From Sony research...

a totally new turntable system

Sony PS-4750
Superb Fidelity from Today’s Most Advanced Direct Drive

Audio experts the world over have been waiting for it... Sony's incredible PS 4750, the ultimate turntable system.

State of the art takes on a new meaning with the PS 4750, probably the quietest turntable ever made.

In one elegant design Sony has reduced rumble, feedback wow and flutter to minute levels far beyond hearing and virtually beyond measurement. Wow and flutter for instance is an amazing 0.03% (wrms.) Signal to noise is better than 70 dB (DIN-B).

Sony achieved this in a number of ways:

First, all the belts, pulleys, idler wheels and other paraphernalia used in conventional turntables to make the turntable spin at the record’s speed, instead of the motor’s, have been eliminated.

The Sony PS 4750 has no need for these troublesome, noisy and fluttering parts, because its slow-revving D.C. motor is directly coupled to the platter.

Speed accuracy takes on new meaning with another Sony breakthrough, the “Magne-disc Servo Control.”

Through a unique multi-gap head, this system automatically reads turntable speed through speed detective signals magnet-coated on to the turntable rim. Should there be any deviation induced by fluctuations in power supply, it immediately “instructs” the servo motor to make micro-accurate adjustments.

Another triumph of Sony research is the very material used to make the cabinet and turntable, B.M.C., developed specifically for audio use because its damping and resonance characteristics are 30 per cent better than the conventional aluminum diecast. B.M.C. is also virtually free of expansion or contraction, freeing the design of any problems arising from temperature changes.

Sony innovation didn’t stop there. Look at the revolutionary rubber disc supports. These insulation mats are of a unique design which firmly grips the record, effectively insulating the disc from vibration when the turntable revolves. By preventing vibrations, these mats contribute to the stereo effect and significantly improve presence.

The precision tonearm is a universal type which accepts all quality shells and cartridges. Some of the Sony PS 4750’s other advanced features are: stylus pressure adjustment (0-3 g), anti-skate compensator, viscous-damped (up and down) arm lifter, see-through stroboscope, independent pitch control (+ 4% on both 33⅓ and 45) and large insulator legs for effective prevention of audio feedback.

If you’ve been waiting for the ultimate turntable, you need wait no more. The superb Sony direct-drive PS 4750 is here.

SONY®
Research Makes the Difference
Developed in our laboratory, this loudspeaker protector will protect your expensive loudspeakers in the event of an amplifier malfunction. As well, it will eliminate switch-on 'thumps'. Details on page 34.

Designed for improving the signal to noise ratio from old movie sound tracks, this sharp-cut low-pass filter unit is compatible with the optical/magnetic preamp described last month. Constructional details on page 42.

On the cover
Our cover this month shows the Opus mini-computer which is being lent to students at Britain's Open University as part of a computer course. Developed for teaching purposes, the Opus offers many of the facilities found in commercial computers, including a store with 120 addressable locations, a 12-key keyboard, console switches and seven-segment displays. Cost is said to amount to only £13 per student. (Photograph courtesy British Information Service.)
"A low-priced high-speed print-out system, reliable and adaptable"

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Our 60 SA/SR mosaic printer is a low priced print-out system which surpasses many higher-priced competitors in performance and reliability. The system comprises a printer and drive/control module that prints a twenty-character line and returns the carriage within one second. Quietly!

Choose from two character modules — 20 character numerical, or 64 character alpha numerical with MOS memory control.

It's reliable and maintenance is negligible. The moving parts are the simplest ever — only seven needles and the transport mechanism. All the hard work is done by electronics. And we've kept it small and light.

And now two new mosaic printers:
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For further information contact ELCOMA Electronic Components & Materials, Box 50, Post Office, Lane Cove, New South Wales 2066. Telephone 421261 or 420361. Branches in all states.

ELCOMA

PHILIPS
Paperless news—but how soon?

In a recent public statement Mr Talbot Duckmanton the general manager of the ABC disclosed that his organisation is interested in introducing an electronic newspaper system in Australia, along the lines of the Teletext/Ceefax/Oracle system being tested in Britain. Readers who saw our rather timely article on this system in the October issue were no doubt in a good position to evaluate the proposal.

Certainly the broad concept of disseminating news and other service information in this fashion has a lot of merit. Conventional newspapers are undeniably wasteful as a means of achieving this end, particularly in view of the fact that only a relatively small proportion of the information in any one copy is actually read.

Naturally enough, conservationists have expressed concern for the large amounts of paper used in newspaper production. Wastage of material resources like paper is certainly involved, although some recycling does take place. Ultimately a proportion of newspapers is pulped and used to make lower grade paper products such as wrapping paper, but probably a major proportion is effectively lost.

So less important in the long term is the physical energy expenditure and human labour required not only to print newspapers but also to distribute them to the dispersed end users. The electrical energy used by the printing presses and the fuel used by the distribution transport are very significant, the more so because unlike paper they cannot be recycled.

Any system which replaces this “hard copy” approach with one involving electromagnetic propagation of the required information directly to the end user is bound to be less wasteful, and therefore more desirable in the long term. However this is not to say that the transition from one to the other will be an easy one, to be embarked upon lightly.

For one thing, as our article last month pointed out, there is a technological/economic “viability hurdle” to be overcome before systems like Teletext can become practical. Until the cost of adding the required decoding circuitry to TV receivers can be brought down to a few tens of dollars, probably by developing a suitable LSI integrated circuit, the system will not be attractive; yet the integrated circuit makers are naturally unwilling to make the huge investment necessary to produce the required LSI device, without assurance of a large market.

Another important consideration is public acceptance. Despite the highly inefficient nature of traditional newspapers, and the fact that very few people really need or take advantage of their “hard copy” presentation, old habits die hard. We humans are used to having our news impressed upon our own private wad of paper. We find it comforting, and I suspect it will take quite a lot of public education before we will be prepared to part with our ink-stained security blankets.

In short, then, while the idea of Teletext is a good one, we don’t suggest that you hold off buying a colour TV set until you can have one with Teletext decoding built in!

—Jameson Rowe
What do Superspeed Irons do best?

SCOPE TRANSFORMER
This transformer is specially designed to provide a safe low voltage power source for Scope Superspeed Irons (and Vibroscope etching tools). An earthed isolation shield prevents capacitive coupling with possible voltage leaks.

1. Provide intense heating power:
The patented heating concept located right behind the tip provides tremendous heat output to get the iron hot fast, then keeps the temperature under your control to complete every joint faster.

2. Let you control the power:
Should you encounter a heat sink which would rapidly drain away tip heat (e.g. thick metal or a need for plenty of molten solder) your finger switch provides another burst of heat to keep the copper tip at correct temperature. Normally only heavy irons have this capacity and take a long time to heat — and cool.

3. Put this heating power right at the tip:
A perfect iron has its heat source right at the surface of the tip — inefficient irons have their’s up the barrel. The Superspeed range generate their heat on the copper tip itself, hence the intense concentration.

4. Lets the tip run cool when not actually soldering:
The tip stays tinned longer and lasts much longer because it switches off when you let go the handle. This feature plus a low heat conductivity stainless barrel keeps the handle cooler.

5. One iron replaces several:
With normal irons, you need several different sized irons to cope with various jobs and avoid the risk of dry or weak joints. Scope has designed an iron that does the work of any other iron from 10 watts to 150 watts.

Scope products are available from all electrical wholesalers.

SUPERSPEED USER SELECTION DATA

<table>
<thead>
<tr>
<th>Low heat conductivity barrel</th>
<th>Superspeed</th>
<th>Mini Superspeed</th>
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<tr>
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<td>Weight (without leads)</td>
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<tr>
<td>Cable lugs fitted</td>
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</table>

User Preference Guide:
Electronic Service work: TV with vac. tubes
Electronic and Hi Fi hobbies: 2nd pref.
Electricians and Linemen: 1st pref.
Home Handyman and Farmers: 1st pref.
Model making — Mechanical Hobbies: 1st pref.

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For free literature, contact the sole Australian agent, British Merchandising Pty. Ltd., 49-51 York Street, Sydney. Telephone 29-1571.

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for the closest approach to the original sound

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A new approach to organ design

Integrated injection logic (I\(^2\)L) and emitter coupled logic (ECL) are currently making headlines in the technical press but, already, they have found their way into prototype electronic organ circuitry. A new device from Philips, Eindhoven, offers a potential alternative to the octave generator ICs which are, themselves, relatively new.

by NEVILLE WILLIAMS

Broadly speaking, the designer of an electronic organ or other such instrument has three main design options.

The first is to use separate oscillators to provide the various pitches, the advantage of the method being that separate oscillators can provide some randomness of pitch and phase, equivalent to that in a pipe instrument.

Offsetting this advantage is the fact that periodic overall tuning is necessary and the pitch can only be modified by complete re-tuning. Nowadays, this approach is mainly the preserve of large, elaborate instruments envisaged as a direct substitute for their pipe counterparts—either classical or popular.

A second major approach—and a relatively new one—is to acquire and store information about waveforms in a digital form, typically involving read-only memories (ROMs) and punched cards. When a player operates the quite elaborate registration tabs and playing keys, internal computer style technology invokes and assembles the required digital information. It is then transformed into an analog signal and applied to conventional amplifiers and loudspeakers.

This approach makes available to the designer a whole array of sophisticated digital technology, which would otherwise have no place in organ design. However, it has important implications in terms of signal component frequency and phase, because data repetition rates must relate ultimately to the basic "clock" frequency. It obviates any problems with tuning or tuning drift, facilitates increments in overall pitch but also eliminates any natural randomness between the tone sources.

The third major approach—and far and away the most popular—is to provide the twelve basic semitones for an octave at or above the top frequency range of the instrument. Frequency dividers are then used to generate the basic tones for progressively lower octaves.

Originally, ordinary tuneable L/C oscillators were used to provide the top reference octave, adding up to an instrument which required limited tuning, allowed for some randomness between intervals within the octave, but no randomness between the same note in different octaves. The basic pitch could only be changed by re-tuning the twelve master oscillators.

More recently, the twelve master oscillators have tended to give place to a single master oscillator, usually at about 2MHz, followed by logic circuitry dividing down to a reference super-octave of tones closely approximating the tempered scale. As before, a chain of flip-flops divides down each note of this reference octave to provide all the basic frequencies required by the keyboards. The high frequency master oscillator can be variable tuned to provide desired changes in pitch, or it can be crystal locked, or switched in predetermined increments.

Whatever the detail, however, all tones in a master-oscillator-divider type organ are frequency and phase-interlocked and designers have to resort to phase modulation of one type or another to simulate the randomness of an acoustic instrument.

For the many manufacturers of this type of instrument, some kind of an ultimate seemed to have been reached, not long ago, with the release of integrated circuits which contained all the logic circuitry necessary to produce a reference super-octave from one 2MHz crystal oscillator or its equivalent. Other ICs provided the necessary divider chains to supply the manuals and pedal clavier. Circuitry which had previously involved large arrays of valves or, later, discrete transistors, was therefore concentrated in a few ICs on a relatively modest PC board.

Now, it seems, Philips are working on an approach for a master-oscillator-divider organ which will offer still further economies. Instead of the complex and relatively costly IC to generate the super-octave, they have come up with one using I\(^2\)L and ECL technology which accepts the signal from a master oscillator at about 8MHz to produce twelve outputs: eleven octave-related tones necessary to supply a particular note in all manuals, together with one output which is lower than the original 8MHz drive signal by the twelfth root of 2, or one semitone.

Typically, one of the new 16-pin ICs might be fed from a master oscillator at a frequency of 8.5728MHz. Dividing by 2\(^2\) it would produce 16744Hz; by 2\(^3\) it would produce 8372Hz and so on for all the “C” notes down to 2\(^8\) and an output at 8.091Hz. In addition to these audio frequencies, the IC would also produce an output 8.0917202MHz, which is suitable for driving another exactly similar IC; this would produce all the “B” notes and, in turn, drive for the “B-flat” IC.

While, on the surface, it might appear that the new approach merely distributes the same functions differently in a similar number of IC packages, the early implication seems to be that an economy will result from using twelve of the new
ICs, which require no external components other than the master oscillator and a simple series resistor between the outputs and the keying circuitry.

A further advantage is that, by dividing down from 8MHz rather than the more usual 2MHz, a closer approach can be achieved to a mathematically precise tempered scale. The maximum deviation occurring in any octave is 49 parts per million or .0049%.

For straightforward instruments, the bank of ICs can be fed from a relatively simple L/C oscillator, which can be rendered intrinsically very stable by careful design, while nevertheless allowing its frequency to be modulated to provide vibrato effects. Since all pitches are derived from the one master oscillator, any deviations, whether deliberate or incidental, affect the overall pitch of the instrument but not its internal frequency relationships.

Typically, the entire tone generating system can be assembled on one PC board measuring 4 x 30cm.

For more elaborate instruments such an economy of space and circuitry makes it relatively easy to incorporate additional generator systems, depending on requirements, these can be used to obtain vibrato and non-vibrato options, “celeste” or off-tune “chorus” effects, glide tone effects and so on. Again, with an additional divider circuitry available, the whole system can be stepped towards or away from the master oscillator, effecting transposition of all the keyboards a semitone at a time.

QUADRAPHONICS: While there are plenty of “knockers”, Edward Tatnall Canby, writing in “Audio” magazine, seems more keen than ever about quadraphonic systems. His renewed enthusiasm flows from the latest generation of quadraphonic equipment which he has been closeted with—CD-4, SQ and QS.

While he is more enthusiastic than specific, the message that comes through is that the new generation of equipment really works, with controls, circuit techniques and automatic this-and-thats which wrap up what might have been seen before as loose ends.

Canby isn’t inclined to argue too much about the particular system; each has its plusses which show up most strongly with certain types of program material but, for Canby, any kind of quadraphonic is likely to be preferable to plain two-channel stereo.

He admits that the new hardware is gimmicky and costly but, for him, the important thing is that it seems to have solved the outstanding technical problems. From here, it should be a downhill run to wider public acceptance, as the hardware is simplified and cheapened, while still doing the same job!

JVC, meanwhile, is optimistic about 4-channel but certainly doesn’t see the future as a “downhill run”.

NEW PHILIPS AUDIO EQUIPMENT

Backed by the Company’s largest-ever promotion for their audio products, Philips have recently launched a variety of new items of special interest to Australian hi-fi enthusiasts. Included is the motional feedback loudspeaker and the electronic turntable mentioned in July.

Pictured above is the complete domestic system 850, which is expected to market at a recommended retail price of $440. It includes an AM/FM radio, with capital city AM stations marked on the dial. The amplifier has all the usual controls and facilities for connection to external tape equipment.

For those requiring a separate tuner/amplifier, Philips are offering the RH750 pictured below. With a power output of 13.5W per channel into 4 ohms, the RH750 has facilities for phono, tape and microphone input, and all the normal controls expected in a hi-fi installation. Both tuners—AM and FM—have built-in aerial provision, adequate for all but poor locations. A tuning meter at the top left corner of the panel serves both reception modes. Rated signal/noise ratio for the FM tuner is 65dB and stereo separation 34dB. For the AM tuner, the rated signal/noise ratio is 45dB. Recommended retail price for the RH750 AM/FM Tuner/amplifier is $239.00.

Conforming to the currently popular “military look” Philips model RR260 (pictured at right) offers AM and FM radio, combined with a full cassette recorder with built-in condenser microphone. There is provision for external plug-in microphone and external speaker, headphones and remote control. Recommended retail price is $99.00.
HIFI NEWS

At the most recent US hi-fi show, a JVC survey indicated that over 50% of prospective customers were interested in 4-channel sound but lost interest when they came up against dealer confusion apathy.

Accordingly, JVC America is currently setting up so-called “Quadracenters” throughout the USA intended to give customers the opportunity to hear the whole range of their 4-channel equipment under properly controlled conditions: receivers, amplifiers, demodulators, tape decks, loudspeakers, etc.

The Quadracenters will be staffed by salesmen who have been through a course covering 4-channel concepts and installations. They are backed by a special “Hot-Line” service, where customers have the opportunity of making toll-free calls to the JVC National Quadracenter aimed at helping them with any difficulties related to 4-channel sound.

QUAD RECORD INVENTORIES: Record company attitudes are continuing to shift in the matter of the release and stocking of quadraphonic versions of new releases.

As noted last month RCA have moved away from their original plan to rely on the CD-4 pressings, where issued, to cover the complete market: quadraphonic, 2-channel stereo and mono.

Superficially, this is possible because the extra information in the supersonic FM channels is ignored by non-CD-4 equipment. All signals in the main channels simply revert to the front arc, as it were moving straight forward, the end result being a close approximation of what one would expect from a 2-channel stereo version.

As indicated RCA ran into a credibility problem: customers didn’t seem to get the message that the discs were compatible; when they couldn’t find an ordinary “stereo” version, they settled for something else. And, of course, there were those who knew the technical story but had reservations about the durability of pressings carrying a supersonic modulation which, for them, was redundant. As a result, RCA have amended their “CD-4 only” policy and have issued “stereo” versions where it seemed appropriate to do so.

Now comes the news that EMI in Britain have made just the reverse decision with a number of their quadraphonic classical releases. Rather than issue separate “SQ” and “stereo” versions, EMI have produced stereo/quadraphonic pressings carrying a rectangle symbol. It parallels the position noted for France, where SQ pressings are often sold with ordinary stereo labelling.

Unlike the CD-4 discs, the quadraphonic information lies totally within the audio band and will be reproduced in the stereo version, however appropriate or peculiar the various phase relationships. The producers have to study each recording on its merits and arrange the mix-down so that the end result is acceptable in all playing models. From reviews published overseas, the exercise has proved to be entirely successful.

COPYRIGHT SITUATION: Prompted, fairly obviously, by recent imports and seizures of “pirate” cassettes in Australia, the ANZ Musical Copyright Agency has issued a letter summarising the official copyright situation covering records and cassettes of musical works. Over the signature of Manager A. J. Turner, the letter reads as follows:

What is the best kind of bearing for a playing deck? The one likely to produce the least rumble? The answer, perhaps, is: no bearing at all, in the mechanical sense; instead, the turntable is supported by the repulsion effect of a magnetic field. A British “Gale” turntable of this type was exhibited recently at the Sydney Hi-fi Show, while a new Stanton design at left uses magnets both to support and to drive the turntable.

It has become apparent that not all persons engaged in the business of importing, distributing or retailing records or pre-recorded tapes obtained from overseas suppliers are aware of their responsibilities under the Copyright Act 1968. The following information has therefore been made available on behalf of this Agency's principals to publicise those responsibilities and the facilities provided by this Agency to assist all such persons in meeting their responsibilities.

(1) ANZ Musical Copyright Agency is the licensing division of AMPAL and represents the majority of Music...
Publishing Companies who own or control the copyrights for Australia in most music in current use. A major purpose of the Agency is to provide for the music industries a convenient central office for the licensing of the importation and sale of recordings of musical works and for the collection of royalties in respect thereof.

(2) It is an infringement of copyright for any party to import into Australia for re-sale any records or cassettes containing copyright musical works without the prior permission of those who control the relevant copyright for Australia or their representatives. This permission cannot be given validly by an overseas exporter who only controls copyright in the country of manufacture or export. (Copyright Act, section 37.)

(3) Any wholesaler or retailer who sells imported records of music which have not been properly licensed for importation by the Australian copyright owners can also be liable for infringement of copyright. (Copyright Act, section 38.)

(4) Applications for permission to import records and cassettes containing copyright music should be addressed to ANZ Musical Copyright Agency, P.O. Box Q123, Queen Victoria Building, Sydney, N.S.W. 2000. The detailed information to be included in such applications is available upon written request to the Agency.

(5) Wholesalers and retailers, in order to avoid risk of liability, before purchasing records made in any overseas country, should enquire from this Agency as to whether such records have been imported with proper copyright clearance.

(6) This Agency is available to provide information and assistance to any importer, wholesaler or retailer in relation to the copyright in musical works and enquiries will be welcomed.

PORTABLE PLUS: Portable transistor radios have been decked out with AM, FM and shortwave bands, cassette tape facilities, a wide variety of styling features and just about everything else one could think of. But Matsushita Electric's latest National RF-1300 has an inclusion that certainly would not have occurred to many up to this point in time: an electronic rhythm generator!

Borrowing the technology developed for electronic organs, the unit offers a choice of eight different rhythms—twist, waltz, tango, etc.—produced by synthesised cymbals, snare drum, bass drum and high hat.

The model has provision for interconnection to microphone, electric guitar, tape recorder, record player, or another radio, and has provision to adjust the tempo to the precise speed required. Presumably the user can superimpose a locally generated beat on external program material or just listen to the beat for as long as he/she likes.

Nor are they stuck with a few milliwatts of power. The RF-1300 supplies 5 watts to a 16cm twin-cone speaker. It can be operated from AC mains, car battery supply or ten D-size torch cells.

NOW WE SCAN SPEAK! It was announced some time ago that Ortofon, well known for their phono cartridges and playing arms were planning to enter the loudspeaker business. The basis for the expansion has now been revealed.

After lengthy negotiations, Ortofon Manufacturing A/S has taken over Scan Speak, the Danish loudspeaker manufacturer. Scan Speak has been the supplier to many local Danish companies but has also marketed the Scansonic speaker systems on an international basis.

Ortofon's Managing Director, Erik Rohmann, has assumed control over the total company, now employing 400 people, while Bent Thomsen is Sales Manager with responsibility for the Scansonic product program.
Computerised modelling & laser techniques aid loudspeaker design

Currently considered the weakest link in the audio reproduction chain, loudspeaker systems are coming in for a great deal of research and development attention, with both Philips and Wharfedale using lasers to show up standing wave patterns in cones.

Although the quality of loudspeakers has been considerably improved in recent years, loudspeaker design has been more a question of intuition and practical experience, rather than a quantitative understanding of the behaviour of loudspeaker cones. Engineers have long had to deduce what might be going on in cone and voice coil assemblies, relying on roundabout means and subjective judgements to confirm those deductions.

Reacting to this situation, Philips Research Laboratories in Eindhoven, The Netherlands, has developed a new computerised modelling technique as a step towards overcoming loudspeaker design problems.

The new modelling aid, developed by F. M. Frankort, enables the designer to perform a theoretical analysis of loudspeaker behaviour. This is done by using a computer to solve 12 simultaneous differential equations for a large number of frequencies and for various types of speaker cones.

In this way it has proved possible, for example, to calculate the frequency characteristics of the sound pressure and the radiated sound power as a function of the geometry and properties of the cone material.

In order to verify the theoretical results on an experimental basis, mechanical vibrations of the cone were visualised holographically (see photographs). In addition, the velocity of the coil, the sound pressure, and the sound power levels of the loudspeaker were recorded as a function of frequency.

At low frequencies the cone vibrates as a rigid entity. Above a certain frequency, standing waves appear on the cone surfaces. These can clearly be seen in Figs. 1 and 2.

Fig. 1: interferogram of a speaker cone driven at a frequency of 2kHz.
Fig. 2: interferogram of a speaker cone driven at a frequency of 9kHz.

In Fig. 1 the drive frequency was 9000Hz. The whole surface of the cone is now covered with patterns of nodes and antinodes, and the cone radiates little sound.

Experimental results agree quite well with theoretical predictions. The graph illustrates the satisfactory agreement obtained between the measured and calculated frequency response of the sound pressure level (Lp) on the axis of an 8in loudspeaker in a box (solid line, experimental; dashed line, theoretical).

Philips state that the new computerised analysis technique could eventually lead to further improvements both in the method of design and in the quality of loudspeakers.

