given for fault-finding in the amplifier circuitry.

by GREG SWAIN & LEO SIMPSON

Last month we completed the description of the PC board assembly, so that attention can now be turned to installation of hardware in the chassis.

Mount the power transformer as shown in the photographs, so that the clamp is closest to the board. Twist the primary leads together and cut to a length suitable for termination at the insulated terminal block. The secondary leads should be taped together and cut to a length of about 15 cm.

Cut all potentiometer shafts and the rotary switch shaft to a length of 15mm, taking care that metal shavings do not fall inside the pots. Loosen the clicker plate of the rotary switch, if necessary, so that it is reasonably easy to turn using the selected knob. Mount all the switches and pots, but leave the escutcheon plate off at this stage to avoid scratching. It can be installed after the amplifier is fully checked out and operational.

The 6-way banks of input-sockets and the loudspeaker sockets may also be mounted now. The loudspeaker terminals we used are spring-loaded and are more convenient than the cheaper screw-terminal panels. Swap one pair of the red and black terminal covers so that the two red terminals are in the centre of the panel. Do not omit the solder lugs associated with input and loudspeaker sockets.

The headphone socket should be insulated from the chassis using two fibre washers and insulating tape. The insulating tape is wound around the thread of the socket where it passes through the chassis and, ultimately, through the front panel. The earth return for the headphone socket is via the PC board, as shown on the wiring diagram.

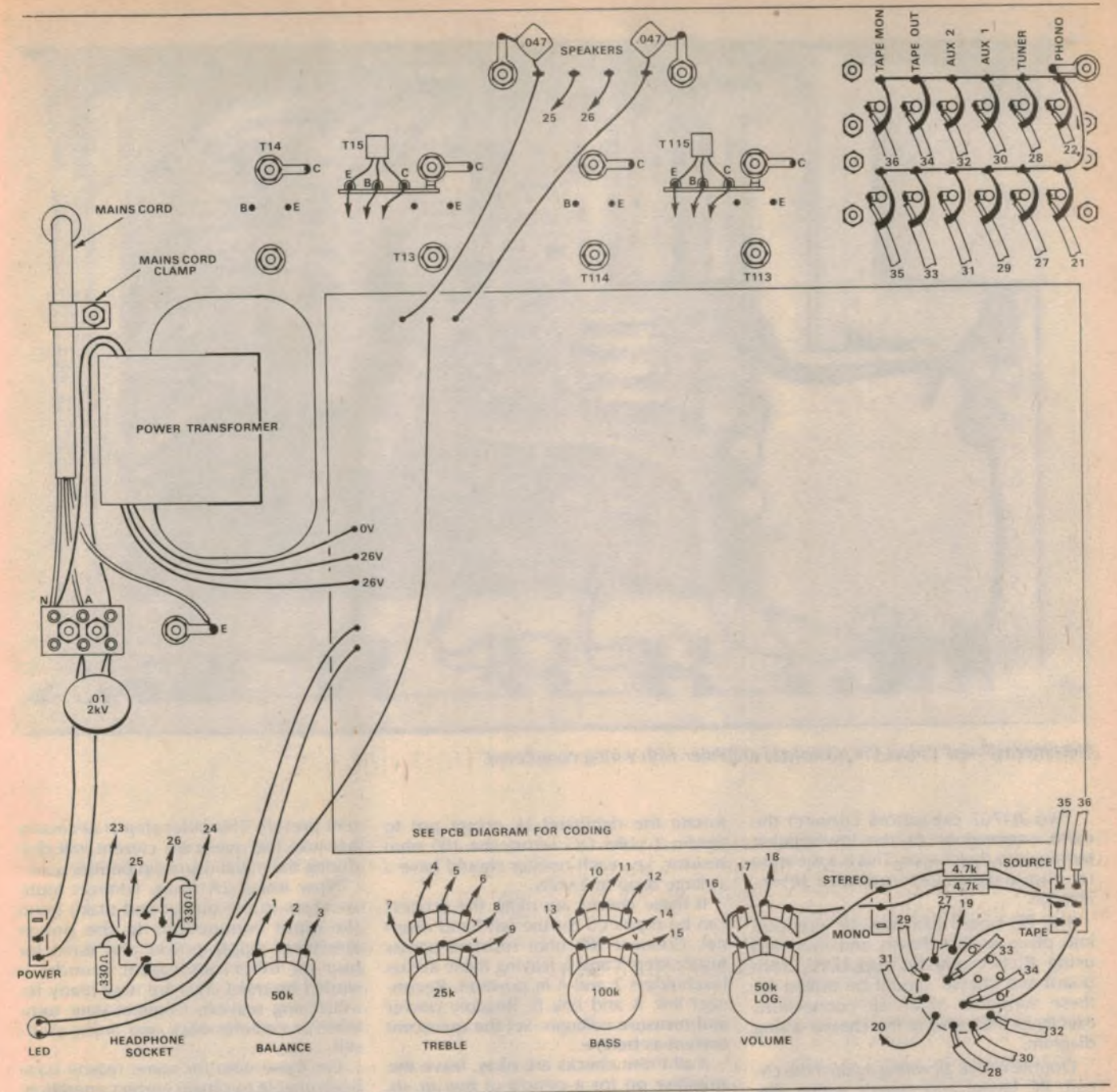
Before mounting the output transistors, ensure that the contact area is completely smooth and free of burrs and swarf. Smear the contact surface and the underside of the transistors with silicone grease compound. A mica washer and insulating bushes must be used to isolate each transistor from the chassis. It may be necessary to shorten the emitter lead of T14 to ensure adequate clearance to the transformer clamp.

Tagstrips are used to terminate the leads from T15 and T115, the thermal compensation transistors. It is recommended that T15 and T115 be soldered to their respective tagstrips before they are mounted in position.

The two tagstrip assemblies are mounted on the rear panel as shown on the chassis wiring diagram. The flat surface of each of the thermal compensation transistors should rest firmly against the back panel under lead tension. Use silicone grease or heatsink compound to ensure adequate heat transfer. If a more secure method of mounting is required, the thermal compensation transistors may be glued to the rear panel using quick drying epoxy cement.

The mains cord should be passed through a grommetted hole in the rear of the chassis and anchored with a cord clamp. Terminate the mains active and neutral to the terminal block and solder the earth wire to a solder lug near the transformer. Run two wires from the terminal block to the mains terminal switch.

The mains switch has a .01uF/2kV ceramic capacitor wired across it, at the insulated terminal block. Keep the leads



Use this diagram in conjunction with the PCB layout in the December issue to complete the amplifier wiring.

to this capacitor short to prevent them touching the chassis. Before soldering the wires to the mains switch, push a length of suitable plastic sleeving over the wires and, after soldering, push the sleeving over the terminals of the switch. This is to make it as shock proof as possible, in case you are foolish enough to dangle your fingers near it while the power is applied.

Wiring from the input sockets to the Selector switch and associated switches can now be installed. Use figure-8 shielded cable, with the shields all terminated to the common "bus" around the input sockets. This bus is soldered to a solder lug retained by one of the input panel mounting screws to become the sole earth point for the amplifier circuitry. The cable shields are not terminated at the Selector switch. Cut them off to avoid shorts with the inner conductors. The cable shields for the phono input are terminated on the PC board.

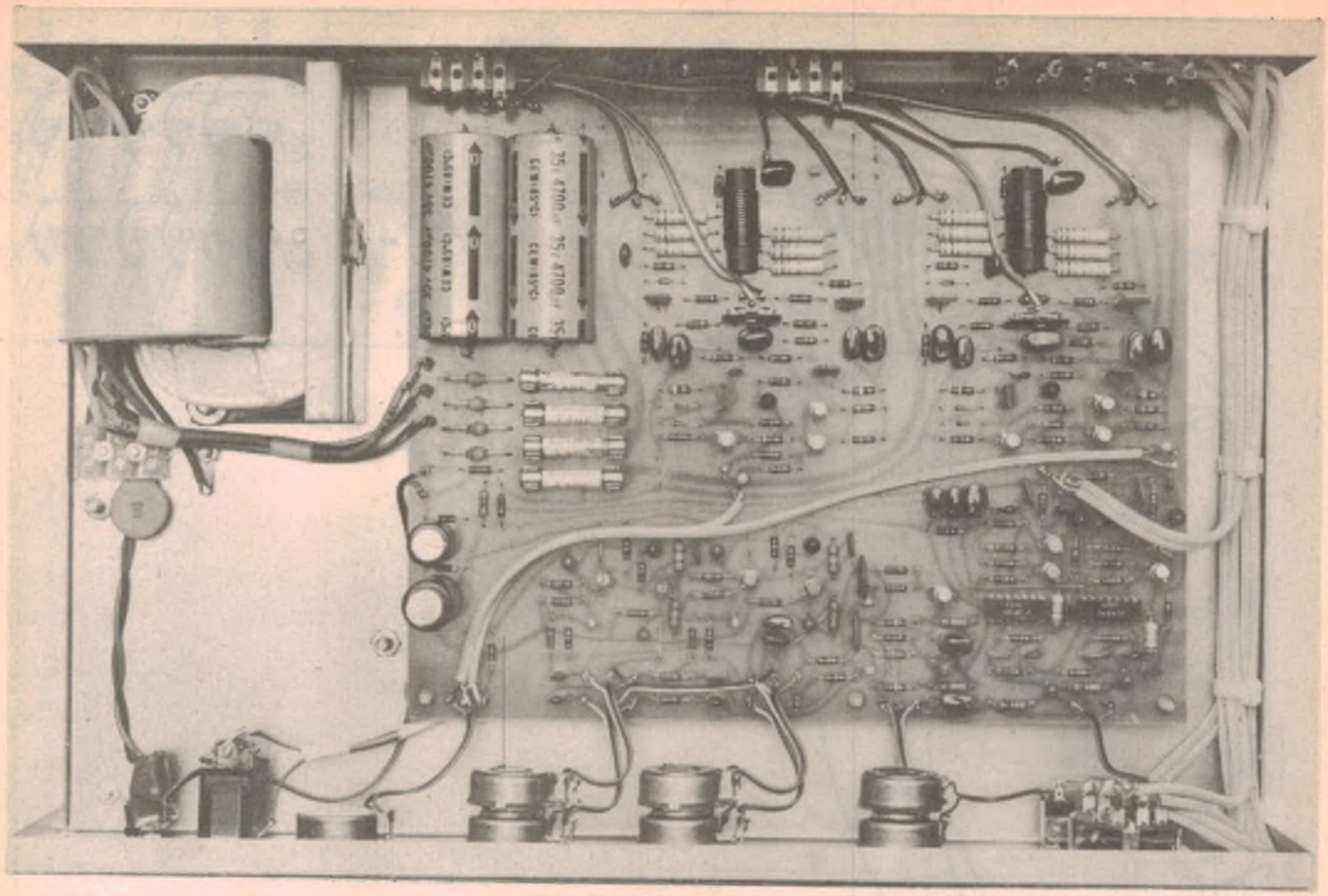
Cut the cables so that they lie together neatly as in the photographs. Use a couple of cable ties if necessary.

There are two 4.7k resistors strung between the tape monitor switch S2 and the stereo/mono switch S3. These resistors should be sleeved in plastic tubing.

Flat ribbon cable (three wires) can now be run from each power transistor and potentiometer, and to the thermal compensation transistors. Each length of cable should be about 15 cm long and stripped and tinned at the free end ready for terminating to the PC board. Note that if PC stakes are not used, this process will have to be reversed—terminate the cable to the PC board first.

By way of explanation, the flat ribbon cable usually comes in ten strand form—just peel off as many strands as needed and cut to length.

Flat ribbon cable (5 wires) can also be used to wire the headphone socket. As a precaution against hum pickup, route the leads well away from the transformer core and tape them to the bottom of the chassis.



This internal view shows the prototype amplifier with wiring completed.

Two .047uF capacitors connect the earth connections of the loudspeaker terminals to the chassis. This is a measure to eliminate mains radiated interference.

The PC board can now be dropped into place in the chassis and mounted using Richco plastic supports. Both board and chassis should be drilled for these supports. Make all connections exactly as indicated in the chassis wiring diagram.

Double check all wiring against the circuit, PC layout and chassis wiring diagrams. You are now ready for the setting up procedure.

Cut link A and link B. Solder 100 ohm/1W resistors across fuseholders 2 and 4. When looking from the front of the chassis, rotate the 1k preset pots fully clockwise. Do not connect any loads to the amplifier outputs. The input cables to the power amplifiers should be disconnected as noted earlier, but the shields of this cable must be connected to tie the power amplifier input earths to the rest of the circuit.

Apply power and check voltages in the right hand power amplifier. There should be less than 1 volt DC across each 100 ohm test resistor. There should be less than plus or minus 100mV DC at the amplifier output. If these checks are okay, the quiescent current can be set. Rotate the righthand 1k preset pot to obtain 2 volts DC across the 100 ohm resistor, i.e., each resistor should have a voltage drop of 2 volts.

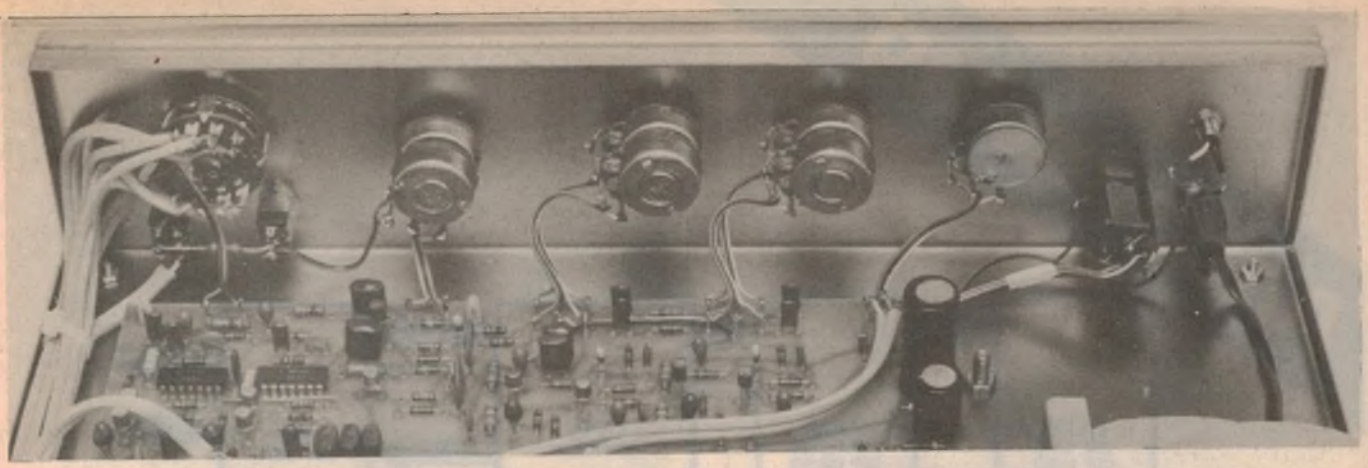
If these checks are okay, the process can be repeated for the left hand channel. Connect 100 ohm resistors across fuseholders 1 and 3, leaving those across fuseholders 2 and 4 in position. Reconnect link A and link B. Reapply power and measure voltages. Set the quiescent current as before.

If all these checks are okay, leave the amplifier on for a period of five or six minutes and re-adjust the quiescent current presets. This latter step is necessary because the quiescent current will drift during the initial warm-up period.

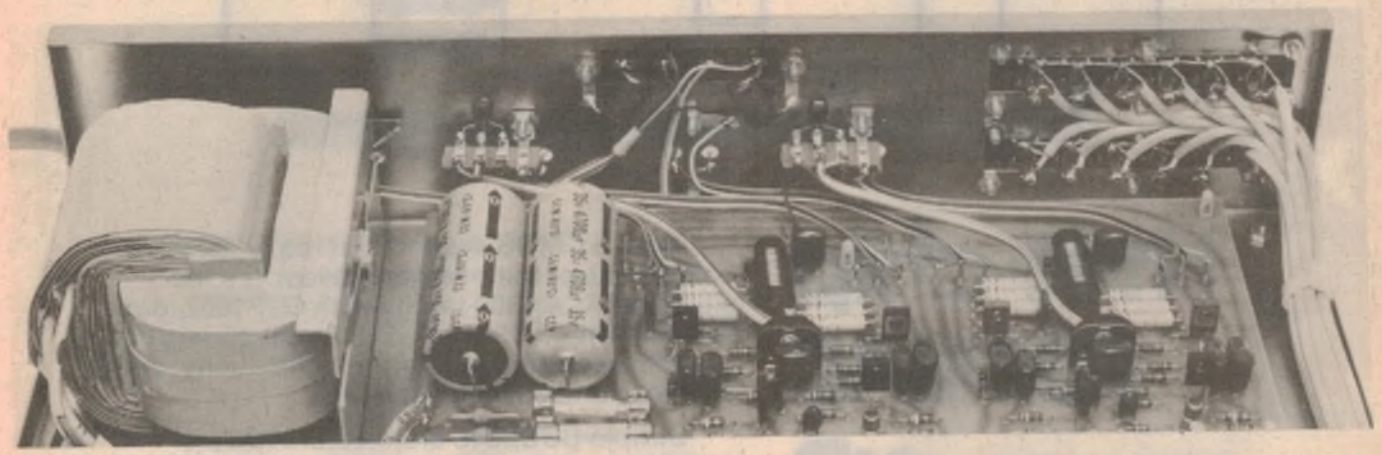
Now install 2A fuses, connect loudspeakers to the output and make good the input connections to the power amplifiers. Apply power and listen for hum or other unpleasant sounds. It should be quiet. You are now ready for a listening session. Connect your turntable or cassette deck and enjoy yourself.

For those who for some reason have been unable to obtain correct operation, we move now to the troubleshooting

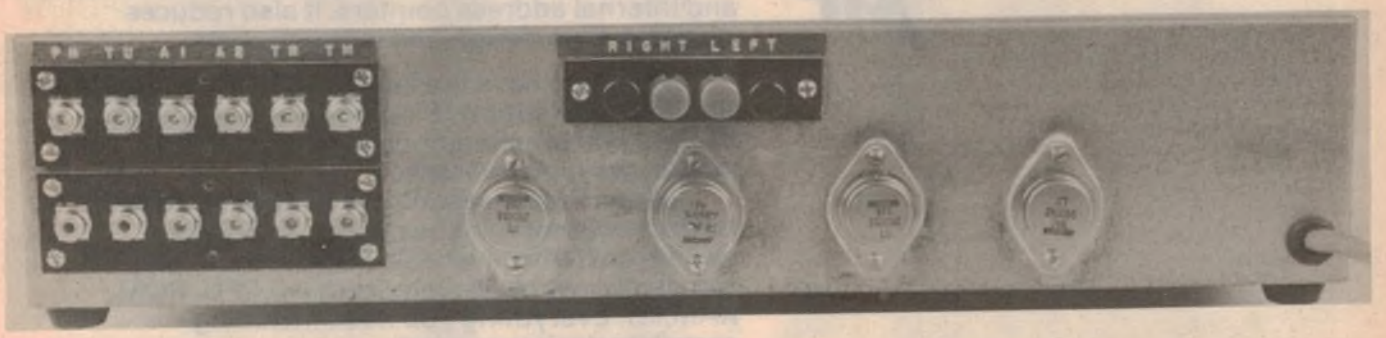
This photograph shows how the thermal compensation transistors are mounted.



Notice that the front panel controls are oriented to keep the associated leads to the PC board short and neat.



Note how the thermal compensation transistors are positioned on the rear panel. Below is the rear of the chassis.



procedure. We will assume that the positive and negative supply rails are operational. If the negative or positive 15V rails are less then 1V, the likely cause is a short-circuited or reverse connected zener diode. On the other hand, if these supplies are substantially higher than they should be, then it is likely that the associated zener diode is open circuit.

Voltage measurements should be made using a meter with a sensitivity of at least 20,000 ohms per volt or alternatively, with a FET volt-ohmmeter which will usually have an input impedance of 10 megohms or more.

Trouble-shooting in the power amplifier circuitry should be performed with the 100 ohm 1W resistors wired across the fuse-holders in place of the 2 amp fuses. If a fault causes the 100 ohm resistors to burn up before the cause can be found no great harm will be done. Just replace the resistors with 100 ohm units of 5W rating or higher, if easily available. These may also become very hot while fault finding progresses but at least they will prevent any further damage to the amplifier circuitry.

Voltages shown on the circuit are intended as a guide only. A normally operating amplifier may have variations which a novice will regard as unusual. The 35V supply rails can be expected to vary by at least plus or minus 5% due to mains voltage fluctuations, so the two voltages marked "+33.6v" and "-33.6V" can be expected to vary by a similar amount.

Similarly, the zener-stabilised 15V supplies can be expected to be anywhere within about 13.6 to 15.7V, partly due zener tolerance and partly to mains voltage fluctuation. Voltages in the preamplifier circuitry can be expected to vary proportionally. Add to these normal variations the innaccuracies inherent in the meter and you should see why we state that the voltage readings are only a guide.

A useful point to remember is that all correctly operating transistors will have a base-emitter voltage drop of 0.6 to 0.75V.

If the output offset voltage is grossly in excess of 150mV, eg ±35V, check first that the input earth of the associated power amplifier is connected back to the appropriate balance control terminal at the front of the PC board. This connection is made via the shielded cable shown

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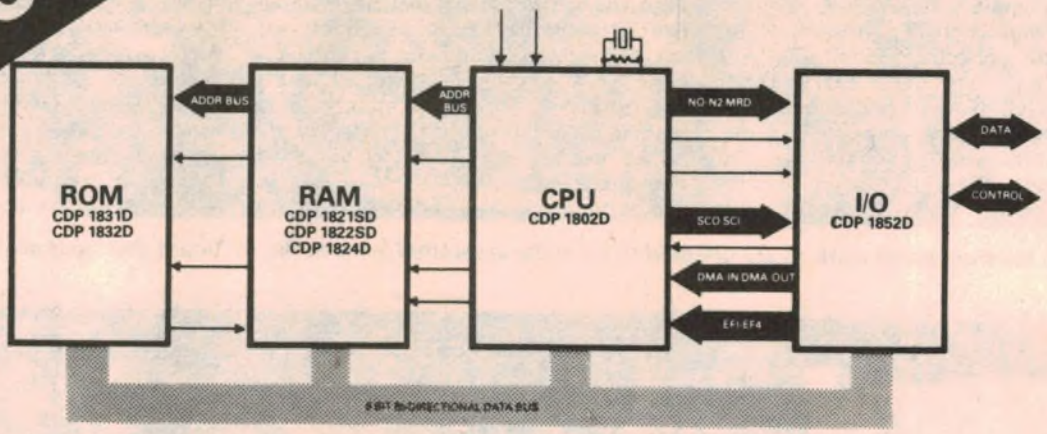

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on the PC layout on page 45 of last month's issue. This check should be made with a multimeter switched to a low ohms range.

If the connection is good, check the base-emitter voltages of T6 and T7 (0.7V) and their collector voltages—approximately +33.6V and equal. If no fault is evident here, check the base-emitter voltages of T9 and T10 and the voltage drop across each 39 ohm resistor. In each case the voltage should be about 0.7V. If these resistors have excessive voltage and/or are burning up, check to see that T9 and T10 are not transposed.

One voltage reading deliberately omitted from the circuit diagram is the DC voltage at the output of each amplifier—referred to as the "output offset voltage" above. While this is nominally zero it may range anywhere between ±150mV depending on component parameters. The offset voltage will typically be about ±30mV. If the offset voltage is more than ±150mV then it is likely that T6 or T7 is faulty.

Two parameters determine the offset voltage at the output of the amplifier. They are the degree of matching of the beta of T6 and T7 and Vbe voltages of these two transistors. Of the two, the former parameter is dominant. Therefore, if readers want to minimise the offset voltage the simplest method is to closely match T6 and T7 for beta. It should be possible to achieve an offset voltage of 20mV or less by this method.

Voltage drop across the 150 ohm resistor associated with the emitter of T8 should be 0.7V, and the collector voltage of T8 should be about −22V. If it is closer to −35V then T8 is short circuit.

If the output offset voltage is within the above limits and the 100 ohm protective resistors are dissipating excessive power then it is likely that the amplifier is unstable or is drawing excess quiescent current. If no variation in the current can be obtained by adjusting the 1k preset potentiometer, T15 is open circuit.

If the power amplifier is drawing excessive current then it may be unstable or T15 may be faulty. A check for instability can be made using an oscilloscope or a multimeter switched to an appropriate (5 to 30V) AC range. If the amplifier is not unstable, as evidenced by no AC output signal, then try to adjust the quiescent current control, the 1k preset potentiometer. If no variation can be obtained, then T15 is open circuit. If no quiescent current can be obtained and the voltage drop across T15 is zero or less than 2 volts, then T15 is short circuit.

Incorrect value resistors associated with T15 will produce similar fault conditions.

Instability in the power amplifier may be due to the following causes: instability in the preamplifier, faulty RLC network in the output stage, faulty 0.1uF supply bypass capacitors, faulty 4700uF filter capacitors or open-circuit .0022uF capacitor associated with the collector of T9.

Instability in the preamplifiers should not be a factor at this stage because they should be disconnected from the power amplifier inputs while trouble-shooting in this section progresses. The capacitors mentioned above may be checked merely by bridging with capacitors of equivalent value.

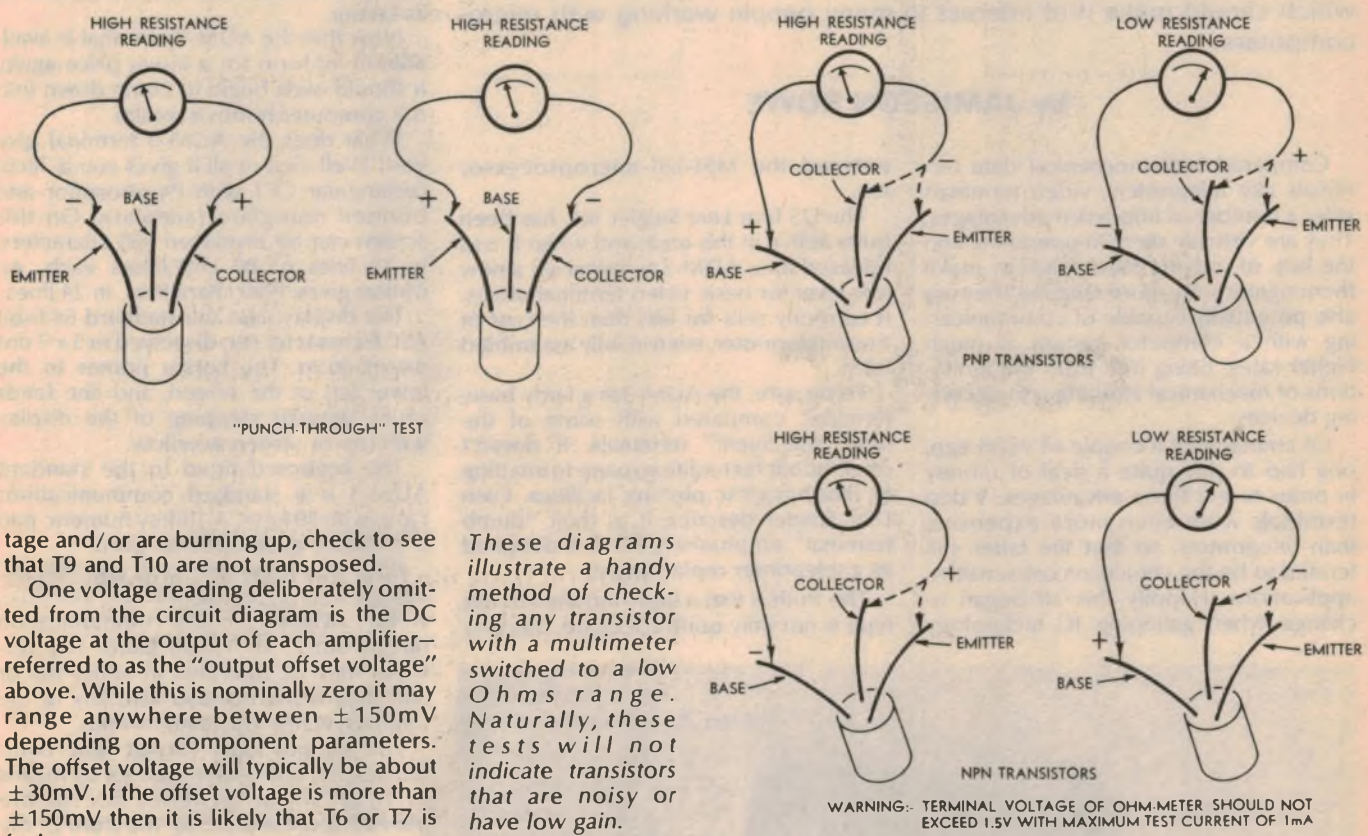
If only one channel is faulty, the operating channel can be used as a basis for comparison for voltage measurements.