Meanwhile, at the Wharfedale factory in England, only a stone’s throw from where Gilbert Briggs created the brand—largely on subjective evaluation—Technical Manager Ken Russell and Senior Projects Engineer Alex Garner are combining the traditional approach with modern instrumentation and laser analysis.

To give some direction to their current work, the Wharfedale Research Department produced a brace of “black boxes” which are used in conjunction with a high quality amplifier/loudspeaker system to introduce identifiable resonance and intermodulation effects.

The subjective significance of these effects can be gauged, as necessary, by enlisting the aid of listening groups, expert and otherwise.

By such techniques the Wharfedale team have been able to establish that damaging colourations can be due to low-Q resonances in the mid-range—the kind of effect that has traditionally been overlooked or dismissed somewhat lightly when viewing ordinary pen-plotted response curves. Armed with this kind of information, the laser becomes a valuable tool in exposing how such effects might be occurring in typical cone structures.

Using techniques developed by holography expert Peter Fryer, PhD, a single laser plate, similar in appearance to those in Figs. 1 & 2, can be made to yield the equivalent of a 3D movie as the eyes are moved to view the hologram from different angles. Already the team has been able to pin-point the effects of voice coil terminations in tweeters, and a variety of other effects in sandwich cones, which can be countered once they have been positively identified.
TEN YEARS FROM NOW, WILL THE BEST ELECTRONIC ORGANS BE BUILT . . .

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AC123/R1HOLT
Cassettes and tapes from BASF

"New", in any language, seems to be the theme behind the latest tape products from BASF, marketed in Australia by Maurice Chapman & Co Pty Ltd. The release includes both cassettes and reel-to-reel tapes for the advanced enthusiast or for professional use.

For many who regard coated magnetic tape as a post-war development, it may come as something of a surprise to read in their product data that BASF supplied the first 50,000 metres of such tape to A. E. G. in 1934. The development program behind their latest LH Super tapes climaxed in 1974—the 40th anniversary of the initial shipment—with worldwide release being effected in the current year of 1975.

While it may be possible to nominate certain milestones in the 40-year history of coated magnetic tape, from the viewpoint of the user the story has really been one of gradually improving technology which has put each new generation of tape a little ahead of the last. Thus, while this year's tape is only a little better than last year's, both are a lot better than the tape available ten years ago, or twenty, or thirty, or that initial run back in 1934!

Interestingly enough, those who purchase and appreciate today's high quality audio tapes owe a lot to tape users in other fields. The demand for a tape which could store frequencies up to 6 kHz for television recording forced tape manufacturers to pursue technology and formulations aimed at securing a frequency response far beyond anything that would normally have been sought for audio work. But the know-how that is now producing top quality video tape has taken most of the hassle from cassette tape capable of retaining the full audio range (typically 15 kHz and beyond) at a scanning speed as low as 1-7/8 ips.

Similarly, computer involved customers have demanded a tape which is notable for its freedom from "drop-outs". A bubble in the coating, or a tiny fragment which flakes from the surface of an audio tape may not even be noticed, while a similar falling in a video tape may produce only a slight flick on the screen. But, in a computer situation, imperfections may drop-out vital "bits" of digitised information, leading to possibly serious errors. Once again, technology aimed at minimising drop-outs for computer customers has contributed to the ultimate quality of audio and video tapes.

As far as their new LH Super tape is concerned, BASF claim that the coating is "pure maghemite", involving iron oxide particles smaller and more evenly graded than ever before. Largely because of this, the intrinsic tape hiss is reduced by something over 2 dB relative to earlier standards. Considered alone, 2 dB is a very modest improvement but it is one more step in the right direction.

BASF also claim an improvement in their coating techniques which has resulted in a greater density of particles in the coating, with good magnetic orientation. This has made possible a wider, flatter frequency response and a 3 dB increase in the maximum recording level as determined, for example, by an arbitrary 5% distortion limit.

Taken together, the lower noise and higher "overload" ceiling offer a better quality recording for a given dynamic range, or improved dynamic range within previous concepts of signal/noise ratio and overload.

Special attention has been given, also, to the mechanical aspects. A "super smooth" finish, self lubrication and close tolerance components in the housing ensure a long service life, with a minimum of trouble, from the new BASF LH Super cassettes. They are available as C-60, C-90 and C-120, styled in black inside a black flip box.

As an aid to storage, BASF are also offering "Modul-Lock" units, a moulded stand accommodating four cassettes. They can be used free-standing on a table or shelf or can be interlocked to form integrated storage units—either free standing or attached to a wall.

The new range of LH Super reel tapes takes advantage of the improved magnetic formulation and technology and shows a proportional improvement in performance characteristics, relative to previously published figures.

Two figures are particularly stressed by the makers:

- The cohesive force is equal to 320 Oersteds—the magnetic force which must be applied by the erase head to ensure that the tape has been fully demagnetised and "cleaned" prior to a new recording. The figure of 320 Oersteds, according to BASF, ensures that LH Super tape will operate on all recorders without special provision or adjustment.

- The relative remanence is 80%—an indication of the high proportion of the magnetic energy applied to the tape which is retained in the coating. The result is a higher level on playback and less likely intrusion of "noise" arising in the playback amplifier.

The new open reel tape is being marketed in two forms. The long play type is designated as LP35LHS and comes on a 13 cm spool accommodating 270 metres, or an 18 cm spool accommodating 540 metres. Because of its thicker base, this tape is recommended for hard wear or for machines which may impose higher than average tensions upon it.

Where this is not a problem, the very flexible double-play tape DP26LHS is recommended, offering as it does an increase to 360 metres and 730 metres on the same spool sizes.

Further information on the new BASF LH Super tapes may be obtained from Maurice Chapman & Co Pty Ltd, 276 Castlereagh Street, Sydney 000.
The case for cassettes...

Who better than Sony to develop a cassette deck that genuinely rivals open reel in performance. After all, Sony made its name by leading the way in open reel technology. That same brilliant Sony engineering now brings you the TC-177SD, a superb instrument for cassette fans.

Consider: Wow and flutter less than 0.07%; Frequency response 20Hz to 20kHz; Signal to noise of 55dB (and even better with Dolby on). All that and cassette convenience!

Sony did it by combining its proven closed-loop dual capstan drive with a number of remarkable new cassette deck developments. First, the TC-177SD has three heads for separate erase, record and replay. This ingenious design avoids the compromise between record/playback head design and permits A/B monitoring of sources and just recorded signals for instant checking.

Second, the TC-177SD is unique in providing Bias/Equalisation switching so that Sony's fantastic new Ferri-Chrome and the normal chrome dioxide tapes can be "tuned" for ideal balance in recording. Naturally Dolby noise reduction is inbuilt. But with a typically Sony difference: four Dolby circuits provide such super features as Dolby monitoring, there's a Dolby oscillator for optimising the particular tape in use, and for Dolby-encoded broadcast FM.

Functions, too, are up to the highest reel standard: feather touch control buttons; FM multiplex filter; full mixing for microphone and line inputs; peak level indicators are LED to complement the Limiter and 2 large VU meters; a memory counter for auto location of desired part, and there's an auto shut-off.

Everything you've wanted for easy, professional quality cassette recording is now together in the fabulous Sony TC-177SD.

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Sony TC-177SD
puts 3 heads together

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GAC.S.7558
Quad FM3 Tuner

Quad is the brand name of the Acoustical Manufacturing Company Limited of England, which has long had a high reputation in the high fidelity field. Here we review the latest model with the Quad name, the FM3 tuner which has complete stereo multiplex facilities in a simple unadorned case.

Compared to the majority of high fidelity equipment sold these days, the Quad FM3 tuner must seem to have quite a Spartan appearance indeed. In this aspect it matches the styling of the Quad 33 stereo control unit.

Colour of the front panel is a hard-to-describe earthy tone, which is offset by an orange stripe at the top and bottom of the dial scale. The dial scale is screen-printed in white. A single large knob adorns the front panel and as you might have guessed it is used for tuning. Pressing the knob and turning also allows the five station markers to be set to any point on the dial.

In keeping with the restrained styling, dimensions are also modest at 260 x 92 x 165 mm (W x H x D) including knobs and rubber feet. Mass is 2.7kg.

Tuning meters are not provided. Instead, two indicator lights on the left hand end of the dial provide accurate indication that the FM 3 is correctly tuned to the centre of an FM station. A similar light at the right-hand end of the dial is the stereo indicator.

While the heavy diecast front panel is spartan in appearance, the plastic dress panel on the rear of the FM3 seems almost "busy" by comparison. It is clearly labelled, as can be seen in the photo.

A small knob is provided to vary the muting threshold between RF signal inputs of zero and 250 microvolts. This is a useful feature which is not found on many tuners. When set correctly it enables a minimum of interstation tuning noise to be produced while still enabling reception of all desired stations. Admittedly it is not important at the moment in Australia.

As can be seen from the photograph of the interior, two large PC boards accommodate the circuitry. They are neatly laid out and all components are labelled clearly. One board accommodates the decoder and power supply while the other contains the RF section and detector.

While the circuit is relatively straightforward there are a number of interesting features. The RF section is fairly conventional. It has 75 ohm coaxial input or 300 ohm balanced input. Two dual-gate MOSFETS are employed, one in the RF stage and one in the mixer. The local oscillator is an NPN transistor operating in common-collector mode and the oscillator signal is injected into the second gate of the mixer MOSFET.

There is no AFC (automatic frequency control). Apparently Quad are of the opinion that it is not necessary and this is perhaps arguable. The stability of modern solid-state FM front ends is such that the extra circuitry required is really not essential, even though there are not many components involved. There is also a disadvantage with AFC in that it should ideally be switched off when tuning into a station and then switched in, which is more complicated than merely twisting the knob.

If output (at 10.7MHz) from the mixer stage is fed via an IF transformer to a multi-element ceramic filter and thence to the IF amplifier, limiter and detector integrated circuit (RCA CA 3089 or equivalent).

A DC voltage from the detector is used to drive the tuning indicator circuitry, which consists of seven transistors. Basically the tuning indicator is a differential amplifier. Balanced output from the differential amplifier drives two Darlington emitter-followers which feed miniature incandescent lamps. When tuning is correct both lamps have the same brilliance.

Part of the alignment procedure of the FM3 is involved with setting the tuning indicator circuitry so that the two lamps have equal brilliance. While the system works very well in practice and is equally effective as a centre-reading meter, we wonder why LED indicators were not used in place of the lamps. Besides being potentially more reliable, they could be more attractive. More on that point later.

When the tuner is not receiving a signal (eg, when tuning between stations) there is a lot of high frequency noise at the output of the detector. This is amplified and detected and used as a control signal to mute the input signal to the decoder and to extinguish the tuning indicator lamps.

The multiplex decoder uses the well-known Motorola MC1310P integrated circuit in a normal configuration, albeit with a few refinements. Instead of disabling the internal VCO to obtain a mono signal from the decoder, the audio output from the detector is fed to an emitter-follower and thence to a separate pin of the output DIN socket. This can then be connected to a separate input on the main amplifier. Thus "direct mono" operation can be obtained, for higher quality in noisy signal conditions.

Left and right outputs from the decoder IC are passed through active filters with an ultimate slope of 24dB/octave to...
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Base loaded antenna with attractive grey jacket and chrome fittings. Stainless steel whip with adapter that provides for 1/4" line tuning adjustment. A stainless steel input protects against shock. Antenna easily slips into "Quick Grip" mount. Soldersless lead connection at antenna PL 259 at set end of coaxial cable. Only 46" high. Frequency 27 MHz. VSWR less than 1.5:1 Impedance 50 ohms. Weight - 1.7 lbs

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27MC TRUNK MOUNT WHIP
Solid fiberglass whip extremely tough. Centre loading wound on whip -- covered with black abrasion-resistant Thermolit tubing. Flat VSWR across the band excellent performance. Includes trunk lid mount. Cable & PL 259 plug removed in seconds. Frequency 27 MHz. Only 48 5/8" high. Weight - 1.0 lb. VSWR Less than 1.5:1

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27MC GPV BASE LOADED VERTICAL GROUND PLANE ANTENNA
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$69.95

VSWR Charts

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>27MC GPV</th>
<th>27MC 36</th>
</tr>
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<tbody>
<tr>
<td>100</td>
<td>1.4</td>
<td>1.4</td>
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<tr>
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<td>1.4</td>
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<td>430</td>
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Area of Wasted Radiation

- 75°
- 60°
- 45°
- 30°
- 15°

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Frequency response in the mono mode (using the separate mono output) was 10Hz to 15kHz ± ½dB and only 0.8dB down at 20kHz. Distortion ranged from 0.06% at 7.5kHz to 0.27% at 10kHz. Surprisingly distortion in the stereo mode was very little worse with the measurements all less than 0.3% and typically around 0.25%.

Frequency response in the stereo mode was within ±½dB from 10Hz to 12kHz and 2dB down at 15kHz. These frequency response figures were taken with the abovementioned filters out of circuit. Separation between channels checked out at 42dB at 100Hz and 1kHz and 31dB at 10kHz. These are excellent figures.

We should note at this stage that the tuner referred to in these tests has serial number 18094 and not 14581 which is shown in the photographs. The latter tuner was submitted for review but testing showed that it was malfunctioning and it was replaced by the distributors.

In summary, we can state that the Quad FM3 tuner is an eminently satisfactory performer which is notable for its low distortion, wide separation and flat frequency response. It should have special appeal to those who like gimmick-free styling. It is a pity that import costs and duties make it so expensive. Recommended retail price is $331.65 including sales tax, insurance and freight to main centres.

Further information of the FM3 tuner and other equipment in the Quad range can be obtained from the Australian distributors, British Merchandising Pty Ltd, 49-51 York Street, Sydney, NSW 2000. (L.D.S.)
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and 182 Wakefield Street, Wellington, New Zealand.

EAT
Yamaha now have a comprehensive range of high fidelity equipment spanning every price range. Here we review one of their lower-priced turntables, the Yamaha YP-450. It is a two-speed, belt-driven unit supplied without cartridge.

A recent trend in turntable design has dispensed with the steel or diecast base plate and separate timber platform and substituted a thick sandwich of compressed particle board. This material is quite dense and is dimensionally stable.

Whether or not this approach is cheaper we do not know, but it must be admitted that it allows a cleaner styling to be achieved. And it is definitely an improvement on some of the quite flimsy timber or plastic platforms we have seen.

On the YP-450 the timber platform is glued up from three layers of 15mm thick particle board which have been milled or routed to provide cavities for the motor, speed change mechanism, arm terminations and other hardware. A hardboard cover closes off access to the underside and the whole assembly is suspended on four compliant rubber feet to provide acoustic isolation from bench or shelf vibrations.

Partly as a result of the baseplate-cum-plinth construction, the styling of the YP-450 does seem particularly light and clean without being in any way flimsy. Helping that impression is the clear perspex cover which, in this reviewer's opinion, is an improvement on the dark tinted covers on some other turntables. Why should a turntable cover be so dark so that you cannot see whether it has a record on it or not? And anyway a dark perspex cover only makes the inevitable accumulation of dust more noticeable.

Another attractive feature of the cover is that it has spring hinges which are friction-loaded to allow the cover to stay open in a number of positions and also prevent it from falling with a bang when it's lowered. A small point perhaps, but many turntable covers have quite unsatisfactory hinges. The cover is not removable.

Overall dimensions of the YP-450 are 440 x 153 x 389mm and mass is 9.4kg.

Clearance required behind the hinges to allow the cover to open fully is about 60mm. A connecting lead about 1.2 metres long is provided and this is fitted with RCA phono plugs. The mains cord is a figure-8 flex and our sample was fitted with the non-approved American 2-pin plug.

Two simple controls are provided for operation of the turntable. These take the form of two levers on a small panel on the right-hand side of the player. One lever selects the speed of 33 or 45 rpm. The other switches the motor as well as providing the lift and lower function for the arm. Both lifting and lowering of the arm are viscously damped. Apart from this, operation is completely manual and there is no automatic cut-out or lift-off at the end of a record.

The thick-rimmed platter has a diameter of 300mm and is driven around an inner rim by the usual flat rubber belt from a synchronous motor via a stepped pulley. The curved tubular arm is balanced longitudinally by its rotatable counter-weight, which also sets the vertical tracking force. Anti-skating is provided by a small dial at the base of the arm—we assume it is a spring mechanism.

No cartridge is supplied with the YP-450. The headshell has the standard EIA locking collar and colour-coded leads and will accept any cartridge with 12.7mm mounting centres. Slots are provided in the headshell to enable adjustment of the stylus overhang. Since the arm is to be used with a wide range of cartridges it is adjustable in height as is the lifting device. These adjustments are made by loosening off the appropriate Allen screws, and then making the setting.

Cable capacitance is less than 100pF so it is possible to use a CD-4 cartridge.

We found the adjustments for height of arm and lifting device quite fiddly, but the rest of the setting-up procedure was straightforward. Tracking force calibrations were within 5% of the mark and antiskating settings were close to optimum.

The Yamaha YP-450 is a manual turntable with simple controls. It is supplied without cartridge.

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**Electron beams speed integrated circuit manufacture**

A major advance in the fabrication of integrated circuits has been achieved at Bell Telephone Laboratories by the development of an Electron Beam Exposure System, known as EBES. By using a beam of electrons to generate the microscopic patterns from which integrated circuits are manufactured, EBES can produce integrated circuit master pattern masks faster, more reliably, with fewer defects, and at lower cost than masks made by existing photographic systems.

"Integrated circuits are becoming more complex, more densely packed with devices, and larger every year," says Eugene Gordon, Director of the Pattern Generation Technology Laboratory at Bell Laboratories Murray Hill, New Jersey. "Pattern generation is one of the important limiting factors in integrated circuit technology," says Gordon, "but EBES now makes possible the routine production of master masks of a quality that was previously possible only at great expense."

The automated, computer-controlled EBES uses an electron beam to write the intricate, microscope integrated circuit patterns. Electron beams are superior to light beams used in conventional mask-making processes. This is because electrons have a smaller equivalent wavelength than light and a much "sharper" writing beam can be generated.

EBES writes its intricate pattern on a chromium-coated glass substrate covered with a film of chemical "resist" which is sensitive to the electron beam. The unexposed portions of the resist and the underlying chromium are then etched out by chemicals, leaving a negative mask pattern of chromium on glass.

The electron beam system can write the microscopic pattern of a single integrated circuit chip over a larger pattern area than conventional optical cameras. Main advantage here is a simplification of the mask-making process for very large chips, resulting in substantial cost savings.

The EBES mask-writing operation is fully computer-controlled. Circuit design instructions are recorded on a magnetic tape and fed into the EBES computer which controls both the electron beam and the movable stage holding the mask blank. The stage, which has a positioning accuracy of a millionth of an inch, moves continuously whilst the pattern is being written. This results in a faster and more accurate exposure than if the stage stopped for each exposure, as do the sequential optical cameras presently used in the integrated circuit industry.

**New mercury arc lamp burns out on cue**

Most light bulbs burn out almost immediately after their outer glass shells are broken. But not all. High-intensity mercury vapour lamps, of the type commonly used for street lighting, sports arenas, gymnasiums, and parking areas, can burn brightly for 100 hours or more after their glass shells have been broken. In fact, it may not even be realised that the lamp is broken.

And therein lies the danger. The mercury vapour arc tube emits intense ultraviolet radiation that can be quite dangerous when the lamp's protective outer glass shell (which normally absorbs ultraviolet) is broken. Depending upon the light intensity, time of exposure and distance from the light source, serious burns to the eyes and skin can result.

In order to overcome this hazard a US firm, Duro-Test Corporation of North Bergen, New Jersey, has developed a new type of mercury vapour lamp. Designated the Safe-T-Vapor lamp, the new lamp incorporates a small tungsten filament wire in series with one of the electrodes at one end of the arc tube. If the outer glass shell is broken, the tungsten filament quickly oxidises and evaporates, breaking the circuit.

Laboratory testing has shown that the new lamps are extinguished within one minute (sometimes within 30 seconds) of a breakage. According to Duro-Test, they have been demonstrated to the US Bureau of Radiological Health (which first raised the safety issue), and are now in production.
Communications satellite for tracking, data relay

RCA Global Communications, Inc. has been awarded a $US1.8 million contract by the National Aeronautics and Space Administration (NASA) for the design of a new satellite communications system. The system, the Tracking and Data Relay Satellite System (TDRSS), will permit the space agency to use direct satellite-to-satellite communications in its daily operations.

RCA Globocom and the General Electric Company, Space Division, have signed a team agreement for the Phase I study. The company will develop a detailed operation and construction plan for the system, including technical, cost and business proposals.

A unique feature of the TDRSS program is the provision for private ownership of the system. NASA will lease services from the system owner, making monthly payments based on usage when service begins.

TDRSS will supplement and largely replace NASA's present tracking system including 18 earth stations located around the world. This ring of stations is now required to maintain communications with spacecraft as they move around the earth. The TDRSS system also will provide telecommunications support for the space shuttle program.

Echo-free chamber for jet noise studies

One of the largest echo-free chambers in the world, recently completed at NASA's Lewis Research Center in Cleveland, is expected to increase the Center's capability in researching ways of reducing the piercing noise of jet airplanes.

Called the Engine Fan and Jet Noise Facility, it is the first all-weather indoor installation at Lewis able to test noise characteristics of quiet fans for advanced aircraft engines as well as perform evaluation tests on new ways to reduce the rumble of jet nozzles.

The facility is 52 feet wide, 56 feet long and 17 feet high. All surfaces of the $US900,000 facility are treated with anechoic (echo-free) 30-inch fibreglass wedges, which absorb sound. Nearly 20,000 cubic feet of fibreglass was used in constructing the wedges. Acoustic tests have shown that the facility can absorb essentially all sound in the region of interest for aircraft engine fan models up to 20 inches in diameter. Jet nozzles up to four inches in diameter also can be tested in the chamber.

The facility uses an existing control room which has been adapted for noise research. The control room is linked directly to the Center's central computer, permitting rapid analysis of much of the data.

European Cos-B satellite will detect gamma rays

Recently launched atop a NASA rocket, the European COS-B satellite will detect and locate gamma rays in space—the most energetic and penetrating form of radiation known. The satellite was developed for the European Space Agency (ESA) by European industry, with a 25 percent share of the development program taken by the British Aircraft Corporation.

COS-B is an astronomical observatory which will enable scientists to study extra-terrestrial gamma radiation. The rays come from radioactive atoms and nuclear explosions or may be the remnants of exploding stars or quasars, pulsars and other radio and X-ray sources.

The satellite has a planned operational life of two years and will orbit every 37 hours, varying in distance from the Earth between 150,000 km and 98,000,000 km. Total weight at launch was 278 kg.

Cheap microwave leak detectors

The CSIRO National Measurement Laboratory, Sydney University, has developed several cheap microwave detectors intended for checking microwave ovens. Microwave ovens may leak dangerous amounts of radiation due to deterioration after long use or after being damaged. Such leakage, for example, could cause permanent eye injury after prolonged exposure.

In one of the detectors developed, a small lamp bulb is the major component. When connected to an aerial—two short lengths of wire—the globe glows brightly when it encounters power levels of 5 milliwatts per square centimetre, a figure generally accepted as the maximum safe level.

The globe itself differs from ordinary torch bulbs in that it uses a special low-inductance filament, achieved by winding the filament into a helix of very small radius. This allows sufficient current to flow to light the lamp at low power levels.

In a second type of leakage detector, the aerial is connected to a hot-carrier diode which causes a LED to glow whenever power leakage is detected. However, this device and the one mentioned previously, will also produce a dull glow at power levels below the maximum safe level. To avoid confusion, therefore, two additional monitors have been designed in which the light switches on abruptly whenever the safe level of radiation is exceeded.

All these detectors are very cheap to build, the components costing between 60 cents and 2 dollars. They are intended for both domestic and commercial oven users and should answer the needs of technicians who install and service microwave ovens but cannot afford existing radiation monitors costing over $1,000.

Dr Lothar Rohde visits Aust.

Dr Lothar Rohde recently visited Australia at the invitation of the Institute of Radio & Electronics Engineers and Kemtron Operations. Dr Rohde, who is co-founder of Rohde & Schwarz (a large West German electronics company), delivered a paper at the IREE Convention entitled "Planning an FM Network in Europe."

Regarded as the "father" of the FM network in West Germany, Dr Rohde was also responsible for planning the FM service in South Africa. While in Australia, he met senior personnel in the broadcasting industry and held talks with his Australian distributor, Jacoby Mitchell Ltd.

Dr Rohde last visited Australia in 1974 as an expert witness at the McLean Inquiry into FM broadcasting. Observers say that it was his submissions that drove the final nail into the UHF coffin, paving the way for an FM broadcasting service on VHF.

Dr Lothar Rohde

Dr Lothar Rohde

ELECTRONICS Australia, November, 1975
For less money, you can now design 2mW per gate digital systems that operate at twice the speed possible using standard TTL.

With Fairchild 9LS low power Schottky TTL circuits, logic designers can now create 2mW-per-gate digital systems that operate at twice the speed possible using standard speed TTL devices. System design is simplified because of low power requirements, reduced heating and low noise operation. This new TTL family operates at gate delays of only 5 ns typical, 10 ns worst case, which is twice the speed of standard 54/74 or 54LS/74LS low power Schottky TTL devices.

The speed/power performance allows the 9LS circuits to replace standard TTL, high speed TTL, low power Schottky (including 54LS/74LS) and some standard Schottky TTL parts with a power savings of 500 to 1000%.

The economies of 9LS do not end with component cost. Figures 1 & 2 illustrate the greater ac stability of 9LS with temperature and loading.

- **High Performance** — the best speed this side of standard Schottky. It's faster than H series at 1/10 the power.
- **Good Temperature performance** — The ac characteristics of our 9LS/54LS are extremely stable with temperature.
- **High Capacitance Drive Capability** — Actually superior to standard power TTL.
- **Compatibility** — 9LS/54LS is directly compatible with all TTL families and modern CMOS families such as 34000, CD4000B and 74C. Fairchild 9LS meets all 54LS/74LS for second sourcing.

**Figure 1**

**Figure 2**

This translates into easier design and fewer problems in the field. The fanout of LS is 20 into other LS circuits, which means fewer added components for buffers. Schottky gates, used as clock or bus drivers have fanouts of 50 into LS resulting in component savings as well as fewer clock skew problems. LS is fully compatible with Fairchild 34000, RCA 4000B or National 74C CMOS. It can go to all CMOS without external components. Interface with other MOS devices are also simplified; MOS typically exhibits a fanout of four LS loads.

- **Low Power** — Next to CMOS the lowest of any modern logic family. In fact, it's lower than CMOS at frequencies of 2 MHz and above.
- **Low cost** — Apart from saving on components, Fairchild 9LS in most instances costs less than standard TTL.
World's largest hydro-electric generator

Workmen look on as the 1,800 ton rotor for the world's largest hydro-electric generator is lowered onto the 8ft diameter shaft that will connect it to the hydro-turbine. A specially designed crane was required to move the 60ft diameter rotor from its assembly area nearly 1/4 mile away. Scheduled for operation last August, the generator is the first of three 600,000kW units to be built by Westinghouse Electric Corporation in East Pittsburgh for a Bureau of Reclamation power plant at Grand Coulee Dam, Washington state.

Australia's first general purpose mini

The first free-standing, commercially available general purpose minicomputer to be designed and manufactured in Australia has recently been announced by Computer Manufacturers (Australia) Pty Ltd of Sydney. According to CM(A)... "Australia can no longer afford to be completely dependent on overseas technological sources for all the necessary elements of data communication and information processing systems."

Designated the CM-202, the Australian mini is said to compare favourably on a price/performance basis with major imported alternatives. Technically, it is claimed to satisfy Australian Government requirements (as expressed in current Australian Government tender specifications for minicomputers for the period 1975 to 1980) in terms of storage capacity and expandability, processing speed, and the ability to operate with all accepted forms of input and output devices.

In hardware terms, the CM-202 is a general purpose 16-bit digital computer with memory expandable in 16k word increments to a maximum of 64k words. Standard processor features include double precision arithmetic, hardware multiply/divide, memory and DMA channel polarity, direct memory access channels, and a vectored priority interrupt system. The basic chassis contains the central processing unit (CPU) together with up to 32k words of memory, three integral peripheral controllers and three spare I/O slots.

A full range of peripheral and control equipment is available with the CM-202. These include fixed and moving disc heads, tape units (including cassette), communications line controllers, VDUs, printers, paper tape equipment, console teletypewriters and analog to digital converters.

Another video disc system... this one from Hitachi

With one video disc system already on the market in Europe, and the two principal contenders in the video disc stakes, Philips/MCA and RCA, ready to do battle in the US, the Japanese company Hitachi has suddenly got into the act with a system of its own. The new system, developed at Hitachi's Central Research Laboratory in Tokyo, uses an optical holographic approach and is said to provide 30 minutes of colour television from a 30cm disc.

The disc contains 54,000 holograms, each storing luminance, chrominance and sound information superimposed in an area that's only 1mm in diameter. This storage density is so high, that the speed of revolution required is only 6rpm. The two other optical video disc systems, one developed by Philips and MCA DicoVision and the other by Zenith Radio Corporation and Thomson CSF, use 1,800 revolutions per minute. Same goes for the RCA system, which uses capacitive pickup.

Hitachi has yet to announce whether it will market the system. However, at first sight it appears to be a promising new contender because of the low speed revolution required. This could greatly reduce the cost and complexity (if not eliminate) the expensive servo systems used in previous video players. The light source used is presumably a low-power laser.

Wentworth Hotel installs cable TV system

Receiving a good colour TV signal amongst the high rise buildings of central Sydney poses many problems. In the case of an international standard hotel, where guests expect the best, a good reception is especially important.

The Wentworth Hotel, faced with reflective problems from certain nearby office blocks, last year commissioned AWA Rediffusion Pty Ltd to carry out a survey on colour TV reception problems.

As a result, the hotel has recently installed AWA 18" colour TV sets in every one of its 400 plus rooms as well as its own cable TV system fed from a series of specially installed highly directional TV aerials on the hotel roof. The system pipes colour TV to every guest suite and can be readily adapted to supply an additional closed circuit channel for entertainment or conference requirements.

The sets and the system were supplied and installed by AWA Rediffusion Pty Ltd—a specialist cable TV joint venture company formed by two of Australia's and Europe's largest communications companies, Amalgamated Wireless (Australasia) Limited and Rediffusion Limited.
India’s schoolroom in the sky . . .

Educational TV via India’s long-awaited Satellite Instructional Television Experiment got underway last August, with programs beamed up to a NASA satellite and relayed back direct to some 2,400 villages. Though much of the programming is educational, India is the first country to distribute TV to its backward hinterland before providing a service for many of its big cities. What the social impact will be is, at this stage, unpredictable.

by BRENDA MADDOX

The need for anticipating the social impact of new methods of communicating has never been so great—and neither has the temptation to label any kind of communications project an “experiment.” Last week, India began its long-awaited Satellite Instructional Television Experiment (SITE). Its objectives are pretty diffuse: “to gain experience in managing a satellite-based educational television system in rural areas; to stimulate national development; and to demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries.” There is also the more specific goal of trying to teach—via satellite—birth control, agriculture, education and nutrition, as well as to train teachers.

For one year the Indian Space Research Organisation (ISRO) will use the National Aeronautics and Space Administration’s ATS-6 satellite to beam television direct into 2,400 isolated villages. About an equal number of villages will receive the television programs by conventional relay from satellite receiving stations in Ahmedabad, Delhi and Amritsar.

The ATS-6 is claimed to be the world’s largest communications satellite. Launched last year, it has a 30ft parabolic antenna and 470 watts of power. NASA is making no charge for lending the satellite, which itself cost $US200 million, but the entire cost of the project on the ground—from equipping the villages for direct reception to making the instructional programs—is being borne by India. It is estimated at about £6 million.

The excitement which SITE, even in gestation, has stirred up internationally concerns the direct reception from the satellite. Each participating village has received a 10ft antenna made of chicken mesh, and a 24 inch solid state television set which has been “augmented” by a front-end converter. The antenna is connected to the set by a 50ft cable.

For villages where there is no electricity the equipment also includes a set of two 12-volt heavy duty batteries. Most of the villages in SITE have been given a simple form of electrification, usually a line run from the agricultural electricity supply in the fields outside the village, in order to power the set.

With no more than this hardware, costing in all perhaps £350, the village can tune into the satellite, even though it may have been untouched by any other form of modern technology, except the transistor radio and the jeep which brought the SITE installation team.

The villages chosen for SITE lie in six clusters in the states of Radjasthan, Bihar, Orissa, Madhya Pradesh, Andhra Pradesh and Karnataka. Each cluster has a headquarters which has the responsibility for keeping all the sets in running order. There are four jeeps assigned to each cluster, each jeep providing service for 100 villages.

In each village a custodian has been hired to attend to the television set, to switch it on and off, and to count the size...
of the audience at each viewing session. If the set breaks down, he checks the faults illustrated on a postcard (no sound, no picture, neither sound nor picture, or a conspicuous electrical power failure) and posts it to the cluster headquarters. (Thus the successful performance of the world's largest communications satellite depends on the efficiency of the Indian postal service.)

Every day in the early evening, each village will get a television program in its own language made up of local news, entertainment and instruction. All-India Radio, which has prepared the program material, has tried to use only indigenous ingredients: folk music, local storytellers and ballad singers for the entertainment, farmers and housewives with their ordinary appliances and tools for the instruction. The lessons are simple and informal—how to prevent rickets in babies by feeding them solid food, how to measure with the knuckles how far apart the rice plants should go, how to make a little superphosphate go a long way.

After its local program, the village will get a half hour program from Delhi. It will carry national news and be in standard Hindi. Then the villages will be able to watch the programs directed at villages in another cluster, whose language they may be able to understand. In the mornings, there will be special programs for children in schools.

Professor E. V. Chitnis, manager of SITE, calmly anticipates the obvious question from critics. "Many people ask us whether it would be better to provide tube wells and drinking water instead of TV sets," he says. "However, what one is attempting to do through SITE is not to give TV sets to villages, but to make people self-reliant and to get them new information which will enable them to do something worthwhile for themselves—to learn to work together and acquire new skills, including those required for digging wells."

One of the fascinations of SITE is that India has so little television of any sort. There has been a television service, by All-India Radio, in Delhi for about 12 years, and two years ago it was extended to Bombay. The service has also been made available in the northern cities of Srinagar and Amritsar, where people were buying television sets in order to watch television "wafting" in from Pakistan. But Calcutta and Madras are still without a television service. What SITE is doing is to bring television to about 2.5 million people in the hinterland before the major metropolitan populations enjoy it, or before a full urban television service has been developed. India is probably the first country in the world to be able to introduce television in this way.

For its part, NASA is keeping a very low profile in Ahmedabad where SITE's headquarters are. Yet the relationship between the two space agencies is close and friendly. NASA's people tell with astonishment about watching Indian engineers from Project SITE set up an antenna when they went on a training visit to Goddard Space Center in the United States. They acted as if they were in India, a NASA man said. They dug a hole in the ground, got the Sun angle, the time of day, a fix on true north—and set up the antenna. "It was pointed exactly at the satellite," the NASA man said admiringly. "We couldn't improve on the position at all." NASA could never operate like that. "We'd have to dig a three foot trench and line it with concrete first," said the US official.

The very existence of Project SITE is evidence of the close relationship between NASA and the late Dr Vikram Sarabhai, who was head of the Indian Atomic Energy Agency in the 1960s (which then included space activities). NASA recognised that its then projected ATS-6 satellite would have a broadcast capability and Sarabhai recognised that India, with its million scattered villages could well utilise satellite broadcasting as a means of ending village isolation.

The decision to go ahead with Project SITE was made formal in a memorandum of understanding between the United States and India in 1969. SITE was to have begun in 1973, but the launching of the ATS-6 was delayed because of budgetary troubles on NASA's side. The Indians were grateful for the delay because organising the project, getting the hardware, recruiting the staff and cutting through the bureaucratic tangle at local, state and national levels of government was a formidable job—quite apart from the difficulties of preparing something to be shown on the television screens.

Then, in late 1971, Sarabhai suddenly died. His place as head of the Indian Space Application Centre at Ahmedabad (the home city of the distinguished Sarabhai family) was taken by Professor Yash Pal, a theoretical physicist from the Tat Institute in Bombay. According to NASA officials, Pal is extremely impressive, and it is reckoned to have been his leadership that enabled SITE—against many bets—to begin on time.
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Educational TV

Though SITE's overall objectives may turn out to be unassessable, the project has nevertheless been organised so that some measurements on the impact of television on village life can be made. There is, for instance, a social science team, including nine anthropologists, and teams of researchers who will either live in or visit the villages participating in the project. They have already conducted censuses in the villages to find out what the beliefs and practices on matters such as family planning and agriculture were, and also to ask the villagers what they thought they needed in the way of help.

The social scientists have posed some interesting questions for themselves. These include the primary one that everyone will want to know when the year is up: did television actually teach? Other questions to be answered include: how has television changed the channels of communication in the village; do small social groups of, say, teenagers or old men still meet in the same way; have their times of meeting altered to accommodate the evening television viewing? Individual research scientists will also conduct in-depth studies on the changes wrought by television on village leadership patterns. Will the custodians of the TV sets become leaders? Is the change in social behaviour (if any) that follows the introduction of television a function of social class?

One charge that can be levelled against SITE is that its research is result-oriented. They are looking for something called "change" and will probably find it. But what brought change about? It is possible that the villagers may learn to be less fatalistic about their environment perhaps not as a result of what they see on the television screen, but from watching a repairman mend the set. Another change is that the school broadcasts will be aimed at too wide an age span (five to eight year olds, nine to eleven year olds) and that there will be too many children in the room (150 is not impossible) for the television to be heard.

It is a great pity that SITE, so long in preparation, should follow close on the heels of the imposition of press censorship in India. For years critics of satellite broadcasting direct to rural populations have argued that it would merely put an instrument of control in the hands of a government trying for a single-party state. Their arguments now have some justification. The daily half hour news from Delhi will, in the light of recent events, be even more skilled than it would otherwise have been.

Those connected with SITE tend to feel that it has succeeded already, simply by becoming a reality. To have managed to get the hardware into 2,400 villages in time for the arrival of the satellite (now stationed at longitude 35° E) before the monsoon rains was no small feat. What mistakes have been made in programming can be corrected in years to come, for the villages chosen for SITE are also reachable by terrestrial microwave.

In any event, like Brazil and Indonesia, India is committed to going to a full national satellite system. In India there is no question of building a full internal microwave network: satellites are going to be used, and what the Indians themselves are asking for from SITE is not so much experimental results but simply experience.

‘Brenda Maddox is a freelance journalist and author. This article first appeared in ‘New Scientist,’ and is reprinted by arrangement.

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Electronics is often represented as an austere discipline, concerned only with profit making and remote from the problems of the individual. However, there is probably no other technology that will do more for the physically handicapped in the immediate future than electronics. Electronics is very much concerned with the "people business," as this story shows.

Life for the blind may be considerably improved in the future, thanks to developing electronic technology. In recent years a number of important new inventions have made an appearance, and these range from ultrasonic and microwave guidance devices to machines that facilitate the handling and manipulation of data.

In France, an ingenious new machine has been developed and was presented for the first time at the International Congress for the 150th Anniversary of the Invention of the Braille System, held at UNESCO headquarters in Paris last May.

The Digicassette, as the machine is known, will make it a lot easier for the blind to read and write, and to perform complex calculations. Interestingly enough, it was developed by a team of blind inventors working for the Valentin Hauy Association in Paris. Mr Schneider-Manoury, one of the inventors and Secretary-General of the Association, demonstrated how the machine works.

In appearance, the Digicassette looks like a small cassette recorder and, indeed, retains the essential functions of a tape recorder. Data is entered into the machine by means of a keyboard equipped with ten keys, and recorded on magnetic tape. A Braille readout panel consisting of some twelve characters is used to display data, either as it is written or read off the tape.

In fact the Braille readout panel is the key to the whole system, although technical details to hand on its workings are quite sketchy. However, it would appear that as data is read off the magnetic tape it is fed to suitable encoding circuitry. This, in turn, drives a number of solenoids which raise pins in Braille formation on the data panel. A technique similar to this was developed at the Electronics Division of the School of Mathematics and Earth Sciences, Macquarie University, for adapting electronic calculators to Braille readout.

The main advantage of the Digicassette system is its versatility, and the ease with which data may be entered, updated, and re-called. The cassettes used to store the data are the same as those used in conventional audio cassette recorders, and can store up to 150,000 Braille characters. Space requirements are thus drastically reduced and ease of handling considerably improved with this format, as compared to the conventional Braille texts.

In addition to its reading and writing capabilities, the Digicassette can be interfaced with an electronic calculator. Set up in this manner, data readout from the calculator can be reproduced in Braille. This is obviously an important extension of the machine's capabilities, and places the computing power of the modern electronic calculator within reach of the blind.

One area where the Digicassette format will obviously be of tremendous value is in providing new employment opportunities for the blind, and in teaching applications. The machine will increase the level of self-reliance and independence enjoyed by blind people and, as such, has considerable social merit. Current plans call for the Digicassette to be mass produced in the near future.
Computer system monitors racing car performance

Winning races like the Indianapolis 500 in the future will require a combination of several important factors: a skilled professional driver, a good pit crew, a carefully prepared racing car and—by the way things are shaping up—a computer! Team McLaren, one of the world’s most successful automobile racing teams, are already using a computer for pre-race tuning and in-race performance monitoring of their cars.

The modern racing car has changed dramatically in recent years. Engines have changed, suspensions have changed, and the aerodynamic shape has changed. But one thing remains the same—the meticulous pre-race preparation that must be carried out on a car in order to ensure the reliability that wins races.

In the fiercely competitive world of motor racing, therefore, any one factor that will help improve reliability and perhaps provide some sort of “edge” is welcome.

In the case of Team McLaren, this “edge” is a small computer tucked in a corner of the pit area. The computer, a Nova 2 made by Data General Corporation of Southboro, Massachusetts, USA, is used for real-time performance monitoring of the Gatorade-McLaren USAC racing car.

Performance monitoring is achieved by the use of sensors in the car’s engine while other sensors are used to monitor vehicle handling characteristics. A small telemetry transmitter in the car receives data from the sensors in the form of electrical impulses, multiplexes the data into a common communications channel, and transmits it to a receiver in the pit area. The data is then fed into the computer for processing.

“The car has 14 of its functions monitored”, said Mr Tyler Alexander, Team McLaren’s Director of Engineering.

“The computer monitors the ride height of each of the four wheels, the forward and sideward acceleration, the oil and water temperature, oil and water pressure, air inlet temperature, engine RPM, turbocharger airflow, and fuel flow,” Mr Alexander said. Some of these measurements are used for pre-race preparations, while others are used for real-time performance monitoring during the race.

Readings such as wheel riding height and forward and lateral acceleration are of primary importance during pre-race tuning. During practice runs the driver’s reactions, together with the data provided, can be used to make suspension and airfoil adjustments to provide a car whose handling meets the requirements...
of the driver and the track.

Of particular importance is the fact that the computerised system can keep track of fuel consumption as the race progresses. This is obviously a vital factor in overall race strategy and, according to Mr Alexander, "there previously was no way to measure the amount of fuel in the car."

This is because the fuel cells in racing cars contain a sponge-like safety material that prevents the fuel content from being monitored. During a race, therefore, it was previously possible only to estimate the amount of fuel left at any given stage. These estimates were made on the basis of previous performance.

To overcome this problem a small, propeller-like flowmeter inserted in the fuel line now monitors the amount of fuel that goes into the engine. Flowmeter revolutions are monitored by a sensor and the information relayed to the computer which calculates the fuel consumption. "This will avoid calling a car in for an unnecessary refuelling, or prevent a car from running out of fuel because its consumption was higher than estimated," Mr Alexander said.

As mentioned above, several readings will be useful mainly for real-time performance monitoring during a race. For example, although acceleration figures are primarily used for pre-race tuning, an increase in lateral acceleration during the race could mean that the tyres are not adhering to the track as well as they should. Race strategy would then dictate that the tyres be changed during the next pit stop.

"Oil temperature is another measurement that can play a role in determining race strategy," Mr Alexander said. "If we see the oil temperature rising it could mean increased friction in the engine, which is an indication that a part is failing. Depending on the degree of increase, the position of the car, and how far along the race is, we can tell the driver to continue at full speed, slow down enough to maintain his position, or call him into the pits before the engine is damaged."

The computer also counts the number of laps the car has made by counting the number of signal peaks as the car goes by. In addition, the lap time is calculated by counting the interval between signal peaks.

Information calculated by the computer can be displayed either on a video display unit, or can be printed out at a teletype terminal to provide a permanent record. The information displayed on the VDU can never be more than one second old.

In addition to supplying the computer, video display unit, and the teletype writer, Data General Corporation wrote the programs that transform the telemetry data into standard units of measurements, and which make all necessary calculations. The 14-channel data acquisition and telemetry system was supplied by EMR-Telemetry, Florida, USA.

The Australian Consumers' Association has tested 13 FM tuners priced under $200. The full findings are published in a comprehensive report in the November issue of CHOICE magazine.

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Protect your loudspeakers against damage with a

Loudspeaker Protector

Ever had the misfortune to "blow" an output transistor in an amplifier without coupling capacitors? Blow your loudspeakers too? You can guard against this possibility by building the Protector circuit described here. It also eliminates switch-on "thumps" from the loudspeakers.

by LEO SIMPSON

Many hi-fi fans do not realise that amplifiers with direct-coupled outlets to the loudspeakers can pose a real hazard to the loudspeakers! By direct-coupling, we are referring to those amplifiers without output-coupling capacitors. Japanese manufacturers refer to them as OCL or "output capacitor-less".

There are several advantages in having an amplifier with direct-coupling to the loudspeakers. It results in better damping factor and improved power output at low frequencies. To the designer it enables elimination of at least one large electrolytic capacitor, with a consequent cost saving. And it also eliminates one possible cause of switch-on transients.

But all these advantages add up to zero if a failure occurs in the power amplifier and applies a large DC voltage across the loudspeakers. It may look ugly, but it can save money! solid-state amplifiers is that they can cause the loudspeakers to thump a short time after being switched off. The Loudspeaker Protector will also eliminate most of this problem, particularly where the thump occurs several seconds after switch-off.

Some amplifiers also occasionally give a sharp "crack" from the loudspeakers at the instant of switch-off. However, that is a problem which cannot be cured by this simple circuit.

Refer now to the circuit. It is simpler than it appears at first sight. Basically it consists of a relay which normally connects the loudspeakers to the amplifier a few seconds after switch-on. If a DC voltage is subsequently applied across the loudspeakers, the relay disconnects them.