Trouble-shooting in the preamplifier follows similar procedures to those used in the power amplifier. Remember to leave the 100 ohm protective resistors in circuit while checking the preamplifiers in case you drop a meter prod on the PC board, or a similar accident occurs.

Note that while the voltage at the output pin of the 741 op amps is nominally zero (as in the power amplifiers) there will normally be an offset voltage of typically ±30mV. If it is much in excess of this figure, T1, T2 or the 741 may be faulty.

If any transistors are removed from the circuit as suspect, it is handy to be able to check them with the aid of a multimeter. The range which is usually appropriate is "R x 100 ohms". First check the transistor from collector to emitter in both directions. Each measurement should produce a high resistance reading. Similarly, check the base-emitter and base-collector junctions. These should give high readings in one direction and low readings in the other.

Hum in the amplifier may be a problem caused by some of the abnormal operating conditions already described, or by incorrect layout. But the latter should not occur if the wiring diagrams have been followed explicitly.



These diagrams illustrate a handy method of checking any transistor with a multimeter switched to a low Ohms range. Naturally, these tests will not indicate transistors that are noisy or have low gain.

The Lear Siegler ADM-3 video terminal kit

A few months ago in the US, Lear Siegler released an assemble-it-yourself kit version of their ADM-3 video terminal. The kit has now also been released locally by AWA, and although quite a basic "glass teleprinter", it offers the main advantages of a video terminal at a price which should make it of interest to many people working with micro-computers.

by JAMIESON ROWE

Compared with mechanical data terminals like teleprinters, video terminals offer a number of important advantages. They are virtually silent in operation, and the lack of moving parts tends to make them significantly more reliable. They are also potentially capable of communicating with a computer system at much higher rates, being free from the limitations of mechanical strobing and decoding devices.

Of course until a couple of years ago, one had to pay quite a deal of money in order to get these advantages. Video terminals were even more expensive than teleprinters, so that the latter still tended to be the choice in cost-sensitive applications. Happily this all began to change when galloping IC technology entered the MSI-LSI-microprocessor era.

The US firm Lear Siegler Inc. has been quite active in this area, and when it was released their ADM-3 terminal set a new low level for basic video terminal prices. It currently sells for less than the cost of a new teleprinter, even in fully assembled form.

To be sure, the ADM-3 is a fairly basic terminal, compared with some of the new "intelligent" terminals. It doesn't offer inbuilt text editing, page formatting or fancy graphic plotting facilities. Even Lear Siegler describe it as their "dumb terminal", emphasising that it is designed as a teleprinter replacement.

The truth is that a basic terminal of this type is not only quite adequate, but very appropriate for communication with modern micro- and mini-computer systems. Offering quiet, reliable and fast operation at a price significantly lower than most other terminals, it has a lot in its favour.

Now that the ADM-3 terminal is available in kit form for a lower price again, it should even begin to come down into the computer hobbyist realm.

What does the ADM-3 terminal give you? Well, first of all it gives you a 30cm rectangular CRT with P4 phosphor and bonded non-glare faceplate. On this screen can be displayed 960 characters, in 12 lines of 80 characters each. An option gives 1920 characters, in 24 lines.

The display uses the standard 64 6-bit ASCII character set, displayed in 5 x 7 dot matrix form. The cursor homes to the lower left of the screen, and line feeds cause upward stepping of the display with top of screen overflow.

The keyboard fitted to the standard ADM-3 is a standard communications type, with 59 keys. A 10-key numeric pad is available as an optional extra.

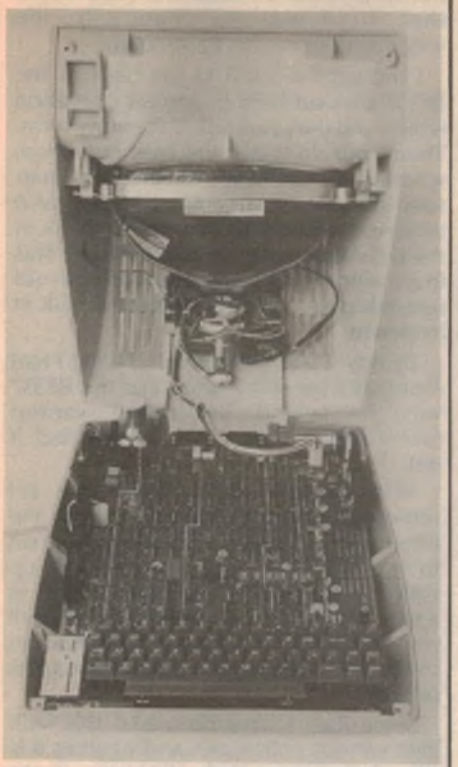
Both 20mA current loop and RS232C voltage interfacing facilities are available, with 11 switch selectable communication rates from 75 to 19,200 baud. The terminal may be operated in either full or half duplex modes, and with any of the usual asynchronous data formats.

The various data format and communication rate options are set by means of small slider switches accessible beneath a dress plate on the front of the terminal, to the left of the keyboard. This makes it possible to set up the unit without opening the case.

Inside the ADM-3 case virtually all of the internal circuitry is mounted on a large PCB. The only exceptions are the CRT sweep and EHT components, which are in a small assembly above the tube yoke. The main PCB mounts the keyboard as well as the power supply, which should ensure a high standard of overall reliability.

Quite distinct from the front panel communication mode and rate switches, there are internal switches to control special non-printing functions. These

An outside view of the ADM-3 terminal showing its clean, functional styling.



Inside the ADM-3 most of the circuitry is mounted on a single large PCB.

include keyboard locking, screen clearing, and destructive space character.

Thanks to the kind co-operation of AWA Data Systems, we were able to hook up a sample ADM-3 terminal to one of the small microprocessor evaluation systems we have been testing. We found it very easy to set up for 110-baud 20mA interfacing, using the supplied user booklet. And when in operation with the system, we found it very convenient to drive.

Character size is quite reasonable, and the display is well focussed providing one doesn't try for maximum contrast. It takes a while to get used to the line spacing, which is rather wide, but if anything this helps readability.

Even though the ADM-3 has no cooling fan, we found it to run quite cool even after many hours of operation.

In short, then, we found the ADM-3 to be a well-made and thoroughly professional video terminal, of the basic variety. One whose interfacing flexibility and price should make it very suitable for a wide variety of microcomputer system applications.

Price of the fully assembled ADM-3 is quoted at $1395, plus tax where applicable. The assemble-it-yourself kit is quoted as $965 plus tax.

Enquiries regarding the ADM-3 and other Lear Siegler terminals may be directed to AWA Data Systems, 422 Lane Cove Road, North Ryde, NSW 2113. (Telephone 888 8111.)

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The Serviceman

Intermittent colour TV fault

There was a time when mention of an intermittent fault in a colour TV set would be enough to give any serviceman a fit of the horrors. But is it all that traumatic in practice? And, from overseas, there is talk of TV sets with built-in ghost suppression.

I came face to face with an intermittent fault in a colour TV set this month—the kind of thing we used to dread when colour TV was only a distant dream (or nightmare!). And the strange thing was that it produced all the classic symptoms of the intermittent fault, just as they were back in the days of radio, when even monochrome TV was a distant dream (or nightmare!).

The set was a Philips K9 and, according to the customer, it had been losing colour and now had no colour at all. When I saw the set in the customer's home the first thing I noticed was that the fine tuning was out, being much too far into the picture carrier on all channels. I spent a few minutes re-setting the fine tuning which, superficially at least, restored the colour.

But there was obviously more to the problem than that. My impression was that there was no red in the picture and a signal from the colour bar generator confirmed this. Faults of this kind sometimes involve one of the three modules in the chrominance section (U260, U270 and U280) and, as I had a spare set on hand, it was a simple job to replace them. This produced the first hint of intermittent trouble because replacing the modules cured the fault—but only for a few seconds. At that point I decided it had best come back to the workshop.

On the bench I first turned down the saturation control and checked the monochrome picture. This was normal, which seemed to remove any faint possibility that it involved the picture tube or any of its immediate circuitry.

I fed in the colour bar pattern and checked again. Yes, the red was still missing. Next I fired up the VTVM with the idea of making a voltage check around the chrominance and colour difference sections.

My first check point was the collector of the BF337 R-Y colour difference amplifier; a fortuitous choice, as it turned out. The moment I touched the collector with the meterprobe the set came good—a classic intermittent symptom. Such touchiness can often make it extremely difficult to make progress on an intermittent fault but, in this case, I was lucky. The restoration lasted only a few seconds after I removed the probe and this turned out to be completely consistent behaviour. I could select either the fault condition or correct operation at will; something which seldom happens in these cases.

I pulsed the set into correct operation with the meter probe and checked the collector voltage. It read about 130 against a nominal 125 on the circuit, which seemed quite acceptable. As a double check I measured the same point on the G-Y and B-Y BF337s, and obtained similar readings.

Then I switched the set off, connected the meter probe to the BF337 collector, and switched the set on. This was to enable me to get a reading under the fault condition without the risk that connecting the probe would pulse the set into normal operation. As I had hoped, the set came on with the fault showing and the meter read 200 volts. This strongly suggested that the transistor was not drawing any current.

Next I connected the CRO to the R-Y output of the demodulator module and established that the waveform was normal with the fault present. Then I pulsed the set into correct operation and noted that there was no change to the waveform when this happened.

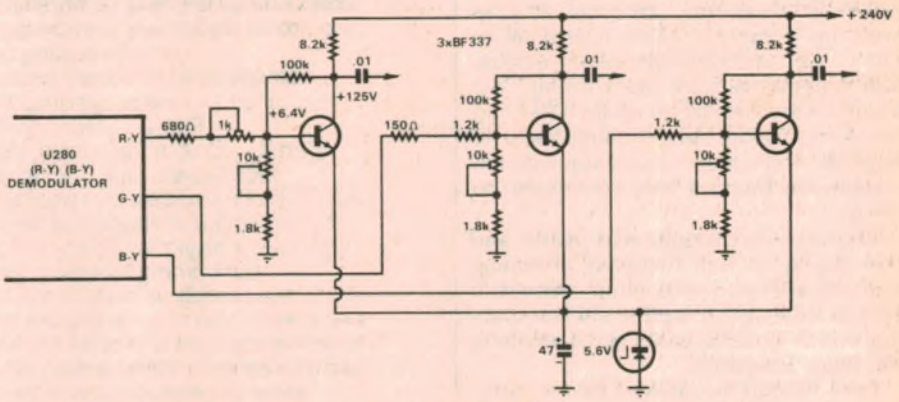
I moved the CRO to the base of the BF337 (the set held in correct operation while I did this) and noted the waveform. Then I pulsed it into the fault condition, whereupon the height of the CRO pattern increased markedly, and was also distorted. I followed this with a check of the DC voltage of the transistor base. This increased from six volts for correct operation to over seven with the fault in evidence.

By now I was convinced of what I had suspected for some time; that the BF337 was the culprit. But I had wanted reasonable evidence before I reefed it out.

With a new BF337 fitted the set returned to normal, with no sign of the intermittent condition. I returned the set to the customer, and followed this up with a phone call about a week later, as a precaution. The owner reported that all was well and that there had been no sign of the trouble. So I considered the point proved.

Since than I have discussed this fault with various colleagues and I gather it is not all that rare. And, of course, it can happen in any one of the three colour difference amplifiers.

Along more general lines, some of the current overseas research and development in the TV field makes very interesting reading.



Simplified drawing of the relevant portion of the K9 circuit. Tracking down the fault was simplified by the fact that it could be reproduced at will. Prime suspect was the BF337 R-Y colour difference amplifier.

Most of us are familiar with various mottos with which senior executives and engineers like to adorn their office desks; "Do it now", "The buck stops here", etc. But the one I have in mind at the moment is, "The difficult we do immediately—the impossible takes us a little longer".

While superficially a contradictory statement, there is more than a grain of truth in it. Today's impossibility has a habit of becoming tomorrow's conquest.

I was reminded of this by a couple of recent reports from overseas concerning the control of TV ghosts. For most of us, TV ghosts are something we have had to

learn to live with because beyond a certain point, there seemed little that could be done to control them.

In the early days of TV it was a bit of a problem trying to convince customers that ghosts were not a product of receiver design and I am sure that at least a few people bought the most expensive sets offering in an attempt to overcome a serious ghost problem.

Most people are better informed these days, but that is only mildly comforting when one is faced with a really bad locality. It is very frustrating if, after the best aerial available has been tried, one still has to tolerate an all-too-obvious multiple image.

The first report comes from the USA and has been mentioned in overseas journals several times in recent months. Basically, it is the same form of attack as of old, namely, the use of special aerials, but with one vital difference. In this scheme both the transmitter and the receiver use a relatively new type of aerial.

More precisely, it is suggested that the transmitters should use a circularly polarised aerial and that, ideally, the receivers should use the same. The idea behind this is that a signal reflected from behind the receiving aerial would appear, to the aerial, to be polarised in the opposite sense and would suffer a high order of rejection.

The idea appears to be sound enough technically and, at first glance, would not seem to be too hard to implement. The scheme would have a large order of compatibility, in that viewers need not, in most cases, change their existing aerials unless they wish to. Existing aerials would still receive the signal, but with a loss of 3dB. This order of loss would not be important except in fringe or near fringe areas.

Nevertheless, this loss appears to be one of the reasons why none of the US stations wants to be the first to use the idea. As they see it they would have to bear the cost of a new aerial—no small item in itself—for the doubtful privilege of decreasing their service area. And, in the cut-throat world of American commercial television, where stations strive to cover as much territory as possible and to woo distant viewers away from their local stations, such a concession to the opposition would be unthinkable.

As a result, it may be left to the FCC to first prove the advantages of the system and then to legislate to put all stations on an equal footing.

It will be interesting to see what comes of the suggestion.

The second report comes from the Japanese publication JEE (Journal of Electronic Engineering) for August 1976. It makes a brief (and slightly garbled) mention of work being done by the Japan Broadcasting Corporation (NHK) Technical Research Laboratories on ghost suppression.

One approach apparently involves the use of two receiving aerials with " . . . a simple adjustment process." Beyond that, one can only guess.

The other approach was more intriguing, since it stirred memories of something I hadn't thought about for some time.

Years ago I dreamed up a scheme which I reasoned would, in theory, eliminate a ghost, if one could take some of the main signal and delay it by a precise amount, it should be possible to cancel the ghost. The delay would have to be equal to the time difference between the wanted and ghost signal, but 180 degrees out of phase. Also its amplitude would have to exactly match that of the ghost signal.

It was all pure fantasy of course. While the means to delay a signal up to a full line period had been developed there was no known way that such a delay line could be made variable. And it would have to be variable and capable of being adjusted in situ after the best aerial siting and orientation had been determined.

Furthermore, while being variable, it would also have to be highly stable, to the point where it could accurately maintain the phase difference between the unwanted signal and the cancelling signal it was generating.

In short, an impractical dream.

Except that NHK's second approach is using—yes—delay lines! And, from what I can glean from the indifferent translation, the idea is along the same general lines of my one-time fantasy.

The point is that we now have two types of delay line which may satisfy the rather stringent requirements, and both are mentioned in the NHK report. One is the acoustic surface wave delay line and the other is the CCD (Charge Coupled Device).

In the case of the surface wave delay line the signal to be delayed modulates a carrier signal and the delay is a function of the dimensions of the delay line and the carrier frequency. So, by varying the carrier frequency, we could vary the delay.

In the case of the CCD the rate at which each sample of information is passed from one storage unit to the next is a function of the clock rate, the clock pulses being the trigger mechanism which initiates the transfer. So, again, we have a convenient means by which the delay can be varied.

Which means that, assuming the scheme can be made to work in the field, it would be possible to buy a set with its own built-in ghost suppression. Something which, until now, we have regarded as impossible.

Just the same, I wouldn't hold my breath waiting for it to appear in the local sets, because a lot of research remains to be done.

There is the all-important question as to how stable the delay determining circuitry can be made—at a reasonable cost. In fact, in the ultimate, it will probably be the economics of the system which will make or break it.

One disadvantage would be that it would suppress only one ghost per delay line. Multiple ghosts, as often encountered in front of sloping terrain would be the least amenable to such a system.

On the other hand the single, clearly defined ghost should be easiest to control. And even if there are lesser ghosts, it may well be that the removal of the major one will render the lesser ones less objectionable, subjectively.

There is also the problem that such a system, in suppressing one ghost, will introduce another. The delay line would be fed with both the direct signal and the reflected (ghost) signal so that the ghost will now appear displaced twice the distance from the main image as before, and in the opposite phase—i.e., a negative image.

However, since the delay line signal will have to be attenuated to match the (usually) lower level of the reflected signal, this second ghost will be attenuated by a like amount. In most cases this would probably reduce it to a negligible level.

In spite of these limitations, there must be many situations where the ability to suppress a single, prominent ghost would make all the difference between an indifferent picture and an enjoyable one. Let us hope something comes of it.

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Un-retouched photo shows transceiver full of sand & salt as opened in our Bankstown store. But it still worked – three weeks after it's 'swim'.

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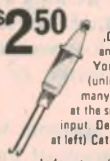

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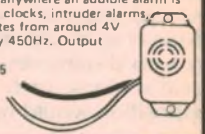

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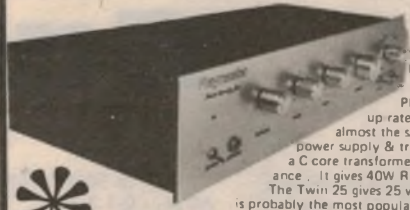

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TWIN 25: The ideal amplifier for the average listening area, or for those who have speakers which will not be adequately rated to handle higher power. Very easy to build, very good to listen to. Just as good to look at!

Cat K-3410 ..... $89.50

89.50

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See your sound in vibrant colours, these units can be used with almost any sound source equiped with external speakers. Simply connect to speaker terminals. The sound will not be affected as the music only switches the lights - it does not power them. Has 30 brilliant diamond pattern flashing lights with master sensitivity control. Colours are Red, Yellow, Green, Blue and Violet.

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Professional version of the above unit. Has 32 diamond flashing lights and 4 individual colour mixing controls

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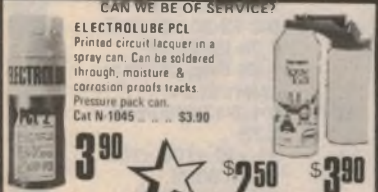

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Printed circuit lacquer in a spray can. Can be soldered through, moisture & corrosion proofs tracks. Pressure pack can.

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$2.50 **$3.90**

SOLDER SUCKER: Not one of your half-baked plastic jobs, this is metal for long life. Comes complete with a nozzle sweeper. Tip (replaceable) is made of TEFLON. You can spend twice as much and get almost the same unit! Value!

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Spare tip (Teflon)

Cat T-2570 ..... $1.50

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Cat N-1031 ..... $3.90

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Heatsink Pliers: Protect expensive components with high thermal cond aluminium heatsink pliers. Two per set.

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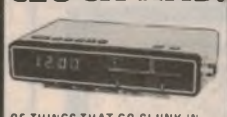
NEW $27.50 ea. (or $55 a pair)

Speakers: For value-for-money it is hard to go past the Plessey C8MX. These sound fantastic in the above enclosure, wide frequency response and handles 10W rms.

Cat C-2012 ..... $7.50 (SAVE $5.00 ON OUR CATALOG PRICE!)

AM-FM 39.90 CLOCK RAD.



OF THINGS THAT GO CLUNK IN THE NIGHT . . . this is not one! A digital display means the clock is silent – a boon for light sleepers! Clock controls AM/FM radio or alarm, but can also be used as a stop watch or interval timer! Lets you know if power has been cut!

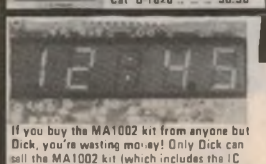
Cat A-4444 ..... $39.90

THE GREATEST YET!

AM/FM MULTIPLEX TUNER 34.50

What you see is what you get! No assembly! Made for Australian standards – covers full FM band, plus AM. Operates from 12V @ 22mA. FM Sensitivity: 3.5uV; IF Rejection 80dB, Image Rejection 52dB. Stereo Separation 25dB.

Cat F-4615 ..... $34.50



If you buy the MA1002 kit from anyone but Dick, you're wasting money! Only Dick can sell the MA1002 kit (which includes the IC module, 6 miniature push buttons, alarm slider switch, special transformer & full data sheets) for the low, low price of just $18.50. Compare everyone else's prices & tell us if we're wrong! Cat K-3434 ..... $18.50

If you want the module only, we have that for just $11.50. It has IC & components on PCB.

Cat X-1052 ..... $11.50

module only 11.50

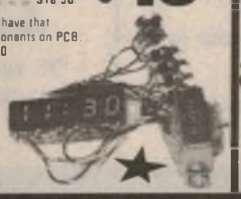
Special transformer to suit:

Cat M-2822 ..... $3.75

MA1002 CLOCK

DICK HAS THE FABULOUS MA1002 ALARM CLOCK KIT – AND HE HAS IT DOLLARS CHEAPER THAN ANYONE ELSE! The incredible new MA1002 IC from NS is a full clock – including the display! It has a few extra components on its integral PCB (power supply, etc) but all the 'works' of the clock is in the IC! All you do is add a power transformer and a few switches for setting, and that's it! You can be telling the time in a few minutes!

$18.50 complete SEE EA DEC 76



VDT BUILDERS – MICROPROCESSOR USERS – LOGIC EXPERIMENTERS – Here is the keyboard you waited for: Full alpha-numeric/symbolic keyboard especially made for computer & allied use. Each key has independent s.p. switch – suitable for ASCII or any other encoding.

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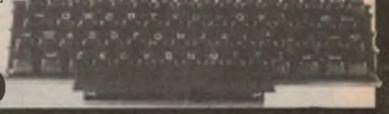
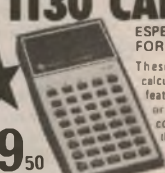


T130 CALC. 29.50



ESPECIALLY MADE FOR STUDENTS!

These incredible value calculators have all the features a student – or anyone else – could want. Better than a sly drool!

Cat O-3730 ..... VALUE! $29.50

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- 2μA suspension movement – 0.05mA/1mV resolution
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±DCA 0-2μS 0-0.03-0.3-1.2-3-12-30mA 0-0.12-0.3-1.2-12 (300mV) ±2%
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- 10μA movement – 100kΩ/V, varistor protected
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±DCV 0-0.3-3-12-30-120-300 (100kΩ) 1.2k (16.6kΩ/V) ±2% 30k (w/HV probe)
±DCA 0-12μA 0-0.3-3-30-300mA 0-1.2-12A (300mV) ±2%
ACV 0-3-12-30-120-300-1.2k (5kΩ/V) ±3% Freq. 20Hz to 1MHz at 3V
ACA 0-1.2-12 (300mV) ±3%
Ω x1 x10 x100 x10k (max. 50M) Batt. 1.5Vx1 & 9Vx1
dB –20 to +63
184x134x88mm 1.3kg

U–60D

- Measurement ranges available.

DCV 0.1 0.5 2.5 10 50 250 1000 (20kΩ/V) (25kV w/HV probe extra)
ACV 2.5 10 50 250 1000 (8kΩ/V)
DCmA 0.05 2.5 50 500 (500mV drop; 100mV for 0.05mA)
Ω Range – X1 X10 X100 X1k Midscale –50Ω 500Ω 5kΩ 50kΩ Maximum – 5kΩ 50kΩ 500kΩ 5MΩ Batteries 1.5V dry cell (UM-3 or equivalent) X2
LI 0.06mA 0.6mA
LV 3V 3V

LI 6mA 60mA
LV 3V 3V

- Allowance. Within ±3% f.s.d. for DCV & DCmA Within ±4% f.s.d. (±6% for 2.5V) for ACV Within ±3% of scale length for Ω
- Size & weight. 133X92X42 mm & 300 gr

75 years of service to Australian industry.

P–2B

- The sturdy midget – quality quality instrument of functional design
- Designed for rugged service – phenol-resin front panel & metal rear case
- Positive range setting – special feature of a pinjack tester
- Reserve instrument – for household or field service

DCV 0-10-50-250-500-1k (2kΩ/V) ±3%
DCA 0-0.5-10-250m (670mV) ±3%
ACV 0-10-50-250-500-1k (2kΩ/V) ±4%
Ω 0-5k 500k Batt. 1.5Vx1
dB –20 to +36
MΩ 0.1–50) using
μF 0.0002–0.6) external power
120x88x40mm 325gr

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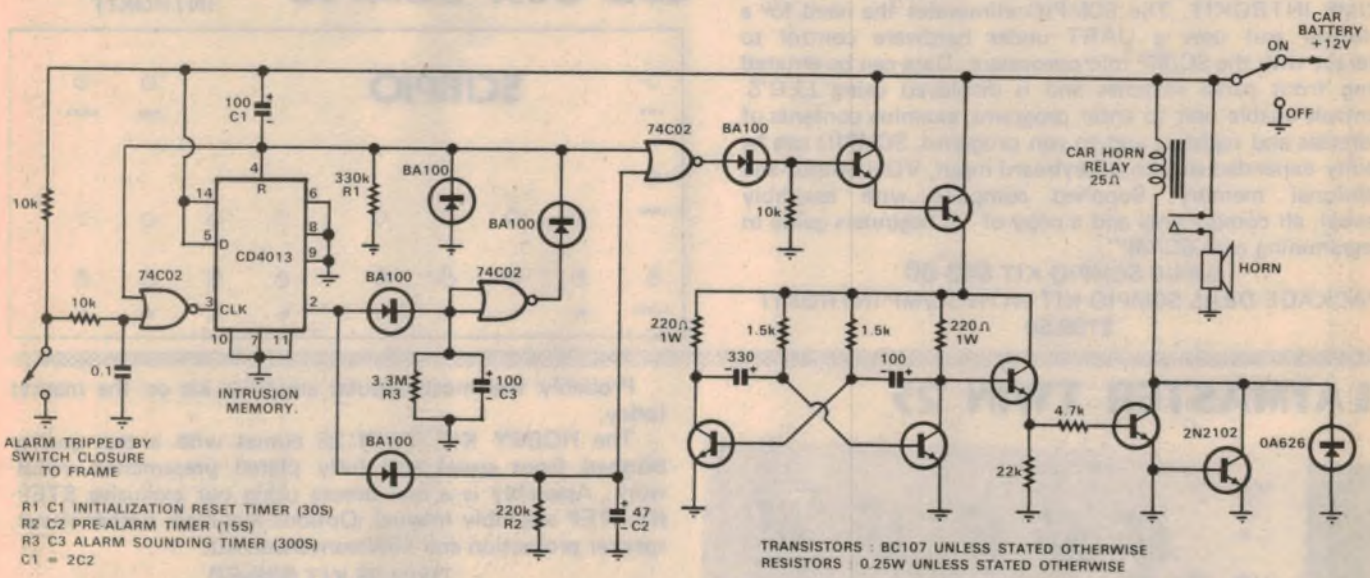
Circuit & Design Ideas

Conducted by Ian Pogson

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

Reliable, low-cost auto intrusion alarm



Many car alarms operate by sensing any change in battery voltage caused, for example, by courtesy lights coming on when a door is opened. This voltage drop, particularly for a new battery, may only be of the order of millivolts, which means that the required sensitivity of the alarm may cause it to be susceptible to noise and temperature.