Five general purpose transistors are used in the circuit. Tr5 drives the relay direct. A diode in the collector circuit protects Tr5 against the inductive kick-back from the relay when it is de-energised. Tr4 controls Tr5 via the 10k resistor. When Tr4 conducts, so does Tr5.

Base bias for Tr4 is provided by a network consisting of two 56k resistors, one 270k resistor and the 100uF capacitor. At initial switch-on the 100uF capacitor has zero charge and so no forward bias is set you back by more than one hundred or more dollars.

Another problem which is common to many solid-state amplifiers is that of switch-on transients. This is more likely to occur in amplifiers with output coupling capacitors—when the output capacitors charge up there can be a loud thump emitted from the loudspeakers. Usually the large DC charging pulse is not likely to damage the loudspeakers, but its audible effect can be annoying.

Both of these problems can be eliminated with the Loudspeaker Protector featured here. Indeed, similar circuits are now featured in many expensive high-power amplifiers.

Another problem common to many

Five transistors, a relay and a few other components make up this circuit which can be built into an amplifier or as a separate unit.
incestuous triple which monitors the amplifier outputs for DC fault conditions. They function as follows:

Both channels of the amplifier in question are monitored by Tr1, 2, 3 via a low-pass filter consisting of four 22k resistors and two 50uF capacitors. In a typical amplifier with direct-coupled output there is a normal "offset" DC voltage at the output which may be anywhere from about 20 millivolts to perhaps 200 to 300 millivolts. These normal offsets must not affect the monitoring network.

**PARTS LIST**

1 case and lid
1 PC board, 102 x 51 mm, code 75L11
1 PC board bracket (see text)
1 flush-mounting mains socket
1 power transformer, 12.6V secondary
1 SPST toggle switch
2 four-terminal connector strips
3 BC547 NPN silicon transistors
3 BC557 PNP silicon transistors
2 EM401 silicon power diodes
1 Varley E3202 relay, 12V double-changeover contacts
1 470uF/25VW PC electrolytic capacitor
1 100uF/25VW PC electrolytic capacitor
2 50uF/50VW PC non-polarised capacitors

**RESISTORS**

(% or ±2% or 10% tolerance)
1 x 270k, 2 x 56k, 4 x 22k, 1 x 10k, 2 x 220 ohms, 1 x 120 ohms.

**MISCELLANEOUS**

7 PC stakes, length of three core flex, solder lug, grommet, rubber feet, screws, nuts, lockwashers, hook-up wire, solder.

**NOTE:** Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may be used provided they are physically compatible. Lower rated components may also be used in some cases provided their ratings are not exceeded. See notes on components in the text.

If one of the amplifier outputs goes positive by more than two volts, Tr3 is forward biased and it conducts to remove the base bias from Tr4. Hence Tr4 and Tr5 turn off and the relay disconnects the loudspeakers. Similarly, if the amplifier output goes negative by more than two volts, the emitter of Tr1 is pulled negative with respect to its base. Tr1 then conducts as does Tr2, and so Tr4 and Tr5 are turned off as before.

So all the transistors function as simple switches which are only controlled by DC signals. AC signals have no effect due to the input filter.

The two 50uF capacitors in the input filter are non-polarised electrolytics. They have to be, since DC voltages of either polarity may be applied to them. The capacitors we used are made by Elna and are referred to by the manufacturer as being "bipolar"—a term normally applied to conventional transistors. We prefer the term "non-polarised".

The 220 ohm resistors on the circuit are marked with asterisks. These should be included where the Protector is used to eliminate switch-on thumps from amplifiers with output coupling capacitors. The resistors allow the output...
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LOUDSPEAKER PROTECTOR

capacitors to charge in the delay period before the loudspeakers are connected. If the resistors were omitted there would be an awful bang from the loudspeakers when the relay is energised.

While the 220 ohm resistors are essential where the Protector is to be used with amplifiers having output capacitors, they should be omitted where used with amplifiers having direct-coupled outputs. If they are included there is a strong likelihood that they will be burnt out in the event of an amplifier fault.

As it stands, the Protector circuit can be built in a number of forms. First, it can be built into the amplifier it is to work with, and powered from it. The supply rail may be anywhere in the range from 12 to 45V DC. The only change necessary to adapt to differing supply rails is that the 120 ohm resistor should be varied so that no more than 12V is applied to the relay. Coil resistance of the relay specified is 205 ohms.

Current drain of the circuit with the relay energised is close to 60 milliamps. If it is run from the main positive DC rail in the amplifier the diode and 470µF filter capacitor may be omitted. Note that the zero volt rail (ie, earth) of the Protector should connect to the main earth point of the amplifier.

It it is inconvenient to power the Protector from the main positive DC rail of the amplifier it is possible to run it from an AC winding on the power transformer provided that one side of the winding is, or can be connected to the main earth of the amplifier. AC input voltage to the rectifier of the Protector may be in the range of 9 to 30VAC. If the resultant DC voltage is more than 25V, the voltage rating of the 470µF filter capacitor should be increased accordingly.

Where the constructor does not wish to incorporate the Protector into an existing amplifier it will be necessary to construct it as a separate unit with its own small transformer to provide the DC supply. Here again it can be built in one of two versions. Note that the Protector transformer must be energised at the same time as the amplifier.

Where the amplifier in question has switched 240VAC outlets the Protector can be plugged into the rear of the case and controlled by the amplifier power switch. If the amplifier does not have a switched 240VAC outlet, the Protector will be required to have its own power switch and a 3-pin mains socket into which the amplifier can be plugged. The amplifier is then turned on and off with the Protector power switch. Our prototype is the latter version.

Our prototype was housed in a neat little case supplied by Bespoke Metalwork, 42C Sydenham Road, Brookvale, NSW. The case is denoted type MT1; comes in crackle enamel finish of blue, black or red and has a clear anodised aluminium lid. Dimensions are 136 x 60 x 104mm (W x H x D). Parts suppliers can order from Bespoke at the above address.

A flush mounting 3-pin outlet and two sets of four-way screw terminals are mounted on the rear of the case. The sets of terminals are for connection of output wires from the amplifier and wires to the loudspeakers. The front panel is bare except for the power switch.

A PC board coded 75L11 and measuring 102 x 51mm accommodates the circuitry. The relay is made by Varley, type E3202, and is soldered directly to the PC board. The non-polarised electrolytic capacitors can be soldered in either way round.

General-purpose small-signal silicon transistors can be used for this circuit. Tr1, 3 and 4 may be BC548, BC108 or any equivalent NPN type, but if the circuit is incorporated into an amplifier and has a DC rail of more than 30V then Tr4 should be BC547, 107 or equivalent. Similarly, Tr2 and Tr5 may be BC558, BC178 or equivalent PNP type, but if the supply rail is more than 30V, Tr5 should be BC557, 177 or equivalent.

Note that if the resistor in series with the relay is modified to cope with a higher voltage DC rail, its power rating should be adequate for the purpose. For a DC rail below 20V, a ½W resistor will suffice.

As it stands, the Protector is suitable for amplifiers with ratings up to about 100 watts RMS per channel. It is to be used with higher rated amplifiers a relay with higher rated contacts will have to be used. The contacts in the relay specified have a rating of 5 amps. Use PC stakes or pins to make connections to the PC board. These make it easy to make and break connections. The PC board was mounted on a vertical bracket slightly larger than the board and made of aluminium.

The power transformer is a miniature type with a 12.6V secondary. Ferguson PF 2851, A & R 6476 or DSE 2851 are suitable.

These transformers normally have a centre tap connection to the secondary. This should be coiled up and taped to prevent it shorting to the case.

The three-core mains cord should be passed through a grommeted hole in the rear of the case and anchored with a cord clamp. The earth conductor should be terminated to a solder lug on the chassis while the active and neutral wires are terminated to an insulated terminal block. Connections to the power switch, transformer and AC outlet are then made from the terminal block. On no account should any connection be made from the earth point of the amplifier.

The loudspeakers when the relay closes will occur if the Protector is switched on immediately after it is switched off.

Fault conditions at the input can be simulated with a nine-volt battery. Just connect across the inputs, either way, and the relay should open after a short delay of less than half a second. If you connect the battery to the output terminals of the Protector you can check that the relay is correctly breaking the circuit when a fault occurs. If it is, the relay will open and close repeatedly until the battery is removed.

When operation of the circuit has been checked, the unit can be connected to the amplifier and loudspeakers.

You can then sigh with relief, because your precious loudspeakers are now safe from damage if your amplifier pops an output transistor.

There is one other advantage of the Protector. It enables you to quickly kill the sound of an objectionable program, rather than letting it fade away after normal switch-off. For example, blah blah razzle dazzle and (click) ...
Fluorescent Readout
LSI Digital Alarm Clock

Here is yet another LSI digital clock. This versatile design provides for either 12 or 24 hour operation, has integral alarm and snooze facilities, and uses a bright 4-digit fluorescent readout display. If you want a digital clock with alarm facilities, this is the one to go for.

Digital clocks are certainly popular projects, judging by the success of the clock described in the April 1975 issue. Over 1500 were built in the space of 6 months, and the figure would certainly be much higher by now.

In view of this popularity, we decided to publish an alternative design of somewhat differing specifications. As with the clock described last April, the new unit is available from Dick Smith Electronics.

As can be seen from the accompanying photographs, most of the clock circuitry is accommodated on a small PC board measuring 104 x 60mm. The unit may be constructed for either 12 or 24 hour operation, and is housed in an attractive plastic case supplied as part of the kit. Overall dimensions of the completed unit are a compact 148 x 77 x 60mm (W x H x D).

The new clock differs from the one described in the April issue in a number of important ways. First, there is the advantage of the integral alarm facility which allows the alarm to be set up to 24 hours in advance. A snooze button permits an activated alarm to be turned off and reset for another 7 minutes. And by the addition of some simple circuitry, the new clock can be used as an accurate time switch. This feature is described later on in the article.

On the debit side, the new clock provides no seconds option, there being a 4-digit readout only as a result of display and chip limitations. In addition it is slightly more complicated to assemble than the April clock.

Ultimately then, the choice between the two clocks will be based on whether you want a four digit readout or six, and whether or not you require the alarm facility. Cost differences are marginal.

The clock described here is designed around a single Texas Instruments TMS3834 digital clock chip. Contained on the LSI chip is all the electronics circuitry necessary to convert the 50Hz pulse input at pin 28 into a multiplex readout for 4 digits, together with alarm setting and alarm output facilities.

Basic clock operation is as follows. First, half rectified 50Hz is applied to pin 28 of the clock chip. An internal signal shaping network squares the signal up in a signal shaping circuit, and then divides it down to 1 pulse per second (1pps). The 1pps signal is fed to a counter which cycles in BCD from 00:00 to 23:59 in the 24 hour mode, or from 01:00 to 12:59 in the 12 hour mode.

BCD output from the clock counter is decoded and multiplexed to drive the display.

In simple terms, multiplexing involves the simultaneous transmission of more than one piece of information via the same path. The path can be thought of as being time shared, if you like. In this case, we need to display up to four numbers simultaneously. Each number has up to seven segments each requiring an item of information.

In fact, when all is taken into consideration each seven segment display requires eight separate lines. Multiply this by four for a 4-digit display and we would need 32 lines. However, in the case of a clock, the most significant digit can never exceed 2 when operated in the 24 hour mode, or 1 when operated in the 12 hour mode. This reduces the number of lines required to 31 and 27 respectively.

If the clock chip were to use a conventional seven segment decoding,
therefore, it would require 31 output connections to the display, plus all the input, supply and control connections. Although not impossible, it would tend to make the package somewhat unwieldy.

Multiplex operation gets around the problem by not attempting to show all the digits continuously. Instead the digits are flashed sequentially, usually at a rate of about 1kHz. At this rapid rate, they all appear to be on continuously.

As with the previous clock, a bright fluorescent readout display is employed. However, whereas the previous clock used separate readout “bottles” for each digit, the digits here are encapsulated in a common “flat” glass envelope. Actual height of the readout numerals is 12.5mm.

Basically, the fluorescent readout display consists of a directly heated cathode, a control grid per digit, and a number of anodes—one for each segment of each digit of the display. In addition, anode segments and control grids are provided for the colon and for the AM and PM indication.

Two very fine wires running horizontally across the face of the display provide the common cathode for all digits. One side of the cathode is tied to the negative supply rail via a 2.2k resistor, and it is fed from a 3V winding on the transformer.

A fine mesh immediately in front of the anodes for each digit acts as the control grid. In this case the anodes are tied to the negative supply rail via 22k isolating resistors, and are normally held off. When driven by the segment driver output of the clock chip, the appropriate segments are brought to ground potential and are therefore positive with respect to the cathode. The display can then be made to light up by making the grid positive with respect to the cathode.

All equivalent anode segments of the various digits are bussed to seven common lines, each driven by a segment driver output of the clock chip (pins 17 to 23). The various control grids are driven by the clock chip via 1k pull-up resistors (pins 5 to 8). Thus for a 4-digit display, there are only 11 separate connections from the clock chip.

To display the various digits correctly, control signals are applied sequentially to each of the digit grids in turn. At the same time, the corresponding common segment lines for each digit are brought to ground by the segment driver output of the clock chip. The signals change appropriately as grid voltage is applied to each digit.

The alarm circuitry consists of a free running or astable multivibrator which generates an audio tone. This is coupled to a small loudspeaker via an NPN driver transistor. A fourth transistor, also in series with the loudspeaker, acts as a switch. When the time counter within the clock chip reaches the same count as the alarm counter, the alarm output (pin 10) delivers a series of 1 second pulses to the base of this transistor, turning it on and off. The loudspeaker thus delivers a pulsed tone.

Three push-buttons are provided for time setting; Hold, Hour Advance, and Minute Advance. The latter two buttons rapidly cycle the time forward. Then, by using the Hold button, you can hold the time static until the precise time required is reached. Note that when the Hold button is released, the clock will begin counting from zero seconds.

Note also that this clock eliminates illegal time displays at switch-on. When power is first applied, 0:00 is displayed. The correct time is then set using the time-setting push-buttons as outlined above.

The clock is, however, tolerant of power failures of up to five seconds (although it will discontinue counting during such interruptions). In practice, this means that the clock will continue to operate despite momentary power failures, as in the case of severe electrical storms. This is obviously a desirable feature where reliance has been placed on the alarm facility.

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LSI Digital Alarm Clock

A general view of the PC board and the internal wiring of the completed prototype. This unit has been built up in the 24 hour operational mode and modified so that the colon is displayed continuously. Full details are given in the text.

available in two versions. The first and the one most likely to be of interest to EA readers, is the kit version for $34.95. For the less confident, a fully built and tested version is available for $37.50. Postage and packing is an extra $1.00 in both cases. At these prices, we judge both alternatives to be good value for the money.

The kit itself is a cinch to put together (once you have decided on whether you want a 12 hour display with AM and PM indication, or a 24 hour display with or without flashing colon). Perhaps the most complicated aspect of assembly is the mechanical construction, particularly the self assembly push-button switches. However, the mechanical layout is clearly explained by means of detailed diagrams supplied with the kit, and there should be no problems here.

Normal good soldering practice should be followed when wiring up the small PC board, which is coded and pre-tinned for easy assembly. Begin by soldering resistors and capacitors into position, not forgetting the number of wire links that must be added, according to your choice of options. Take particular care when soldering polarised components into position, i.e., transistors and electrolytic capacitors.

Two integrated circuit connector strips (as made by Utilux and other companies) are supplied as the IC socket. The terminals should be inserted and soldered with the leader strip intact. The leader strip should then be snapped off so that each pin connector is separated from its neighbour.

Before mounting the display, it will be necessary to complete the external wiring to the function switch, the time setting switches, and the speaker. This is because the display obstructs the foil side of the board when mounted in position.

The display tube is mounted on the copper side of the PCB. Push the pins all the way in to the step and solder. The tube is then bent through ninety degrees so that it is parallel to the board. A plastic "locator mount" is fitted between the top edge of the display and the board.

Due care should be exercised when handling the TMS3834 clock chip. This is a MOS device and, as such, is susceptible to damage by static charges. Do not touch the pins of the device. Instead, hold the two ends of the device between your fingers, and push it firmly and evenly into the IC connector pins.

Be sure to orient the IC so that the notched end is as indicated on the circuit board. Because the IC can be so easily damaged, we recommend that it be left
in its protective foam package until required. It should be installed in the circuit as the final job of assembly.

As originally supplied the clock is intended to be built either in the 12 hour mode with continuous colon and AM and PM indication, or in the 24 hour mode with flashing colon. As a matter of personal preference, the author initially constructed the clock in the latter mode.

However, the flashing colon was subsequently found somewhat irritating. Worse still, the brightness of the display varied in sympathy with the flashing colon, this effect being slight but noticeable.

The solution to this problem is fortunately quite simple, and involves modifying the clock slightly so that the colon is displayed continuously. All you have to do is omit the JP-3 wire link, and insert the JP-4 link. Note that the JP-4 link simply involves tying the appropriate two pins of the display (Dco and Co) together after the display has been inserted and soldered into position.

A word of warning for those who construct the clock in the 12 hour mode. As originally conceived by the manufacturer, the TM53834 IC clock chip was intended for 24 hour operation only. Advice to hand indicates that the 12 hour mode was added to the chip almost as an afterthought, as was the AM and PM indication.

The result of all this is that the chip has an inherent design limitation when operating in the 12 hour mode. This limitation affects the AM and PM indication signs, such that these are always an hour late in changing. In other words, instead of changing at 12 noon and 12 midnight, the AM and PM signs change at 1 o’clock in the afternoon and 1 o’clock in the morning. This means that between the hours of 12 and 1, the sign shown will always be the wrong one!

What can be done about it? Absolutely nothing. Those who build the clock in the 12 hour mode will just have to be content with this feature which, at worst, can only be considered a minor annoyance. Of course if you build the clock in the 24 hour mode, the problem becomes irrelevant anyway.

As mentioned earlier, the alarm output of the clock chip can be used to turn another appliance on or off at a predetermined time. As accurate time switch is a very useful device, and can be used to control all manner of equipment eg, radios TVs, lights, garden watering equipment, tape recorders etc. The extra circuitry involved is straightforward, and is reproduced here for the benefit of interested constructors.

The circuit is one recommended by Dick Smith Electronics. It has not been built and tested in our lab, but we leave arrangements will be necessary to enable the bistable switch to be reset. This simply involves interrupting the positive supply rail to the bistable circuit. We leave the details to individual constructors.

Note also that some kind of switching arrangement will be necessary to enable the bistable switch to be reset. This simply involves interrupting the positive supply rail to the bistable circuit. We leave the details to individual constructors.

And there you have it—a further LSI digital clock project, with its own unique features. The choice is yours.
Improving sound from 9.5 & 16 mm projectors—2

Sharp-cut low pass filter

Offering very sharp roll-off at any desired turnover frequency, the simple low-pass filter described here is very suitable for improving the signal to noise ratio from old movie sound tracks. It is also suitable for tailoring bandwidth in amateur radio transmitters—for example, after clipping or peak limiting.

by JAMIESON ROWE

If you fit your projector with a silicon photodiode, provide it with the optimum load resistance and feed it through the updated preamp circuit as described in the first of these articles, you should find that the reproduction from most normal sound tracks is very good indeed. But there is still the problem of very poor sound tracks, some of which need much more than “normal” treatment if the reproduction is to be made acceptable.

I soon discovered this myself when testing the updated preamp. Reproduction from most films seemed much improved, and quite impressive. But that from the very poor contrast print which had actually spurred me into rebuilding the unit was still very noisy, and left a lot to be desired. It was as if the complete sound track was accompanied by a continuous and torrential rainstorm!

My first thought was to try coloured filters in the sound scanning light path, in an effort to improve the effective contrast of the track. However, although I tried a variety of different coloured filters, the results were inconclusive.

At this stage I thought the best idea was to talk to someone who had more experience with the problem. So I contacted Mr Murray Stevenson, who was Chief Engineer of TV station ATN-7 in Sydney at its inception and for many years. If anyone would have experience with coaxing sound from poor sound tracks, I reasoned, he should!

This certainly turned out to be the case, and Murray very kindly gave me the benefit of his experience. Unfortunatelly there isn’t room here to pass on all of the useful information he was able to give me, but the upshot was that he suggested I try an adjustable turnover low-pass filter with a sharp cutoff slope.

Apparantly experience in the TV stations has shown that this type of filter can be very useful with problem sound tracks. It allows the total bandwidth (and hence the noise bandwidth) to be trimmed back, to the point where the best compromise is reached in terms of effective signal-to-noise ratio.

At times, I gather, it can prove necessary to chop back the bandwidth to as low as 2.5kHz to obtain acceptable reproduction, although this rather drastic degree of filtering is not often needed. Despite the low bandwidth, such films can still sound acceptable, particularly if the bass response is reduced a little as well. And the clarity of speech can actually be improved by having a small peak in the response of the main low-pass filter, just before its steep cutoff.

Armed with this information, I decided to build up an adjustable filter of the type required. My first approach was to use a couple of modern op-amps, in an active filter configuration. However while these worked, they had to be very critically adjusted in order to achieve a suitably sharp cutoff slope. And it became apparent that this type of filter is not really suitable where the turnover frequency must be switched over a significant range.

When I mentioned this result to Neville Williams, he suggested that it might be worthwhile looking at a simple L-C filter design he had used many years ago in a scratch and heterodyne filter project. We looked up the project concerned, which turned out to be in the December 1949 issue of “Radio and Hobbies”. And sure enough, the basic filter configuration did look as if it would be suitable for the present purpose.

The basic filter is shown in Fig. 1. It uses three inductors and two capacitors, with the two series inductors mutually coupled. Although its detailed operation might be rather complex to analyse, broadly speaking it seems to combine the characteristics of "T" and "pi" section filters. With suitable scaling of component values, it can give a passband flat-

FIG. 1. BASIC FILTER CONFIGURATION

At right is the filter board as wired for fixed-cut off operation. The basic filter configuration is shown above.
ness of better than 1dB, with a cutoff slope of around 22dB per octave.

As originally described, the filter was designed to work at an impedance level of 2k, driven by a triode-connected 6SJ7 valve. The inductors were air-cored types, wound on home-made wooden bobbins. I decided to aim for a lower impedance level—say 1k, with the idea of reducing the required inductance values, and hopefully making them easier to wind. I also decided to try winding them on ferrite toroids, as this would not only reduce the number of turns needed, but also obviate possible hum pickup.

To cut the story short, this approach has turned out to be quite successful. As you can see from the circuit of Fig. 2 and the photograph, I have been able to come up with a simple filter unit of updated design, which seems to do the job very well. The complete circuit mounts on a small PC board, runs from 18V DC, and has unity gain.

You can either build it up with fixed capacitors on the PC board, giving a fixed turnover frequency, or use a two-pole switch as shown to give a selection of turnover frequencies. The switch can also be used to give straight-through or "flat" operation, where filtering is not needed.

For film work, the filter unit is intended to be connected between the preamp described last month and the main amplifier. It will handle the output level produced by the preamp without significant distortion, and with negligible effect on the system signal to noise ratio. Its own output impedance is around 5k, which should be suitable for feeding into most solid state or valve amplifier systems.

Of course there is no reason why you can't use the filter for other applications. It would be quite suitable for use in a modulator for amateur radio work, either for simple bandwidth restriction or for cleaning up the output from a speech clipper. It would also be suitable for audio filtering in direct conversion receivers.

Getting back to the circuit in Fig. 2, you can see that it is basically the filter of Fig. 1 provided with switching for the two capacitors. A buffer amplifier using a uA741 or TBA221 op amp is used to drive the filter from a stable source, and also provides a gain of 2 to make up for the filter losses.

Low frequency response of the complete filter unit is 3dB down at around 30Hz, which is more than adequate for film work. It could be tailored if desired by reducing the values of the buffer input and output coupling capacitors, from their current values of 0.1uF and 4.7uF.

Inductors L1 and L3 are mutually coupled by winding them on a single ferrite toroid, while L2 is wound on a second toroid. Both toroids are the Philips type 3E1 (catalog number 4322-020-36571), which has a plastic coating to permit the wire to be wound on directly. At the time of writing this toroid is in good supply, and should be obtainable from your usual supplier.

L1 and L3 are each 80 turns of 30 B&S enamelled copper wire, giving about 20mH each with unity coupling. L2 is 70T of the same wire, giving about 15mH.

The PC board pattern for the filter, reproduced actual size to allow tracing if desired. The isolated pads are for toroid anchoring.
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**Display:** 5 in flat faced CRT giving 10cm x 8cm display EHT — 3.6 kV overall.

**Vertical Deflection:** Two identical input channels. Y1 and Y2. Bandwidth (-3dB) DC-10MHz. Sensitivity 5mV/cm to 20V/cm in 1 2 5 sequence. Input Impedance 1M 'approx. 28pF. Input Coupling DC-GND-AC.

**Display Modes:** Single Trace Y1 and Y2. Dual Trace chopped or alternate modes, automatically selected on timebase switch. Chop rate approx. 250kHz. X-Y mode with Y1 input giving X deflection and Y2 input giving Y deflection. Bandwidth DC to 500 kHz < 3° phase shift at 200 kHz.

**Horizontal Deflection. Timebase:** 1 μs/cm to 0.5 s/cm in 18 ranges (1 2 5) sequences. X Expansion — X10 pull switch gives fastest speed of 100 ns/cm. Variable control gives > 2.5:1 reduction in sweep speed.

**Trigger:** Variable level control with option of bright line in absence of signal. Source Internal Y1 or Y2, or External + or —

**Coupling AC, AC fast TV Frame. Sensitivity Internal 2mm approx. 40Hz 2MHz. External 1V approx. 40Hz 2MHz. Internal 1cm approx. 80Hz 10MHz. External 5V approx. 80Hz 10MHz.**

**Additional Facilities:** Calibrator 1V ± 2%; square wave at supply frequency. Dimensions .18cm(7") x 29cm(11") x 42cm(16")*. Approx. 7 kg (15 lb).

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Specifications quoted are for general guidance only, are subject to verification and change without notice.
SHARP-CUT FILTER

Because of the closed magnetic circuit of the toroids, the windings are not critical in terms of shape, nor is it necessary to have L1 and L3 overwound or butting.

Winding toroids is not much fun, of course, but in this case there are only a few turns. You'll need about 3 metres of wire for the two larger windings, and 2½ metres for the smaller. All three can be wound quite easily in about 30 minutes.

As you can see, I have produced a small PC board to make the filter unit easy to assemble. Coded 75/12, it measures 100 x 75mm. Space is provided for mounting the two toroids on the board, held in place by three short lengths of wire—soldered to isolated copper pads so that they don't form "shorted turns".

The wiring of the PC board is quite straightforward, and should be evident from the small diagram. Note that the pattern has been arranged so that you can drop in an op amp in either the 14-pin DIL, or the 8-pin "mini-DIL" packages. You could also use one in a 12 section 1-pole 6-position rotary switch.

Note also that if you want the filter to have only a single fixed turnover frequency, the capacitors can be mounted directly on the board.

The curves of Fig. 3 show the characteristics obtained with the five capacitor combinations shown in the circuit. Note that the combinations giving the two lowest turnover frequencies produce peaks of between 2 and 3dB just before roll-off. This gives a small amount of ringing, which appears to improve intelligibility. The capacitor combinations shown give approximate turnover frequencies of 8, 6, 4.5, 3 and 2.5kHz respectively, together with the "flat" characteristic. These provide quite a lot of flexibility, and should cope with most requirements. However, if you want a turnover frequency between any of these figures, or above 8kHz, this can be achieved simply by a suitable choice of capacitor values. Note that the value of C1 (in series with L2) is roughly 50% higher than that of C2.

Having used this filter for a while now, I am able to verify that the sort of characteristic it provides can be very worthwhile in improving the reproduction from poor sound tracks. Providing the film is not too atrocious, the filter allows quite a good compromise to be reached between noise and bandwidth.

I must admit, though, that there still tends to be a problem with the very worst tracks—like that which started me off on this present foray. This is because with such films there is a basic conflict: the filtering which would be necessary to reduce noise to an acceptable level would also render the signal unintelligible!

Fairly obviously, no "static" filter of the type just described could cope with this sort of situation. If there is any possible solution to the problem, it lies in dynamic filtering: the use of a filter which changes its characteristics depending upon the presence or absence of signal.

I have been experimenting with a filter of this type, used in conjunction with the static filter just described, and the results seem promising. Details will be given in the third and final article in this series.

LIST OF PARTS

1 PC board, code 75/12 (75 x 102mm)
1 uA741, TBA221 or similar op amp IC
2 Philips 3E1 toroids (catalog number 4322-020-36571)
1 2 section 1-pole 6-position rotary switch
RESISTORS (5% 1/4-watt)
2 x 1k, 1 x 4.7k, 1 x 150k, 2 x 220k,
1 x 470k
CAPACITORS
1 0.1uF LV polycarbonate
1 4.7uF 6VW tantalum electrolytic or LV polycarbonate
1 100uF 25VW single ended PC type electro
Filter capacitors, LV polycarbonate:
1 x 0.022, 1 x 0.033, 1 x 0.039, 1 x 0.047,
1 x 0.082, 1 x 0.1, 1 x 0.15, 1 x 0.22,
1 x 0.27, 1 x 0.33
MISCELLANEOUS
PC connection stakes, approx. 8½ metres of 30 B&S enamelled copper wire for winding coils on toroids, connecting wire, solder, metal case if required, suitable 18V DC power supply, two audio connectors as desired.
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our 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 ratings are not exceeded.

Above is the board wiring diagram for the filter, with the fixed filter capacitor positions shown dashed. If op amp packages other than the 14-pin DIL are used, connect using the guide diagrams below.

Below is the complete schematic diagram for the filter.
Using the LM3900 quad op-amp IC

If you’re working with circuits using op-amps, then you’re at a disadvantage if you don’t know about the National Semiconductor LM3900 IC. It offers no less than four op-amps in a single low-cost package, and although these use a slightly unfamiliar “current difference” input circuit, they can be used for many common applications.

by J. BRIAN DANCE, M.Sc

One of the most economical linear integrated circuits available at the present time is the National Semiconductor LM3900 device. Although the retail price of this IC is only around $1.75, it incorporates four separate amplifiers which are designed to operate from a single power supply line. They can be used in a wide variety of applications, from waveform generators to phase-locked loops, and produce a large output voltage swing.

Encapsulation

The LM3900 is encapsulated in a standard 14 pin dual-in-line case with the connections shown in Fig. 1. The characteristics of the device are specified over the temperature range 0°C to 70°C, but a similar (marginally more expensive) device, the LM2900, can operate over the range -40°C to +85°C.

Inputs

Each amplifier of the LM3900 has a non-inverting input (marked +) and an inverting input (marked -), but the input circuit is different from that of conventional operational amplifiers. The output voltage depends on the difference between the two input currents rather than the difference between two input voltages.

The special symbol recommended for current differencing ‘Norton’ amplifiers of this type is shown in Fig. 2. The use of this symbol avoids confusion with other types. The arrow on the non-inverting input shows this is a current input.

The two inputs of each amplifier are kept at one diode voltage (about 0.5V) above the potential of pin 7. Input voltages must be converted into currents by series resistors in the input circuit; for optimum stability, metal oxide or metal film resistors should be used.

The LM3900 can be used over the wide power supply range of 4V to 36V; its amplifiers provide outputs which can vary between 1V less than that of the positive line and a fraction of a volt above ground potential. Alternatively, one can feed the device from balanced supplies of between ±2V and ±18V. The supply current is typically 6.2mA (max. 10mA) when the output current from each of the four amplifiers is zero; this supply current shows little variation with the supply voltage or with temperature.

The LM3900 may be damaged if the power supply is connected with the wrong polarity. The shorting of one of the outputs to ground or to the positive supply will not cause immediate damage, but may result in excessive heat dissipation and damage within a short time.

For simplicity, the power supply connections to pins 7 and 14 of the LM3900 will not be shown in the following circuit examples.

Simple Amplifiers

The simple inverting amplifier shown in Fig. 3 can be used at audio or higher frequency and provides a gain of $R_2/R_1$ ($= 20$ with the values shown). If one wishes the quiescent output voltage to

Three simple amplifier configurations using the LM3900 quad op-amp device. At top left is a basic inverting amplifier, with a non-inverting amplifier below it for comparison. Above is a DC coupled power amplifier using a Darlington pair at the output.
be half that of the positive supply line, the value of R3 should be twice that of R2. However, the value of R3 can be selected to provide any quiescent output voltage within the device range. The gain-bandwidth product is 2.5MHz for the Fig. 3 circuit.

The effect of power supply hum can be greatly reduced by returning R3 to a decoupled supply. For example, one may employ a value of R3 equal to R2 and return R3 to a decoupled supply of V+ /2.

A non-inverting amplifier is shown in Fig. 4. The gain is R1 /R3, or 100 with the values shown, and this gain can be obtained up to 1MHz. R2 and R3 should be equal for a quiescent output voltage of half the supply voltage. The lower end of R2 may be connected to the junction of two 47 kohm resistors which are connected in series across the supply lines; this junction should be decoupled with an electrolytic capacitor. This decoupled supply may be used to supply any reasonable number of amplifier stages.

In the circuit of Fig. 5 the LM3900 amplifier output is fed to a high current Darlington amplifier. The output transistor should be mounted on a heat sink, in which case output currents of over 3A can be obtained.

**Square Wave Generator**

In the circuit of Fig. 6, the capacitor C1 alternately charges and discharges via R1 between voltage limits which are set by the other resistors. The circuit is basically a form of Schmitt trigger which, with the values shown, produces a square wave output of frequency about 1kHz.

The circuit of Fig. 7 employs two of the LM3900 amplifiers to generate square and triangular waves simultaneously. The amplifier on the right hand side operates as a Schmitt trigger circuit, whilst the other amplifier operates as an integrator. If R1 = 2R2, the waveforms will be symmetrical. The frequency is inversely proportional to C1 and R1.

**Audio Mixer Unit**

Fig. 8 shows the use of the four amplifiers of an LM3900 in an audio mixer unit. The amplifier on the right hand side sums the outputs from the other three amplifiers. When the switches S1 and S2 are in the open position (as shown), the current flowing through the 5.1M ohm resistors will saturate these amplifiers and only the third input will contribute to the output signal, S3 being closed.

**Conclusion**

Many further applications of the very versatile LM3900 quad op-amp device are given in the National Semiconductor Application Report AN-72; they include voltage regulation, active filters, staircase waveform generators, digital circuits, tachometers, voltage controlled oscillators, etc.

The LM3900 is available from most suppliers, including Dick Smith Wholesale Pty Ltd, 160-162 Pacific Highway, Gore Hill, NSW 2065.
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48 ELECTRONICS Australia, November, 1975
RF dummy load

Here is a very useful accessory for the radio amateur. Although easily built up in a couple of hours, it can be almost invaluable when testing transmitters. If you’re a Novice just starting to equip your ‘‘shack’’, it would be well worth building.

by IAN POGSON

It is necessary sometimes to make prolonged tests on an amateur radio transmitter, and as the regulations do not allow a transmitter to be fed into a radiating aerial for such tests, it becomes necessary to use an “artificial aerial”, “dummy aerial”, or a “dummy load”. All three names mean the same thing in this context. They describe a device which when connected to a feedline from the transmitter, looks the same as a properly adjusted aerial system. Ideally, this will be a pure resistance, in the range 50 to 75 ohms and capable of dissipating the full amount of RF power output from the transmitter.

If the power to be dissipated is only 10 watts, or even less, then the traditional way of producing an economical dummy load is to use 12 or more 1 watt non-inductive resistors connected in a series-parallel arrangement. For power ratings up to 100 watts or so, a suitable number of larger resistors similarly connected, to give the required 50 or 75 ohms, can be a satisfactory arrangement.

The power dissipation capability of a dummy load can be increased quite markedly by immersing the resistive elements in a suitable oil. It is also possible to add a metering circuit across the dummy load to measure the actual amount of power being dissipated by the load, which also corresponds to the power output from the transmitter under test.

An alternative type of dummy load is one which uses a resistive element specially designed for the job. An example of this is a 50 ohm, 50 watt resistor imported by Dick Smith Electronics Pty Ltd. This resistor is in the form of a ceramic tube, with the element deposited on it and with about 12 mm at each end metal sprayed to allow contact to be made. There are no signs of spiralling and the type of construction should result in a resistor with very low inductance. Made by Sankyo Tokusyu Musen, of Japan, it is designated the “Erema type SP”.

Having acquired the resistor, the question arises as to how best to arrange it for use as a dummy load. Possibly the most convenient form is to mount the element in some sort of metal enclosure. This makes it easy to handle and it also gives a considerable amount of shielding, which will further reduce the possibility of radiation. While this arrangement also reduces the heat dissipation if the element is simply mounted “in air”, it also makes it possible to immerse the heat element in oil and this more than offsets the former disadvantage.

We solved the problem of a suitable container by raiding the kitchen cupboard, coming up with an empty “Ovaltine” tin. This tin which has a press-on lid, is about 98 mm in diameter and 120 mm high. This turned out to be just high enough to give sufficient end clearance to the resistor and mounting arrangement. While the diameter is perhaps a little more than necessary, it allows for a good quantity of oil if it is used, and the power dissipation will be increased accordingly.

A one litre paint tin should also be suitable—but choose one which can be cleaned out. A water-based plastic paint would be a good choice, allowing the tin to be cleaned out very easily.

The way the problem of mounting the resistive element was solved may be seen from the picture and the drawing. Unless you have ideas of your own, we suggest that you follow the method used in the prototype. This is how we did it.

Basically, there is a clamp at each end of the element. Each clamp consists of two parts as shown in the drawing. The blank size of each piece is 48 mm long and 13 mm wide. Each piece is bent up as shown, using the end of the resistor to obtain the correct radius. The clamps are then screwed to the resistor and the other pieces made and soldered to the clamps.

Our clamps and other pieces were
RF dummy load

made up from pieces of tinplate, salvaged from another tin. This is cleaned up and the pieces are cut out with a pair of tin snips. If you are lucky enough to have access to some thin sheet copper or brass, then this may be used instead of tinplate.

The type of coaxial socket which you use will be up to your own preferences; no doubt one which you have standardised on for all coaxial connections. The socket is fitted to the lid of the container and the resistive element mounting brackets can hopefully make use of the same screws.

Prior to finally mounting the element assembly, a lead must be provided to run from the centre terminal of the socket, to the far end of the resistor. This lead may be a stout gauge of tinned copper wire but the inductance of the lead may be reduced by using either a strip of copper, or this may be simulated by soldering together three or four pieces of 18 or 20 gauge tinned copper wire to form a flat strip.

The assembly, fitted into the container, is at this point, the basic unit and may be used as a dummy load on small transmitters such that the dissipation can be handled comfortably. On the other hand, if you want to take it further and to handle higher power, then further work must be done to make it suitable for oil cooling.

A hole is drilled in the lid, alongside the socket, to clear a screw about 4BA size. A nut is soldered to the outside of the lid and over the hole. With a screw in this nut, the arrangement is a simple pressure-relief device. To reduce the possibility of oil leaks to a minimum, solder around the coax socket. Joints of the tin should be filled with a run of solder. The inside of the tin should be clean and make sure that all soldering resin is removed. Methylated spirit may be used for cleaning.

By now, you will be asking what kind of oil to use. Perhaps the best choice would be transformer oil, if you are able...
to obtain a small quantity. On the other hand, when we described a dummy load way back in May, 1967, we suggested that Castrol Z10 could be used. We have just been in touch with Castrol and they advise us that the Z10 is no longer available. However, they suggest that an alternative may be Castrol TQ (Dexron), which is an automatic transmission fluid. We have not tried it at this stage, but it seems to be a good possibility.

Quart packs of Castrol TQ (Dexron) may be obtained from Repco Auto Parts Pty Ltd, Grace Bros, and possibly other automotive houses.

The idea of using light motor oil should be approached with caution, as the additives may adversely affect its use for our purposes.

If it is your intention, now is the time to fill the container with oil to a level that will cover the resistor body, making sure to leave some space for expansion. When the lid has been fitted and when satisfied that all is well, it is a good idea to fix the lid with a couple of blobs of solder. This will prevent the lid from being accidentally removed, with possible unpleasant results.

So far, we have only considered the needs of those who use a nominal 50 ohm transmission line system. What about those who have settled for a 75 ohm system? Unfortunately, the answer to that one is that no 75 ohm resistor is available similar to the 50 ohm one just discussed. There is an alternative of course and this was touched on at the beginning of this article. The well tried idea of placing a number of resistors in parallel between two plates, or other similar conductors, can be put to good use where a 75 ohm system is required.

A 75 ohm dummy load along these lines was described in May, 1967 and to make the treatment complete, we will repeat brief details of this unit. Unfortunately, the availability of suitable resistors has changed considerably in recent times and it will be largely up to each individual to find resistors which will suit the particular application.

Using our former prototype as a guide, a typical dummy load can be made up. For the HP and VHF range, an ordinary germanium diode, such as the OA91 may be used as the rectifier. For higher frequencies, a hot carrier diode should be used. The series resistor in the filter and metering circuit should be a value such that full scale reading is not exceeded under likely maximum power conditions. With these criteria met, the meter will give relative readings of output power.

If you wish to calibrate the meter in terms of RF volts, then perhaps the most convenient method for the average person would be to calibrate it against a known AC voltmeter, at 50Hz. The two 0.01uF capacitors should be increased temporarily to 1uF or higher and the series resistor may be adjusted to give a full scale reading when 100V AC is applied. The extra capacitors should be removed after this operation.

Still another application is available. At the point marked "scope", an oscilloscope may be connected. This allows the modulation envelope to be checked, so that you can make sure your signal is clean and linearly modulated.

If you need or want a 75-ohm load, this is still the way you'll need to build one. Use a number of suitable power resistors, connected like this for low inductance.
Very flexible timer IC, active filter

First item this month is an LSI timer device which uses digital counting to provide precise long-period time delays. Known as the LR171E, it is made by a firm called Elremco in Essex, UK. Apparently it has been designed both for industrial process timing and for domestic use in washing machines, cars, battery chargers and similar applications.

The circuit for the LR171E is shown below. Essentially it consists of an RC clock oscillator whose frequency is set by external components Ct and Rt, and whose output is fed to a digital counting chain consisting of 12 flip-flops. Logic circuitry detects when all FFs have been set and similar applications.

To this basic system are added a few frills, which provide additional facilities. The Q-bar outputs of the last three FFs in the counting chain are brought out at pins 9, 10 and 11, and this allows subdivision of the basic time period into T/8 segments. This also allows sequencing, by means of an external decoder. An inbuilt gating oscillator controlled by pin 6 also allows the main outputs to be pulsed, for direct triggering of Triacs and SCRs.

An internal D-A converter connected to the last 6 stages of the counter chain provides a staircase current output at pin 8. This is suitable for driving a 1mA meter movement, to give convenient display of lapsed time during the timing cycle.

The LR171E has its own internal supply regulators, and will operate from voltages anywhere between 6 and 450V DC merely by changing the series resistor value.

Triggering of the device may be from switch contacts, TTL gates, an LDR or any similar source. The device is readily protected against noise for operation in industrial environments.

Suggested applications for the LR171E are for automatic battery chargers, and for control of parking lights, headlights, and windscreen wipers in cars.

Local agents for Elremco are A. J. Ferguson Pty Ltd, 29 Devlin Street, Ryde, NSW.

Another interesting new IC is a device called the AF100, it is available for around $3.25 in similar quantities, but an industrial grade version of its solar cell array, this BPX47A, will apparently operate to 10kHz with a realisable Q range to 500. Power supply range is from ±5V to ±18V, and the frequency accuracy is quoted as 1% unadjusted.

Another device from National is a precision reference IC, the LM199, which they claim to be 20 times more stable than zener diode references.

Basically the LM199 consists of a zener derived reference circuit on the same chip as a temperature control circuit. The latter operates from between 9 and 40 volts DC, and dissipates only 300mW.

The zener element in the reference circuit of the device is a subsurface breakdown type, in which breakdown is forced to occur well below the chip surface. This eliminates the surface-related instabilities that plague other zeners.

The performance specs of the LM199 are very impressive. Long term stability of its nominal 6.9V output is 0.02%, with drift less than 1ppm/°C. The zener output impedance is half an ohm, making it two orders of magnitude less sensitive to operating current than a standard 7.5V reference zener. A 1% change in operating current at 1mA changes the voltage by only 5uV, compared with about 1200uV.

The LM199 comes in a four-lead TO-46 hermetic metal package. Price of the premium device is around $35 in 100-off quantities, but an industrial grade version called the LM399 is available for around $3.25 in similar quantities.

Applications for the LM199 include a standard cell replacement, a precision clamp and a portable calibrator.

National Semiconductors are available locally from NS Electronics Pty Ltd, cnr Stud Rd and Mountain Hwy, Bayswater, Vic. (J.R.)
Dear Customer,

In the next few pages we are presenting a whole lot of new products. There are too many for our usual adverts, so we decided on the Mini-Cat to save the space. Some of you suffer from customeritis. We have recently taken over a new 4,000 sq ft warehouse which will house our mail order and kit departments. The fact that our business continues its dynamic growth is proof enough that our customers enjoy dealing with us. Our staff now totals 48 and a large percentage of them are dedicated electronics enthusiasts too.

Our whole business has been built on the fact of service - this was the reason I set it up to begin with: YES! We will continue to give the best possible mail order service. We have just as good a service to counter customers because we feel they deserve it. We will continue selling individual items. We avoid prepackaging unless it means real benefits to you - as in our computer selected packs. We still look for new ideas. We've crashed the price of digital clocks. We've almost given away transistors. Our special offer packs in E. & M. lasted just 2 days. We try to help them with helpful suggestions. We often have substitutes. We try to help them with helpful suggestions. We often have to search.

YES!! As a service to our growing numbers of professional customers we have installed a helpline for your convenience. We also now have a special 10% Australian tax-free price list. It's the difference we're making you service!! But can the difference we're making you service!! It's the difference we're making you service!! And once again it's over to you!