In the auto intrusion alarm shown, this problem is avoided by taking the input circuit from the door switches that control the interior and boot lights. The circuit is designed around two CMOS packages, the CD4013 flip-flop and the 74C02 quad 2-input NOR gate. The resistor-capacitor combination R1, C1 develops a reset command signal to the intrusion memory when the alarm is enabled to allow exit of passengers. Once the reset time expires, the flip-flop is ready to detect a switch closure to frame at the input. Thereafter, opening a door or the boot will trigger the alarm and, following another short interval (to permit the driver to enter the car and disable the alarm by a hidden switch), the horn is pulsed approximately 50 times per minute so as not to sound stuck. After several minutes, the alarm circuitry resets itself ready for another intrusion. All the time delays can be adjusted by changing resistor values.

The Darlington pair at the output of the third 74C02 IC is used as a switch performing a function similar to an SCR but not latching with the removal of bias from the input. The simple astable circuit based on a long-tail pair is self-starting and reliable. The circuit was designed as a pulse generator rather than a square wave generator because the former was found to produce a more urgent sound. The Darlington output pair acts as a current booster to supply the 0.5A peak needed to drive the car horn relay while requiring a bias current that does not load down the astable circuit. Furthermore, the sensitivity of the Darlington pair ensures instantaneous switching of the relay during the short period in which the output of the astable is building up following the triggering of the alarm. A diode (OA626) across the 2N2102 output transistor affords protection against reverse voltages.

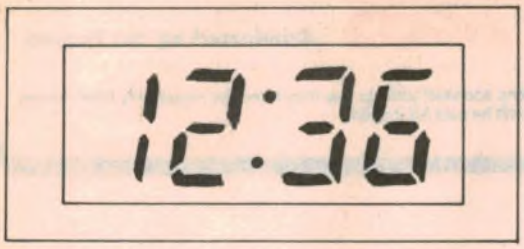
The circuit current drain in the quiescent state is approximately 20uA. The total cost of parts is around $5.00 at present prices, which makes the alarm both an economical proposition and a worthwhile project for the do-it-yourself electronics enthusiast.

(By Mr R. C. Tychsen, 25 Epping Avenue, Eastwood, 2122.)

Modification to Tune-Up Tachometer

Having built the Tune-Up Tachometer described in October 1975 by Leo Simpson, I found it every bit as useful as he suggested. I did however, find two disturbing points which were the lack of exact correlation between the two scales and some difficulties experienced in calibration.

There is however, a small modification which eliminates both faults and that is to use a 4:1 range change instead of the original 5:1 change. This can be achieved by using a series/parallel timing capacitor switch. Any pair of metallised polyester capacitors can be taken off the shelf and I used a pair of .022uF ±10%. In parallel this gives .044uF and in series, .011uF. The latter gives a short enough time constant for 6000RPM but more important, even if the two capacitors are on the limits of +10% for one and −10% for the other, the ratio of 4:1 is correct within 1%. Even if you had the correct gear, you would have to go through quite



AC1003K AUTOMOTIVE CLOCK

Designed around the preassembled MA1003 clock module this kit comes complete with case, remote setting switches and full instructions. Features crystal controlled time base for long term accuracy. Ideal for cars, boats, caravans, homes and portable equipment. Display is a brilliant green, 12 hour operation with flashing seconds display.

$34-95 pack & certified post $2.50

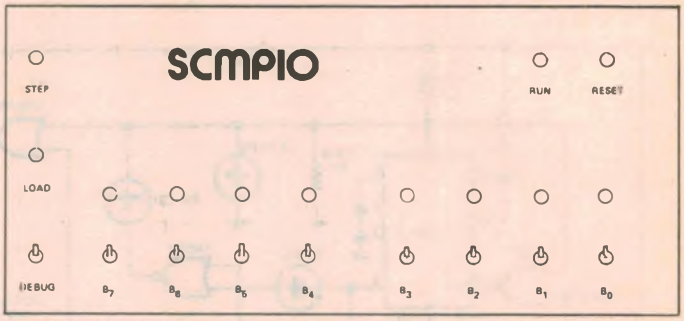
Low Cost SCMPIO

1/0 FOR SC/MP INTROKIT

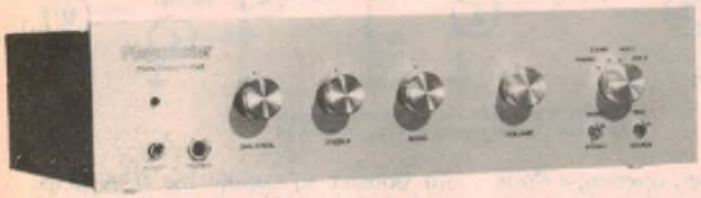
Now at last you can build a home computer using the SC/MP INTROKIT. The SCMPIO eliminates the need for a Teletype and uses a UART under hardware control to interact with the SC/MP microprocessor. Data can be entered using front panel switches and is displayed using LED'S. Controls enable user to enter programs, examine contents of addresses and registers and to run programs. SCMPIO can be readily expanded to accept keyboard input, VDU output and additional memory. Supplied complete with assembly manual, all components and a copy of "A beginners guide to programming with SC/MP".

BASIC SCMPIO KIT **$49-50**

PACKAGE DEAL SCMPIO KIT WITH SC/MP INTROKIT $139.50



PLAYMASTER TWIN 25



Probably the most popular amplifier kit on the market today.

The HOBBY KIT TWIN 25 comes with a top quality brushed front panel and fully plated prepunched metalwork. Assembly is a real breeze using our exclusive STEP-BY-STEP assembly manual. Options included: timber sleeve, speaker protection and 40W conversion kit.

TWIN 25 KIT **$89-50**

Options: timber sleeve $9.50, speaker protection $11.50 40W conversion kit $25.00

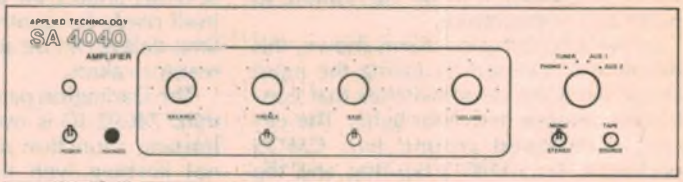
TWIN 40 (SA4040)

Now with a redesigned front panel and fully imported knob set this is a most desirable amplifier to build. Based on the design by Leo Simpson at EA the SA4040 is a low profile unit delivering a clean 40W per channel at rated distortion.

BY POPULAR DEMAND we have now included 2 additional front panel switches so that you can add speaker switches, loudness control, rumble filters, or scratch filters (details on request). Options include timber sleeve, speaker protection, rumble and scratch filters.

TWIN 40 (SA4040) KIT **$105-00**

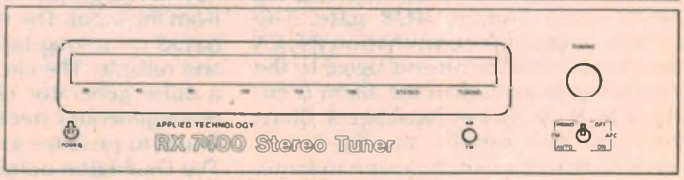
Options: timber sleeve $9.50, speaker protection $11.50, rumble, scratch filter module $9.50



RX7400 VARICAP FM TUNER

Based on our very successful ETI 740 tuner we have now redesigned the front panel to match the TWIN 25, TWIN 40 amplifiers.

The RX7400 uses a unique "electronic dial" using LED'S and now features a new LED tuning indicator. Provision has been made to accept the AM200A AM module (subject to component availability) and front panel controls have been fitted.



RX7400 TUNER KIT **$125-00**

option AM100A AM module $20.00

(p. & p. $2.50)

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a stock of capacitors to get two values like the .0082uF and .033uF within this accuracy.

The two ranges can be 0-1500RPM and 0-6000RPM, in which case you can easily calibrate the lower range directly with a low voltage mains supply. You do not even have to rectify it as the SAK140 does this for you. Even with the small meter which I used, 100RPM scale points give all the accuracy needed for tuning.

There is also another point worth noting. A smoothing capacitor across the meter can help to take out the residual flutter on the meter needle which shows with a very light meter movement at low speeds.

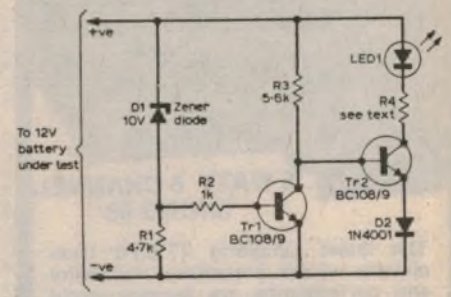
(By Mr A. Dixon, 30 Browns Avenue, Paruranga, Auckland, New Zealand.)

Battery discharge indicator

This simple circuit gives an early warning of the discharge of batteries. In many cases, due to the varying loads on lead-acid batteries, it is often difficult to determine their state of charge. The simplest method is to use a voltmeter, and keep an eye on it when drawing current. This is adequate if the user can read a meter out of the corner of his eye, and is in a position where he can obtain meters at reasonable prices.

The circuit here will give a 'GO' or 'NO GO' visual indication of any significant fall in supply voltage. The zener diode D1 is chosen for the voltage below which an indication is required. (The values shown in this case are for 12V operation.) In this instance the zener is a 10V device and was chosen as it puts about 2V on the junction of R1, R2 causing TR1 to conduct. The collector voltage thus falls to a low value keeping TR2 switched off.

Should the supply drop to below 10V, D1 will cease to conduct causing TR1 to shut off. Its collector voltage will now rise causing TR2 to start conducting via LED



1 and its limiting resistor R4.

$$R4 = \frac{\text{voltage of zener diode} - 2}{\text{LED current}}$$

Layout is by no means critical, as fifteen units have been built with uses ranging from a car battery indicator to a battery indicator for a cheap radio using a 9V battery. D1 in this latter case was a 6.8V zener.

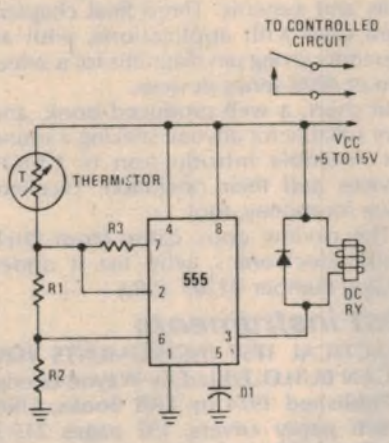
(From "Practical Wireless".)

Electronic thermostat

This non-timer use of the 555 is as a thermostat or an interface between a thermistor and a power supply. For example, it can be used to turn on a cooling or ventilator fan when the temperature reaches a certain level and turn it off when the temperature has dropped to a preset low level. Similarly, the circuit might be used to control the temperature of photo processing chemicals and baths.

The on and off states of the controlled device are determined by the values of R1, R2 and R3 and on the resistance and temperature coefficients of the thermistor.

(By Robert F. Scott, in "Radio-Electronics".)

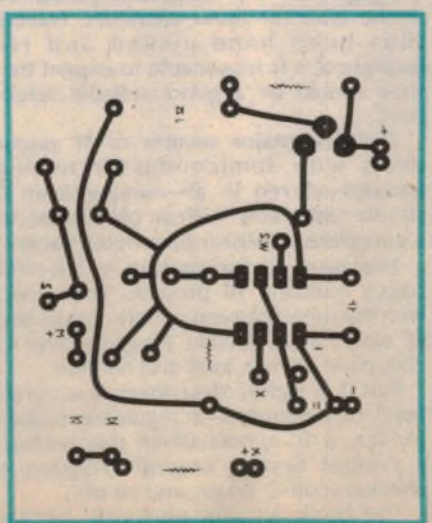


Printed board for Capacitance Meter

Attracted by the article in October, 1976, describing the construction of a Direct Reading Capacitance Meter, I decided to build one for my own use. However, on close inspection I noticed that it made use of one of the standard DIP boards which were designed for general use. As I have the facilities to make an artwork and make up a printed board, I decided to make up a special board for this project.

Having produced a board and used it for the Capacitance Meter, the thought occurred to me that other readers may wish to duplicate my pattern. The artwork is reproduced here in actual size and I have included sufficient identification marks on it so that the pattern may be readily related to the circuit diagram.

(By Norman Marks, 57 Bellamy Street, Pennant Hills, NSW. 2120.)



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Books & Literature

Understanding CMOS

UNDERSTANDING CMOS INTEGRATED CIRCUITS, by Roger Melen and Harry Garland. Published by Howard W. Sams & Co, Indianapolis, 1975. Soft covers, 135 x 215mm, 144pp, many diagrams. Price in Australia $5.95.

Superficially this little book gives the impression of being just another paperback on a topical technical subject. But on inspection, it turns out to be well written and technically quite sound, as well as being very readable and down-to-earth. And both authors turn out to be Ph.D.'s with solid grounding in electronics, not just enthusiast-writers.

The books starts with basic digital concepts, progresses through CMOS device operation and fabrication, design of circuits and systems. Three final chapters then deal with applications, with an appendix giving pin diagrams for a selection of 4000-series devices.

In short, a well produced book, and very suitable for anyone seeking a sound yet readable introduction to CMOS devices and their operation. Excellent value for money, too!

The review copy came from Dick Smith Electronics, who list it under catalog number B1260. (J.R.)

Test instruments

PRACTICAL TEST INSTRUMENTS YOU CAN BUILD. Edited by Wayne Green. Published 1974 by TAB Books, USA. Stiff paper covers, 192 pages 215 x 135mm, illustrated by diagrams and photographs. Australian price $5.95.

The projects in this book, according to the preface, have all been selected from the pages of "73" magazine, published in the USA for radio amateurs. Having thus been hand-picked and re-published, it is reasonable to expect that they should be a good, reliable selection.

The first major section of 57 pages deals with semiconductor testing gadgets—eleven in all—ranging from a simple "interface" with an ohmmeter, to a complete transistor parameter tracer.

The next major section of 40-odd pages contains 10 projects concerned with the measurement of volts, ohms and RF watts, while section 3 is given over to "Dippers" of one kind and another.

Part 4 is rightly described as a "grab bag" of oddments—a regulated supply for ICs, a 10-minute timer, test probes, a crystal tester, crystal frequency checker, coil Q tester, and so on.

The book is quite obviously slanted towards the licensed amateur operator and, for each project, presents circuit, an explanation of how it works and what it is supposed to do and, here and there, a picture of the prototype.

It is notable that the prototypes are all real "ham shack" products, built in available boxes, hand calibrated, with never a pretty label in sight. This is not meant as a criticism but, rather, as possible encouragement for those who may want to "have a go" without spending a fortune on instrument hardware and cosmetics. And the modest price of the book should be a further encouragement. Our review copy came from the Technical Book Co, 295 Swanston St, Melbourne 3000. (W.N.W.)

Historical

VINTAGE CRYSTAL SETS 1922-1927, by Gordon Bussey. Published by IPC Business Press Ltd (Wireless World Imprint), London, 1976. Soft covers, 154 x 248mm, 128pp, many illustrations. Price in UK £2.50 plus postage.

Written mainly for the radio historian and nostalgia enthusiast, this monograph on vintage crystal sets catalogues some 400 trade names, 600 companies and 200 receivers. It appears to be devoted almost exclusively to British crystal sets, however, making virtually no mention of other countries.

If you're interested in the subject, it should make a worthwhile reference.

No information on local price or availability was provided with the review copy, which came direct from the publisher in London. (J.R.)

You-build-it

21 SIMPLE TRANSISTOR RADIOS YOU CAN BUILD, by R. H. Waring. Stiff paper covers, 142 pages 210 x 130mm, illustrated by circuits and diagrams. Published 1975 by TAB Books, Blue Ridge Summit, Pa, USA. Australian price $4.95.

Unlike many "you can build" books, this one opens with about 25 pages of theory, serving to introduce the novice reader to the subject. It then progresses to crystal sets, tuned circuits, amplifiers and output stages, transistors, TRF receivers, regenerative and reflex receivers, and superhets. From page 93 onwards, the author reverts to components, circuit construction, and to something on FETs and ICs.

The approach is a good one, mixing theory with practice, hopefully to leave the reader with a mixture of both.

Sample reading of the early pages looked promising, but then I came across Fig. 4.1 where the relationship between coil tappings, gain and selectivity appears to be thoroughly confused. Thereafter, in diagram after diagram, the aerial is shown connecting directly to the hot end of the coil, as if the draughtsman knew no better, and despite the fact that it wrecks the behaviour of the tuned circuit!

Then, in chapter 8, the author explains the TRF principle but, in Fig. 8.3 he presents a simple transistor detector with a single tuned proprietary coil "eliminating the need for ganged tuning capacitors"!

In Fig. 9.6 a mistake in the diagram neatly shorts the coil secondary; Fig. 9.11 features a rather dubious combined reaction and volume control, while Fig. 10.1 (relating to a superhet) explains AGC as feeding back "a proportion of the signal after detection". Then Fig. 10.2 shows a 1-transistor superhet front end and "one stage of IF amplification"—actually just an IF transformer.

Faced with things like this, I couldn't help but wonder whether the author's original text had been assembled into a book by others whose grasp of the subject was less thorough. You might still find some help in it but don't treat every detail as "gospel". Our copy came from the Technical Book Co, 295 Swanston St, Melbourne. (W.N.W.)

Contructor's guides

SIMPLE CIRCUIT BUILDING, by P. G. GRAHAM. Newnes-Butterworth, London, 1976. Soft covers, 135 x 216mm, 112pp, many diagrams. Price $4.00.

PRACTICAL ELECTRONIC PROJECT BUILDING, by A. C. Ainslie and M. A. Colwell. Newnes-Butterworth, London, 1976. Soft covers, 135 x 216mm, 106pp, many diagrams. Price $4.00.

PROJECT PLANNING AND BUILDING, by M. A. Colwell. Newnes-Butterworth, London, 1976. Soft covers, 135 x 216mm, 102pp, many diagrams. Price $4.00.

These three low-cost little books are part of a "constructor's guide" series currently being published by Newnes-Butterworth. Apparently the series is designed particularly to help those who wish to build up magazine projects, but find that they lack background knowledge and practical experience.

Together they provide a surprising amount of down-to-earth information on both basic electronics theory, design and construction. On the practical side there is lots of useful material on selection and use of tools, design and etching of PC boards, wiring, metal "bashing", layout, panel lettering, and basic troubleshooting.

In short, very practical reading.

The review copies came from Butterworth Australia (I.R.).

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PL24/20VA	24 volts at 0.83 amps	12 volts at 1.67 amps
PL30/20VA	30 volts at 0.67 amps	15 volts at 1.33 amps
PL40/20VA	40 volts at 0.50 amps	20 volts at 1.00 amps
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PL30/40VA	30v, 27v, 24v, 18v, 6v at 1.33A	15v, 12v, 3v at 2.67A
PL50/40VA	50v, 45v, 40v, 30v, 10v at 0.8A	25v, 20v, 5v at 1.6A
PL30-9/40VA	30v at 0.5A with 9v at 3.0A	15v at 1.0A with 9v at 3.0A

PL1.5-18/40VA
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Additionally centre tap configurations are all obtainable e.g.-
9V-0-9V, 7.5V-0-7.5V, 6V-0-6V, 4.5V-0-4.5V, 3V-0-3V, and 1.5V-0 1.5V.

CHASSIS OR FRAME MOUNTING 60VA

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL30/60VA	30v, 27v, 24v, 18v 6v at 2.0A	15v, 12v, 3v at 4.0A
PL50/60VA	50v, 45v, 40v, 30v 10v at 1.2A	25v, 20v, 5v at 2.4A
PL80/60VA	80v, 70v, 60v, 50v 20v, at 0.75A	40v, 30v, 10v at 1.5A

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Basic readout devices

The output information from digital systems must often be displayed visually in numerical form. This chapter looks at the variety of basic readout devices used for output displays of this type. Those described are gas-discharge tubes, light-emitting diodes, fluorescent displays, incandescent filament tubes and liquid-crystal panels.

by JAMIESON ROWE

In many applications of digital electronics, the output from a system is interpreted as a number which must be displayed directly to the operator in visual form. A good example of this is provided by digital instruments such as frequency counters and digital voltmeters (DVMs), where the number displayed corresponds directly to Hertz or volts, respectively.

Over the years many different types of display device have been used to provide this sort of readout, some with more success than others. To cover all of them here would take a great deal of space, and in many cases the effort spent would be largely wasted as the devices concerned have long since faded into obscurity. We will therefore look only at the devices and techniques which have survived the test of time, and are still in current use.

Probably the first really successful digital display device to be developed was the shaped-cathode gas discharge tube, shown in Fig. 1. These are often given the generic name of "Nixie" tubes, although this name is strictly a trademark of the Burroughs Corporation in the USA who first developed tubes of this type.

Basically these tubes are a development from the simple neon lamp, which has two metal electrodes sealed inside a glass tube containing neon gas and a trace of mercury vapour. When a potential of about 75 volts DC is applied between the electrodes, the gas inside the tube ionises and a glow discharge is produced in the immediate vicinity of the cathode (more negative electrode).

It is this confinement of the glow discharge to the immediate vicinity of the cathode which is exploited in the shaped-cathode display tube. Here there is not one cathode but ten, and each is shaped in the form of one of the ten decimal numerals 0-9. The ten cathodes are stacked one behind the other, as shown, with the anode in the form of a fine wire mesh in the front. The tube may thus be arranged to display any of the numerals at will, simply by activating the appropriate cathode.

Typically this is done using a circuit of the type shown. The anode of the tube is connected to a source of around 150V DC, via a resistor R. Each of the cathodes is connected to ground (negative) via a high-voltage switching transistor, with the transistors controlled by the outputs of a BCD-to-decimal decoder. The decoder

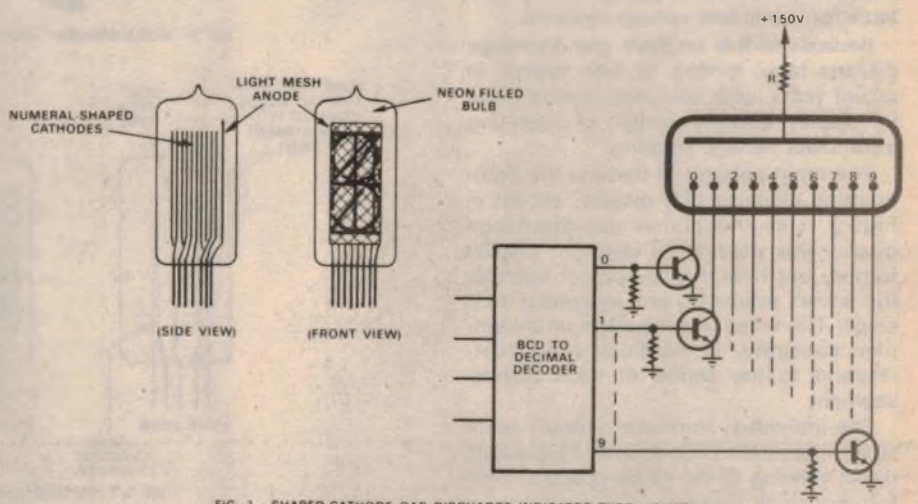

FIG. 1 SHAPED-CATHODE GAS DISCHARGE INDICATOR TUBE ("NIXIE")

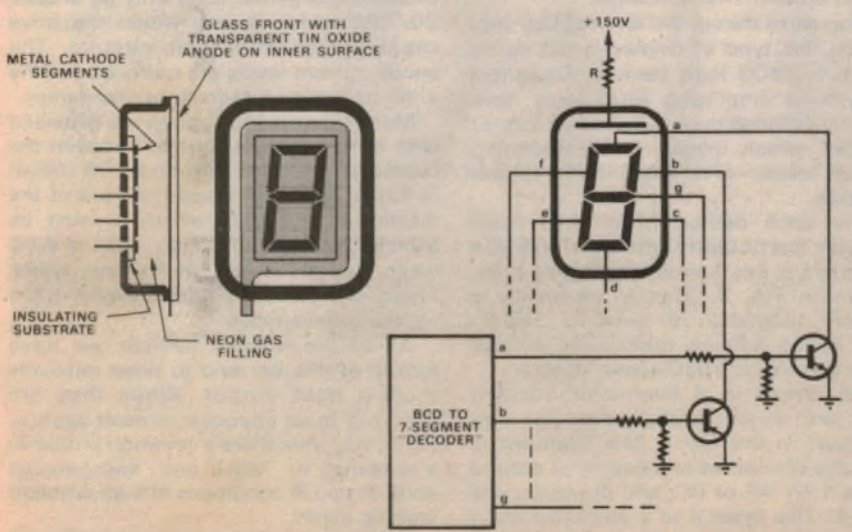

FIG. 2 PLANAR GAS-DISCHARGE DISPLAY

thus causes the tube to display the decimal numeral corresponding to the BCD code presented to its input.

The anode series resistor R is required because although the tube has a voltage drop of around 70V when ionised, it requires at least 120V for ionisation to take place. The resistor absorbs the difference in voltage, and also tends to maintain the tube current relatively constant despite differences between the various cathodes. Typically the resistor value is between 50k and 100k.

While the shaped-cathode display was used in a great many digital readouts, it had one main disadvantage. This was that the discharge produced by the cathodes near the rear of the tube tended to be obscured by the cathodes in front, making them difficult to read.

In order to obviate this problem, designers came up with the planar type of gas

discharge display shown in Fig. 2. This uses a somewhat flatter construction, with the multiple cathodes all in the same plane. But in this case there are only seven cathodes, arranged in the now-familiar squared-8 or "seven segment" format, so that the various decimal numerals may be displayed by activating combinations of segments simultaneously.

Thus a "1" is displayed by activating cathodes b and c, for example, or a "6" by activating cathodes c, d, e, f and g. The cathodes are again controlled by high-voltage switching transistors, as shown, but in this case the transistors are driven by a BCD-to-7-segment code translator rather than a decoder.

Note that the anode of a planar gas-discharge display is not usually a wire mesh, but rather a transparent electrode of tin oxide deposited on the inside of the glass front plate. This tends to give improved visibility also, over and above that provided by the single-plane type of display.

Of course the planar gas discharge display shares with the original shaped-cathode type the need for a high-voltage power supply, and for switching transistors capable of withstanding up to 120V or so. This makes both types rather unsuitable for use in low voltage systems.

Because of this problem gas discharge devices have tended to lose favour in recent years, with designers opting more for display devices capable of operating from lower voltage supplies.