Dick Smith Electronics Pty Ltd

Associated Company, Dick Smith (Sales) Pty Ltd

Electronic Enthusiast Centre

Our Address: M/F, Robina Books

162 Pacific Highway, Lane Cove NSW 2060

Tel: 439.5311 (Office)

24 hour STD: 439.5344

Dick Smith
Mini Catalogue
Christmas 1975
NEW TOOLS

No. 201 Transistor Nippers. Intended for professionals, these low cost cutters measure 115 mm long with 14 mm edge. $3.50

No. 200 Cutters. Large rivet joint to prevent twisting. Fine sharp edges with smooth cutting side. Measure 125 mm with 18 mm cutting edge. $6.20

No. 100 Diagonal Cutters. Feature box joint for more rigid support of the jaws which won't twist or distort. Very fine sharp edges with smooth cutting side. Measure 125 mm with 22 mm cutting edge. $4.75

No. 300 Long Nose Cutting Pliers. For general use. High quality gunmetal. Oval shaped jaws with flat and rounded edges. Built in cutters with wire stripping hole. 150 mm long with 60 mm jaws. $4.50

No. 310 Long Nose Cutting Pliers. Fine tip and arranged serrated jaws for general use. Budget priced. With built in cutters 125 mm long with 40 mm jaws. $3.75

No. 500 Flat Nose Pliers. Have completely smooth jaws. Ideal for precision instrument repairs or where serrated jaw could cause damage. Chromium plated. 145 mm with 42 mm jaws. $2.78

No. 5C-46 Soldering Iron Stand. Flat, stand takes your iron and saves it melting insulation or burning the bench. Unique non-slip rubber base. $2.50

No. 77 Pin Vice. For machinists, toolmakers, jewelers, as well as hobbyists. Holds small drills, taps, dies. Hardened steel jaws. Two chucks grip up to 2.5mm dia. $2.50

No. 86 Pearl Catch. For reaching awkward corners. Virtually 3 armed tweezers with super action. A must for retrieving nuts and washers. Keeps your tool for $1.00

No. 360 Sado Cutting Pliers. For linesmen or general use. High quality gunmetal. Polished finish. Flat and rounded jaws with wire cutters. 150 mm long with 25 mm jaws. $3.75

No. 400 Flat Nose Pliers. Feature box joint for more rigid support of the jaws which won't twist or distort. Very fine sharp edges with smooth cutting side. Measure 125 mm with 18 mm cutting edge. $4.20

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Screwdrivers are made of hardened and tempered tool steel and nickel plated. Handles are amber plastic, unbreakable, flameproof and shockproof and will withstand 15A V.

No. 81 Screwdriver 6mm blade in 3 lengths 16mm 50x 220mm 50x 310mm $1.10.

No. 518 Screwdriver Set. Chuck type handle takes 6/32" x 20 twist drill. 3 sizes (4, 5 and 6 mm screwdrivers, 2 sizes of Phillips, plus 2 square lights). 5mm blade or get the three for $1.00.

No. 711 Aligner. All plastic screwdriver with spring steel tip. Unbreakable plastic for easy trimming. 155mm long 2mm tip or 250mm long 754.

No. 722 Aligner. All purpose for trims and trimmers. One end has projecting tip other is recessed. Both are stainless steel 200mm long with 3mm blades.

DON'T BE A LUG MUG!

“Why pay up to $40.00 for similar crimping tool kits? YES! Oils has imported a great little Electrical repair kit that contains the following:

-12 types of common basic colour coded and plated, copper solderless lugs & terminals for easy, identifi- ation and trouble-free crimping.

-Strongly built tool head with nearly $80.00 worth that doubles as a wire cutter & stripper.

-Rugged plastic PVC snap-lock case with see-thru 8"0 opening brackets - hang it on the wall of your Workshop.

-Large roll of PVC insulation tape. Everyone must have a No. 1331 kit for only $1.75.

EL. 1 SOLDER Sucker Full metal construction unlike pricy? Nice plastic case. Simply mount release thumbs mechanism. Complete with easy to read instructions for only $1.75.

No. 366 Aligner. Big, tough fibre reed screwdriver blades and recessed brass blade. 175mm long 5mm open.

UNIMAT MINIATURE MACHINE SHOP

What more could you need with the range of fantastic tools included with this machine?

Complete kit includes: 2400-3500 rpm, motor with a sound range from 155 to 6000 rpm. Faceplate & drill arbor, vertical milling drilling surface grinding etc. Includes: 3 jaw self centering lathe chuck, 3 capacity drill, grinding wheel,paint,colors...

UNIVERSAL MINI DRILL runs on 3.5v or 6V for use in the car or boat, or with a 12V 1A transformer from domestic mains. Ideal for model work, jewelry, etchings, etc. Only $7.75 (75c P&P).

MINIDE L DRILL runs off 4 UM3 cells or 6V d.c. 600mA 2500 rpm drilling holes from 0.0236 to 0.059". Ideal for all PC drilling, model makers, jewelers.

This is a new line at $1.75 (75c P&P). Now a bargain at $1.75.

5-VOLT DESIGN ENGINEERING MACHINE SHOP

The range of fantastic tools included with this "workshop" includes:

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ELECTRONICS Australia, November, 1975

**TV. Accessories**

**TV. RIBBON AND CABLE**

TV Ribbon and Cable 300 ohm clear ribbon — designed for indoor applications — very low loss — maintains perfect balance.

<table>
<thead>
<tr>
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<td>75 Ohm Coaxial Cable 3C2V</td>
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</table>

This cable is designed for television feeder systems. Excellent connecting and isolating for use up to 500 MHz. 5/16" diameter, solid center conductor and braided shield, black.

| 300 ohm Black Ribbon | $2.00 per 100 meter roll |

**300 OHM (Twin Ribbon) ACCESSORIES**

NR2103 - 5039 4 Set Coupler Handley colour, black & white & FM radio, etc.

F50 Male Cable Connector. For use with 3C2V and RG8/210 cable. Mates with F51A and F58 connectors.

| 300 ohm input impedance 93.50 ohms | 4 Set Coupler Handley colour, black & white & FM radio, etc. |

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| 300 ohm Black Ribbon | $2.00 per 100 meter roll |

N10020 Indoor FM Antenna 300 ohm dipole FM antenna brings in good signals in all local areas. May be placed behind set, or hidden out of sight. Molded ends make mounting easy. Long life of lead terminators in spade lugs for simple hook up to set. Special.

| 304.40 per Meter | 

**75 OHM (Coaxial Cable) ACCESSORIES**

90607 Two Way, Hybrid Splitter. This compact splitter provides two 75 ohm outputs from one 75 ohm input. Designed to provide two outlets from one TV aerial. Passes AC/DC power. Frequency response 5 to 300 MHz. Insertion loss 3.5 db. Operation 30 db. Requires 3 x F59 connectors.

| 1-9 | $2.50 per 100 meter roll |

**LOW COST CONNECTORS**

Honest Branded Coaxial Connectors. Mated in tough, black plastic for TV, radio and instrument use. 75 ohm.

| 1-9 | $4.00 per 100 meter roll |

F.M. ANTENNA

The latest VHF-FM aerial. Suitable for both vertical or horizontally polarized signals and must for good FM reception.

| 0.50 | $13.50 per set (98) |

**LATE NIGHT OPENING!**

We are now open on Thursday evenings until 8 p.m. at our GORE HILL CENTRE (ONLY 'TIL CHRISTMAS)
**PRODUCTS**

MINIATURE TAPE COUNTER NOW AVAILABLE
- 3 dpi (10-999)
- Large glossy drive, one rotation one digit
- Requires 6" x 4" or larger base
- Operating life: 100,000 hours

GET ONE NOW; ideal for coil winding machines & tape measuring equipment
- Only 2½ x 2½ cm approx
- Order as 25's, inkl. GST: $97.50 each

**LATEST BOOKS**

- **TRANSISTOR EQUIVALENTS, 5th edition**
  - 204 pages, 60 photos
  - $5.95 (incl. GST)
  - This handbook lists more than 6,000 transistor types.
  - A practical approach to the techniques of solid state electronics.

- **DIODES EQUIVALENTS, 1st edition**
  - 144 pages, 44 photos
  - $5.95 (incl. GST)
  - This book will serve all up-to-date designers for all types of high-current and low-current diodes.

- **SOLID STATE 10WATT AUTOMOBILE P.A. AMP**
  - $36.00 (incl. P&P $2.00)

- **ELECTRONICS**
  - November, 1975

**STUDENT EDITIONS**

- **ELEKTRO- AND MAGNETIC CIRCUITS**
  - A. Mechtel - 256 pages, $8.50 (incl. GST)
  - A practical approach to the techniques of solid state technology in electronics.

- **SUPERSENSITIVE METAL DETECTOR**
  - Use one as a car alarm, doorbell etc.
  - Simply connect to mains, ideal for any location giving wide dispersion.

- **3 WAY CAR CONVERTER IN STOCK AGAIN**

- **CAR REDUCER**
  - 3-Way, 510 deal
  - $5.00 each

- **MINIATURE TAPE COUNTER NOW AVAILABLE**
  - Order as 25's, inkl. GST: $97.50 each

**NEW KITS**

- **LE WEE**
  - 600mA, 4000 vac max output.
  - $7.50 (incl. P&P $1.00). 101 TV TROUBLES SYMPTOM TO REPAIR.

- **STUDENT EDITIONS**
  - Introductory definitions, codas and symbols.

**WIDE RANGE OF NEW CMOS AT PRICES THAT MEET OUR CUSTOMERS!**

<table>
<thead>
<tr>
<th>TYPE</th>
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<th>PRICE 1</th>
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<tr>
<td>GCA1004</td>
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**SENSITIVE METAL DETECTOR**

- In stock.

- Easy access from TV transformer.

- Range depends on size of room.

- Uses the equation $\text{Price} = \text{GST} \times \text{Base Price}.

- **ELECTRONICS**
  - November, 1975
SAVE on Hi-Fi

LATEST NEWS: Extra duty on head-phones, buy now & SAVE!

DETRON DSH - STEREO HEADPHONES

$6.95

OR

ONLY $10.95

MODEL SMS20 STEREO HEADPHONES

An Bohn headphone at a realistic price. Cushioned salt on these phones let you drift into another world. Expanding headband with salt pads and salt switches. Enter the world of stereo with the SMS20 Complete with lead and stereo salt. Dick’s price (Before the increase in duty) is an amazing $5.95

COLOUR YOUR WORLD WITH EXPO

Complete with lead and stereo salt. Enter the world of stereo with the SM220 suits egotists and diet watchers.

$12.99

A high value, fast selling product which Dick Smith has always vouched for. The SM220 is a complete stereo system for the money. The sound is excellent and the price is right. Dick’s price is only $12.99.

HEAD DEMANDER

Even wondered why your cassette or tape recorder sounds flaky even after you have cleaned the heads with a cotton wool bud and cleaned them? The answer is magnetism - most people do not realize that the so called "magnetic head" must not have any residual magnetisation in it. If it does the head adversely affect both recording and playback. Dick's Head Demander will answer to your "Flaky Tape" in the form of a very convenient "head demagniser". Plug your tape into the AC outlet and watching the probe about a foot away from the heads gradually bring the probe down towards the following. Taking the probe close to the heads, swing it up and down until you are again a foot away. The probe is all done with a semi-circular-arc.

In doing this the head probes any magnetism from the heads and leaves them ready for recording or playback.

Dick recommends you do this every five hours of recording or playback.

The cost of preserving your tapes is a ridiculous low $6.95. (Dick’s price $19.50)

AT LAST! An AM/FM Radio at a LOW PRICE

Finest in black plastic with solid sides - a carryin" handle comes with the whole design. A large indicator dial gives a semi circular readout showing clearly FM in MHz and the AM band in kHz. The volume control has ten position indicator for precise setting of your favourite volume level. Band selection via a clearly indicated control under volume control.

Telescopic aerial for FM reception and an outlook jack for ear recording. The price is ridiculous low $18.95. Dick has been planning this little beauty for months and as we have had none back for repair, he has the Unit absolutely guaranteed for a real two year warranty on the FM part.

The answer is magnetism with a Cotton wool bud and cleaned them, sounds flicky, even after you have attacked the heads with the Head Demanders.

DUAL PHONE LEAD

Get the stand phone jack into your audio and one meter later there are two standard stereo salt sockets. Plug in two pairs of headphones and listen to your heart's content.

The lead that can stop divorce from Dick is $3.00 (Dick's price $9.50)

COLOUR YOUR WORLD WITH EXPO

$9.95

DICK SMITH

CUBE SPEAKER SENSATION

Now everyone can have Quadraphonic Sound with these fantastic little extension speakers.

Check their features:
Scuff resistant sali-xt exterior
Modern colours
Rugged 4" Bourn speaker 50W 200000Hz-4kats
- Good music
Black face
- Only $5.95 each

Complete System

$499

(p & p freight on)

LON.

$50.00

DICK SMITH

One of England's most pursuing turntables is now available at Dick Smith Electronics.

THE BSR SR201 - The Car Radio Bargain

Has been among the little beauts for months and as we have had none back for repair, he has the Unit absolutely guaranteed for a real two year warranty on the FM part.

The BSR SR201 has 9 transistors and 6 diodes and best of all sounds great. The price is $69.95. (Dick’s price $49.95)

Pianaola SR2201 - The Car Radio Bargain

The Pianaola SR1206 is also available at $69.95. This unit is identical to the SR2201 except it can be used on 12v car and fly by cars. THIS IS Y0111 BEETLE OWNERS!

THE BSR SR1206

The BSR SR2201 has a 10 and 12 inch dynamic speaker balanced arm and an auto spindle (both supplied)The tone arm is made for either spherical or elliptical styli. There is an anti skating device in the form of a very convenient "head de magnetiser".

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DUAL PHONE LEAD

Get the stand phone jack into your audio and one meter later there are two standard stereo salt sockets. Plug in two pairs of headphones and listen to your heart's content.

The lead that can stop divorce from Dick is $3.00 (Dick's price $9.50)
NEW SWITCHES

MINIATURE ROTARY SWITCH MS220A
This professional quality switch is fully dual rated and will last a lifetime. Contacts are rated at 240V 1A Switch offers 5 pin position selection, requires 5.5mm mounting screws supplied complete with pointer (brass $3.90)

SUBLIMITER LEVER SWITCH L1039-60
This is a specially designed switch to which has been added a special lever action. Configuration is 2 pole 4 way (Supplied complete with mounting bracket and remote black handle). Input selector for amps etc. Mounting screws at 32.5mm centres.

FAST SWITCH
Features: rubber cushioned, metal case, durable diaphragm, ideal for terminating panels, spares, etc. A nut and bolt taking a minimum of four minutes or a miniature action $ 0.50

SLIDE SWITCHES
Mini SL52/4 MINIATURE DPST ideal compromise switch for all applications. Black plastic actuator. 18.5mm mounting centres.

MODEL SL52/3 18.5mm 10k
Similar to the above switch, but this one has an extra miniature strip action which}.

MODEL SL52/2 18.5mm 10k
A subminiature 3 pole, 4 way switch with spring action aluminium actuator. Mounting screws at 32.5mm centres.

MODEL SL52/21 32.5mm 19.5mm
A miniature DPDT switch with a Black plastic actuator and panel mounting where looks are important. Mounting holes at 28.5mm centres.

ULTRASONIC WIRELESS SWITCH
Here is a truly novel design for garage door opening and remote control of all kinds of applications. It consists of a receiver at the door, switched on by a frequency of 30kHz. Operating range is 1000ft with a frequency deviation of 3kHz. A special tone is transmitted when the door opens. Ideal for garage doors.

ROTARY SWITCHES
Our new range of rotary switches at the extremely reasonable price is ideal for all applications. Spring loaded, positive action type. 1” diameter with 1 1/2” shaft (plated all). All one series. Same price.

$4.75

THE ORIGINAL DUST RUG
A New type of belt driven rug has the brilliance of design and the ruggedness of construction. With a brush which is cleaned the second you start playing. This also acts as the DUST RUG. This has in stock the original CECO W1TS L4R/4 or.

Simple but effective - and original

DICK'S PRICE $5.99 (dplk 75c)

NEW SCOTCH CLASSIC CASSETTES
This new cassette contains the unique qualities of D-8 with a base of greater tape life. The tape is supplied in the 3M 'Technilube' laxing being nickel coated for exceptional wear and still has the added feature that the tape is clean and shiny. The base is non-scratching and does not have the usual dust and debris. "The belt is almost non-existent - it's that clean!"

DICK'S PRICE 3.60c each

GOLDRING ES70S MAGNETIC CARTRIDGE SCOOP!

We have this cartridge in our catalogue at $17.50, but you can get it for only $15.99! This is one of our best sellers and we think you will agree it is the ES70S scoop. It has only 5db above the ES70S, and is very much more reliable.

DICK'S PRICE $14.99 (dplk 75c)

MINI-CATALOGUE

Mini-Catalogue

ECONOMY TOGGLE SWITCHES
P5215 1 pole 2 lead DPDT 1A at 240V £1.40/10 Solder lug, 6x1.5mm DIN 3,70" long, with 1 1/2" leads. £1.50/10 .

DICK'S PRICE $1.20 (dplk 25c)

SPECIAL

Cassette Epicer Libery Pack

SPECIAL

NATIONAL RS-678 US
A Front loading Cassette deck of superior specifications

Track System - 4 track 2 channel stereo

Frequency Response - 400 to 15,000 Hz

Repeat - 1000 x

NATIONAL RS-478 US
A Front loading Cassette deck of superior specifications

Track System - 4 track 2 channel stereo

Frequency Response - 400 to 15,000 Hz

Repeat - 1000 x

WRAPAROUND CASSETTE

DICK'S PRICE $5.25

(plus freight on)

Mini-Catalogue

SUPERSPECIAL

CANNOT BE REPEATED
OFFER ON C102, C60

SPECIAL

NATIONAL RS-678 US
A Front loading Cassette deck of superior specifications

Track System - 4 track 2 channel stereo

Frequency Response - 400 to 15,000 Hz

Repeat - 1000 x

ECONOMY TOGGLE SWITCHES
P5215 1 pole 2 lead DPDT 1A at 240V £1.40/10 Solder lug, 6x1.5mm DIN 3,70" long, with 1 1/2" leads. £1.50/10 .

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Frequency Response - 400 to 15,000 Hz

Repeat - 1000 x

WRAPAROUND CASSETTE

DICK'S PRICE $5.25

(plus freight on)
I calls. flare's your chance to get a full licence, the two casettes you should be reedy to receive at the same speed to more difficult material. Thus the moderate speed using simple material and then building it is unusual, especially is claimed to work by starting at has seen evolved alter years of practical experience.

BARLOW WADLEY
BARLOW WADLEY need no IEEE RE RIGHT (see E.) A R M. May 73, A R Sept 73. This. as been Amateurs been found in many ways. It is a commonly discussed general purpose computer. It is likely to have been used in many ways. It is a commonly discussed general purpose computer. It is likely to have been used in many ways. It is a commonly discussed general purpose computer. It is likely to have been used in many ways. It is a commonly discussed general purpose computer. It is likely to have been used in many ways.

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Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Component source

There must be many of your readers—keen hobbyists like me—who are frequently very frustrated at the business of buying odd components. I have often found that the stocks held or on offer are not too comprehensive and also that the prices and delivery dates are a little daunting.

Perhaps my experience will help these unfortunate. Through my daughter in the UK, I have been put in touch with a dealer there who carries an extremely wide range of components and assemblies. The prices are much more reasonable than those applying here and the delivery is simply fantastic—I have had four orders from him in the past three months and on each occasion the goods have arrived, per air mail, within 16 days of posting the order. Even when the cost of air mail is added to the goods ordered, the prices paid are competitive in the extreme.

If any of your readers are interested, I can put them in touch with the dealer concerned—I can assure them that they will not be disappointed. Perhaps I should add that I have no direct connection with the firm concerned and I shall derive no financial benefit. But having had such good service from him, I feel that many people in Australia might like to emulate me.

Incidentally, one of the benefits derived is a system of credit vouchers. With each cash purchase, the buyer is given vouchers which, in effect, amount to 8% discount on purchases, these vouchers being redeemed on subsequent orders.

V. L. Fisher
11 Wilcox Road
Elizabeth, S.A. 5112

Circuit symbols

Members of the Institute of Draftsmen, Australia have frequently favourably acknowledged the choice of symbols used in circuit drawings published in "Electronics Australia".

Currently the Standards Association of Australia is preparing a series of standard symbols relevant to circuit drawings. Along with other relevant organisations, this Institute's representatives have played an important part in formulating definite and practical standard symbols.

Prior to the publication of these standards, symbols for new electronic components used in your magazine often proved well chosen and Draftsmen frequently adopted these as a temporary standard. As "Electronics Australia" has a wide circulation and the SAA symbols standards are now becoming available, you will of course adopt the standards in full.

However, may this letter be received as a mark of appreciation from Draftsmen for the policies adopted within your editorial organisation through a very difficult era in circuit drafting.

(Mrs) P. Sherid: Federal Secretary, The Institute of Draftsmen, Australia.

Transistor ignition

In the August edition of your magazine, there was an article featuring a transistor assisted ignition system. I've been looking for something of this nature for several months and I think it is an excellent idea. The problem is that on going to Elcoma components they presented me with a form stating that the BDY98 transistor used in your circuit was obsolete. This disappointed me, and I think that there may be quite a few of your readers who would also feel this way. Perhaps you may know of an alternate transistor for this purpose. Elcoma has a BDY96 which is the closest to the BDY98, but they do not recommend it for this purpose. Perhaps you could publish something in a forthcoming issue. I feel it would be much appreciated.

J. Wedlock, Cooroy, Qld.

COMMENT: Your letter indicates how the situation surrounding the BDY98 has been widely misunderstood and misrepresented. When we published the article the transistor was a current type, and we were told by our major parts suppliers that they were able to obtain stocks of BDY98. Subsequently, when Philips Elcoma re-ordered from Eindhoven, Holland they were informed that production of the BDY98/49798 series had produced very low yield of the BDY98—all the yield was going into the higher rated (and more expensive) BDY97 and BDY96. Ergo, the BDY98 is obsolete. It would seem possible that the situation might change in the future and the BDY98 might suddenly become "current" again.

The BDY97 and BDY96 may be considered to be more suitable than the BDY98 for use in transistor-assisted ignition system by reason of their higher ratings. Unfortunately, they are very expensive. At this stage, we cannot suggest any other alternatives.

A lot to learn?

Your expert who runs the Information Centre still has a few things to learn. I am referring to his reply to N.T. of Eaglehawk, Victoria, on page 105 of the June issue.

I have received Radio Nederland (9715kHz) on my Sharp 6-transistor MW pocket receiver, which was not modified in any way. All I had to do was to place the receiver next to the mains cord of the power pack. Obviously the 5th harmonic of the set's local oscillator was responsible for this reception. It can be explained as follows: at the dial setting of 1579kHz, the oscillator frequency is 2034kHz; 455kHz above; its 5th harmonic is 10,170kHz, 455kHz above 9715kHz.

I have a QSL card from Radio Nederland, Hilversum to verify this reception.

I have thought of designing a multiband receiver which utilises the harmonics of the local oscillator instead of switching in different oscillator coils as is normally done.

Dennis Daniel, Ph.D.
Nelson, New Zealand.

COMMENT: In our reply to N.T. in the June issue we didn't suggest that it wasn't possible to receive signals by means of image reception or interaction with oscillator harmonics. We were making the point that not all ways of "fiddling" a set to produce such reception are equally desirable. In particular, we were frowning upon the idea of detuning the RF selectivity by deliberately shorting turns in the aerial coil. Nothing in your letter contradicts this point, which we still believe to be entirely valid. Incidentally if it is to work properly, a receiver along the lines you propose will probably still need a number of coils in the oscillator section—to select the appropriate oscillator harmonic for each range. Otherwise, the receiver will have a host of spurious responses.

STATION LISTS

We wish to thank those readers who wrote to register their support for continued publication of the radio and TV station lists. We hope to publish an updated list shortly.
Forum
Conducted by Neville Williams

Sidebands: as per a Fourier analyser

In the July issue, "Forum" dealt with one of the oldest of all arguments in the world of wireless: the existence or otherwise of the sidebands in an AM transmission. The article has now turned up a verification for the sideband concept based on one of the newest equipments in the world of electronics!

Perhaps that last sentence in the introduction is a trifle exaggerated but what self-respecting journalist would pass up a convenient turn of phrase, simply on that account? Sufficient to say that the equipment concerned—a Fourier demonstrator, a computer and a pen recorder at Sydney's Macquarie University—add up to a very modern and useful teaching aid. They make it possible to synthesise a complex waveform from its Fourier components, displaying the result either on a CRO screen, or on paper.

In the July article we talked of the conceptual problem which had over the years in respect to modulation sidebands, to the point where some have denied their existence altogether. Arguments put forward by the no-sideband school were examined, and hopefully disposed of in a deliberately non-mathematical way.

There the matter might have rested for another respectable period had it not caught the eye of a Senior Lecturer at Macquarie University, School of Mathematics and Physics. We are indebted to him for the following letter:

Dear Mr. Williams,

I refer to your Forum in the issue of July, 1975, which recently came to my attention.

Convincing students of the reality of sidebands is of course of interest in universities, and one technique used could be of interest to you and your readers.

The method is to synthesise a complex waveform from its Fourier components, and display the output on an oscilloscope. Instruments to do this have been manufactured, both in universities, and now commercially. The result is a very direct and appealing demonstration of the truth of the theory.

I have also written a computer program to plot such waveforms, and these are more readily put in a form suitable for printing; four such plots are enclosed. All assume a carrier frequency of 2500 Hz and a modulation frequency of 500 Hz.

Fig. 1 shows how a carrier plus a pair of in-phase sidebands can result in normal AM. The zero crossings occur where the carrier would have them (every 200 usec.) indicating the absence of FM. Fig. 2 shows how, if the resultant of the pair of sidebands is put at right angles to the carrier, a considerable degree of FM is obtained.

Fig. 3 shows how a further pair of sidebands can remove most of the residual AM of Fig. 2. Fig. 4 simulates what happens to Fig. 3 if the CRO timebase is expanded, and triggered off the waveform. The FM is readily evident here.

If this material is of interest, you are welcome to use the four diagrams as you wish.

Yours sincerely,
Keith S. Imrie (Senior Lecturer)

We are indeed indebted to Dr Imrie for his observations and have no doubt that many will study the diagrams with interest—not because they need to be convinced but because the equipment can display, or plot in very short order what could be done graphically—given sufficient time and patience. You may recall that we referred to the graphical approach in the July article—without attempting it!

Well, Dr Imrie's computer and plotter have done the job for us and for this we are grateful.

Changing the subject, the persistent problem of hard-to-get components has
surfaced again with a letter to hand from Dick Smith, Sydney's self-styled "electronics nut". While a published letter might seem to indicate all kinds of hard feelings, it isn't really like this. Dick Smith warned us that the letter was on the way and hinted that the matter had also been raised elsewhere.

The broad problem of electronic components is not new, of course. We devoted one whole instalment of "Forum" to it in May of last year, emphasising the difficulties that suppliers—and particularly mail order suppliers—had to cope with at the relevant time. We quoted from the English journal "Everyday Electronics" as an indication that similar difficulties were being encountered, even in a compact country like Britain.

Things haven't really changed for the better in the intervening period. There are still problems of communication and supply at all levels, the main difference being that they are now much more costly! The figure of $2 which we quoted then as the bare minimum to generate a simple project is not new, of course. We devote all the care we can but, frankly, if we were to wait until all stockists had every component on their shelves, or had access to multiple supply sources, we would never describe anything but the most routine, mundane items. Then we would be roundly criticised for being stodgy, unenterprising, and behind the times!

Dick Smith Electronics Centre

Dear Sir,

Re Radar Intruder Alarm Kit 79, ET702.

On 26/6/75 I placed an order for the above item and paid an additional sum of $5 for a different kit which I have since received.

I am at a loss to see that a large establishment such as yours cannot honour your commitments in a reasonable time.

Even your delay notice of 3 weeks has exceeded your time limits. Please advise as soon as possible.

M.T. (Como, W.A.)

Curiously, the focus of the above complaint is not an E.A. project at all, but we take no refuge in that. Electronics Australia does not hold a monopoly on either problems or solutions. They are quite ecumenical!

Speaking for ourselves, we do regularly check out the supply position on components—despite Dick Smith's implications to the contrary. We'd be crazy not to do so.

As if to emphasise the point, we currently have two completed projects "on ice" because the initial shipment of certain key components has not arrived. As soon as the essential bits show up, we'll run the articles in the fervent hope that stocks will thereafter keep pace with demand.

And herein lies a further part of the problem. One can only guess at the interest any particular project will stir up, so that suppliers and stockists alike have to "take a punt" as to how many items to order. Too many, and they're landed with dead, expensive stock; too few and they're abused for not being able to supply. Further to complicate the situation, a project may interest an equipment manufacturer and, next thing, most of the components designated for the hobby market have been bought up.

In producing the magazine, we must complete projects and designate them for publication about 6 weeks ahead of the on-sale date. At that point in time we have to make a judgement about the future supply position and hope that nothing will go off the rails while the issue is being assembled, printed and distributed.

We exercise all the care we can but, frankly, if we were to wait until all stockists had every component on their shelves, or had access to multiple supply sources, we would never describe anything but the most routine, mundane items. Then we would be roundly criticised for being stodgy, unenterprising, and behind the times!

(Continued on page 107)
When you buy the Dual Trace 539B, you get

**BUY THIS**

Typical frequency response

-3db

DC to 16MHz -3db

From 10mV to 50V/cm

**GET THIS FREE!**

This is the tip of the performance range. Like the iceberg, there's a lot below the surface... and when you buy a bwd539B for its performance to 16MHz, you get the measuring capability to beyond 50MHz for FREE.

**These are just some of the features:**

- **Sensitivity**: 10mV/cm DC to 16MHz
  - ≈ 30mV/cm at 30MHz
  - ≈ 100mV/cm at 50MHz
  - ≈ 500µV/cm 3 Hz to 30kHz cascaded
- **Time Base Range**: 100n Sec to 2.5 sec/cm
- **Trigger Range**: <5Hz to beyond 30MHz
- **TV Trigger, Identical X-Y, 3.3KV EHT**
- **8 x 10 cm display,**

and it's Australian designed and manufactured.

For detailed information send for a data sheet

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**Model**

539B

**DUAL TRACE OSCILLOSCOPE**

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1955/1975 20 YEARS OF AUSTRALIAN DESIGN INNOVATION

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Customers—and their funny ideas

As I may have hinted before in these columns, the most difficult part of a service job is often the customer; occasionally because they are just naturally hard to get on with, but more usually because they quite innocently say and do all the wrong things. On the other hand, their quaint ideas certainly break the monotony.

Take the “dear old ladies” (D.O.L.) for instance. Whenever I get a call from a D.O.L. I reckon it’s an odds-on bet that she will come up with some previously unheard-of theory or inexplicable outlook regarding modern electronic technology. The most recent call was no exception.

The complaint concerned a Philips hybrid TV set (model 12F) and was to the effect that it would receive only radio station 2JJ on all channels. For the benefit of interstate readers, 2JJ is Sydney’s recently established “rock style” station on about 1500kHz, near the top end of the broadcast band.

Mind you, I couldn’t blame her for complaining. It is bad enough to have a fault of any kind develop in a TV set, without having insult added to injury by it being one which brings in 2JJ. I mean, 2JJ is quite definitely an acquired taste; it certainly isn’t my cup of tea and the D.O.L. could give me a few summers, so I suppose it would be even less to her taste than mine.

From a purely technical angle, I wasn’t completely surprised that 2JJ was involved because she lives quite close to their transmitter. And, while I had not the faintest idea what had gone wrong, it is not unusual for solid state circuits to turn on some funny acts in the presence of RF signals. Even audio circuits are not immune, as one pop group found out recently when taxi calls found their way into a high power guitar amplifier.

When I was finally ushered into the D.O.L.’s lounge room she lost no time in demonstrating the fault. She switched on the set and up came 2JJ immediately—loud and clear. (Well, I think it was clear; it’s a bit hard to tell with their programs!) Anyway, it was good room volume.

That much established I waited for a picture to appear. But after about a minute, with no sign of a picture, I tried another channel. Still no picture; just 2JJ rocking round the clock. This was a completely new development; there had been no mention of a picture failure in the message I received, nor had the D.O.L. bothered to mention it when I arrived. She seemed to be completely obsessed by the presence of 2JJ on all channels.

“See,” she said, “It’s everywhere. I can’t get rid of it.”

“But,” I pointed out, “There isn’t any picture.”

She barely acknowledged this fact.

“Yes, but I can’t get rid of this radio station, even when I change channels I still get it.”

I gave up. How do you explain to a D.O.L. that, technically, the absence of the picture was a far more significant symptom than the freakish reception of a radio signal? The truth is you don’t; there is just no way. All the same, I did wonder how she would have reacted had I simply fixed the sound and left the set with no picture!

Delving into the back of the set I quickly established that the basic problem was simply lack of HT supply. As I mentioned earlier, the set was a hybrid type. More precisely, it was solid state with the exception of the vertical oscillator and output stages, and the horizontal output stage. The power supply was a two section arrangement; an HT supply delivering about 250V after the rectifier-four type OA110 diodes. So I promptly replaced all four diode terminals, but rather at a nearby cabinet. Suddenly the set burst into life with an ear shattering roar—the D.O.L. had turned the volume full up in her efforts to get TV sound, and left it that way. I had restored the HT with the prod by simply bridging a hairline crack in the pattern.

So that was it. A few moments’ work with the soldering iron and I had bridged the break permanently and the set was back on the air—minus 2JJ.

But I was intrigued as to the cause of the hairline crack. This particular set has a 15W resistor connected after the bridge rectifier. It is quite a large device, nearly half an inch square and about one and three-quarter inches long, and is clamped hard down on the printed board. Over the years the heat from the resistor had buckled the board, eventually to the point where the copper track failed.

An inherent weakness which is worth remembering.

Equally intriguing was the reason why the set refused to receive the TV sound, since all the necessary circuitry was solid state and still operational. While I can’t be sure, I imagine it was a function of the AGC system, which normally derives its controlling bias from the line output pulses. With no HT on the line output stage and no pulses, it seems likely that the bias of the tuner and video IF stages was so upset that they would not function in the normal way. And that left the way open for any strong RF signal to be rectified by the most convenient non-linearity it could find.

But I didn’t try explaining that to the D.O.L.!

Another recent job was interesting in that it involved a colour TV set and a fault which I had heard about, but not seen before. The complaint amounted to lack of purity or, as the customer described it, “... coloured patches in the corners”.

More precisely, when I saw the set the top left hand corner of the screen featured a cyan patch about 8 inches in diameter, with a similar area of green in the bottom left hand corner. It certainly produced some grotesque effects on certain types of picture.

My first impression was that either the purity had never been adjusted correctly or that someone had subsequently fiddled with the yoke position. So I loosened the yoke clamps, disconnected the blue and green guns, and tried for a normal red screen purity adjustment. It didn’t take me many minutes to realise that this was not the answer; the purity adjustment just wouldn’t work.

Then I did what I probably should have done first; degaussed the tube. But still no joy; the aberrations stubbornly persisted.

I was standing beside the set, wondering what to do next and taking the weight off my feet by resting one hand on a nearby cabinet. Suddenly the penny dropped—the cabinet I was leaning on was one of a pair of speaker cabinets, the second one being in the opposite corner of the room.

But this one was only about 18 inches from the TV set. Could its magnetic field be strong enough to affect the set at this distance? I moved the cabinet about 6ft

ELECTRONICS Australia, November, 1975
The world's most experienced maker of PAL colour TV uses this test equipment.

(So should you.)

Philips range of CTV test instruments are the result of 30 years of experience in Colour TV research, development and manufacture.

They are instruments of the very highest standard, used by Australian Technical Colleges and service schools for their training programmes.

CTV Pattern Generator PM 5509
Invaluable for servicing or aligning black/white and colour receivers as well as Video Cassette Recorders. It provides 5 colour and 5 black and white test patterns which can be electronically tuned to almost all available TV channels for video and audio.

CTV Sweep Generator PM 5334
This enables quick and easy alignment and servicing of black/white and colour equipment. Sweep frequency is variable between 8 and 50 Hz. The stabilized RF output voltage can be alternated 80 dB down from max. of 200 mV (into 76 ohms load). It has one variable and three fixed markers.

Dual Trace Oscilloscope PM 3110
This dual trace 10MHz oscilloscope has automatic triggering without necessarily for level or stability control. Thus the signal is free-running showing a clearly visible trace at all times. The Timebase switch is linked to the chopper/alternate function so change-over for optimum display is automatic. This control gives fully automatic derivation of line and frame once the triggering position is selected. The PM 3110 can take knocks and abuse — making it ideal for TV service work.

Contact: Sydney 2 0223, Melbourne 69 0141, Adelaide 223 4022, Brisbane 44 2471, Perth 21 3131, Canberra 95 0321, Hobart 28 0121.

To Test & Measuring Instruments, Philips Scientific & Industrial Equipment, G.P.O. Box 2703, Sydney, New South Wales, 2001
1. Please send me full details of your Philips PAL service equipment.
2. Please arrange a demonstration for me.

NAME

ORGANISATION

ADDRESS

POSTCODE

38.2513
away and went through the degaussing routine again. Result: a beautiful pure red screen from corner to corner.

Only one problem remained; to get the message across to the lady of the household, who was a foreigner with only a limited command of English. I decided that this was a case where action speaks louder than words.

Leaving the red pattern on the screen, I called her into the room. "Oh lovely," she exclaimed, and I realised that I had put that part of the message across. Then I moved the speaker cabinet back to its old position, immediately destroying the even pattern. The reaction was a little delayed this time, but she was soon nodding her head vigorously and indicating that she understood.

Then, of course, I had to move the speaker away and degauss the tube again. Still, it was worth it, particularly as she understood.

As I said at the beginning, this is a fault I have heard a lot about but have never actually encountered. In fact, I have heard lots of stories about the dreadful things which household appliances can do to colour TV sets, mainly from reports in the daily press.

One of the things which these garbled reports invariably fail to mention is that such appliances, to the extent that they constitute a problem at all, do so only if they happen to be switched off in the immediate vicinity of the TV set. If a vacuum cleaner was close enough to a TV set when it (the cleaner) was switched off, and if the switch happened to break the circuit at or near the peak of the AC cycle, then the collapsing magnetic field could magnetise the picture tube shadow mask and/or the shield.

These reports also fail to mention that even if this did happen, the chances are good that the TV set's own degaussing circuit would take care of the problem the next time the set was switched on. In fact, the problem I have just described may well have responded to the set's degaussing circuit, once the speaker cabinet had been removed. The reason I used my own degaussing coil was to avoid waiting 15 to 20 minutes for the set's system to cool down.

After I had written the foregoing, I had the opportunity to discuss the problem with the service engineer of one of the larger set manufacturers. It so happens that he is an inquisitive type of person who wanted to prove or disprove the theory for himself. So he placed a typical domestic vacuum cleaner under one of their models, which stands on 9in legs, and proceeded to switch it on and off.

His conclusion was that the picture tube could be magnetised on an average of about one switch-off in 25, but that the degree of disturbance was well within the capability of the set's degaussing system, when switched on from cold.

So there you have it, straight from the horse's mouth!

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**PICTURE TUBE QUICK-HEATING CATHODES**

Recent overseas announcements have described a quick-heating type picture tube capable of producing a picture within five seconds of switching on. I was intrigued as to how this was achieved until I came across a brief but lucid article on the subject in a recent issue of "Elcoma Brief". It is reproduced below by kind permission of Philips Elcoma.

For many years the public have been accustomed to having instant sound when using transistor radio receivers, and in a similar way the transistorised sound circuits of television receivers can also provide this facility. However, since cathode ray tubes are still fitted with thermionic cathodes, it has so far not been possible to provide the "instant picture". As a general rule this means that after the set is switched on, the viewer may have to wait up to 30 seconds before the picture appears on the screen.

In an attempt to offset this disadvantage, some manufacturers have incorporated circuit designs which work on the principle that, when the receiver is switched off, the cathode ray tube heater remains in circuit, but operates at a slightly lower voltage than normal. This means that the cathode is allowed to remain hot, and when the viewer switches the receiver on again, the tube fairly quickly reaches its optimum working temperature, thus producing the effect of an instant picture.

Since it is so relatively simple to produce "instant viewing" this way, why is it that more manufacturers do not provide this facility? In certain respects this question can be answered commercially but from a technical stand-point two rather important points are raised. Firstly the television receiver must always be connected to the mains supply in order to provide the "instant on" facility, which in itself may constitute a hazard.

Secondly, the receiver is consuming power whilst switched to the stand-by position, even though the equipment is not being used.

With these problems in mind, the quick-heating cathode-ray tube has been developed using a new type of cathode construction enabling a picture to be available on the screen within 5 seconds of switching the receiver on.

The main details of this new style cathode construction can be seen in comparison with the earlier version (see Figs. 1 & 2) and are given below:

1. The use of smaller components makes it possible to heat the cathode to the required temperature more rapidly.
2. The old-style construction with a long M-shaped filament has now been replaced by a more compact puller-wound heating coil.
3. The inside of the cathode cylinder is given a special coating which ensures very good conduction characteristics between the coil and the cathode.
4. The improved efficiency in warming-up time is achieved entirely by the cathode construction, and does not involve any increase in the total power supplied to the heating coil. In fact one of the many advantages of this type of tube is that the new design has resulted in a 20% reduction in the power required. The new construction is used in 22in and 25in colour shadow-mask tubes using 110° deflection, and 12in monochrome tubes.
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The measurement of "Q" - and an economy Q-meter

by F. G. CANNING, FIREE (Aust)"

Here is a novel design for an easy to build, low cost Q-meter. Fully solid state, it incorporates a low distortion RF oscillator and a measurement bridge system using two MOSFETs. The author gives full coil details to cover the frequency range from 250kHz to 23MHz.

Some years ago an American technical magazine carried a reader's letter with which, rightly or wrongly, I profoundly disagreed. The writer of the letter was complaining that the amount of space being devoted to constructional projects was excessive. He concluded on a rather supercilious note by saying that "he supposed he would have to put up with it until the readers learned to act like engineers and buy their instruments ready-made."

Apart from the obvious fact that a host of small laboratories, both private and commercial, simply do not have the funds to buy numbers of expensive and highly specialised instruments which sit idle on the bench for most of the time, it may be doubted if it is wise to breed a generation of technologists to whom the possession of manufactured and specialised "black boxes" is indispensable to their daily work, particularly if they have only a hazy acquaintance with their internals and principles. The tendency for the young graduate engineer or technician to seem rather helpless in his job unless provided with thousands of dollars worth of sophisticated instruments, like those on which he presumably was trained, was becoming noticeable in industry many years ago and the increasing complexity of electronics is probably accelerating the process.

All the same, it is true that some of the specialised instruments do save much time and effort in experimental design work and anyone who has had daily access to a good commercial Q-meter knows that it comes to seem indispensable.

This article describes a rather simple arrangement for Q measurements over a limited frequency-range, which can be made up cheaply by an experimenter and requires only the simplest calibration to give acceptable results. The circuits used are not new, but some work was done to make them practicable.

DEFINITION OF "Q": The symbol Q, first popularised in the USA, refers to that property of a resonant circuit which has been called "circuit magnification factor" in Britain and parts of Europe. It is an indicator of the quality of a circuit or component and is defined as the ratio of reactance to resistance at the test frequency; thus $Q = \frac{X}{R} = \frac{2\pi fL}{R} = \frac{1}{2\pi fCR}$. Note especially that R is the total AC resistance of the complete resonant circuit, not of any individual component.

BASIC CIRCUITS: Fig. 1 shows a simple series-resonant circuit corresponding to the above equations. If we inject a small EMF, denoted by $e$, at a frequency $f$, in series with the tuned circuit, a current $i$ of the value $e/R$ will flow when the circuit is tuned to resonance with $f$. Then the EMF generated across the inductance will be $(i \times XL)$ which at resonance equals $(i \times XC)$.

We have seen that the Q, or magnification, of the complete circuit is $Q = X/R$ or $iX/iR$; thus $Q$ equals the ratio of the EMF $E$ developed across either of the reactances, at resonance, to the injected EMF $e$; or $Q = E/e$. So if we can inject the signal $e$ at a constant level, we can then use an RF voltmeter of negligible losses connected across either the inductor $L$ or the capacitor $C$ and calibrate it to read $Q$ directly.

Remember that $R$ in the equations is not the ohmic resistance of any part of the circuit but, rather, the total AC resistance of the complete circuit at the test frequency; therefore we are measuring the $Q$ of the whole circuit, and not that of any component. This means that if we want to know, for example, the $Q$ of the inductor $L$ (in which most of the circuit losses are likely to reside) we must use every effort to make all other losses in the circuit negligible. Fortunately this can usually be done and the ratio $E/e$ can then be taken as the true $Q$ of the inductor or other component under test. Actually, there are several associated factors, such as the self-capacitance of inductors, which make an absolute value of $Q$ difficult to measure directly, but they are too complex to take into account here; it is sufficient to remember that the measured value of $Q$ will always be lower than the true value by a few per cent.

There are, however, some points which must be observed if anything like a true $Q$ value is to be obtained. These are:

(a) The means used to inject the signal $e$ must introduce a negligible additional loss into the circuit.

(b) The voltmeter which measures the magnified signal $E$ must have extremely high input impedance and negligible losses, or it will load the tuned circuit and reduce the effective $Q$.

(c) Unless the voltmeter has an accurate square-law response (which almost none of them have, at least over the voltage range needed here) it is necessary that
the injected signal shall have a pure sine wave-form, otherwise the voltage readings may be unreliable. This is an important point which seems seldom to be brought out.

(d) The injected signal must come only from the injection point; i.e., there must be no stray coupling or leakage of signal between the signal source or oscillator and the measuring circuit. This is not always easy to achieve.

Fig. 2 shows three possible ways of injecting the signal. All three are used in commercial instruments, the choice being dictated largely by the frequency involved. What we really want is to develop the injected Q-meter EMF across an impedance of zero magnitude in series with the tuned circuit. As this is an impossibility we have to be content to see across a very small pure resistance or reactance.

Fig. 2a shows injection across a resistor, usually of around .01 to .03 ohm, small enough to be negligible with respect to the rest of the circuit resistance and specially constructed to have RF resistance virtually equal to its DC value. The method is useful for frequencies up to about 25MHz, after which it becomes increasingly inaccurate due to rising RF resistance.

Figs. 2b and 2c show injection across a small inductive reactance and a small capacitive reactance respectively. Inductive injection is often used for frequencies above, say, 20MHz because its resistance and capacitive losses can be made small enough to leave the tuned circuit almost unaffected, but for lower frequencies the reactance falls to such a low value that an impractically powerful oscillator is needed to maintain the injected voltage at the proper value. The inductor used may be of about 0.1 microhenry.

Capacitive injection (2c) calls for a large capacitor of zero inductance and very low losses; it has the opposite characteristic to 2b, working well at low to medium frequencies but failing above about 25MHz because of increasing demands on the oscillator which begins to see something like a short-circuit. The residual inductance of the capacitor also becomes troublesome.

2a and 2b are not practicable for the small laboratory because of difficulty of construction and measurement to the accuracy needed. 2c, however, is straightforward if its frequency limitation can be accepted, because the capacitive components can be bought with sufficient accuracy or built up with the help of a simple capacitance bridge. This is the method used here. It has the further advantage that small stray capacitances are less likely to affect the injected voltage.