The most popular of these is the light-emitting diode or LED display, shown in Fig. 3. Like the planar gas-discharge display this uses the 7-segment display format, but here the sources of light for the seven segments are individual LED chips. The chips are mounted on a common substrate, in positions which correspond to the centre of each display segment.

The individual chips are typically quite small—less than 1mm square. This makes direct viewing of the chips practical only for very small displays, such as those on digital watches and pocket calculators. Even for these applications, moulded plastic lenses are usually fitted in front of the chips to provide optical magnification.

For larger displays, the technique shown in Fig. 3 is generally used. Here a moulded plastic block which mounts in front of the chips on the substrate is provided with tapered slots, the inside of which are metallised to form mirrored "light pipes". In front of these again is a red tinted diffusing filter, and together the mirror pipes and filter effectively spread the light from the LED chips out to form uniformly lit segments.

Electrically the LED chips are usually connected either with their cathodes commoned, as shown, or with their anodes commoned. Devices with both arrangements are made and used, as each has advantages in certain applications. The advantages of having one side or the other of the chips commoned are twofold: the number of device connections is reduced, lowering package cost, and the common connection allows convenient electrical control of the display digit as a whole.

LED displays tend to have high reliability and a long operational life, as a result of the solid state construction. And conducting LED chips have a voltage drop of around 1.7V, making them quite compatible with most digital system power supplies. These features have made them very popular as digital displays in a wide variety of applications, although as a LED chip typically requires an average current drain of around 15-20mA for a reasonably bright output, a full 7-segment digit display tends to have a current consumption of around 140 milliamps.

Because of the current drain of LED segments, this type of display is not easily driven by MOS logic devices. Designers of systems employing MOS logic have therefore tended to use alternative display devices, which involve lower operating current levels—or at least lower control currents.

One such device which has been popular particularly among Japanese designers is the fluorescent display tube, shown in Fig. 4. This is essentially a modern adaptation of the early "magic eye" tuning indicator tubes, used in valve radio sets in the 1930's and 1940's.

The device is a thermionic vacuum tube, with an electrically heated fine wire filament in the front. The filament is typically connected to a supply of around 1V to 1.5V AC or DC, and draws around 40mA. This heats it to a point just short of incandescence, sufficient to release free electrons from the surface of the wire, but not sufficient to make the wire visible.

At the rear of the tube is a substrate with seven metal anodes, shaped and laid out in the familiar 7-segment format. The anodes are covered with fluorescent paint, which glows with a greenish-blue light when struck by electrons. Any anode segment may thus be caused to glow by making it positive with respect to the heater filament, so that some of the free electrons released by the filament are attracted to the anode and made to impinge upon the fluorescent paint coating.

The positive anode voltage required to produce this action need only be around 20-25V, which is well within the drive capability of MOS logic circuits. The anode current levels are quite low, in the order of tens to hundreds of microamps.

Many fluorescent displays are provided with a mesh grid electrode between the heated filament and the anodes, as shown in Fig.4. The grid is used to control the display as a whole, where it must be switched on and off rapidly. This is done using a negative bias on the grid, which repels the electrons and prevents them reaching the anodes.

All of the display devices we have looked at this far tend to have relatively modest light output. While they are generally quite adequate in most applications, they thus share a common problem: a tendency to "wash out" and become hard to read in conditions of high ambient lighting levels.

A display device which is somewhat

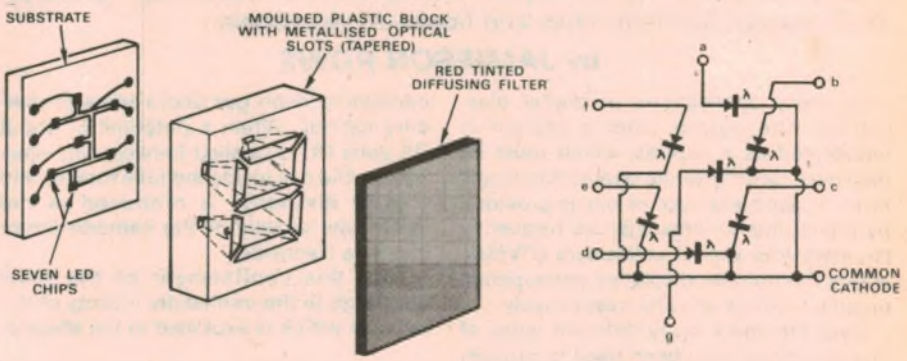

FIG. 3 SEVEN-SEGMENT LED DISPLAY (COMMON CATHODE)

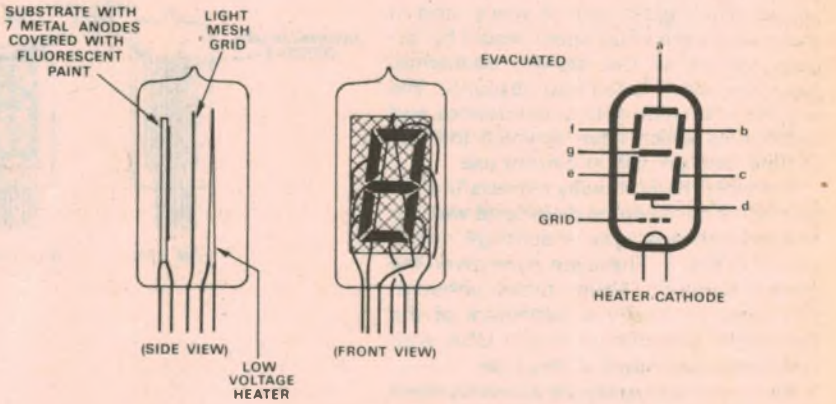

FIG. 4 FLUORESCENT 7-SEGMENT DISPLAY TUBE

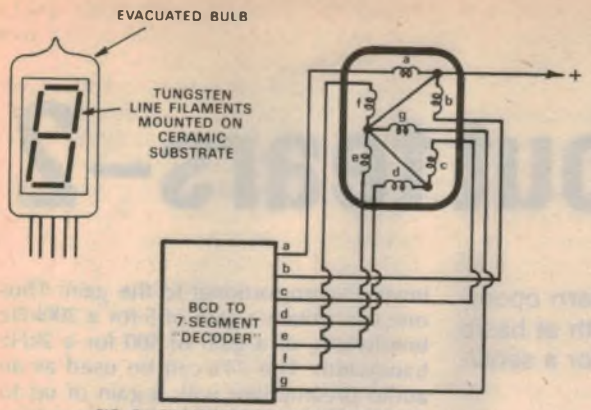

FIG. 5 : FILAMENT 7-SEGMENT DISPLAY

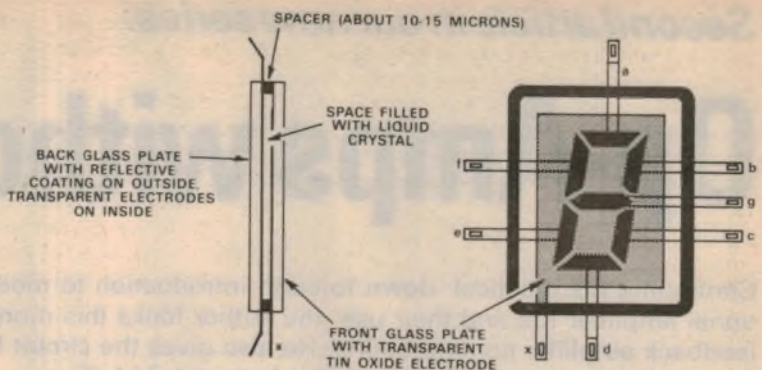

FIG. 6 : LIQUID-CRYSTAL DISPLAY

better in this respect is the directly-viewed filament display, shown in Fig. 5. This is basically a development of the conventional incandescent lamp, with seven tungsten wire filaments arranged in the standard 7-segment format. However, the filaments are here operated at a bright red heat—around 1400 degrees K (Kelvin)—compared with the white-hot 2500 degrees K temperature used with normal household lamps. This gives a very significant improvement in reliability, together with an average life expectancy of over 100,000 hours.

And despite the apparent fragility of the fine filaments, the displays turn out to be surprisingly rugged. So much so that in view of their high visibility in bright conditions they are widely used in high-shock applications such as aircraft cockpit displays

The ability to provide a highly visible display in conditions of high ambience is also possessed by the most recent type of readout device, the liquid-crystal panel. This competes with ambient lighting not by attempting to out-shine it, but by using it, ie, the liquid-crystal panel is basically an optical filter or modifier of existing light rather than a source.

Actually there are a number of different types of liquid-crystal display rather than a single type. All depend upon the rather unique properties of liquid-crystal materials, and the way these properties can change when the materials are subjected to an electric field. But different displays make use of different properties, or put the same property to different use.

One type of display make use of the property whereby a liquid crystal may be optically transparent when its molecules are at rest, but becomes cloudy due to molecular turbulence when an electric field is applied.

This type of display is known as the "dynamic-scattering" type of liquid-crystal panel, and is the type most widely used.

The other main type makes use of the fact that some liquid-crystal materials may be made to exhibit a light-polarising ability, which is again affected by an applied electric field. This type of liquid-crystal display is known as the "field-effect" type.

Both dynamic-scattering and field-effect displays may be made in either of two forms: transmissive and reflective. With transmissive displays the panel acts as a selective filter, modifying light which passes through it from behind. Reflective displays act instead as selective mirrors, modifying light incident on them from the front.

The construction of a dynamic-scattering reflective type of display is shown in Fig. 6. As you can see it is basically two sheets of glass sandwiching a very thin layer of liquid crystal. The inside of the front glass sheet is covered by a transparent electrode, usually of tin oxide, while the inside of the rear sheet has seven similar electrodes laid out in the familiar 7-segment format. The outside of the rear glass sheet also has a reflective mirror coating.

With the rear segment electrodes at the same potential as the front electrode, the molecules of the liquid crystal are at rest and the display appears bright due to the clear optical path to and from the rear mirror. However, if an external voltage is applied between any of the rear electrodes and the front electrode, the liquid crystal molecules immediately in front of the active segments become turbid, clouding the optical path. This makes the desired display evident, as a dark digit displayed against a light background.

Liquid-crystal displays are the most efficient of all in terms of electrical power consumption—typical power consumption is in the order of microwatts. They are also relatively low in cost, and these two features make them attractive for battery-operated consumer applications such as pocket calculators and digital watches.

It seems likely that liquid-crystal displays will be used much more widely in the future, although there are still some problems to be solved. One is response speed, as at present they are very much slower than other types of display in terms of turn-on and turn-off times. Another problem is display appeal—at present liquid-crystal displays tend to look drab and grey, compared with the other types. Until recently they also had a rather limited operational life, although this problem now appears to have been largely solved.

Before closing this introductory look at digital display devices, there is one point which should be noted. Although all of the examples shown in the diagrams have been single-digit displays, many of the different types of display device are also made in multi-digit form—providing 2, 3, 4, 5 or more digit displays in the one package.

The actual operation of such multi-digit displays is exactly the same as for single-digit displays, although the method of driving them from the associated logic often differs. A technique often used with multi-digit displays is multiplexing, which both reduces the number of connections required for the displays themselves, and also simplifies the driving circuitry.

We will look at multiplexing and demultiplexing techniques in the next chapter.

Second article in our new series:

Op-Amps without tears–2

Continuing his practical, down to earth introduction to modern operational amplifier ICs and their use, the author looks this month at basic feedback amplifier configurations. He also gives the circuit for a sensitive electronic microammeter using a low cost 741 IC.

by J. BRIAN DANCE, M.SC

Last month we discussed some of the limitations of operational amplifiers used without any feedback. We will now consider some practical circuits in which negative feedback is used to stabilise the gain, increase the frequency response, and otherwise improve performance. When a suitable amount of negative feedback is employed, the differences between integrated circuit operational amplifiers of the same type number can be made negligible for all practical purposes.

As the 741 device is a very economical general purpose operational amplifier which is readily available, we will continue to base our circuits on it. However, almost all of the ideas discussed also apply to other operational amplifier devices. In later articles we shall discuss circuits using other devices for applications in which the 741 is unsuitable.

INVERTING AMPLIFIER

The basic circuit of a 741 inverting amplifier is shown in Fig. 9. The input signal is fed to the inverting input of the 741 via R1 and therefore the output is inverted in sign with respect to the input. For simplicity, the power supply connections are not shown in this circuit, but they must of course be included, as in the circuits discussed last month. By omitting these connections and the offset nulling circuit, we can concentrate more easily on the parts of the circuit to be discussed.

If there is a small rise in the input potential fed to the resistor R1, this will tend to produce a very small rise in the potential of the inverting input of the 741 (marked "–"), and this results in a fall in the output potential. This fall is fed back through R3 and tends to cancel the rise at the inverting input.

We have already seen that operational amplifiers are designed to have an extremely high gain, so the fall in the output voltage is adequate to almost completely cancel the rise in voltage at the inverting input of the amplifier. It cannot completely cancel the input rise, since a minute change of input potential is needed to produce the output voltage change. However, the inverting input of the 741 remains virtually at earth potential and is therefore usually described as a 'virtual earth' point.

Operational amplifiers are designed to have a very high input impedance. The currents which flow to the inputs of the 741 circuit of Fig. 9 are therefore very small. As the inverting input is virtually at ground potential, the current which flows through R1 is equal to the input voltage, Vi, divided by R1. Similarly, the current flowing through R3 is Vo/R3 where Vo is the output voltage. These two currents are almost equal, since the current flowing to the inverting input is very small indeed.

$$Vi/R1 = Vo/R3$$

$$\text{Hence } Vo/Vi = R3/R1$$

But Vo/Vi is equal to the gain of the circuit with feedback. Thus the gain is equal to the ratio of the resistor values R3/R1, and is unaffected by the gain of the amplifier used.

In actual fact this result is only an approximation, since we have assumed that the potential at the inverting input is always zero and this cannot be quite true. Nevertheless, if the gain of the amplifier device itself without feedback is much greater than R3/R1, the gain with feedback is very closely equal to R3/R1.

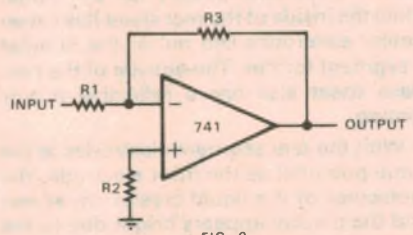

FIG. 9

The input impedance of the circuit of Fig. 9 is almost exactly equal to the resistance of R1, since the one side of this resistor always remains at about earth potential. If one wishes to minimise the effect of small currents flowing into the amplifier inputs, the value of R2 should be approximately equal to the value of R1 in parallel with that of R3.

If one requires a voltage gain of 50 times (34dB), one may select a value of 50k for R3 and 1k for R1. The bandwidth using a typical 741 device will be about 20kHz at –3dB down, for this gain. However, the bandwidth is essentially inversely proportional to the gain. Thus one can obtain a gain of 5 for a 200kHz bandwidth, or a gain of 500 for a 2kHz bandwidth. The 741 can be used as an audio preamplifier with a gain of up to 50 (or 100 for a more limited frequency response), but special audio preamplifier devices are available which are operational amplifiers with lower noise level than the 741.

Readers wishing to try this circuit may use two 9V batteries as the source of power. Alternatively a supply derived from the mains and regulated by a suitable device may be used, but there is no point in applying more than ±15V and risking damaging the amplifier device.

NON-INVERTING AMPLIFIER

The input voltage is applied to the non-inverting input of the circuit of Fig. 10 and no inversion of the signal waveform therefore occurs. A potential divider, R1 and R2, is included across the output circuit and the negative feedback signal taken from the junction of these resistors is applied to the inverting input of the 741 device.

If the input potential rises by a small amount Vi, the output voltage will rise by an amount we will call Vo. A fraction of Vo is fed back to the inverting input to provide negative feedback. The potentials at the two inputs rise by almost equal amounts; if this were not so, the difference in potential between these inputs would be multiplied by the very high open loop gain of the 741 device so as to cause a very large change in the output voltage.

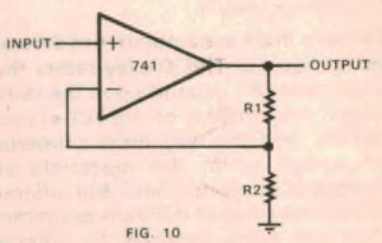

FIG. 10

The voltage across R2 is equal to the fraction R2/(R1 + R2). If we assume that the gain of the 741 is so high that the potentials at the two inputs of the device are equal,

$$Vi = Vo\ R2/(R1 + R2)$$

$$\text{and Gain} = Vo/Vi$$

$$= (R1 + R2)/R2$$

$$= R1/R2 + 1$$

If R1 is much larger than R2, the gain of the circuit is approximately equal to R1/R2, and as before is independent of

the particular amplifier in use.

OFFSET

One may include an offset nulling potentiometer in either of the circuits of Figs. 9 and 10. This involves connecting a potentiometer (perhaps 10k ohm) between pins 1 and 5 of a standard 8 pin 741 device, with the slider of the potentiometer connected to the negative supply line (see Fig. 5 of last month's article). If one selects the feedback resistor values for moderate gain (10 to 100), one will immediately notice that the adjustment of the nulling potentiometer is far less critical than when the 741 is used at full gain without any negative feedback.

Indeed, the adjustment of the potentiometer changes the output voltage by only a small fraction of a volt in the Fig. 9 and Fig. 10 circuits at moderate values of gain, whereas in the Fig. 5 circuit a small adjustment of the nulling potentiometer would cause the output to sweep from one extreme to the other. The voltage offset at the input in these circuits is multiplied by the gain of the circuit at zero frequency. Thus in the practical circuits of Figs. 9 and 10, the output potential can be set to zero fairly accurately. It will drift somewhat with temperature, but this drift will be far less than if the 741 is used in the Fig. 5 circuit without feedback.

BUFFER AMPLIFIER

A simple buffer amplifier having a high input impedance and a low output impedance is shown in Fig. 11. It is essentially similar to the circuit of Fig. 10, but the whole of the output voltage is fed back to the input instead of only a fraction of the output voltage. This type of circuit is known as a voltage follower, since the output voltage follows changes in the input voltage.

In the circuits of Figs. 10 and 11, all of the input current flows into the non-inverting input of the operational amplifier device. The 741 is designed so

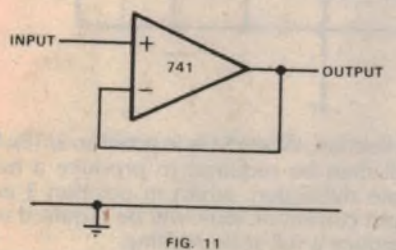

FIG. 11

that this current is quite small and therefore the input impedance of these circuits is much higher than that of Fig. 9 where approximately equal currents flow through R1 and R3.

The circuit of Fig. 11 is therefore very useful when one requires a circuit of fairly high input impedance which will not impose an appreciable load on most circuits which are likely to be used to feed it. Apart from the name 'voltage follower', this type of circuit is sometimes called an 'impedance converter', since it converts the high impedance at its input

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to a relatively low output impedance. The input impedance of the circuit of Fig. 11 is typically 1 megohm with a minimum value of about 0.3 megohm for any 741 device, whilst the output impedance of the circuit is somewhat less than 1 kilohm.

The circuit of Fig. 11 can be used when no voltage gain is required, whereas the circuits of Figs. 9 and 10 can provide gain. If desired, one of the feedback resistors may be made variable so that the gain can be controlled.

A typical circuit which can provide a very wide range of gain values is shown in Fig. 12.

Many other variations on the basic operational amplifier circuits are possible. For example, the circuit of Fig. 13 shows how a high gain inverting amplifier can be made with a high input impedance. If the circuit of Fig. 9 is to have a very high gain and the value of R3 is not to be excessively high, R1 must be fairly small and this will result in a relatively low input impedance. However, R1 can be quite large in Fig. 13 even if the gain is to be very high, since R3 and R4 can be chosen so that the fraction of the output voltage fed back is small and R2 does not then need to be especially high.

SENSITIVE MICROAMMETER

The circuit of Fig. 14 shows how a 741 device can be employed to make a sensitive meter with a full scale deflection of 1 microamp. Apart from being a really useful circuit, the inexperienced reader will learn much about the practical use of operational amplifiers by making such simple circuits.

If an input current flows into the circuit, an almost identical current flows through R3, since the input impedance of the device is high. If the input current is 1uA, this current flowing through R3 will produce a potential of 0.22V across this resistor. As pin 2 remains at zero voltage, the 1uA input current thus produces an output voltage of 0.22V. If the total resistance of the meter M1 and the variable resistor VR2 is 4.4k ohm, a current of 50uA will flow through the meter. Thus the 1uA input current causes a full scale deflection of the meter.

The diodes D1 and D2 will not pass any appreciable current unless the output voltage exceeds about 0.6V; in this case one of the diodes will conduct and will prevent the meter from being overloaded and possibly damaged. The equal input resistors R1 and R2 help to reduce drift of the offset voltage.

If the input is positive (that is, if a conventional current flows into the resistor R1), the output will become negative. The positive side of the meter must therefore be grounded and the negative side connected to the 741 output. If desired a 50-0-50 microammeter may be employed, in which case currents of either polarity can be measured with the centre reading meter.

When the meter is to be used, VR1 should first be adjusted so that the meter indicates zero with no input current. A current of 1uA is then passed into the input. One way of doing this is to connect a 10V source through a 10 megohm resistor to the input of the circuit, the negative side of the source being connected to the zero volt line. The 'Set FSD' control VR2 is then adjusted until the meter shows a full scale deflection.

It is also possible to use a 0-100 microammeter in this circuit, but the value of VR2 should then preferably be reduced to about 2.5k ohm. Other fairly sensitive meters can also be employed, with FSD figures up to about 500uA, by reducing the value of VR2 to suit.

The input bias current to a typical 741 device is 0.2uA (maximum value 0.5uA); it is the average of the two input currents. The input offset current is the difference in the currents to the two inputs when the output is at zero voltage; the input offset current has a typical value of 0.03uA (maximum 0.2uA) for the 741 and varies with temperature. Thus errors will occur if an attempt is made to increase the sensitivity of the Fig. 14 circuit by a large factor so as to obtain a full scale deflection with much lower input currents. In due course we shall show how other devices can be used to measure much smaller currents than those for which the Fig. 14 circuit using the 741 is suitable.

The circuit of Fig. 14 can also be used as a voltmeter for measuring steady voltages; VR2 can be adjusted so that the full scale deflection is 200mV. The power supply and offset nulling circuits shown in Figs. 14 and 15 are also suitable for use in the circuits of Figs. 9 to 13 inclusive.

MULTI-RANGE METER

The circuit of Fig. 15 shows the use of a 741 device in a microammeter having several input ranges. When S1 is in position 1, a current of 5uA flowing through R1, R2 and R3 (total of 200 ohm) will produce 1mV across these resistors and this can be used to produce a full scale deflection. When S1 is in position 2, 10uA will then be required to produce a full scale deflection, whilst in position 3 an input current of 20uA will be required to produce a full scale reading.

The gain of this circuit is approximately 200 (= R6/R4), so 200mV is available at the output for driving a current of 100uA through the meter. The adjustment of VR1 is carried out as for the Fig. 14 circuit. The correct full scale deflection is set using VR2 on any one of the current ranges and the full scale deflection on the other ranges will then also be correct, since R1, R2 and R3 are close tolerance components.

Next month we will cover further practical 741 circuits and learn more about operational amplifiers.

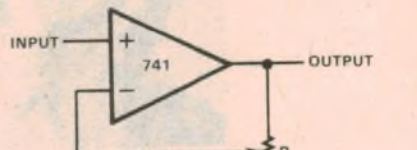

FIG. 12

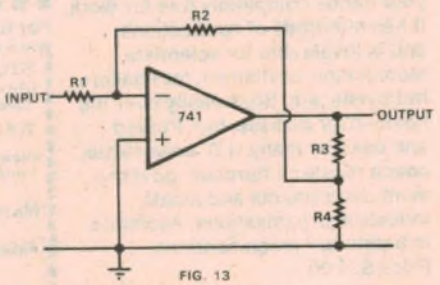

FIG. 13

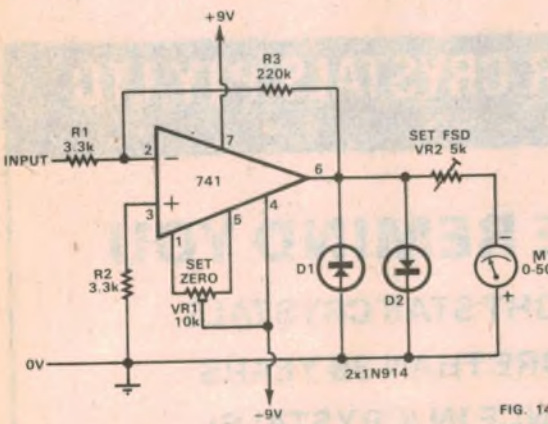

FIG. 14

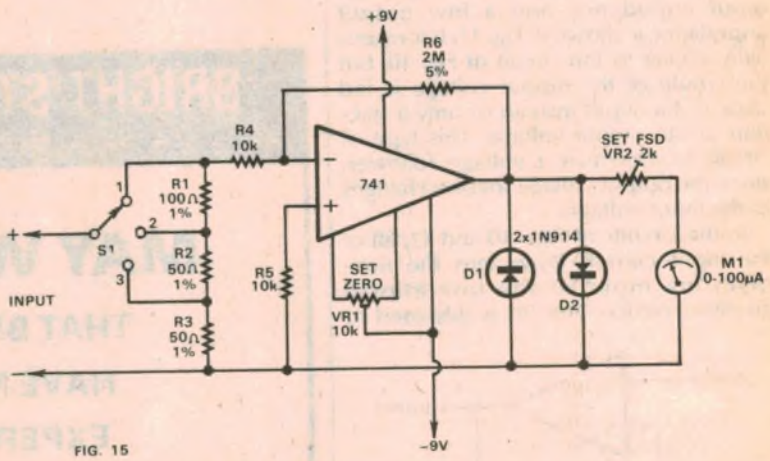

FIG. 15

New Products

Portable ultrasonic alarm

A portable ultrasonic intrusion alarm which has recently become available on the Australian market should be of particular interest to anyone with an awkward security problem. Completely self-contained, it would seem to be ideal for protecting specific areas of limited size.

The device is called the Porta-D-Tect and is manufactured by Unisen Inc, California, USA. It is being marketed in Australia by Electronic Concepts Pty Ltd.

The unit is housed in a black plastic case measuring approximately 135mm wide, 98mm high, and 45mm deep. It weighs 298gms (10.5oz). This is small enough and light enough to be carried in a brief case or even in a (large) pocket.

The unit is equipped with two ultrasonic transducers, both facing forward from the front of the case. One is a transmitter which projects a 45° cone of ultrasonic energy and the other is a receiver which picks up portion of this energy reflected from the surroundings.

While ever the reflected energy remains constant the alarm remains dormant, but is triggered by any change in the energy pattern. When it triggers, it sounds a high level alarm which continues for between two to three minutes. At the end of that time the device re-arms itself and remains silent if there is no further movement in the area. Further movement will trigger the alarm again.

The device is fitted with delay systems and coded switches to allow setting up, and legitimate exit, entry, and switch off. It is switched on or off by two 10 position slide switches, each side of a common row of numbers. While ever the two switches are set to a certain number combination, unique to that particular unit, the system is turned off.

To turn it on, either or both switches can be set to any number other than the one nominated. The system is now armed and the user has about 15 seconds to get clear of the area. After that any movement in the area will trigger the alarm but, again, only after a 15 second delay. This allows the legitimate entrant time to set the switches back to their "off" combination and thus deactivate the system. The "on" condition is indicated by a small red light (LED) in the back of the case.

The whole unit operates from an international 9V size 216 battery, but the instructions emphasise that this should be an alkaline type or, if preferred, a nickel-cadmium type. Current consumption is given as 15mA in the standby condition and 130mA in the alarm condition.

The makers suggest a variety of applications for the alarm. Because of its small size, it can be locked in the drawer of a filing cabinet to protect vital documents. It can also be positioned in a room to supervise likely entry points, such as a door or window, even while the occupant is asleep in the room.

Other suggested locations are hallways, inside the boot of a car, in a caravan or boat, or even, according to the makers, inside a brief case.

In use, we found the device commendably simple to operate. The only controls are the two switches forming the combination so that it is only necessary to activate these and point the device at the area to be protected. The makers claim an alarm level of 106dB and, while we cannot confirm this figure, we can vouch that it is disturbingly high.

The unit is supplied with an imitation soft leather zippered carrying case, alkaline battery, and operating instructions. Australian price is $79.00, including tax. An optional extra is a nickel-cadmium battery and charger at $20.00 for the two.

Completely self-contained, the Porta-D-Tect alarm is suitable for use on display stands, counters and even in filing cabinets.

Further details may be obtained from the agents, Electronic Concepts Pty Ltd, 52-58 Clarence St, Sydney. (P.G.W.)

Automatic distortion meter

The model E2001 is a recent addition to the range of test and measuring instruments manufactured by NF Circuit Design Block Co Ltd. It is a low cost automatic distortion meter designed for general audio workshop and laboratory use. Ease of operation is ensured by automatic null tuning and balancing facilities.

Bandwidth of the THD measuring circuitry is 20Hz-20kHz, and the E2001 has ranges down to 0.1% FSD. The instrument can also be used as a high sensitivity AC voltmeter, with ranges from 100V down to 100uV FSD in 10dB steps. Bandwidth for AC measurements is 10Hz-200kHz. Pushbuttons are used for range and function selection. Oscilloscope outputs are provided for analysis of null products.

For more demanding applications, NF Ltd has also recently added three professional models to their range.

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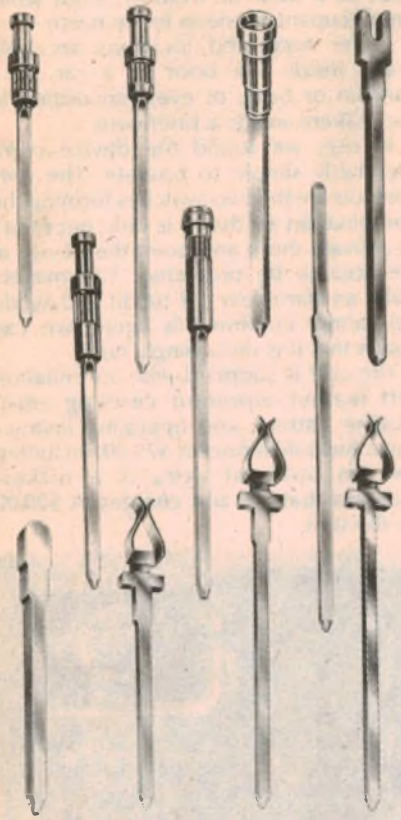

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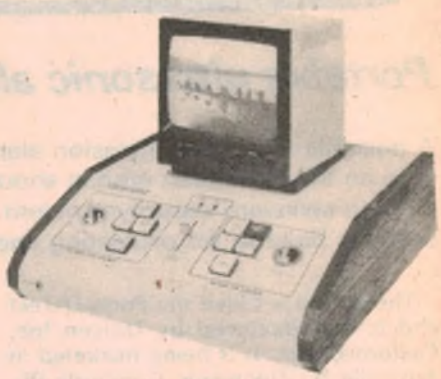

The ECS-1 Editing Control System.

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For further information contact C & K Electronics (Aust.) Pty Ltd, Office 2, 6 McFarlane St, Merrylands, NSW 2160. Telephone Sydney 682 3144, Adelaide 269 2544.

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BWD Electronics Pty Ltd has released a new version of the very successful Model bwd 160A Waveform Generator. Output impedance is now 50 ohms via a BNC connector and a two step 40dB switched attenuator has been added, enabling the output to be reduced from 20V p-p down to the mV region.

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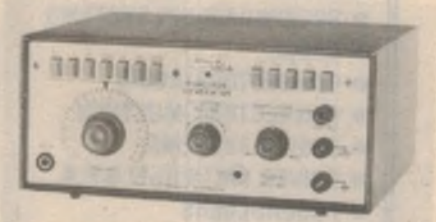

Further details from BWD Electronics Pty Ltd, Miles St, Mulgrave, Victoria 3170. Telephone 561 2888.

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For further details contact A & R Soanar Electronics Group, PO Box 170, Box Hill, Victoria 3128.

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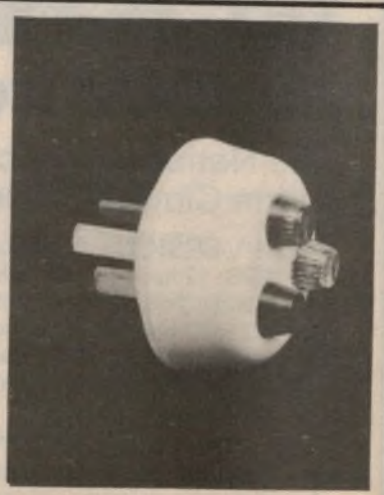

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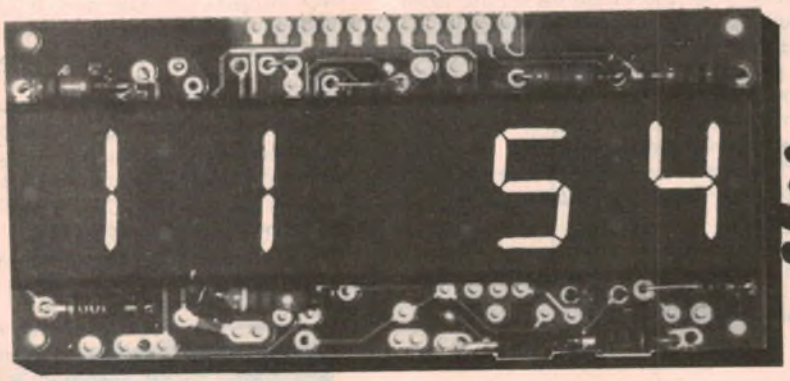

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Letters to the editor

Radio pioneer

I have been reading the article on page 30 of the June 1974 issue headed "Australia's Radio Pioneers".

In 1927 I was operating from 97 White St, Rangiora, using the call sign OZ3AU, and I carried out tests with VK2ME every Wednesday and Saturday for some time. I have a card from VK2ME thanking me for the contacts and reports. I was using a Hartley oscillator with 2 tubes in parallel for modulators, and 1000V on the Philips tube oscillator, to produce about 100 watts on 28.5 metres; this was fed into a long wire antenna about 80ft high. Band signals were very good from VK2ME and I was quite thrilled to carry out tests with such a fine station.

Of course there was no QRM from cars or electrical machines to affect signals, and the band was not packed with signals as it is now. There was just VK2ME and myself. I was just a lad at the time, apprenticed to the electrical trade and very interested in radio and electricity. It was a very exciting time for me. My Radio Licence was issued in February 1927 and was the 13th issued in New Zealand.

I lost the call sign OZ3AU during the war, and have been operating as 3AW ever since. I am still active. Prior to licensing here I experimented with spark transmitters and a low power receiving tube transmitter.

I talked with Australian amateurs many times around 1927, and I am sure Mr. Newman would be among those I contacted during experiments.

Many thanks for an interesting series of articles.

H. Owen Hills, ZL3AW
Kaiapoi, New Zealand

Radio clubs

I believe there is a need, if not an urgency, for preparing youth to be introduced and assisted in the pursuit of hobbies and occupations to help them enjoy, or at least cope with, the leisure hours which the "electronic revolution" is promising us.

Amateur radio has much to offer in the so-called leisure field, apart from its instruction and education potential. It is not enough for the Wireless Institute of Australia, its divisions and branches to promote the hobby. Clubs, groups and individuals should be actively engaged in creating interest, instructing and giving technical assistance.

May I respectfully suggest that your magazine with its extensive circulation could assist by devoting space for information regarding Youth Radio Club schemes, clubs and other educational groups, perhaps along the lines of a directory.

The Central Queensland branch of the WIA is preparing for classes for both the Novice and full AOCP licences, to commence in the new year. Already the branch's monthly meetings are being preceded by a 1-hour lecture or talk of general "amateur" interest, with equipment demonstrations.

John W. Emmel, VK5CGB/4
PRO, Central Qld. Branch,
Wireless Institute of Australia.

COMMENT: In fact we have been doing what you suggest ever since the Youth Radio Club Scheme began, Mr. Emmel. The latest list of clubs was published in the December issue, and amounted to no less than three magazine pages. Our amateur radio correspondent Pierce Healy regularly devotes a good deal of space to radio clubs, and in the past few years we have run a number of features on clubs and their activities.

Wrong transformer

We refer to your article "Simple Power Supply for Microprocessor Systems", in the September issue. We have noted what appears to be a minor error.

You have suggested that our transformer type PT 7311 is suitable for this project. However we regret to advise that you have apparently overlooked the fact that this transformer has no centre tap.

We thought it best to bring this to your attention, even though it might lose us some sales. Thank you however for mentioning that our lower priced alternative, the PT 5509, is also suitable for this application.

P. J. Roberts
Aust. Sales Manager
A & R Electronic Equipment
Box Hill, Victoria

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Classical Recordings

Reviewed by Julian Russell

Wagner & Bartok: "well worthwhile"

WAGNER—Prelude and Liebestod from Tristan and Isolda.
BARTOK—Concerto for Orchestra. Melbourne Symphony Orchestra conducted by Hiroyuki Iwaki. Recorded by the Australian Broadcasting Commission for RCA. Stereo VRL1 0114.

It is a matter for thought how few performances of Wagnerian excerpts are heard in the concert hall nowadays—or recorded either for that matter. Is it a manifestation of dislike for the man himself after many recent revelations about his shabby character? I doubt it. The time to reject the influences of such a musical giant has long since past. His music dramas are still played in their entirety all over the Western world. To some of the younger generation who so heartily approve the mindless repetitious chatter of the baroque they are considered too long and often too static. The organisation of thought that went to the creation of Wagner's masterpieces are daunting to such simple minds. But excerpts—very rare indeed. When I was a young man, every Monday night was a Wagner night at the Queen's Hall Proms, during which his overtures, preludes, orchestral interludes and vocal highlights were played to enthusiastic audiences.

Most heard nowadays are the Prelude and Lieberstod from Tristan and these are offered by Hiroyuki Iwaki and the Melbourne Symphony Orchestra in a quite respectable performance. The string tone is on the whole excellent and Iwaki can prepare for and reach a climax in fine style. The balance is generally good, although there is a tendency to favour the lower bass notes occasionally. My chief objection to Iwaki's reading is a feeling that he is too eager to embark on a new phrase before having satisfactorily concluded the previous one. This tends to lend the music a slight impatience that should be reserved for only special occasions. Iwaki shows the same idiosyncracy in both items; otherwise it is a reasonably good example of Australian music making, although I doubt if it would meet with much enthusiasm overseas.

Everyone connected with the recording seems to be more comfortable in the Bartok. This Iwaki and the orchestra play with complete understanding of its purpose. And here the balance is always more sensitively controlled so that only rarely does the ear miss an occasional detail. The instrumental soloists and family groups that are such an important feature of the work are worthy of considerable praise, although I did notice that the second part of the movement seems now and then to lose little of its emotional momentum. But the second movement is especially commendable for its cleanness of attack, its phrasing and its "jocular" approach to this scherzo-like music. Iwaki's sensitive control of the fast changing dynamics is also a feature to be admired. And one must add admiration for the excellence of the engineering too. The typical night sounds of the Elegia come of splendidly if a trifle forwardly and there is plenty of passionate authority in the more forceful parts of the movement.

The fourth movement is notable for its many lyrical moments, interrupted by a jesting parody of Lehar expressed in Bartok's inimitable manner. There is a trace of pre-echo at the beginning of the Finale but the Presto goes like wildfire. A really rousing end to a slightly uneven but well worthwhile disc. A special word of praise for the longish pianissimo that precedes the coda.

CHOPIN—Piano Concerto No. 2 in F Minor. Grande Polonaise Brilliante preceded by Andante Spianato, Op. 22. Rafael Orozsco (piano) and the Rotterdam Philharmonic Orchestra conducted by Edo de Waart. Philips de Luxe Stereo 9500 024.

Orozsco plays this concerto with a true Chopin touch—pearly but not thinkling. The work is really Chopin's first concerto, though it is numbered No. 2. The unnamed writer of the sleeve notes pleads a special case for Chopin's commonplace orchestration. Chopin showed little interest in the concerto as developed by Beethoven. Chopin's works are piano pieces with orchestral accompaniment "the solo part written by a rapidly maturing genius, the orchestral part the work of a talented student". The writer goes on to many interesting facts too numerous to quote here. Chopin was only 19 years old when he composed this concerto but his elegant style was already well in evidence. Orozsco's playing is never showy and de Waart matches Orozsco's to perfection. Some might prefer rather more spirited playing in the faster movements though I found the whole work very persuasive. It is seldom presented so poetically nowadays.

Orozsco's articulation is always smooth even in the fastest bars of the coda and the Rotterdam Orchestra, while not having all the lustre of the Concertgebouw, does very well indeed. The Andante Spianato precedes the Grande Polonaise, joined to it by a single chord which makes it act as a suitable introduction. Orozsco shows no evidence of lack of power in the Polonaise but never thumps, although it is all beautifully accented. And he makes it all sound so very easy. The whole disc is enchantingly refined.

Mozart — Requiem in D Minor: shaky, forward

MOZART – Requiem in D Minor. Emmy Aveling (soprano); Barbara Scherler (alto); Louis Devos (tenor); and Roger Soyer (bass) with the Symphonic Choir and Orchestra of the Gulbenkian Foundation of Lisbon conducted by Michel Corboz. Erato Stereo (issued by RCA) STU 7094.

This is not the place to go into the controversial facts about the Requiem—its completion by another hand, its commission by a mysterious stranger, its odd liturgical style when compared to the composer's great C Minor Mass and other still contentious issues. I shall therefore give only my impression of the performance. Barbara Scherler is very shaky during her first entrance in the first movement. Conductor Michel Corbez stresses the—unusually for Mozart—romantic tenderness of the work to very good purpose. The first fugue is splendidly clean in the enunciation of all its voices, vocal and instrumental. The orchestra is sometimes recorded a trifle too forward and the male voices in the chorus could be a little stronger.

Bass Roger Soyer is also very shaky, his voice almost disappears in the very lowest register. Rather than a bass I would describe him as a bass-baritone. Louis Devos has one of those operatic tenor voices used here with much too much "expression." Emmy Aveling's soprano is usually true but never very exciting. Hers is the only really steady voice among the principals and even she's not always so. The diction of all concerned is not always easy to follow.

The music is much more chromatic and dramatic than most of the liturgical works of the period but this is all I have the space to say about the many anomalies only too frequently encountered in the Requiem. Those who wish to pursue further studies, especially on the influence of Freemasonry on the music of a "good" Catholic, will find much informative material in Einstein's standard books on Mozart.

TCHAIKOVSKY—Serenade in C Major for strings. Hamlet. Fantasy Overture. CBS Stereo SBR235794.

There is more than a little resemblance between Leonard Bernstein of the present day and Leopold Stokowsky of a half century ago. Let there be no mistake, both are fine conductors but that is not the only feature they share in common. Both demand the last particle of schmaltz from their orchestras, especially their own which are always superbly trained, richly endowed to obtain the finest players available. Both have a great gift for attracting plenty of personal publicity and both can alternately charm and irritate their more critical listeners with occasional exaggerations. And last but by no means least, both are highly valuable properties of the companies for whom they record. Bernstein has one gift seldom displayed by Stokowsky—he is also a composer, sometimes a good one, sometimes not.

The music of Tchaikovsky is custom-made for the exercise of their very great talents. He writes beautiful melodies that lose nothing in being immediately attractive and these he intersperses with well chosen dramatic moments. And in this new disc Bernstein displays all the features I have mentioned above. He opens the Serenade with its strong, Handel-like theme producing luscious characteristic sound. The playing and recording are faultless during the whole recital. He reduces the dynamics to an almost inaudible whisper at the end of the first movement, compelling your attention whether you like it or not. He takes the waltz at a slightly slower tempo than usual and in doing so milks it of every possible nuance. His sense of rhythm holds the attention in all circumstances. He sometimes turns something innocently charming into an occasion to indulge himself in a tendency to pompousness.

In the Elegy he wears his heart so prominently on his sleeve that you can imagine him squeezing little drops of blood from it. And his Finale, after the andante opening, could not fail to raise the spirits of even the most critical audience. Some musicians might find things sometimes slightly overdone, a little gamey in the sense that the French use the work faisandee. But of one thing I am sure—this disc will sell in thousands.

Hamlet is the least often played of Tchaikovsky's symphonic poems which all have the same characteristic of lyricism interrupted by sharp conflict. Somewhere in the 1920s the great British musicologist Sir Donald Tovey undertook to work out the program incidents in Elgar's tone poem, Falstaff, just from reading the score without the aid of the composer's program notes. He was quite wonderfully successful, though he went wrong in a couple of minor details. I doubt if even he could have done the same thing with Hamlet.

There is little in the music that can be interpreted in terms of Shakespeare's tragedy, though an air of tragedy and Hamlet's "infirm of purpose" thought—I know the quotation comes from Macbeth—is often in evidence. Otherwise the composer supplied no information on any program. In this way it differs from the more popular Romeo and Juliet and Francesca da Rimini. But as Edward Downes states in his sleeve notes, "the developments are broadly musical". It goes without saying that is is performed with the same high polish and gorgeous tone characteristics of the great orchestra and its conductor.

* * *

SCHUBERT—Piano Sonata in D, Op. 53. 16 German Dances Op. 33d. Played by Alfred Brendel. Philips de Luxe Stereo 6500 763.

Brendel stamps his authority on this work in the very first bars. The first movement was written in such a happy mood that it might easily be trivialised by a performer. Not so Brendel. His first bars are almost in the nature of warning and much of the rest of the movement, taken very briskly indeed, is not without its underlying hint of caution. Brendel has an ever so slight tendency to push the prevailingly fast tempos but I found it quite free of affectation, and in Brendel's reading, never anything but exhilarating.

In the second movement the change is immediate. In the breath and subtle warmth of its contours there is more than a hint of Beethoven though Brendel shows no desire to linger over the music, as some pianists do. After all, it is marked con moto. Some of his quiet passages about the middle of the movement are utterly enchanting. Altogether his constant changes of dynamics are consistently superb. Throughout the entire work the piano tone is unfailingly faithful. And the movement dies away not in despair, resignation or self-pity but like a quietly ended conversation, the last word a gentle confirmation of what has gone before.

The Scherzo starts so cheerfully that it might almost be described as cheeky. The tempo is again brisk and again, in this unbuttoned mood, the sensitive quality of Brendel's nuancing has to be heard to be believed. The key to the mood of the Finale is in what the Germans call gemuthlichkeit—which might best be translated as the geniality of the beer garden. The merry pace makes a splendid contrast to all that has gone before. And this mood is sustained throughout, despite some daunting counterpoint. The 16 German Dances from Op. 33 will give you all the enjoyment you expect.

All are different in melody and variety of rhythms.

Some are simple to the point of innocence, others quite complex. All are played by Brendel with perfect sense of occasion. They make a splendid fill for the recording of the sonata. And don't think that because they are little dances they are not full of surprises.

TCHAIKOVSKY—Symphony No. 4 in F Minor. The New York Philharmonic Orchestra conducted by Leonard Bernstein. CBS Stereo SBR 235781.

Here is what you might well expect from a combination of Bernstein, Tchaikovsky, and the New York Philharmonic—beautiful playing of music which encourages a high degree of showmanship from the conductor and immaculate playing by his fine orchestra. You will find plenty of contrasting dynamics and tempos, all of them exemplarily produced and recorded. I can guarantee that the production will have instant appeal to those who admire this sort of thing. You will also hear many minor counter themes given more than usual prominence, even though introduced just to be different. And, of course, plenty of passion, always well controlled and never ragged or undisciplined. It's all in the good old Stokowski tradition of "sock it to 'em, boys."

But despite the juiciness of Bernstein's reading there is some undoubtedly lovely playing and one cannot but admire, if not entirely approve, of the whole exercise. The first desk men are as good as you'll hear anywhere and the string tone glorious.

In some bars of the first and second movements it slows down so much it nearly stops. But as I wrote above it is bound to have many delighted admirers.

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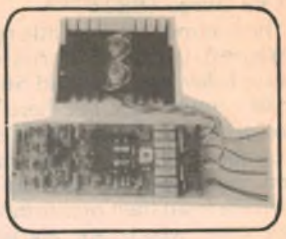

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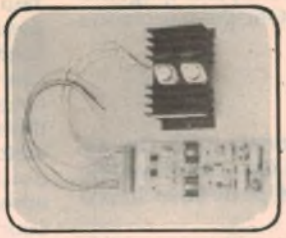

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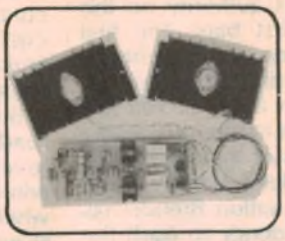

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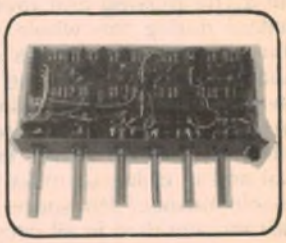

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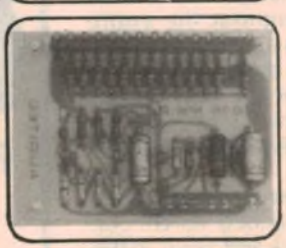

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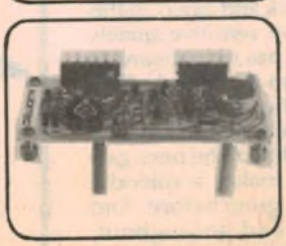

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Lighter Side

Reviews of other recordings

Devotional Records

COUNTRY SOUND: "Travellin' On". Stereo, Focus FS-1015. (Distributed by Spotlight Music, 264 Pitt St, Sydney, 2000).

Country and western music, whether Gospel or secular, is a taste which you may or may not have acquired and it's not for me, here, to try to convince you one way or the other. It is sufficient to say that if you like C&W Gospel, you should enjoy this album of the "Country Sound" group: Charley Boyter (lead guitar), Bruce O'Hara (rhythm guitar), Alan James (Fender bass); they are supplemented here by Paul and Colleen Trenwith (mandolin, guitar, dobro) borrowed from the Slim Dusty show.

The titles, most of them local compositions, include: Where The Soul Of Man Never Dies – Singing The Good News – Roses Never Fade – There's No Tellin' – Have Thine Own Way – Gospel Hoedown (instrumental medley) – Born Again – Had It Not Been – Travellin' On – Life Abundantly – Seek Ye First – How Can You Refuse Him Now.

Produced by Ron Goodfellow and recorded at the ATA Studios in Glebe, NSW, the sound is clean and well balanced and epitomises the message and the convictions of this successful team. If you're a C&W enthusiast, have a listen. (W.N.W.)

* * *

A JUBILANT SONG. The Mormon Tabernacle Choir, conducted by Jerold D. Ottley. Stereo, CBS, SBR-235800.

One of the World's best known choirs on record, from the Mormon Tabernacle in Salt Lake City, turns its attention here to a group of 20th century choral works. Described as "first recordings", they were the Choir's contribution to the American Bi-centennial celebrations.

Maybe it was the words of "The West Wind" that were responsible but, as I listened, I couldn't help but think of the Australian Christmas Carols by William James and John Wheeler—wind, birds, nature, the joy of people singing.

But the themes are more varied: praise to God, lament for a loved one who has died, concern for one who is straying, jubilation, and even an adaptation of a poem by Robert Burns. The words of all 8 items are given on the jacket: The One Hundred Fiftieth Psalm – I Lift Up My Eyes – Rainsong – The West Wind – Glory To God In The Highest – Let The Whole Creation Cry – Make A Joyful Noise Unto The Lord – Oh, My Love's Like A Red, Red Rose – A Jubilant Song.

Modern as the arrangements are, they will certainly not upset those with traditional preferences and the Mormon Choir does them full justice. If you're at all partial to choral music, you should consider this one for your collection. (W.N.W.)

WHAT A FRIEND WE HAVE IN JESUS. Tom Netherton, presented by Lawrence Welk. Interfusion (Festival) L-25215.

Although Tom Netherton is a new name to me, he apparently appears regularly on the Lawrence Welk TV show, singing well known hymns. And a very pleasant voice he has—baritone, ranging down to a rich bass, excellent diction, accurate pitch and completely equal to the challenge of intimate close-mic recording.

The titles: God Is Alive – How Great Thou Art – What A Friend We Have In Jesus – Softly And Tenderly – In The Garden – Amazing Grace – He Touched Me – The Old Rugged Cross – Peace In The Valley – Beyond The Sunset – Just A Closer Walk With Thee – A Wonderful Time Up There.

Recorded with backing chorus, rippling piano and light instrumental backing, it conforms to the Lawrence Welk formula – aiming to please those with conservative tastes but with just enough "swing" to prevent it from becoming too dour.

One more point in its favour is that the sound is completely clean, with not a whisper of intermodulation. Recommended. (W.N.W.)

Instrumental, Vocal and Humour

BRAHMS SYMPHONY No. 4 in E Minor.—Boston Symphony Orchestra conducted by Charles Munch. RCA Victorola VICS 1154.

The Fourth is perhaps the most difficult yet most rewarding of Brahms' four symphonies. It is nowhere near as popular as the 1st and 2nd symphonies and if you like both of these you should approach the 4th with an open mind—it is unlikely to be what you expect. It takes some listening to be fully appreciated. Once you reach this stage, it is a very satisfying piece.

Having assumed that most readers will be unfamiliar with the symphony, I can thoroughly recommend this re-issued version by RCA. Charles Munch, who died in 1968, was a most notable conductor and he extracted a very fine performance from the Boston Symphony Orchestra on the occasion of this recording. You need have no qualms about the recording quality—it is excellent. (L.D.S.)

* * *

THE WORLD OF MENDELSSOHN. Decca 'The World Of Great Classics' SPA 433

Decca are doing the music lover a great service in releasing records such as this, as they generally cover a good sample of the composer's work, in this case with ten works or excerpts from same: A Midsummer Night's Dream, Overture – Octet in E flat Major – On Wings Of Song – The Hebrides, Overture – Symphony No 4 in A Major 1st Movement – Violin Concerto in E Minor, 2nd Movement – Spring Song – The Bee's Wedding – O For The Wings Of A Dove – O Rest In The Lord from Elijah.

This last track features the late, incomparable Kathleen Ferrier, recorded in 1946. Other artists featured are Joan Sutherland, Suisse Romande Orchestra, Ruggiero Ricci, Wilhelm Backhaus, and the Choir of St. John's College, Cambridge.

The quality overall is good, except that the review pressing is marred on both sides by a loud tick and a thump in the opening tracks. (N.J.M.)

* * *

STRINGS OF THE MELBOURNE SYMPHONY ORCHESTRA. Conductor, Leonard Dommett. RCA Red Seal stereo VRL1-0115

Unfortunately for this disc, the title is misleading. It conjures up a Palm court pot-pourri—excerpts from this composer and that, with saccharin arrangements. But actually the disc can make a fine addition to any light classical collection. In addition to "Eine Kleine Nachtmusik" by Mozart there are two other serenades by Elgar and a less well-known Swedish composer Dag Wiren. And to round it off, Samuel Barber's "Adagio for Strings".

Each composition is supported by brief but informative and interesting sleeve notes. I will not succumb to the

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards (D.W.E.) and Greg Swain (G.S.).

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LIGHTER SIDE—continued

temptation to quote from them.

Both the standard of playing and the recording quality are excellent, thoughout the whole album. My compliments to RCA and the ABC Music Studios in Melbourne for a fine production. (L.D.S.)

★ ★ ★

LOVE SCARLATTI. The Baroque Pops conducted by Ettore Stratta. CBS stereo SBP 234862.

I am a little ambivalent toward albums of "souped up" classics. Sure, they introduce many people to classical music as also does the much-maligned Palm court variety of musical melange. But having been introduced, I suspect that many of these musical neophytes are never weaned onto the more solid and satisfying diet of whole compositions (instead of excerpts).

Having said that, it is appropriate to comment while the arrangements on the album are certainly novel and complementary to the often piquant nature of Scarlatti's music, they are marred to a degree by a heavy handed rhythm section. That could be a point in its favour for some listeners. It gave me a headache!

Each track is based on one of the multitudinous sonatas by Scarlatti (55 in all) and titled as follows: The King And Court – Feel The Joy Of Spring – Morning Flight – Samba Antigua – Night Moods – Sunday's Best – Love Scarlatti – On a Lonely Summer's Day – Argento – Luminous Garden – The Message. Recording quality is good. (L.D.S.)

★ ★ ★

HAWAII AGAIN. Les Adams and his fabulous Hawaiians. Astor stereo ALPS 1047.

Keen fans of the Hawaiian music idiom will be well aware of the local group Les Adams and his Hawaiians. They have several previous recordings. This is quite an enjoyable album although a few of the arrangements are a little pedestrian. Recording quality is very good.

There are fourteen tracks: Low Moon At Waikiki – Whispering Sea – Flower Of Hawaii – Starlight Serenade – Pretty Red Hibiscus – Paradise Isle – It Happened In Kaloha – Twilight In Hawaii – White Silver Sands – Dreams Of Old Hawaii – South Sea Island Magic – Sweet Someone – Sand In My Shoes – Sweet Lei Lehua. (L.D.S.)

★ ★ ★

LOS TROPICALES. The Rhythms of Rio. Astor Gold Star stereo GGS 1505.

This bright and cheery Latin-American album will find favour amongst L.A. fans and dancers. No further comment is needed other than to state that recording quality is good.

The selection of twelve tracks is as follows: Nube Gris – Fammi Un Favore – Componte Condunga – With All My Heart – Bossa Nova – Y Viva Espana – Aquello Ojos Verdes (Green Eyes) – Taboo – Misionera – Via Veneto – Tres Palabras – (Without You) – Se Eu Encontrar Com Ela. (L.D.S.)

★ ★ ★

GRAEME BELL AND CANADA'S CLIMAX JAZZ BAND, Live In Toronto. Interfusion L35927. Festival release.

This is one of the most enjoyable records of 'Trad' jazz I have heard for many a day, with Graeme Bell at piano with the Climax Jazz Band at Malloney's Bar in Toronto, recorded live. Other personnel are Bob Erwig – Cornet, Bruce Bakewell – Clarinet, Geoff Holmes – Trombone, Mike Warmsley – Banjo-Guitar, Jack Vincken – Bass, Al Mayers – Vocal.

The ten tracks are: Swanee River – Memphis Blues – Malloney's Boogie – Black And Blue – Tishimongo Blues – I Want A Little Girl – Grenville Street Blues – China Boy – Yellow Dog Blues. The album was originally released in North America on the band's own label, Tormax and engineered by Ted O'Reilly, with very pleasing results.

I only hope we will hear more of this combination of Australian and Canadian talent. (N.J.M.)

★ ★ ★

HAPPY SOUND III. The Albert Lizzio Orchestra. Dolby stereo cassette, contata A-104. (Distributed through Goldring Sales & Service.)

This one opens in the expected "happy" style with an organ track from "My Fair Lady" but what follows is a mix of solo vocal, instrumental, choral and orchestral, in an obvious effort to vary the style from track to track. It's supposed to be happy but many may judge it rather as varying between boisterous and forced.

The track titles: My Fair Lady – Raindrops – Chirpy, Chirpy, Cheep, Cheep, – Catch My Hat – Without Love – Turkischer March – In The Mood – Two Thousand Years – Yesterday – In The Shadow Of Your Smile – It Is Such A Good Night – ABC.

General sound quality is about normal for a pre-recorded cassette but I couldn't rate the program as any more than routine, and not one that I personally would choose to listen to again. (W.N.W.)

★ ★ ★

SANLUCAR. Flamenco guitarist. CBS stereo SBP 234808

For those who are impressed by flamenco guitarists but find a continuous display of virtuosity monotonous, then Manolo Sanlucar will be attractive indeed. There is no doubt of his considerable skill but his interpretive technique and originality plus uptempo

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LIGHTER SIDE—continued

backing, on some tracks, combine to make the whole disc entertaining.

Recording quality is good throughout both sides of the disc.

There are only eight tracks but each is fairly long: Caballe Negro – Duelo de Guitarras – Dialogos – Raza – Colombiana de Bajo-Guia – Caireles – Fantasmas de la Guerra – Pieneta Cubana. (L.D.S.)

★ ★ ★

THE VOICE OF ST JOHN'S, CAMDEN. Organ recital by David Johnson. Stereo, Focus FS-1016. (Distributed by Spotlight Music, 264 Pitt St, Sydney).

Camden is a small rural town about 40 miles south-west of Sydney and, while I have driven through it many times, I was not actively aware of St John's Church, or its historic organ built by Bates of London in 1821 and reconditioned in 1969. It is a modest instrument: one manual with 7 stops (3 x 8ft, 2 x 4ft, 2ft & mixture) and a pedal board with one 16ft and manual coupler.

Resident organist is David Johnson, trained at the Sydney Conservatorium, Teachers College and University, and currently Area Secondary Music Adviser to the NSW Department of Education.

The program opens with Widor's well know Toccata in F-major, in some ways an unfortunate choice inviting comparison with many performances on heavyweight instruments, and emphasising the limitations of the Camden organ in the pedal department. But, as the hour-long recital progresses, attention tends to shift to the upperwork and one often forgets that there are only 462 pipes altogether, not many times that number!

The sixteen excerpts would take more space to list than is available here but they are relatively well known and include items from Widor, Pachelbel, J. S. Bach, Purcell, Beethoven, Telemann, Handel, W. F. Bach, Walton, Clarke, Jackson.

The final track, Toccata in D-Minor by J. S. Bach, lacks the "thunder" end of Bach's own description "thunder and lightning" but, by this time, the listener has come to accept the instrument for what it is: a smallish instrument but a nice one to have in a rural church out along the Hume Highway.

The recording itself is clean but definition of the various voices is no more than average. (W.N.W.)

★ ★ ★

THE MAGIC ORGAN, Polka Album. Interfusion L25269. Festival Release

It is hard to guess the exact instrument used on this recording, probably a Hammond or similar type of electronic instrument, played in a fashion to imitate the old style barrel instrument.

The rhythm backing is so consistent in timing I imagine that it is synthesized, but

CLASSICAL ORGAN: "3-Star Winner"

THE BEST OF PACHELBEL. Douglas Lawrence playing the Ormond College Organ. Move Records, stereo MS 3013. Also on cassette, MC 3013.

I was prepared to make allowances for this local recording, if necessary, in view of the likely interest to organ enthusiasts. But this proved to be quite unnecessary. In fact I can say quite honestly that it is one of the most satisfying organ records I have ever heard.

I would rate it a 3-star winner: the organ is delightful, the playing is superb and the recording is excellent.

First the organ. This is Ron Sharp's neo-classical tracker instrument, which he completed in 1974. I must confess that I haven't heard it live, and this is presumably the first recording to be made on it. But judging by the recording, it is an instrument of which Mr Sharp has every reason to be proud.

I remember him telling me a couple of years ago that his main aim in building organs was to produce satisfying musical instruments, in the full sense of those words. Now I think I begin to understand what he meant! Balanced tonal architecture, cleanly speaking and unforced pipework, virtually noiseless action—the Ormond College organ certainly seems to have all the essential attributes.

Next, the playing. I can quite understand why Douglas Lawrence now spends much of his time on concert tours. He is now surely in world class as a recitalist. I have only one word to summarise his playing of the Pachelbel pieces on this disc: superb.

Finally, the recording. Move Records have done an excellent job of this, equal to any organ recording I have ever heard. The instrument is captured cleanly and distinctly, with no hint of intermodulation on crescendos or muffling on the sections with fuller registration.

In short, then, a first-rate recording in all respects, and surely a "must" for all organ lovers.

One small point. Don't be put off by the front of the sleeve, or the title. It isn't very appropriate, giving one the uncomfortable feeling that Johann Pachelbel may have suffered the same posthumous indignity as Engelbert Humperdinck. Never mind, it's the disc that counts . . .

Suggested retail price of both disc and cassette versions is $6.50. Most major record stores ought to be able to get it for you, but in case of difficulty it is available direct from Move Records, Box 266, Carlton South, Vic. 3053. (J.R.)

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don't let this detract from a pleasant disc of polka hits and medleys. Some of the tracks: Helena Polka – Tavern In The Town – Papa Won't You Dance With Me – Chop Stick Polka – Round And Round – Love That Polka – My Melody Of Love.

Judging by the sleeve, this is one of about eight albums in the same manner, so if you fancy the style, there are plenty more to choose from on the same label. The quality, by the way, is excellent, with a pleasing stereo image. (N.J.M.)

★ ★ ★

HAMMOND HITS. Miguel Ramos. Hispavox stereo L 25235. Distributed by Festival Records Pty Ltd.

Miguel Ramos should not be confused with that noted exponent of the Moog synthesizer, Miguel Rios. While not as well known I suspect that the polished performance of Miguel Ramos on the Hammond organ will have far more permanent appeal than those of Rios. The arrangements are lively and suitable for dancing or dining. Recording quality is good.

Track titles are: Killing Me Softly With His Song – Tie A Yellow Ribbon – My Love – Velvet Mornings – Una Bella Historia – Get Down – Ven, Ven – Kodachrome – Forever And Ever – Daniel – Y Viva Espana. (L.D.S.)

★ ★ ★

THE SHIRLEY BASSEY COLLECTION. United Artists stereo L45301/2 2-record set.

Recorded back in 1969, this two-record set is as fine a collection of Shirley Bassey performances as any afficionado could desire. Shirley Bassey brings a tremendous amount of talent and verve to bear on every song and the big and brassy instrumental backing complements her personality and style admirably. Recording quality is good throughout.

All told, there are twenty-four tracks. Some of the collection are as follows: This Is My Life – Sunny – Who Am I? – Where Is Tomorrow – I Only Miss Him – Hold Me, Thrill Me, Kiss Me – Softly As I Leave You. (L.D.S.)

★ ★ ★

THE BEST OF W.C. FIELDS. Mono, CBSS2BP-220180.

Prompted by the release of the Universal film "W. C. Fields and Me", CBS released this double album of broadcasts for the CBS network by W. C. Fields, re-recorded from a variety of sources. Dating mainly from the golden years of radio—the 30's and 40's—they're in the style of the era, as typified in Australia by Jack Davey, Hal Lashwood, Mo and many others who teamed with them.

But whereas the older generation of Australians can identify with the local artists, I wonder how many will manage to do so with W. C. Fields, and with the gimmicks and the characterisations that the mere sound of his voice kept alive for his American audience.

If you can identify with the inimitable W. C., you'll find plenty to giggle at in tracks like: The Pharmacist – Temperance Lecture – Snake Story – Promotions Unlimited – Father's Day – The Golf Game – The Skunk Trap – Tales Of Michael Finn – Strike Up The Band – Fire In The Home – Romeo and Juliet – The Purple Bark Sarsaparilla Pitch. Several of the tracks were done, by the way, with Don Ameche, Edgar Bergen and his ventriloquist's doll Charlie McCarthy – providing the inspiration for a whole string of cracks at the expense of the little wooden character.

Taken, presumably, from film and transcription recordings, the quality gives no cause for worry and the two discs provide an interesting bit of history and possible nostalgia.

But, if you're not interested in history, and W. C. Fields is just a name that crops up in magazine articles, you'd better listen to a couple of tracks—say "The Golf Game" and "Fire In The Home", just to discover what it's all about. (W.N.W.)

"You can't beat music while you work!" (BASF Newsletter)

LISTEN TO THE BAND. Shirley Jacobs, with the Kinderplay Allstars. Vol 1. John Bye, JBP-7608. (Released through Crest International, 122 Chapel St, St Kilda Vic 3182).

I'm never quite sure what records will appeal to children, or in what circumstances, but my reaction is that this one certainly ought to!

Shirley Jacobs has had a lot of experience singing for children and she is backed here by a group of working Australian jazz musicians. She opens the record with the sound of a steam train (recorded in full stereo) then introduces a couple of musical instruments and proceeds to sing "Down By The Station".

Additional instruments are introduced from time to time and the backing

gradually builds for the songs: Sally's Galoshes – Can You Tell Me? – Ten Little Indians – The Old Man – The Grand Old Duke Of York – I Am A Fine Musician.

By the time side 2 is reached, jazz band, sound effects, singalong and actions are going great guns for: Happy Song – The Hokey Pokey – If You're Happy And You Know It – My Grandfather's Clock – Stop, Look And Listen – Don't Forget Your Traffic Code.

It's a happy, infectious sound and, if it doesn't get the littl 'uns in, it won't be for want of trying by Shirley and her gang, or by those responsible for the recording itself.

You've got a couple of small kids? You run a kindergarten? Best you have a listen! (W.N.W.)

★ ★ ★

ROLF HARRIS. American Revolution Bicentennial 1776-1976. Souvenir Album. Interfusion stereo (Festival) L-35990.

In his lengthy jacket notes, Rolf Harris reminisces about his early efforts to make it up the entertainment ladder by developing a pseudo-American accent, and, so equipped, to crash the American scene. Instead, he made it with the ultra-Australian "Tie Me Kangaroo Down Sport"—an acceptance that was climaxed in 1974 with his Australian show in the 1974 Expo at Spokane, Washington.

On this album you get a broad cross-section of the Rolf Harris style, with a dozen tracks: Ev'ry Mother's Sun – Lazy Day – Turkey Strut – Papillon – Black Midnight Swamp – Eefin And Eyefin Freak – Jindabyne – Just Can't Wait To Hold You – She'll Be Right – Northern Territorian – Yarrabangee – Down Under In The Outback.

In his notes, Rolf Harris gives the background to each item and this should be of special interest to those who are unfamiliar with them. It's a pity, in a way, that the album is so identified with a particular celebration; it may help to date it quite unnecessarily. Maybe Festival should re-release it later under a more enduring title. But, in the meantime, forget the American connotation; it's Rolf Harris, all the way. (W.N.W.)

★ ★ ★

JEAN SHEPARD, MERCY AIN'T LOVE GOOD. United Atists L35946. Festival release.

Judging by the release note supplied with the record Jean Shepard has been on the Country Music scene for more than two decades and the experience from this certainly shows in this collection of ten titles: Mercy – Come On Home – A Satisfied Woman – I Can't Imagine – Name Dropper – Ain't Love Good – Slowly – Sing Me An Old Fashioned Song – We're All The Way – Wife Of A Hard Working Man.

The Backing group, The Jordonaires, do a good job as do the other musicians listed, the whole enjoying the usual good quality sound of Nashville recording studios. (N.J.M.)

★ ★ ★

THIS IS ONE GIRL. Madeline Bell. Astor records SPLP 1470.

This album starts off with a very rousing title track, but doesn't maintain the same pace throughout. At times it slows down, as Madeline shows off her style. And she can certainly handle a variety of styles, ranging from a very rocky version of "Delta Lady", to slow ballads such as "I Think I'm Getting Over You".

Overall, I found this record very good listening. In fact, I'll probably give it a spin at a party sometime, as it seems to have just the right mixture of tempos and styles. Technically, the record is quite good although there is some background noise. (D.W.E.)

D.C
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10 MEMORY EXCHANGE WITH X	Yes	No
Log LN	Yes	Yes
Trig (Sine, Cosine, Tangent, INV)	Yes	Yes
HYPERBOLIC (SINH, COSINH, TANH, INV)	Yes	No
HYPERBOLIC RECTANGULAR ↔ → y^x, e^x, 10^x, $\sqrt{x}$, $1/x$, $x!$, $x \leftrightarrow y$, π, CHS	Yes	No
$\sqrt[x]{y}$ through INVERSE	Yes	Yes
GRADIANS	No	Yes
DEGREE RADIAN CONVERSION	Yes	No
Degree Radian Mode Selection	Yes	Yes
DEC DEG MIN SEC	No	Yes
Polar to Rectangular Conversion	Yes	Yes
Recall Last X	Yes	Yes
Scientific Notation, Fixed and Floating	Yes	Yes
Fixed Decimal Point Option (0-9)	Yes	Yes
DIGIT ACCURACY	12	10
DISPLAY OF DIGITS	12	10
%, Δ%	Yes	Yes
GROSS PROFIT MARGIN %	Yes	No
Mean and Standard Deviation	Yes	Yes
Σ+, Σ−	Yes	Yes
Product Memories	Yes	Yes
C-F DIRECT CONVERSION	Yes	No
F-C DIRECT CONVERSION	Yes	No
LIT GAL DIRECT CONVERSION	Yes	No
KG-LB DIRECT CONVERSION	Yes	No
GAL LIT DIRECT CONVERSION	Yes	No
LB KG DIRECT CONVERSION	Yes	No
CM-INCH DIRECT CONVERSION	Yes	No
INCH CM DIRECT CONVERSION	Yes	No

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We have listed some of the many features, but let's amplify on some highlights:

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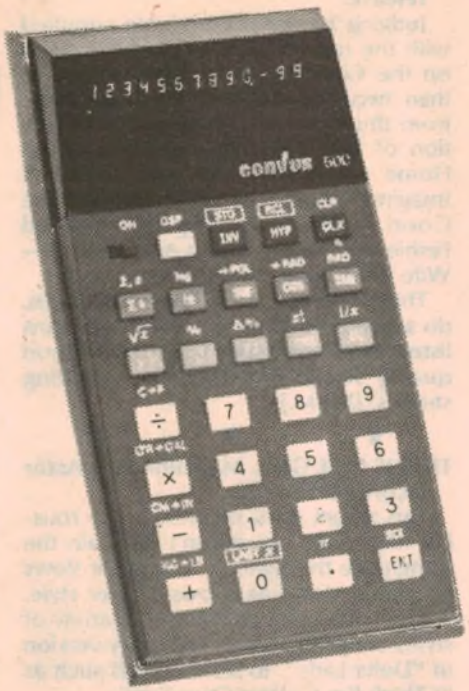

Your problem is solved the way it is written, left to right sequence, eliminating restructuring, unnecessary keystrokes, and the handicap of having to write down intermediate solutions. And all information is at your disposal — just roll the stack (R) to any intermediate information desired. You arrive at your solution faster, more simply and, therefore, more accurately.

Perhaps at this point we should address ourselves to the controversy between algebraic entry and RPN. One question we must ask is why proponents of algebraic entry always use an example of sum of products and never an example of product of sums:

$(2+3) \times (4+5) =$

Algebraic 2 + 3 = MS 5 + 4 = X MR =
TOTAL 12 keystrokes (SR51, add 2 more keystrokes)

RPN: 2 Enter 3 + 4 Enter 5 + x
TOTAL 9 keystrokes

2. THE CORVUS 500 and HP-45 HAVE 10 ADDRESSABLE MEMORY REGISTERS, 4 LEVEL OPERATIONAL STACK, and a "LAST X" REGISTER (10th Mem. Reg.) With 10 addressable memories, you have access to more entries, or intermediate solutions; less remembering, or writing down. YOU have to do. And less chance for error. The stack design also permits X and Y register exchange, and roll-down to any entry to the display for review or other operation. The "last x" register permits error correction or multiple operations when a function is performed, the last input argument of the calculation is automatically stored in the "last x" register, which can be quickly recalled to correct an error, or to perform another operation using the same number.

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The Amateur Bands

by Pierce Healy, VK2APQ

The Youth Radio Scheme

Assisting persons to achieve the status of amateur radio operator is an aim clearly set out in the memorandum and articles of association of the various state divisions of the Wireless Institute of Australia. The Youth Radio Scheme is one method by which this aim can be implemented.

When discussing the YRS with Ken Hargreaves, VK2AKH, NSW YRS Education Officer at the recent combined field day at Rathmines Park, Lake Macquarie, he suggested the theme for 1977 be–"YRS is there to be used". He also recalled some salient facts about the scheme.

"Fourteen years ago a body was formed within the WIA, to service the needs of clubs for those wishing to further their knowledge of radio and electronics. The Youth Radio Scheme as it was then called, was framed principally with the young enthusiasts in mind, although over the years, club members of all ages have gained through the scheme. In recent years the advent of the novice grade licence has been the principal area of concern in both clubs and YRS.

"The principal aims of the YRS involve encouraging and developing an interest in electronics as a hobby and vocation, assisting clubs and instructors with courses and resource materials, and to give encouragement and recognition to these members who progress through YRS courses."

The objects of the scheme are:–

(a) To develop in young people an interest in radio and electronics as a vocation or worthwhile hobby.
(b) To provide students with a hobby which will reinforce their school activities in science and mathematics.
(c) To co-ordinate the activities of youth radio clubs and non-club participants, and to promote co-operation and exhange of ideas among club leaders.
(d) To assist leaders and instructors of youth radio clubs and non-club participants by providing ready made programs of activity.
(e) To co-operate with schools and youth organisations in fostering youth radio clubs.
(d) To give encouragement and recognition to club members and non-club participants who attain certain specified standards of skill.

A series of proficiency certificates has been developed to give a form of recognition to members who develop their knowledge to standards specified.

These certificates, in several of the examination levels, are readily accepted by prospective employers as a positive indication of an applicant's aptitude.

The IREE awards a pennant each year to the clubs which have made most progress in instruction of its members.

Correspondence courses in electronics are available to those who are unable to attend radio clubs.

The latest service available through the YRS is a trial novice examination which can be conducted by clubs for members about to attempt the PMG's Dept. examination for the novice licence. These trials are conducted under examination room conditions by qualified persons.

The following is a report from Ken Hargreaves on the trial examination held prior to the PMG exam in November, 1976.

YRS in NSW successfully completed a trial novice examination on 30th October, 1976. Examinations were held for approximately 80 candidates in club centres at Westlakes, Wireless Institute Centre Sydney, St George Amateur Radio Society, Western Suburbs Radio Club Sydney, Blue Mountains Branch WIA Springwood, Griffith Police Boys Radio Club, Central Coast Amateur Radio Club Gosford, and Wagga District Radio Club. South Australia and Tasmania conducted similar tests.

Candidates were examined in theory and regulations by multiple-choice type papers, and tests in receiving and sending Morse code were held for each candidate.

The aim of the examination was to give novice candidates experience in examination conditions and technique and to point out any weaknesses in candidates' knowledge. After the examination marked papers were analysed and an analysis was sent to each club for revision purposes.

One feature of the examination was the marking procedure. As soon as the next paper was in progress the previous paper was being marked, so that the candidate was handed his or her results upon leaving the examination centre just three hours after arriving!

The response suggests that such a trial examination should be held prior to each novice examination.

Pertinent details of the subjects covered in the six stage YRS training course, as well as notes available to clubs and individuals, were also received from Ken Hargreaves. This will be covered in future issues of these notes.

Further information may also be obtained from supervisors in the following states.

NSW– Rex Black, 10 David Street East, Springwood, 2777.
Vic– Reverend Bro. Frank Whittom, St Johns College, 204 Churchill Ave, Braybrook, 3019.
S. Aust.– Gerry Preston, 13 McGowan Road, Para Hills, 5096.
Qld– Roger Davis, 2/32 Farrington Street, Alderly, 4051.
Tas– Reg Emmett, 111 New World Ave, Trevallyn, 7250.
Correspondence Section–Bill Tremewen, 34 Flower Street, Fern Tree Gully, 3156.

YRS VICTORIA

A book titled "Logic and Logic Circuits" is available from the Victorian Division YRS. It is intended to be used as a basis for classes on the subject in some schools.

The writer of the book is Roy Hartkopf, VK3AOH who has been associated with logic circuits from the time they were a laboratory curiosity and wrote what was probably the first article published in Australia on logic and "Logical Circuits" as they were then called.

The article was published in "Radio and Hobbies", November 1959, under the title, "An Introduction to Switchcraft".

Included in the book is a 24 page liftout discribing the design and construction of a logic trainer together with eighteen experiments designed to give the student a thorough grounding in the basic principles and enable him to read and understand logic circuits.

The trainer covers some fundamental points which, as far as is known, are not covered by other similar equipment. It also has a unique facility for testing the students knowledge. Modules can be added to give the trainer any degree of complexity desired.

Copies of the book together with parts or further information may be obtained from the Victorian YRS state superisor–F.H. Whittom, VK3BAN, 204 Churchill Avenue, Braybrook, Vic. 3019.

The Victorian YRS also has available, through the same source, a number of other publications. These include three elementary stage 1 and four elementary stage 2 books of about 40 pages each.

During 1976 there was a drop in activity in some states. However, in NSW where the scheme originated about 1960, progress has been of a high standard.

This drop could be attributed to less enthusiastic officers, lack of promotion by divisional councils or especially, the loss of federal co-ordination. A postal vote, arising from discussion at the 1976 WIA federal convention, was passed which means–"that the federal YRCS no longer exists and divisions would be responsible for this activity within their respective states". (WIANEWS–Amateur Radio p4, Oct 76).

However, the motion passed does provide–"that the Institute agrees to render every possible help and assistance for the training of youth as heretofore with the object of preparing them for the amateur examinations, including the continuing provision of certificate forms, publications and the like" (AR p4 Oct 76).

Allowing a situation to develop where the federal body of the WIA is no longer directly involved in educational activities is not understandable. Especially when the largest amateur organisation, the American Radio Relay League is undertaking a costly and extensive education program associated with its WARC-79 activities.

In the October issue of the ARRL publication "QST" general manager Richard L. Baldwin, W1RU wrote–

"Growth is important to us. We have made a good case for expanded amateur allocations, based on the worldwide growth of the amateur service. The training program is designed to speed the growth and maintain the quality of amateur radio in this country. We have heavily invested in people and training materials to provide impetus for the training program and our investment is going to have to be even more extensive before we are finished.

"Indeed, if at some point we are able to convince the Commission to let amateurs play an even greater role in the examination and licensing procedures, we may have to at least double the size of the existing Club and Training Department. That is going to take money but it's going to make for a stronger amateur radio."

AMATEUR PUBLICITY

Various ways of publicising amateur radio were demonstrated to me during a visit to southern NSW and Victoria during October last year. The first example was at the South West Zone Convention at Tumut on the 2nd and 3rd of October.

There the local tourist bureau, racecourse committee, motels, caravan parks and other bodies assisted the convention committee with information and accommodation facilities for visitors.

Over 150 attended the convention dinner, where a welcome to Tumut was extended by the local council.

The convention was very successful, with all events being keenly contested.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

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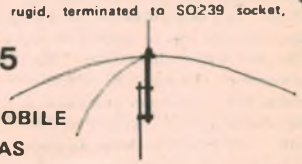


27 MHz MOBILE ANTENNAS

Model M1 27 MHz base loaded whip, stainless steel, 40.5 ins long, 50 ohm impedance, vswr less than 1.5. Includes roof-top mount, optional boot lid mount, spring and coax with PL259 plug. $27 *

Model G2 as above with gutter clamp $29.90 *

27 MHz truck antenna, twin centre loaded mirror mounted antennas. Complete with cables, plugs, connecting brackets. $42 *

$59 ANTENNA COUPLER

Quality coupler for 27 MHz, handles up to 200w pep. input 50 ohms unbalanced. output 10-300 ohms unbalanced. Insertion loss bettter than 0.5 dB. A must for every shack!

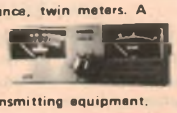
SPLITTER $31

This unique device permits operation of your car radio from a 27 MHz antenna. Can be used with any series fed 27 MHz antenna. Finished with RG58/u and car radio high impedance lead, each 60" long. Includes adjustable 27 MHz match for optimising vswr.

SWR/PWR METER

The popular VC2 swr/pwr meter operates 3–150 MHz with power measurement 12/120 watts. Will handle up to 1000w. 50 ohms impedance, twin meters. A bargain.

* * $35



A licence is required for all transmitting equipment. For friendly and helpful service.

VICOM

Head Office and mail orders
139 AUBURN RD, AUBURN, VIC. Ph 82 5398
Sydney (439 1271), Adelaide (437981), Brisbane (384 4480)
Canberra (82 3581), Perth (463 3232)

AMATEUR BANDS

On Wednesday, 6th October, I visited the WIA Federal Headquarters, Toorak, Melbourne. During discussions with Business Manager, Peter Dodd, VK3CIF, it was stated that, although it was too early to make a full assessment, it appeared that the WIA "8000" campaign was bearing good results. Discussion also centred around the recent Region III directors' meeting in Singapore and WARC 1979.

The third instance was an inspection of the Moorabbin and District Radio Club rooms. These are located in a Moorabbin District Council's $95,000 building which provides club rooms and facilities for our social activities for four local clubs one being the MDRC. The complex includes kitchen, toilets, and a large auditorium in addition to individual club rooms and storage areas.

A committe comprising representatives of the four clubs and the council control the project. My inspection was arranged by Ken Pincott, VK3AFJ, and Ron Higginbottom, VK3RN, MDRC trustees, and Graham Mason, VK3YGM MDRC secretary.

The fourth was a visit to the Geelong Amateur Radio & TV Club, Stoorer St., Geelong. Here excellent club rooms have been established by voluntary work in a building acquired by the club. A discussion with several of the GARC committee members indicated that good public relation promotion had greatly assisted the club. Significantly, visiting the club for the first time was a prospective member who had become aware of the GARC through a recent issue of these notes.

The visit to GARC was organised by Ron Wilkinson, VK3AKC, well known for his 1296MHz moonbounce experiments. These have been widely reported in various publications locally and overseas. A demonstration of his 6 metre diameter dish antenna and associated transmitting and receiving equipment was most impressive. Ron's efforts have publicised the technical aspects of amateur radio.

To all who made my visits pleasant and informative, my sincere appreciation. The friendships generated through amateur radio are second to none.

CENTRAL COAST FIELD DAY

Sunday, 20th February, 1977. An event for amateurs, their families and friends. Program details next month. Don't miss this field day of the year.

VHF MID-SUMMER CONTEST

The VHF & TV Group, NSW Division WIA, is conducting this field day contest over the Australia Day weekend.

Starts–0100GMT Saturday 29th January, 1977.

Finishes–0300GMT Monday 31st January, 1977.

Contact points are biased to encourage tunable operation, rather than net operation.

Copies of the rules may be obtained by sending a stamped self addressed envelope to–VHF & TV Group, NSW Div., WIA, 14 Atchison Street, Crows Nest, 2065.

MORSE CODE PRACTICE

The Morse code practice broadcast from VK2BWI is a service provided by the New South Wales Division, WIA. The aim is to provide, at relatively slow speeds, a practical means whereby those wishing to do so may learn and improve their ability to receive Morse code.

The broadcast originates from a different location each evening but always commences at 0930GMT (1930EST or 2030 Daylight Saving Time) on or slightly below 3550kHz in the 80 metre band.

The content of each session is generally varied, as is the technique. It is hoped that the differences help to provide a wider scope for practice.

The call signs of the operators and their locations are shown so that listeners will be aware of the reason for varying signal strength that may occur due to propagation effects.

Day	Call sign	Location
Sunday	VK2AKE	Moss Vale, NSW
Monday	VK3AKN	Hawkesdale, Vic
Tuesday	VK2DI	Mt Colah, Sydney
Wednesday	VK2BKE	Lord Howe Island
Thursday	VK2BLK	Oatley, Sydney
Friday	VK2BGG	Wauchope, NSW
Saturday	VK2EF	Avalon, Sydney

The service is conducted under the call sign VK2BWI by the voluntary operators through their own stations. Reports on reception and suggestions as to the format of the sessions are appreciated and should be forwarded to–Morse Code Practice, PO Box 177, Mona Vale 2103.

WARC 1979 AGENDA

At a meeting held in Geneva during June and July, 1976 the Administrative Council of the International Telecommunication Union, adopted an agenda for the general World Administrative Radio Conference scheduled for 1979.

Planning for WARC-79 in amateur circles has been based on the assumption that each of the 45 articles of the ITU Radio Regulations would be subject to revision at this conference.

One effect of the agenda just adopted would be to limit consideration only to those articles which are applicable to radio services in general, and to preclude consideration of those articles which deal with but a single service. Thus while frequency allocations of the amateur service and other services would be considered in 1979, the rules for amateur stations contained in Article 41 of the Radio Regulations would not.

The conference is scheduled to convene on 24th September, 1979, for a period of ten weeks. The following items on its agenda have a possible impact on the amateur radio service.

–To review and, where necessary, revise the provisions of the Radio Regulations relating to terminology, the allocation of frequency bands and the associated regulations (Articles 1 to 7).

–To review and, where necessary, revise the provisions applicable to the coordination, notification and recording of frequency assignments (Articles 9 and 9A) except those articles relating to a single service.

–To review and, where necessary, revise other regulations applicable to services in general (Articles 12 to 20).

–To propose to the Administrative Council and to the Plenipotentiary Conference a program for convening future administrative radio conferences to deal with specific services.

ITU policies are determined by its Plenipotentiary Conferences, which are held on the average of once every six years and at which all ITU members may vote.

The last such conference was held in Torremolinos, Spain, in 1973 and the activities are governed by an Administrative Council. The present 36 members of the Administrative Council were selected on a regional basis at Torremolinos.

In other actions, the Administrative Council sought to postpone for one year a World Administrative Radio Conference on the aeronautical mobile (R) service which had been originally scheduled for March 1977, owing to financial considerations. The council adopted a $24 million budget for ITU activities during 1977.

The above information appeared as International News in QST October, 1976.

IGNITION INTERFERENCE

It is expected that Canadian amateurs will experience less interference to reception due to ignition interference over the next few years. The DOC has published new requirements for the control of interference caused by ignition systems. This became effective on the 1st September, 1976 and applied to all engines, except aircraft, manufactured in Canada or imported after that date.

RADIO CLUB NEWS

EASTERN AND MOUNTAIN DISTRICT RADIO CLUB: The editorial in the November, 1976 issue of the club magazine–The Radio Bulletin–contained an interesting comment which should be of interest to novice and full call operators.

"The informal net on 27.125MHz at noon on Sundays has certainly proved very popular. The control station is VK3BNW, the Club's second callsign.

"A few comments may help those not familiar with the eleven metre band.

(a) The most commonly used frequencies are 27.125MHz and 27.135MHz.

(b) The use of horizontally polarised antenna will provide disappointing results. A quarter wave whip on the garage roof will work very well.

(c) Remember novices are limited to crystal controlled frequencies, so full-call holders will need to net accuractely onto novice signals. Particularly as some novices do not have clarifiers.

(d) Many novices have AM equipment only, so if you have that mode available give it a try.

(e) Those 80 metre cross-town rag chewers might give eleven metres a try during summer when the noise level is high on 80 metres. There is also the possibility of a band opening.

The Southern Cross Award was instituted by the EMDRC in 1971. It is a certificate gained by radio contact with specified number of EMDRC members.

Australian and New Zealand stations must work 10 club members. All other countries, five contacts with club members.

Contacts with club stations VK3ER and VK3BNW count as two contacts.

Short-wave listeners must log the same number of stations as set down for transmitting stations.

A certified log, together with a fee of $0.50, should be sent to the Awards Manager, Jack Gutcher, VK3APU, PO Box 87, Mitcham, Vic. 3132.

Your log of contacts may be certified by any officer of a recognised amateur radio club, or any two licensed amateurs.

If interested in attending AOCP or novice licence classes contact Ken Pallises, VK3GJ, Flat 4, Cootamundra Crescent, Blackburn, Vic. 3130. Telephone, during business hours, 850 5511.

ILLAWARRA AMATEUR RADIO SOCIETY: The eclipse of the sun on the 23rd October, 1976, provided a unique opportunity for the VK2AMW moonbounce installation at Dapto to obtain information on—

(i) the diameter of the "radio" sun at 70cm.

(ii) the proportion of its energy, at 70cm, radiated from the corona.

(iii) effects of the eclipse on properties of the ionosphere, specifically related to rotation of signal polarisation.

Preliminary results of the experiments indicate that—

(i) the "radio" sun at 70cm is appreciably greater in diameter than the "optical" sun.

(ii) the corona generates a significant percentage of the RI energy emanating from the sun at 70cm.

A chart record and numerical results were obtained and are being evaluated, and may result in modification of VK2AMW beamwidth pattern, obtained by using the sun as a half degree diameter noise source.

The most unusual part of the experiments was in obtaining echoes of transmitted signals back from the moon when it was directly in front of the sun. Rotation of the polarisation of the reflected signals during its passage through the ionosphere was not significantly affected by the eclipse at the Dapto location, possibly due to the effect of the residual solar energy from the 6% of the sun disc still visible and from the corona.

The experiments were carried out by Lyle Patison, VK2ALU, assisted by VK2ZVX; VK2ZHU and VK2APG, members of the IARS. A visitor present was a maritime mobile operator, JA3SVG.

BLUE MOUNTAINS RADIO CLUB: On the weekend 16th-17th October, 1976 the club operated a station for 48 hours during the Jamboree-on-the-Air.

The exercise took place at the Mt. Riverview Scout Hall, under the call sign VK2BUS. The local scouts assisted in the erection of aerials and setting up the station, as well as supplying meals and refreshments to the operators throughout the two days.

Many contacts were made with other scout and guide groups in all states of Australia, and New Zealand.

Both the scoutmaster of the 1st Mt. Riverview Scouts and members of the club who participated, agreed that it was a very successful event and are looking forward to similar activity next year.

THE SOUTH EAST RADIO GROUP: The October, 1976 issue of "BLURB" the official publication of SERG, contained these brief details of moonbounce contacts by Chris Skeer, VK5MC located near Millicent, South Australia, operating on 144MHz.

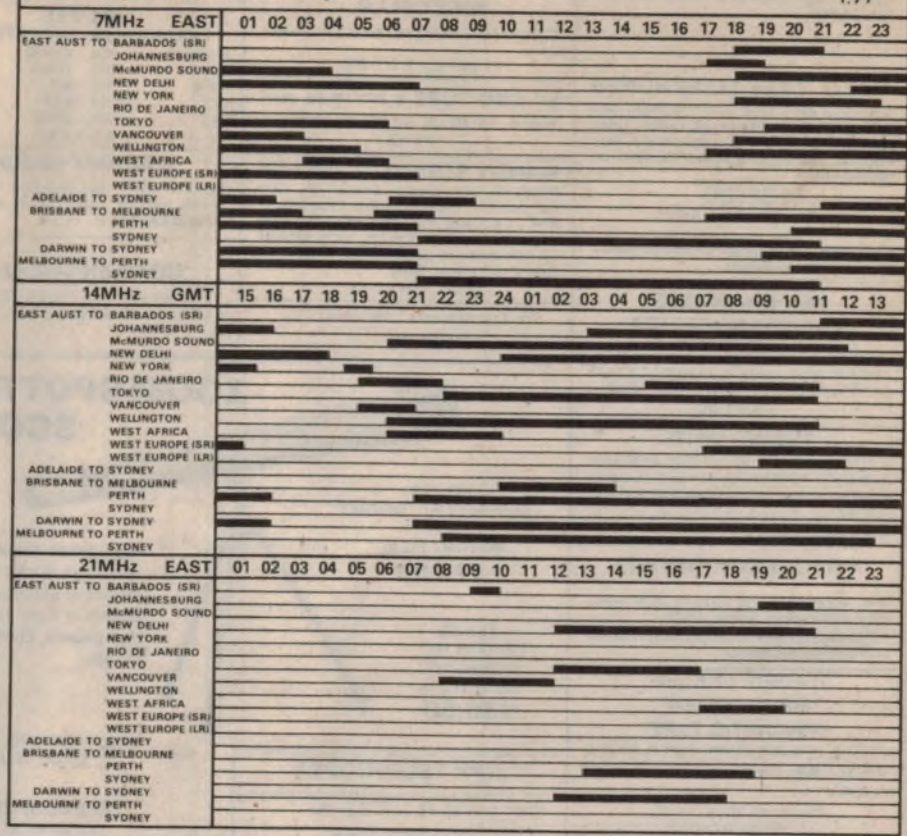
21st July—worked K8111 who gave an "O" report and R3 S4 T9. The time was 1738GMT.

24th July—Heard WA7BJU and W2AZL in contact with each other, also K8III calling him but no contact was made.

28th July—Worked K9HMB for the first time and received an "O" report and sent R4 S3 T9. On the same date Chris reported a 3dB excess noise from the Milky Way and 17dB of sun Noise.

IONOSPHERIC PREDICTIONS FOR JANUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. I.77



INTERNATIONAL SOCIETIES

Space did not permit our including the following list of organisations in last month's club list. We suggest that they be added to that list.

INTERNATIONAL AMATEUR RADIO UNION — C/- 225 Main Street, Newington, Connecticut, USA.

AMERICAN READIO RELAY LEAGUE — 225 Main Street, Newington, Connecticut, USA.

RADIO SOCIETY OF GREAT BRITAIN — 35 Doughty Street, London, England.

NEW ZEALAND ASSOCIATION OF RADIO TRANSMITTERS — Box 1459, Christchurch, New Zealand.

RADIO SPORTS FEDERATION OF USSR — Box 88, Moscow, USSR.

JAPAN AMATEUR RADIO LEAGUE — Box 377, Tokyo, Central Japan.

FEDERATION OF AMATEUR RADIO SOCIETIES OF INDIA — Honorary General Secretary, 38C Mount Road, Post Box No. 725, Madras 600 006, INDIA.

WIRELESS INSTITUTE OF AUSTRALIA — FEDERAL EXECUTIVE, PO Box 150, Toorak, Melbourne, Victoria 3142.

Corporate members:—

Australian Capital Territory Division — PO Box 1173, Canberra City, ACT 2601.

New South Wales Division — Wireless Institute Centre, 14 Atchison Street, Crows Nest, NSW 2065.

Victorian Division — Wireless Institute Centre, 412 Brunswick Street, Fitzroy, Vic. 3062.

Queensland Division — GPO Box 638, Brisbane, Qld. 4001.

South Australian Division — GPO Box 1234K, Adelaide, SA 5001.

Western Australian Division — GPO Box N1002 Perth, WA 6001.

Tasmanian Division — GPO Box 869J, Hobart, Tas. 7001.

Full details of membership, fees, activities and meetings may be obtained by writing to the secretary of the appropriate division.

SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the Courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Personal Classes for 1977 will commence on Tuesday, February 8th., 1977. Applications which are accepted in order of priority, are now being received. Correspondence Courses may be commenced at any time.

For further information, write to

THE COURSE SUPERVISOR, W.I.A.
14 ATCHISON STREET, CROWS NEST, N.S.W. 2065

BC221 FREQUENCY METERS

Brand new in original packing cases—unopened complete with 240 volt power supply. Charts etc. $90 each—cartage to rail $2. Freight payable at nearest attended Railway Station.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00
(2 TELEPHONE SETS)

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TEN CHANNELS VHF TRANSCEIVER

TR1956. 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

TUNING UNITS

T.U. Series. Contains variable condenser suitable for aerial tuning, vernier 5" Ceramic Coil Former, etc. 19" rack mounting, only $9.50 ea. Post A $2.30, B $3.75, C $4.80, D $6.55.

FREQUENCY METERS

AN/URM 32 A 120 KHz to 1000 MHz, with 240V power supply. $125

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

ILFORD 17.5 mm SPROCKETED MAGNETIC TAPE

1000 ft reels brand new original packing **$4.00 ea.** quantity available.

Post A $1.30, B $2.00
C $2.30, D $2.80

No. 62 TRANSCEIVER

With headphones, accessories etc.

$60

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army. Don 8 perfect condition $35 per drum. $1 cartage to rail freight payable at destination.

PRISMATIC COMPASSES

Genuine ex-army Mk 3, liquid damped, as new $45.00 P & P A $1.70, B $2.25, C $2.40, D $2.65.

MORSE KEY	MORSE KEY BUZZERS
$1.40	**$4.25**
Post 40c	Post 60c

DYNAMIC TRANSISTOR CHECKER

Provides a visual indication of signal output. Tests: electrode open circuits, short circuits, current gain. **$14.95 ea.**
P & P A $1.70, B $2.25, C $2.40, D $2.65.

MULTIMETER

A compact and handy tester for workshop or lab where quick circuit checks are required.

DC Volts 2.5 to 1,000V (20,000 OHMS per volt) AC Volts 10 to 1,000V (10,000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM Decibels minus 20 DB plus 62 DB complete with instructions only **$19.50** Ea. P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$23.75** P.P. $1.05.
Only $17.25 ea. Post $1.05.

BENDIX PIONEER

Drift Sight
Type B3
$250.00

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

$1.25 each P & P 60c

NIBBLING TOOL

Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16inch.

ONLY **$9.95**
Post $1.10

NIFE CELLS

1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.

$1.50 each P & P 80c

5" CRO TUBE

5 BPI **$6.50** each.
Post A $1.40, B $2.25, C $2.70, D $3.45.

HANDY SIGNAL INJECTOR

Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On/Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only

$6.50. Post $1.10

522 Transceivers. 100-150M. CS.

$35.00

POSTAGE KEY:

A: NSW.
B: Vic, Qld.
C: SA, NT, Tas, New Guinea.
D: WA.

VALVES

BRAND NEW IN CARTONS

6SN7GT	95c	CV850	$1.50
5U4G	95c	1H6G	75c
EF50	75c	832	$5.00
SY3	$2.25	6X4	$2.25
2 x 2	75c	VR65	75c

P & P 40c

AIRCRAFT CLOCKS

Genuine eight day jewelled movement sweep second hand. Dash mounting. $29.50 EA. P. & P. $1.10.

CONDENSER LENS

1½" Diam 4½" F.L. 75c 2½" Diam 2" F.L. $1.50 each. Or $2.50 per pair. P & P 40c.

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb.
$23.95

45 x 40
LENGTH 16",
HEIGHT 10"
WEIGHT 2 lb.
$36.50

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.

POST: A $1.70, B $2.25, C $2.40, D $2.65.

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only $4.75 each post 60c

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case

7 x 35 Wide Angle	$35.50
8 x 40 Wide Angle	$39.50
7 x 50	$31.50
10 x 50	$32.50
12 x 50	$33.65
20 x 50	$37.95

P & P A $1.80, B $2.50, C $2.20, D $3.20

TELESCOPES

25 x 30 **$6.50**
P & P A $1.70, B $2.25, C $2.40, D $2.65.

SMALL CLIP-ON POCKET TELESCOPE

15X $3.95. Post 60c

RECEIVER No. 210

2-16 M/cs **$65.**
Transmitter No. 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones, Mic, Morse Key, Antenna **$110.**

SOLENOIDS

Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio, etc.

$2.50 P & P 20c

200 MA 24 volt, ⅛in push movement.

$2.50 P & P 20c.

SELSYN MOTORS MAGSLIP

MK 11 **$5.25 ea.**

3000 TYPE RELAYS

P.M.G. 2000hms — 1'500Ohm
Coils **$2.50** each P & P 60c

P.M.G. TYPE KEY SWITCHES.

75c P & P 20c

Cossor Double Beam Oscilloscope 1035. Tested.

IMPELLER PUMPS

New gunmetal body, Stainless Steel Shaft, Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5"

⅜" **$23.30**
½" **$31.95**
¾" $35.95

P & P A $1.90, B $2.75, C $3.20, D $3.95

LAVOIE FREQUENCY METER Fr-/6U

100 to 500 M/HZ
240 Volt operated
PERFECT CONDITION
$375.00

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.95. We haven't got time to sort them, so you reap the benefit.
P & P A $1.80 B $2.50 C $2.80

SMALL COMPUTER PANELS

3in x 2in containing 2 valves, qty of resistors, etc.

ONLY 75c. P & P 60c

ELECTRONIC FREQUENCY COUNTER

Austronic type DFC 4 240V 50 cycle 0-100KHz **$150**

PANORAMIC ADAPTOR

E.M.I. type PRA-1 455 variable Kc
Course 440-520 Kc
Centre Freq 520-440 Kc
Fine Centre Freq 20-0-20
Filter band with 50, 100, 200 L.F.
200 H.F. Sweep band width 0-200.

$75.00.

TRANSCEIVERS Ex Army

No C42 set. 36 to 60 MHz complete with 24V power supply, headphone, mic, leads etc **$65.00.**

No C45 set. 23 to 38 MHz complete with mast, headphones, mic, 24V power supply etc. **$95.00.**

$1.00 cartage to rail, freight payable at nearest railway station.

Hartley double beam oscilloscope. Type 13A with probes.
Working **$150.00**

77D x RCA STUDIO RIBBON MICROPHONES Variable pattern & response music or speech. $80.00 ea. Post A $3.30 B $4.00 C $4.30 D $4.80.

EX-ARMY TWO-WAY FM RADIOS

1.2 WATTS OUTPUT
SUPERHET
PRC9 AND 9A 27 to 39 M/HZ
PRC10 AND 10A 38 to 55 M/HZ
WITH HANDSET
ANTENNA ONLY $25 EA
$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated. Complete with Speaker and Amplifier.

CINEVOX $150.00
BELL & HOWELL $250.00
SIEMENS $375.00

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

WALKIE TALKIES 2-WAY RADIO, PMG APPROVED

7 TRANSISTOR $55.00 Set of 2
1 watt, 11 transistor $142 set of 2

P & P A $1.80, B $2.50, C $2.80, D $3.20

MICROPHONES OMNI DIRECTIONAL 50K OHMS

FREQ. RESPONSE 100-10,000Hz
Sensitivity 56dB complete with 5ft cable. Microphone Holder and Stand Base only $7.95 ea.
P&P A $1.70, B $2.25, C $2.40, D $2.65.

REPERFORATOR

Genuine Siemens Type 33c **$65.00**

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C.O.D.

Shortwave Scene

by Arthur Cushen, MBE

The problems of identifying languages and knowing how far signals will propagate on medium wave is a subject which the new listener often find difficult to understand. We attempt to clear up the misconceptions by giving some basic principles.

Newcomers to the hobby of listening, particularly on medium wave, are often not aware of the fundamentals of propagation of medium wave signals. It should be remembered that signals on this band only travel long distances when there is darkness throughout the reception path. There is some variation to this, as it can be dusk at the transmitting site or dawn at the receiving end and distant signals can be received.

One of our readers in Victoria has submitted details of reception of some Latin American stations which he has claimed to hear on medium wave, but we feel that he is listening to signals from Asia and not South America. For instance reception on 950kHz of Radio Belgrano at Buenos Aires was claimed to be heard up to 1506GMT, which would be 11.06am in Buenos Aires. Other examples included stations in Brazil listed at the same time on other frequencies

We have pointed out to our reader that such reception is not possible. Readers will be aware that during the hours of daylight signals are restricted to, at the very most, 1000km during daylight under very good receiving conditions. It should be also remembered that as well as Australian stations, signals from New Zealand are also heard. There is little possibility of receiving stations further afield unless a loop is used to tune out the unwanted signal.

The use of long-wire directional aerials for medium-wave listening with lengths of up to 1000 metres are being used by some New Zealand listeners, who excel in reception from South America; but the time listening to this area is restricted from late afternoon to around 1200GMT for stations on the Pacific Coast.

SINGLE SIDEBAND TEST

The test transmissions from Radio Sweden using single side-band have been heard on 21670kHz at 1100GMT, when an English broadcast is received. At the same time the normal transmission is on 21690kHz. The power of the transmitter is 30kW, and it is located at Hoerby.

Up to March 6 a new schedule is in use for these test transmissions and these will be broadcast as follows: 0500-0800GMT on 17775kHz; 0900-1300 on 17770; 1300-1400 on 17835; 1400-1600 on 17775; 1600-1800 on 15390; 1800-2130GMT on 11770kHz.

A special verification card has been issued for these SSB transmissions, by the Swedish Telecommunications Administration, Radio Department, Broadcasting Division, S-123 86 Farsta, Sweden, and shows a map of the world. The programs are a relay of the Swedish home program, except for the period 0900-1400GMT when the normal Radio Sweden short-wave service is broadcast. This includes English 1100-1130 and again 1230-1300GMT.

This is the first regular test on single side-band by an international station using the recognised short-wave bands.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summertime, 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

NEW JAMMING LOCATED

In recent months, a new type of jamming has been heard by short-wave listeners, and this has been located as coming from a station in the Ukraine. This machinegun-type noise is very severe, and according to a BBC report seems to have no fixed schedule or frequency. Our reception has been around 1400GMT when the signal is very severe and causes interference to the BBC on 9410kHz.

In Sweden the interference, although not heard round the clock, has been audible every day at varying times over a wide range of frequencies. Sweden, Britain and Austria jointly managed to locate this transmitter which is situated in the Poltava area of the Ukraine. Although its power is not known, one report puts it as high as two megawatts.

The International Telecommunications Union, of which the USSR is a member, had received reports from various quarters and the Swedish National Telecommunications Administration had written three letters—all unanswered—to its Russian equivalent. One theory, which the chief engineer of the Defence Research Institute, FOA, thought fairly reasonable, is that the transmissions are from a short-wave radar.

CONVENTION '77

The New Zealand Radio DX League has held many successful conventions, the last in Wellington. This year the convention will be held in Christchurch over Easter, April 8-11. The host will be the Canterbury Branch, and the plans are well under way to provide a variety of activities in the listening and social field.

Indications are that there will be overseas members attending from Australia, Hawaii, the United States and possibly Germany. Apart from DX sessions, several special calls from overseas broadcasters are planned from both short-wave and medium wave stations. Social activities will include a visit to the Radio Avon studos, Ferrymead Historical Park, a picnic at Akaroa and a dinner evening. Further information is available from the Convention Committee, Convention '77, NZRDXL, PO Box 18560, Christchurch, New Zealand.

ATHENS BROADCAST

Athens Radio has two daily transmissions to Australia in Greek and English. The present schedule, effective up to March 6, shows the morning transmission is 2100-2250GMT is on 6140kHz. The evening service for reception in this area is 0900-0950GMT on 15345kHz. Other transmissions which carry English as well as Greek include a broadcast to Europe 1900-1950 on 6240, 7215 and 9675kHz, and a service to Japan 1000-1050GMT broadcast on 11760 and 15345kHz.

INDONESIAN SIGNALS

There have been several changes of frequency of stations in Sumatra, according to David Foster of Melbourne. RRI Tanjung Pinang on 3225kHz closes at 1521GMT with identification following the Jakarta relay. RRI Mataram on the nearby frequency of 3223kHz closes at the same time. RRI Bengkulu has a news relay from Medan at 1400GMT, Local News at 1430, and sign-off at 1600GMT on 3265kHz. RRI Pangkalpinang on 3385kHz has been heard closing at 1538GMT. RRI Tanjung Karang on 3395 has been heard with popular Indonesian music to 1558GMT, with the same program on 4001kHz.

TIMOR VERIFIES

A letter verification has been received from RRI Kupang, which operates on 3550kHz. According to the letter the station has the power of 10kW and uses a Delta antenna system. The station was heard with a news bulletin in Indonesian at 1400GMT when reception was very good. The letter in Indonesian gives details of the program for the day and was signed by Harry A. Silalahi. The address is RRI Kupang, Jalan Tom Pello No. Kupang, Timor, Indonesia.

ENGLISH FROM CHILE

The Voice of Chile has been providing good reception during the early afternoon with transmissions on 15159kHz. The English programs are heard at 0110, 0210 and 0310GMT and last for 20 minutes. According to station announcements, the transmissions have been extended with several services in English, but the only other suitable time for reception is at 1030GMT when the frequencies of 6190, 9590 and 15150kHz are used. The signal at 0100GMT is received at fair strength on 15150kHz.

LISTENING BRIEFS

EUROPE

NORWAY: Radio Norway in Oslo has two transmissions which give good reception in this area. The first, broadcast 0700-0830GMT, is on 9550kHz, while 11895kHz and 15135kHz also carry the transmission. The second broadcast 1100-1230GMT is on 15135 and 11850kHz. English broadcasts are heard on Sundays for the last 30 minutes of the transmission.

GREAT BRITAIN: The BBC World Service beamed to the Pacific has made only one change for the present summer season, and is using 15260kHz 2000-2245GMT from the Ascension Relay. The transmission on 11955kHz now opens at 0700GMT instead of 0545GMT as in the past.

ASIA

SYRIA: Damascus on 15290kHz has been heard with the Home Service in Arabic by Peter Bunn of Melbourne. News was broadcast 0515-0530GMT with music up to 0600GMT when the time signal was broadcast. At 0625GMT the signal suffered interference from Radio Malaysia opening with its English service.

PAKISTAN: The latest schedule from Radio Pakistan shows two transmissions beamed to this area. The first, broadcast 0230-0245GMT with slow speed news in English, is on 17830 and 21590kHz, while another transmission 2345-0045GMT is heard on 7195, 9460 and 11750kHz. The transmission to Europe in English is broadcast 1915-2145GMT and is on 6115 and 7085kHz. A further slow speed news bulletin in English has been noted 1100-1115GMT on 15110 and 17665kHz.

VIETNAM: English broadcasts from Hanoi have been altered according to the BBC Monitoring Service and are now heard as follows: 0900-0930 and 1000-1030GMT on 7470, 10040 and 12035kHz; 1530-1600 on 7470, 10040 and 12035kHz; and 1800-1900, 2030-2130GMT on 10040 and 15012kHz.

AFGHANISTAN: The 1000-1030GMT broadcast in Arabic to the Middle East from Radio Afghanistan, Kabul, is now transmitted on 15390kHz instead of 15195kHz.

AMERICAS

U.S.A.: The Voice of America, in its service to Oceania, has made one frequency change for the morning transmission. The broadcast 2200-2400GMT is now on 21610kHz, replacing 15205kHz. Two other frequencies, 17820 from Dixon and 15290kHz from the Philippines, also carry the broadcasts. The transmission for our evenings from 1100GMT is still broadcast on 5955 and 9730kHz from Dixon, and on 6110kHz from the Philippines.

MEXICO: XEQM Radio Sus Panteres has been widely reported in North America on 6105kHz at 1200GMT. According to Tropical DX the station has typical ranchero music at this time, with frequent station announcements in Spanish.

DIGITAL AUTO CLOCK

KIT SI-20
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$29.95
Plus $2.95 Airmail post/registration.

Let your car, van, boat, caravan, truck, aircraft or any other vehicle join the Digital Revolution with our new Digital Auto Clock.

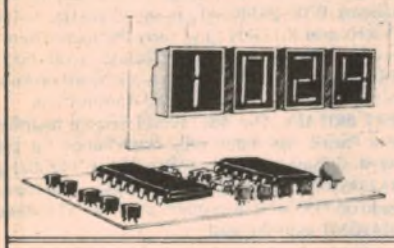
FEATURES

9-14 VOLTS AC OR DC OPERATION • TWO-WIRE NON-POLARIZED POWER INPUT • BRIGHT .27" RED LED DISPLAY • DISPLAY BLANKS WHEN IGNITION TURNED OFF • 12 OR 24 HOUR TIME DISPLAY • QUARTZ CRYSTAL ACCURACY TO WITHIN .002% (ADJUSTABLE) • HIGH-TEMP ABS PLASTIC CASE WITH MOUNTING BRACKET • CAN BE MOUNTED ON OR UNDER VEHICLE DASH • BATTERY BACK-UP FOR POWER FAILURE OR MOVING FROM HOUSE TO CAR ETC. • EASY TIME SETTING VIA HIDDEN SWITCHES IN FRONT OF CASE • VOLTAGE SPIKE AND NOISE SUPPRESSING CIRCUITRY.

Complete kit includes all parts, displays, etched and drilled PC Boards, Case and mounting bracket (less 9V transistor battery).

ALSO AVAILABLE WITH .36" DISPLAYS. KIT SI-204 . . . . . $33.95 + postage as above.

4-DIGIT DECADE COUNTER



The Decade Counter is a basis for a wide variety of instruments.

- On-chip internal oscillator for scanning speed
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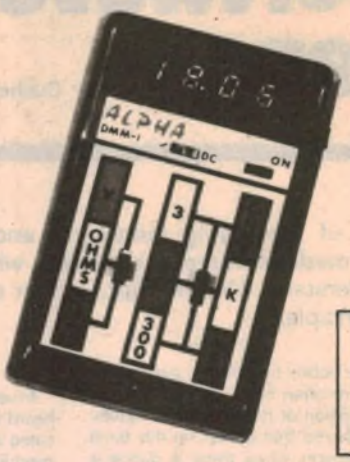
- Circuit board can be cascaded to 8-12-16 digits
- Kit includes all components, PCB's, LED displays (you select the size) and complete instructions

KIT SI-12A (with 0.27" displays) $23.95
KIT SI-12B (with 0.50" displays) $27.95

ALPHA MODEL DMM-1ER DIGITAL MULTIMETER KIT



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Measures:
- AC VOLTAGE
- DC VOLTAGE
- AC CURRENT
- DC CURRENT
- RESISTANCE

specifications

AC VOLTAGE
1 millivolt to 300 volts on three ranges. Input impedance: 10 megohms. Accuracy: 1%. Frequency Response: 0 to full scale voltage between 40 and 100 Hz, 0 to 2.4 volts between 100 and 10,000 Hz, 0 to 1.5 volts between 10 Khz and 50 Khz.

RESISTANCE
1 ohm to 6 megohms. Accuracy: 0.1%.

CURRENT
DC current: 1 microamp to 2 amps. Accuracy: 1%. AC current: 1 microamp to 300 milliamps. Accuracy: 1%. AC Frequency Response: Same as for AC voltage.

DC VOLTAGE
1 millivolt to 600 volts on four ranges. Input Impedance: 10 megohms. Accuracy: 0.1% to 300V, 1% to 600V.

RESOLUTION
1 millivolt, 1 microamp, 1 ohm.

GENERAL
Readout: 3 digit LED. Power Source: four AA (penlight) size batteries (Ni Cad, alkaline or carbon zinc). Over range Indication: display flashes when input exceeds value of range selected. Polarity Indication: automatic (negative voltage and current indicated by display). Size: 5.1" x 3.4" x 1.5". Weight: 8 oz. Case: high impact Cycolac. Color: Red.

TEST LEADS AND BATTERIES NOT INCLUDED

FM WIRELESS MIC.

Kit SI-36 is a completely new design in FM wireless transmitters. A unique PC foil layout eliminates the need for a wire-wound coil. Use with any dynamic type microphone to broadcast over the FM band. Use as an Intercom, Baby Alert, Magic Shows, School Science Project etc. Transmitting frequency adjustable via a trimmer cap.

Battery and microphone not included.

Frequency Range: 50 MHz to 200 MHz
Output Power: 100 milliwatt with 9 volt
Max Output Power*: 1 watt with 50 volt
Current Consumption: 10 mA to 50 mA max.
Input Impedance: Maximum 22 K ohms.
Size: 1.5 in. x 2.0 in.
*Intermittent

KIT SI-36 $3.95

CRYSTAL TIME BASE

60 HZ OUTPUT

Here's the ideal kit for converting your AC powered digital clock to DC operation. This unit has a 60Hz output, but is ideal for use with clock chips such as the MM5314, MM5316, CT7001 and others which have both 50 and 60Hz inputs.

Features include: Low power consumption (5mA typ.), 5-15 VDC operation, small size (1" x 2"), adjustable accuracy to .005%.

Kit includes all components, PCB and easy assembly and hookup instructions to interface with most MOS clock chips.

KIT SI-62
$6.95

DISPLAY LED's

FND-70	C.C.	25" red	0.85 ea.	5/ $ 3.95
FND-357	C.C.	36" red	1.20 ea.	5/ $ 5.65
FND-503	C.C.	50" red	1.50 ea.	5/ $ 6.95
FND-510	C.A.	50" red	1.60 ea.	5/ $ 7.55
FND-800	C.C.	80" red	3.95 ea.	5/ $18.75
FND-810	C.A.	80" red	3.95 ea.	5/ $18.75
DL33MMB	C.C.	11" x 3	1.45 ea.	5/ $ 6.75
DL 747	C.A.	60" red	2.95 ea.	5/ $14.25
XAN 654	C.C.	60" grn.*	2.95 ea.	5/ $14.25
XAN 664	C.C.	60" red*	2.75 ea.	5/ $12.95

* Denotes device has no decimal point.

C.C. = Common Cathode C.A. = Common Anode

9-DIGIT DISPLAY

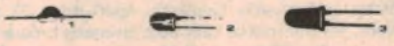
Off spec. devices. The only fault we found with them is that some digits may be slightly dimmer than others. All segments light. At 11 cents a digit you can't lose. Ideal for a mini digital clock, stop watch or calculator. COMMON CATHODE

SPECIAL — $0.99 each . . . . . 3 for $2.60

LED DRIVER IC's

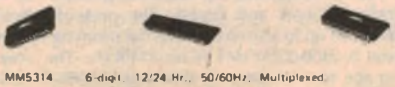
75491 Quad Segment Driver . . $0.39
75492 Hex Digit Driver $0.49

DISCRETE LED's



Description	Fig	5	10	100
Submini Red	1	0.60	1.10	10.00
Submini Green	1	0.90	1.70	10.00
Mini Red	2	0.60	1.10	10.00
Mini Green	2	0.80	1.50	13.50
Jumbo Red	3	0.80	1.50	13.50
Jumbo Orange	3	1.25	2.40	22.00
Jumbo Yellow	3	1.25	2.40	22.00
Jumbo Green	3	1.20	2.30	21.00

CLOCK CHIPS



MM5314	6-digit, 12/24 Hr., 50/60Hz, Multiplexed, 24-pin dip	$3.95
MM5316	4/6-digit, 12/24 Hr., 50/60Hz, Alarm, Snz., 40-pin dip	$4.50
MK50252	6-digit Alarm, Snz., 12 Hr/60Hz, 24 Hr/50Hz, 28-pin	$3.95
MK50381	4-digit direct LED drive, Alarm, Snz., Radio timer, non-multiplex, 40-pin	$6.95
PCB for MK50252, etched and drilled		$3.95
PCB for MK50381, etched and drilled, also accommodates 4 x FND70		$3.95

All clock chips supplied with data sheets.

LINEAR IC's

308	Micro Power Op Amp	1.00	10/$ 9.00
380	2 Watt Audio Amp	1.00	10/$ 9.00
555	Timer	0.59	10/$ 5.50
565	Phase Locked Loop	1.75	10/$16.00
567	PLL Tone Decoder	1.39	10/$12.70
723	Voltage Regulator	0.55	10/$ 4.95
741	Op Amp	0.25	10/$ 2.25
709	Op Amp	0.25	10/$ 2.25
309K	5V/1A V. Regulator	1.00	10/$ 9.50
7805	5V Regulator TO-220	0.95	10/$ 9.00
7812	12V Regulator TO-220	0.95	10/$ 9.00
7815	15V Regulator TO-3	1.25	10/$11.50
7824	24V Regulator TO-3	1.25	10/$11.50
2102	1K Static RAM	2.25	10/$21.50

SPECIAL CIRCUITS

MK5002	4-digit decade counter/latch/decoder, 7-seg and BDC outputs, 28-pin dip with data	$12.50
MK5005	4-digit decade counter/latch/decoder, 7-segment output only, 24-pin dip, with data	$ 9.50
MK5007	4-digit decade counter/latch/decoder with BCD outputs only, 16-pin dip with data	$ 7.00

OOPS! WE RAN OUT OF SPACE....

... to list many other kits and components. No worry, they are all in our flyers which are sent with every order. However, if you want the flyers only, send two International Reply Coupons and we'll rush them to you via Airmail.

All prices are listed in Australian dollars. Please add postage where shown. We pay Airmail postage on all other items. Remittance must be by Bank Draft (preferably for an equivalent amount in U.S. dollars) or by International Postal Money Order, in which case original receipt should be enclosed with order.

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INFORMATION CENTRE

RHYTHM BOX: I have read with interest your articles on the electronic organs. Could you please inform me if you intend to publish any articles about rhythm boxes, suitable for small organs? (V.G., Reynella, SA).

● As you have probably noticed already, we began describing such a unit in the October issue.

VIDEO BALL GAME (May 1976, File No. 3/EG/8): I have tried to build the video game, following exactly the circuit diagram and the layout for the PCB. The horizontal sweep oscillator will not start. Subsequently, I rebuilt that section separately, checking all components, but again, no oscillation. Only if I decrease the 10k resistor in the supply line of the 4.7k hold pot. will the oscillator start, but then the span of the control is minimum and the frequency is too high.

I have exchanged the 74C00 three times, and obtained the same effect. Could you please give me some indications as to how to get reliable starting, and an adequate frequency without upsetting the correct pulse distribution. (N.L., St. Ives, NSW).

● We are a little perplexed by your problem, N.L., as this circuit is usually quite reliable. Possible faults include a faulty or wrongly oriented start-up diode (D1), or a fault in gate 3a. We also find your comments concerning the range of the hold control confusing. Decreasing the 10k series resistor should increase the frequency range of the hold control, rather than limit it, as you have found. This suggest a fault in one of the five resistors connected to the wiper of the pot.

Other possibilities include excessive loading on one or more of the oscillator output, caused perhaps by a short between tracks on the PCB.

CASSETTE DECK SHIELD: I read your review of the Sony TC-204SD stereo cassette deck in the September issue of "Electronics Australia". Your reference to the disadvantages of stacking this type of deck on top of amplifiers is certainly correct. Therefore I would like to enquire if there is some type of shielding available to solve this problem. I would like to be able to stack my deck on my amplifier because of shortage of space. (I. H., Punchbowl, NSW.)

● The only effective solution would be to use a heavy gauge steel plate at least 6mm thick. This may not be practical as it may hinder ventilation of the amplifier. Nor is it very attractive, unfortunately.

PIPE LIKE BASS: As a complete novice, can I ask you some silly questions about your 80W loudspeaker system in the July '76 issue? Please help. (Here follow a number of questions). (J.Y., Balmain, NSW.)

● Ordinary figure-8 lamp cord can be used as the lead, but preferably not the much lighter figure-8 "speaker lead" sold in some radio shops. Inside the box, where the length of lead is relatively short, lamp cord, speaker lead or hook-up wire can be used. A radio shop should be able to supply you with a suitable plug and socket; the exact type is not important. Either that, or bring the lamp cord straight out through a small, snug fitting hole in the back of the cabinet. The amplifier driving it does not need to be

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing for 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

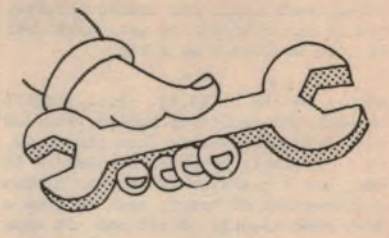
COMMERCIAL SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia".

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

PUT YOUR HANDS TO WORK MAKING MONEY



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AM15 module...$10.75 kit....$8.75
15 Watt RMS amplifier module. Has low distortion, typically less than 0.1%, full frequency response of 30Hz to 50 kHz, has 9 transistors and two diodes a fibreglass PC board, and requires a dual power supply of +28 and -28 volt

AM30 module...$13.75 kit...$11.75
30 Watt RMS amplifier module. Same as above, but requires +35 and -35 volt

PA40 module...$15.75 kit...$12.75
Preamp and controls suitable for use with AM15 and AM30. Magnetic input is 3mV into 50k ohms. Other inputs 100mV into 100k ohms. Output 200mV into 10k Signal to noise better than 60dB, and distortion better than 0.1%. Controls +14dB and -18dB at 50Hz and 10kHz. PC board mounted pots for volume balance treble and bass. A fibreglass board.

SQ1 module...$12.50 kit...$10.50
Uses MC1312 IC, requires power supply of 18 to 22 volts.

SQ2 module...$33.50 kit...$29.50
Uses MC1312, MC1314 and MC1315. This unit has full decoding and wave match control. Ideal for building up a four channel system at low cost.

TU1 module only....$8.50
AM tuner module, 9 or 12 volt supply, ferrite rod, superhet model.

TU2 module only....$29.50
AM and FM stereo tuner. provision for stereo indicator and tuning meter. 12 volt supply, 3.5uV sensitivity. High quality unit at a new low price.

KITS .....just five of the kits from our range.

ETI422 50 Watt stereo $119.00
Comes complete with wooden sleeve.

ETI424 Reverberation unit $49.50
With metal cover.

ETI427 Graphic equaliser $99.50
Comes complete with wooden sleeve.

ETI440 25 Watt stereo $89.50
With metal cover.

EADFC 200MHz counter $115.00
Complete kit with metalwork, front panel and prescaler.

PM141 5 Watt stereo $29.50
Comes with transformer, pots, power supply, but without knobs and front panel. Ideal for construction under a turntable. Suitable for high output ceramic, and crystal cartridges.

EA75CDI Updated system $19.50
Complete with drilled metal case and prewound secondary coil. A reliable and easily costructed kit.

proportional radio control

TRANSMITTER-MODULATOR
TXM Module...$13.50 Kit...$11.50

27MHz. crystal controlled transmitter -modulator. Requires antenna, crystal and 12 volt supply. Typical range is 100 metre, output is 300mW. Input is suitable for Amplitude modulation.

RECEIVER
RX Module...$13.50 Kit...$11.50

27MHz. crystal controlled receiver. A 9 volt supply, antenna and crystal is required. This receiver uses a ZN414 integrated circuit chip, and an IF of 455kHz.

CRYSTALS
XT2 Pair...$ 6.95

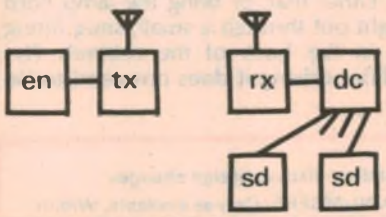
A matched pair with 455KHz separation

ENCODER
EN15 Module...$13.50 Kit...$11.50

15 channel proportional encoder. This is a pulse width modulation type with synchronisation. It requires a 5 volt supply, and can directly drive a TXM module. All channel positions are set by 10k potentiometers, these are not supplied with the module or kit. This encoder can easily be converted to a system with fewer channels.

DECODER
DC15 Module...$13.50 Kit...$11.50

15 channel proportional decoder with synchronisation. It requires a 5 volt supply and is driven directly by the receiver module. Servo and drive unit will be featured in a later issue.



printed circuit boards

Boards required for building EA and ET projects will be available about one week from issue of the magazines. Also boards can be made to your artwork. In both cases the cost will be...

Single side laminate..	basic	80c
	per square inch	5c
Double side laminate..	basic	90c
	per square inch	9c
Single side fibreglass..	basic	80c
	per square inch	9c
Double side fibreglass..	basic	90c
	per square inch	13c

specials

.....only while present stocks last

7400	28c	74121	50c
7413	28c	74151	$1.00
7440	28c	741D (linear)	40c
7442	60c	SC141D	$1.20
7445	80c	2500uF 25V	49c
7446	80c	8.2V zener	14c
7448	80c	12V zener	14c
7460	35c	24V zener	14c
7479	40c	27V zener	14c
7483	95c	30V zener	14c
7492	70c	BC350 pnp	9c
7496	95c	4016 CMOS	60c

22K	Double gang linear pots	69c
47K	Double gang linear pots	69c
100K	Double gang linear pots	69c
47K	Double gang log pots	69c
BC350	PNP, similiar to BC559	9c
500mW	Zeners, 8.2, 12, 30 volt	14c
LM309K	5 volt, TO3 regulators	$1.25
LM741D	DIL 8 case IC	.40
1101	256 bit RAM, +5, -9 volt	$1.95
2102	1024 bit RAM, +5 volt	$3.50
ZM1000	Nixie readout tube	99c

LINEAR IC

LM301D	87c	LM741T	70c
LM301T	87c	LM749T	$2.35
LM307	$2.20	LM777T	$1.78
LM308D	$2.32	LM795	$6.50
LM308T	$2.32	LM1303	$2.15
LM309K	$1.25	LM3900	.83
LM339	$3.20	LM3909	$2.65
LM380	$2.04	LM7805	$2.36
LM381	$3.20	LM7812	$2.36
LM702T	$3.20	LM7815	$2.36
LM709	.64	MC717P	$1.50
LM709T	.64	MC1312	$4.34
LM710T	.82	MC1314	$6.89
LM715T	$3.20	MC1315	$10.84
LM716T	$2.90	NE555	.92
LM723	$1.14	SN76023	$1.90
LM723T	$1.14	TAA840	$2.95
LM730T	$3.20	TCA220	$1.95
LM734T	$2.90	ZN414	$3.25
LM739	$2.15	8038	$7.50
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a special "bass" amplifier but it must have enough power output for your requirements. For other than bass work, the system would need to be supplemented with a mid-range and possibly a tweeter speaker but we can't discuss that here; it would require more work and another whole article. If you want a general purpose speaker system for guitar and electric piano, watch out for a system that we will be describing in the near future expressly for this purpose. It will be more expensive, but it is the kind of thing sought by group musicians.

PLAYMASTER TWIN 25: I must congratulate you on an excellent amplifier which worked from the start. I had some motorboating when the volume and tone controls were fully advanced on phono with an input plugged in. I found it would settle down by either backing off the volume or bass boost a little. I cured the fault by isolating the headphone socket from the chassis and running a separate earth return back to the PC board. Now, at full volume, full bass and full treble on phono there is only a slight hiss and no hum. Backing off to normal listening levels makes it dead quiet. I hope this letter may help someone with similar problems. (P. G., Blacktown, NSW.)

● Thank you for your comments. This precis of your letter should be of help to other readers.

AUTOMOTIVE PROJECTS: Those automotive projects described in the magazine are invariably designed for 12V vehicles. What about the 24V electrical systems used in large transports? Many transport drivers would like to be able to use the various projects, but are unable to do so. I have tried making some of these by using twice the values on resistors, capacitors etc, but they just don't come good. What about an automatic charger suitable for both 12V and 24V systems?

I have been reading the magazine for about 10 years now and have made up several projects. I regard the magazine as the best of its kind, and well worth the price. (K.B., Miranda, NSW.)

● Thank you for your suggestion and kind remarks about the magazine, K.B. We appreciate your problem with 24V systems but, unfortunately, the demand for such circuits would be relatively small and it may be difficult to justify the effort in developing circuits for these alone. In some cases, where the current drain is small, 12V designs may operate from higher voltage supplies using dropping resistors, in conjunction with zener diode regulators along the broad lines described in "Using Your Tape Recorder in a Car" (July 1969, File No. 3/MS/ - 17). In other cases is would be necessary to design the device for the higher voltage.

Redesigning the Automatic Battery Charger for 24V operation would be a major undertaking, and difficult to justify. More conventional chargers would not be difficult to provide. Automotive diodes in a bridge configuration should be more than adequate and could be fed from a transformer of suitable current rating and delivering about 24 volts or a little more. Some series resistance may be necessary to control the rate of charge.

MUSICOLOUR COMPRESSOR: After reading your article on the new Musicolour Mk 3, with special regard to the compressor stage, I was wondering if you knew of any compression circuits which could be incorporated into the Musicolour Mk 2.

Also, for the benefit of other readers, I overcame the problem of the headphone socket switching off the loudspeakers, by building your "Universal Headphone Adaptor" (August 1973, File 1/MS/10). This enables separate control of the signal to the Musicolour while still allowing the loudspeakers and/or headphones to be used. (T.H., Brighton Beach, Vic).

● There is no easy way of incorporating a compressor stage in the Musicolour 2. This is partly the reason we published the completely new circuit of the Musicolour 3. Any reader who was contemplating the addition of a compressor stage to the Musicolour 2 will find it more straightforward to purchase and assemble the complete PC board for the new Musicolour 3. This fits easily into the chassis of the superseded model.

Thank you for your hint involving the Headphone Adaptor.

NOTES & ERRATA

STEREO DYNAMIC NOISE FILTER (January 1976, File No. 1/F/10): The .0015uF capacitors on the circuit and PCB wiring diagram should be .0022uF, as noted in the parts list and text.

3.5MHz SOLID STATE TRANSMITTER (September 1976, File No. 2/TR/60): On the PCB for the exciter, a piece of copper track is missing between the collector of TR1 and the adjacent pad for the 100k resistor. This should be bridged with a piece of tinned copper wire.

AUTO RHYTHM UNIT FOR ELECTRONIC ORGANS (October 1976, File No. 1/EM/42). In the circuit diagram on page 41, and in the text on page 40, amplifier B1 was incorrectly described. The centre frequency of the amplifier should be 1kHz, not 2kHz. This should be 200Hz. For both amplifiers, the values shown on the circuit diagram, and on the PCB overlay are correct.

AUTO RHYTHM UNIT FOR ELECTRONIC ORGANS (November 1976, File No. 1/EM/43). In the parts list on page 43, the entry for the transformer should read "1 Ferguson PL24/20VA or similar 24V transformer".

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CHASSIS & ETCHED PANELS: Our list of manufacturers in the November issue included the Star Delta Co Pty Ltd, Granville under these two headings. Star Delta have advised us that all enquiries for these items should be directed to their associate company, Cowper Sheet Metal & Engineering, 11 Cowper St, Granville, NSW, 2142.

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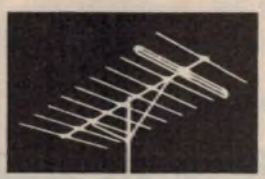

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d) A/B side mark (indicates which side is ready for play).

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