BLOCK DIAGRAM. Fig. 3 shows the essentials of the proposed arrangement. A well-screened tunable RF oscillator with a continuously-variable output, capable of supplying 1 volt RMS to the Q-meter input at all frequencies of interest, feeds the Q-meter through a short co-axial RF cable. This standard input of 1 volt is reduced through a capacitive potentiometer to .01 volt for injection into the Q-meter circuit which is tuned by a low-loss variable air-dielectric capacitor. The magnified voltage appearing across the tuned circuit at resonance is measured on a VTVM or other RF voltmeter having scales of 0 to 1 and 0 to 5 or 10 volts. The same voltmeter, on its 1 volt range, can be switched to measure the 1 volt input to the Q-meter. Thus, with the input set to 1 volt and reduced by the capacitive potentiometer to .01 volt for injection, an output of 1 volt across the tuned circuit represents a Q of 100; likewise any observed output voltage, multiplied by 100, represents the Q of the circuit or of the coil under test in the case of an inductor. No additional meters are needed in either oscillator or Q-meter. The high-impedance voltmeter with RF probe which I described in the November 1974 issue of "Electronics Australia" is very suitable for this purpose, but any RF voltmeter with appropriate scales could be used. The Q-meter incorporates impedance-transforming buffers which make very high voltmeter input impedance unnecessary.

Fig. 4 shows three possible ways of injecting the signal. The closest magnetic coupling and the least capacitive coupling between windings is, as usual, to be aimed for; windings arranged in a single layer, end-to-end and close together seem satisfactory.

Anyone who may have found transistor oscillators at all tricky might be recommended to give this circuit a trial for other purposes. A limiting resistor of about 200 ohms permanently in series with RE is a wise precaution to prevent accidental reduction of the emitter resistor to zero, with probable damage to the transistors. RL is not critical and may be around 20k ohms for a start.

FUNDAMENTAL Q = METER CIRCUIT.

This is a rather unusual but very useful push-pull long-tail arrangement using small-signal high gain transistors of the cheapest kind. Fig. 4 shows its essentials. The circuit first came to my notice in an interesting and valuable paper on transistor oscillators by P.J. Baxandall (1) published in 1960. A vigorous oscillator of good stability and fairly high efficiency, it can give a pure RF waveform with distortion as low as 0.1%. As can be seen, the number of parts required is minimal.

The turns ratio of the feedback winding, base to collector, is about 1:10 and not critical. Oscillation is obtainable up to about a quarter of the transition frequency of the transistors used, and down to very low audio frequencies. By making the emitter resistor RE variable a moderate degree of amplitude control can be had without distortion. The load resistor RL, shown dotted, is usually needed below about 5MHz in a tunable oscillator to prevent saturation of Tr2, which can produce distortion. The base battery can be 1.5 or 3 volts, the collector battery of 9 to 18 volts according to output required. Note the polarity of the windings; both are in the same direction and F indicates finish. The closest magnetic
capacitive potentiometer formed by the capacitors of 51pF and 5000pF. A voltage of .01 volt is thereby injected into the tuned circuit across the 5000pF capacitor which is common to both circuits. This capacitor is too large to seriously affect the tuning and if its losses and residual inductance are minimal it will not appreciably reduce the circuit Q.

The magnified voltage corresponding to the Q appears across the tuning capacitor and is monitored by Tr1 and the same external voltmeter with switch S set to "Q". Inductor L represents a coil whose Q is to be measured, connected to the terminals provided. A number of plug-in coils can be provided as accessories, to permit checking of other components such as fixed capacitors or RF chokes by connecting them across the complete tuned circuit.

Field-effect transistors more nearly match the very high input resistance and low losses of the original valve type than do bipolar transistors. They are connected as source-followers to more thoroughly isolate the voltmeter from the tuned circuit and oscillator. In the practical circuit this thought was carried further by using MOSFETS (with insulated gate) instead of the junction FETS of Fig. 5. They are fully comparable with BC108C transistors, but other types work well with minor circuit adjustments and the BC109 should also be satisfactory. The current gain of the chosen type should be high—say 300 upwards. Tr1 and Tr2 together form a buffer stage of the compound series-feedback type which isolates the oscillator from varying loads and gives a low-impedance output at nearly unity gain without introducing distortion, provided the amplitude control R7 is not advanced unduly. R1 controls output to the Q-meter.

The whole oscillator, including batteries, is completely enclosed in a metal box, with a screening partition between oscillator and buffer as shown. All earth connections should be separately brought to the one earth point at the output co-axial socket. Note that neither side of the tuning capacitor is directly earthed. An insulating coupling between its shaft and the outside control dial or knob removes hand-capacitance detuning. The linear type output control R1 may be of either carbon or wire-wound type. The isolating capacitor C1 is not needed for use with the Q-meter, but is included to allow the oscillator to be used separately for other purposes where the output load may be conductive.

THE PRACTICAL Q-METER CIRCUIT

Fig. 7 gives this circuit. The only critical components are the voltage-divider capacitors C6 and C7, which for accurate Q measurements should ideally be of ±1% tolerance, or as near as can be managed. 50pF will be the nearest size commercially obtainable for C7 and should be good enough. If the "preferred value" series is obtainable, C6 and C7 can be made 47pF and 4700pF respectively. They must both be of the silvered-mica type and the wire joining them should be fairly short and of low capacitance to metalwork and other components. C6 must be joined to the "L" terminal and to the tuning capacitor C2 by the shortest possible portions of its own pigtailed to keep its inductive component to a minimum. The actual layout will depend somewhat on what is used for C2, which should be of the best quality obtainable, if possible with ceramic stator insulation. A straight-line-capacitance law (i.e., with semi-circular rotor plates) is perhaps best on the whole, giving a more rational capacitance calibration.

C3, a variable air trimmer of 30 to 50pF maximum with an external dial, together with the "C" terminals or sockets, can be
omitted if desired but is very useful for fine tuning and as a means of measuring small capacitors and the capacitance and Q of switches, sockets, RF chokes, etc. If included it should have ceramic insulation and it is normally set at half-capacitance; its dial is then calibrated in plus and minus picofarads either side of this zero point. If C2 is to be calibrated capacitance; its dial is then calibrated in Q of switches, sockets, RF chokes, etc. fine tuning and as a means of measuring omitted if desired but is very useful for C2. Also include C6 in such calibration.

The chosen MOSFETs have a fourth lead-out connected to the substrate and to the case, denoted by the arrow; this must be grounded. Their drains are decoupled and effectively grounded by C4 and C5 which can be ceramic types. The external voltmeter is switched between their sources by S1. Note the idle contact between the V and Q contacts; this must be grounded, again to reduce stray coupling. The source bias and load resistors R3 and R4 are linear carbon resistors R3 and R4 are linear carbon connecting potentiometers with their sliders connected through R2 and R8 to the trimming potentiometers with their slides, which are usually cheap. It can easily be distinguished from other plastics by its peculiar metallic tinkle when dropped or struck. Choose clear material in preference to coloured kinds, and be careful when soldering on or near it—it will not tolerate heat, even as low as 100°C, without softening. And never allow kerosene or any other petroleum spirit on or near it, or it will “craze” or crack. Other good materials would be polyethylene (polythene), Teflon or polycarbonate, if obtainable in sufficient thickness, but all are rather flexible and may need some support. First-grade ruby mica is also satisfactory and can sometimes be had from suppliers of insulating materials in sufficient thickness to make small panels of adequate strength. Its cut edges are best sealed against moisture with a good tropical waterproof varnish or wax before finally mounting in place.

Input to the Q-meter is by a 50 ohm or 75 ohm RF coaxial cable about 9 inches long with a suitable RF plug at each end, to match corresponding sockets on oscillator and Q-meter. Output to the voltmeter would ideally be by a similar socket and plug but this could be inconvenient, and if the previously-described voltmeter and probe is to be used, two terminals on the Q-meter will be more suitable to receive the existing crocodile clips on the probe.

SETTING UP. (1) Set R3, R4, and R5 of the Q-meter to around half their travel. Connect a multimeter, set to a low DC volts range, temporarily across the drains of Tr1 and Tr2. Connect a 10mA meter in series with the 18-volt supply. Switch on and adjust R3 and R4 until the multimeter reads zero volts (indicating equal drain currents) and the total supply current is about 3 milliamps. Switch off and disconnect the multimeter. (2) Temporarily disconnect the tuning capacitors C2 and C3 from terminal “H” and connect this terminal to the RF input (junction of C7 and C8). Connect up the oscillator and voltmeter and switch on. Adjust the oscillator output to give a reading of about 1 volt on the voltmeter, then adjust R5 until throwing S1 from “V” to “Q” gives the same voltage reading. The two buffers are now balanced. Restore the connections to C2 and C3. If these procedures (1) and (2) cannot be made to give equal “V” and “Q” readings, Tr1 and Tr2 differ too much in their characteristics and another pair will have to be selected. I found it helpful to make up the essentials of the two buffers, less tuning circuits, temporarily on a single panel of Veroboard provided with two transistor sockets, to permit the above balancing procedure to be proved before permanent installation in the Q-meter.

OPERATION. This is quite simple. With the voltmeter on its 1 volt scale and S1 of the Q-meter set to “V”, switch on the oscillator, set its output control to give about 0.75 volt reading, and adjust the oscillator amplitude control R7 while watching the voltmeter. Note the position of R7 at which the voltage ceases to rise and then back off R7 until the voltage falls by 5 to 10%. The waveform (Continued on page 107)
Modified wiper pulser for variable speed systems

Here is a short article following on from that in the May issue describing a windscreen wiper pulser. Contributed by a reader, it describes a modified version of our design which is suitable for cars having an existing variable speed wiper system.

by B. M. BYRNE*

In the May 1975 article of EA describing a variable delay one-shot windscreen wiper, it was noted that the circuit was unsuitable for existing variable speed wipers. It went on to say that these wipers were probably completely satisfactory anyway, but my experiences have shown this to be untrue.

I fitted a single delay, relay/capacitor unit in my previous vehicle, and was reasonably satisfied with it for eight or nine years. But two years ago I changed vehicles and found that my new vehicle had variable speed wipers. These were not satisfactory in all weather situations.

In actual practice the variable speed system has really only a two speed range—about the same as any other two speed system, but with the wipers continuously variable—unnecessarily.

between the two limits. The variable aspect is futile.

Happily your article provided the small amount of inpetus I needed to design a modified version which is suitable for use with a variable speed system. The design has been constructed and tested, although not yet permanently installed in the car.

The main variations from the design presented in the May issue can be seen by inspecting the circuit diagram. I have used a rotary switch instead of pushbuttons, as this involves less dashboard clutter. The number of clicks around is easy to sort out without looking away from the road. As a bonus, it is easy to incorporate extra delays, by using a six-position switch.

A larger relay, with four changeover springsets is necessary. The heavier load of the springsets is associated with a lower resistance coil, so it is necessary to use a discrete transistor as a power amplifier. With the type of relay specified, a 2N3645 PNP type is satisfactory, although with a lower coil resistance, it may be necessary to use a 2N4036 type.

The existing speed control system of the wiper system is rather astounding. It involves a four pole two position switch with the “on” position being rotated further to engage a rheostat for shunt field speed control. The most remarkable feature is that the motor has both series and shunt wound fields, with the park switch actuated by the motor running in the “on” position.

When the wipers are switched off, the motor fields are connected in series, and in reverse polarity. The park switch then opens when it senses the reverse rotation at the end of the wiper travel. In order to achieve the desired delay system, it is necessary to simulate the action of the control switch exactly. Hence the requirement for a four spring set relay.

By taking the power supply from the “off” position of S1a, the wiper switch overrides the timer, dropping it out in “mid-flight” if necessary. The reset time adjustment trimpot has to be set to leave the timer long enough in the “on” phase to ensure enough motor rotation to operate the park switch. At the end of

---

*118 Central Avenue, Indooroopilly, QLD 4068

---

**Diagram:**

The diagram shows a modified wiper pulser for variable speed systems. It includes a relay, capacitor, and series/parallel field control. The diagram also includes a rotary switch for selecting different delay times. The circuit includes a timer switch, a variable speed switch, and a park switch. The relay and capacitor are shown in the circuit diagram with detailed labels for each component.

---

1. S1: Wiper Switch
   - 1: Off (Timer Usable)
   - 2: On (Timer Disabled)
   - 2+: Variable Speed (Timer Disabled)

2. S2: Timer Switch
   - 1: Off
   - 2: 16 SEC
   - 3: 8 SEC
   - 4: 5 SEC
   - 5: 3 SEC
   - 6: 2 SEC

---

**Components:**

- RLA1: Omron LY4
- RLA2: Omron LY4
- RLA3: Omron LY4
- RLA4: Omron LY4
- S1 Park Switch
- S2 Timer Switch
- 2N3645
- RLA
- 12V 100n
- EM401
the delay, the wipers park by the same surprising field reversal system.

The 20A automotive diode, on a 1250 sq. mm heatsink, is to prevent inadvertent operation of the timer from the voltage drop across the motor armature when in ordinary wiper service.

While this system may not accommodate exactly every variable speed drive, I believe it can be adapted to suit most such systems. Vehicles fitted with the wound series and shunt field system as described in this article include the Rambler range—Matador, Javelin, and probably the earlier Rebel. Early Dodges are also fitted with this system, as is the Leyland P76.

The approach of this circuit system is suitable for virtually any vehicle at all, providing it has a self-park wiper system. With four changeover springsets, it is possible to "dip" into any circuit, with the "break" legs of the springset providing the override facility for normal control, and the "make" legs completing the circuit when pulsed.

The main difficulty in fitting the unit to any particular car is to sort out the wires at the rear of the wiper switch. This is best done by using the vehicle workshop manual, and observing the colour code. The actual method of construction, and the way in which the unit is installed, will depend quite heavily on the type of vehicle, and the available dashboard space, so no details have been included.

---

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Using only a 3-terminal regulator, one operational amplifier, and two resistors, this circuit can supply up to 1 amp voltages between about 7V and 33V.

The operational amplifier is used to hold the common terminal of the regulator at a fixed voltage, as determined by the ratio of the two resistors. The output voltage is then 5V more than this reference voltage. A circuit analysis shows that the output voltage is given by 5(R1 + R2)/R1.

The maximum output voltage is determined by the maximum allowable input voltage. For the devices specified, this is 35V, so with a minimum drop across the regulator of 2V, the maximum output voltage obtainable is about 33V.

The minimum output voltage is determined by the capabilities of the op-amp. With the type specified, voltages down to about 7V can be achieved. The line and load regulation will be the same as would normally be achieved with the 3-terminal regulator alone.

If a variable supply is required, then the resistors can be replaced by a potentiometer. The 0.1uF capacitors shown across the input and output may be necessary to ensure stability.

(By David Edwards, E-A staff.)

Wow and flutter tests

Rather specialised equipment is needed to measure wow and flutter and listening tests are quite subjective, as it is not easy to distinguish between small amplitude and frequency variations. The following tests with relatively simple equipment give useful results, particularly for comparison purposes.

(a) If you have a professionally made test tape with sinewave tones, select a track of about 1kHz. Feed an output from the recorder (playback) into the vertical input of a CRO. Into the horizontal input feed an audio signal generator having good frequency stability and set the frequency to 1kHz to produce an almost stationary 1:1 Lissajous pattern, in this case varying from a diagonal line to a circle. Wow will cause the pattern to oscillate slowly through various phase angles, and flutter will produce rapid overlapping ellipses. The higher the frequency of the two inputs to the CRO, the more sensitive the test will be, limited only by the stability of the audio oscillator and the quality of the test tape.

(b) If a professional test tape is not available, make a recording from the oscillator using a good quality cassette (just rewound), and proceed as before. In this case the observed wow and flutter will be the algebraic sum of the variations during record and playback, reaching twice the value obtained by method (a). If wow is due to friction in the cassette it may be partly cancelled. A square wave recording also produces an easily interpreted pattern, but use a sinewave on the horizontal input.

(c) Another version of this test is simply to view the output wave on the CRO with the normal timebase free running (without sync). Assuming the timebase frequency is stable (not necessarily the case) and having set the fine frequency control for a stationary pattern of a few waves, any frequency variations cause the pattern to drift, the direction of movement indicating the direction of frequency shift. Again, the higher the frequency used the more sensitive the test, as it is phase change we observe which is related to frequency change, not percentage frequency change as detected by the ear.

(By Mr P. H. Mathieson, M.I.E. Aust., Box 115, Kathmandu, Nepal.)

Method of measuring amplifier distortion

Most audio amplifiers have negligible phase shift over a reasonably wide frequency range. By using a nulling technique as described below, it is possible to make distortion measurements quite simply within this range.

The two circuits show how the distortion of inverting and non-inverting amplifiers may be measured using only a signal generator, some resistors and an AC RMS voltmeter. For non-inverting amplifiers a signal generator with a floating output, or an isolating transformer, is required. The resistor should be selected as follows:

R2/R3 = V_s/V_o, with R2 + R3 = 10k

where \( V_s \) = maximum signal generator output for inverting amplifier arrangement and \( \frac{1}{2} \times \) maximum output voltage for non-inverting arrangement.

Vo = maximum desired amplifier output
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(By Ross Dannecker, Electrical Engineering Dept, University of Qld, St. Lucia, Qld 4067.)

% distortion \( \approx \frac{V_2 . R_2.R_{in} + R_3.R_2 + R_3.R_{in} . 100}{V_1 . R_2.R_{in}} \)

where, \( R_{in} \) = input impedance of device used to measure V2

If an oscilloscope is used to measure V2, the nature of the distortion can be identified. Since a differencing technique is used, distortion levels within limits, below the distortion of the signal generator can be measured. It should be noted that this method is not suitable for amplifiers with frequency dependent gain like RIAA preamplifiers.

(By Mr N. Pollock, 126 Abbott Street, Sandringham, Vic. 3191.)
SILICON CONTROLLED RECTIFIERS

This Teach Yourself Board introduces the thyristor or, to be more exact, one of the thyristor family known as a silicon controlled rectifier (SCR). This board was made to show that an SCR functions as a switch which is easily turned on, but not so easily turned off.

The lay out of the board is shown in the photograph. It was built on a standard wooden chassis as described in part one of this series.

The circuit diagram is shown in Fig. 1. The arrows on the lines showing current flow indicate the direction in which current is conventionally said to flow — out of the positive terminal of the battery and in at the negative terminal. The arrows are therefore pointing in the direction opposite to the direction of electron flow.

The wire model was laid out, as can be seen, with components placed in the same relative positions shown in the circuit diagram.

The "switch in the gate circuit of the SCR was simply a strip of brass soldered at one end to the nail between resistors R1 and R2. It acts as a push button when pressed against the nail below its free end. The battery, comprising two AA cells, was held on the board with an aluminium clip.

The prototype used a G.E. C6A SCR which will carry 1.6 amps and block 100 volts; it is therefore overrated for its duty in this model. Almost any SCR which will carry half an amp would do instead, but the terminal pins would have to be arranged to suit. However, it is important to select an SCR which can be turned on with less than three volts. The C106Y1, available at $1, has high gate sensitivity and is a suitable alternative to the original used.

If any trouble is experienced with turning on the SCR, the value of R1 should be reduced so that the voltage applied to the gate is increased.

PARTS LIST

- 3 1000 ohm resistors 1/4 watt
- 1 torch bulb for 2 cell torch
- 1 silicon controlled rectifier C6A, C106Y1, or similar
- 2 AA cells
- 1 crocodile clip, brass, aluminium, nails etc

FIG. 1
WHAT AN SCR DOES

The SCR (silicon controlled rectifier) is one of several members of the thyristor family, and probably the best known one. The (SCR) is an electronic switch. But, unlike an ordinary switch, an SCR can only turn the current ON. It can’t turn it off. Also, unlike an ordinary switch, it will carry current only in one direction—in at the anode and out at the cathode.

Put the red clip, which is the positive lead from the battery, on to the terminal marked +. Notice that the lamp does NOT light even though there appears to be a circuit through it, as shown by the dashed line in the diagram.

Now press the springy brass strip down, and let it go. The lamp turns on and stays on. The only way to turn the lamp off is by removing the clip. When you pressed the brass strip you momentarily applied a voltage to the gate terminal of the SCR. The voltage was 1.5 because it came from the junction of two equal 1000 ohm resistors R1 and R2, connected in series across the three volt battery—see the solid line in the diagram. Some SCRs need a pulse of more than 1.5 volts to turn them on.

The third resistor R3 of 1000 ohms is always included in an SCR circuit between gate and cathode, to stabilise the operation. Note that, unlike a transistor, an SCR can NOT be used to control the amount of current flowing through it—at least not in the simple DC type circuit considered here.

Please park the red clip.

FURTHER SUGGESTIONS

There are some further experiments which could be carried out by beginners who have a multimeter available.

1) Measure the voltage between the anode and cathode of the SCR when the lamp is on. It will be about 0.8 volts.

2) Now, unscrew the lamp from its holder (which turns off the SCR) and substitute resistors of various values (say 47 to 470 ohms) one at a time, in place of the lamp.

After each resistor has been connected, switch on the SCR using the springy brass strip, and measure the voltage between the anode and cathode of the SCR. Note that the voltage across the SCR stays fairly constant. The SCR does not follow Ohm’s law.

In these experiments you have turned off the SCR by reducing the current flowing through it to zero—by removing the battery lead or by unscrewing the lamp. More precisely, the SCR is turned off by reducing the current through it until it reaches a critical value called the holding current.

You could experiment with this by substituting for the lamp a 10000 ohm potentiometer used as a variable resistor in series with a milliammeter. Set the variable resistor to about 500 ohms, and turn on the SCR. Read the current flowing through it. Now increase the resistance (be careful not to decrease or the milliammeter may be overloaded) and the current will drop.

At some critical value (the holding current), which may be between 0.5 and 5 milliamps, the current will suddenly drop to zero, and will not increase even though the resistance is decreased—because the SCR has been turned off.

On this board you have used what is, in effect, a push button switch to turn the SCR on. In many cases this may be inconvenient. In the next section we will look at a device which is often used to turn on an SCR, without a push button. It’s called a unijunction transistor, and it can provide just the right sort of pulses needed to ‘trigger’ or ‘fire’ an SCR.

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ELECTRONICS Australia, November, 1975
Orff, Carmina Burana: “disappointing”

ORFF—Carmina Burana. Cantata for voices and orchestra with Judith Blegen (soprano); Kenneth Riegek (tenor); and Peter Binder (baritone) and the Cleveland Orchestra and Chorus and Boys’ Choir conducted by Michael Tilsom Thomas. CBS Stereo SBR 235726.

This work has had an unusual history. When first generally heard just after the war it made a terrific impact on European and American musical circles where it was hailed as a masterpiece. Learned critics commented sagely—and to my mind correctly—on its simplicity of style. Much was made, indeed, of the bareness of the words, especially as most were of 13th century monkish origin. In other words it was the smash hit of the immediate post-war years. Since then it has declined in popularity and some critics, after a second look at the score, have had second thoughts about its value. Personally I still find a good occasional performance of the work an exciting experience. Alas, I cannot say the same about the performance under review. Carmina’s success lies in the physical impact of the forceful use of Orff’s deliberately simple, steady rhythms which give the work its elemental atmosphere. To alter this is to deprive it of much of its appeal. Yet, again and again Thomas does just this, going after artificial means by increasing speed to chase mounting excitement, thereby sacrificing much of the primitive appeal. His tempos, usually initially fast, gain wild momentum as the episode continues to scramble towards a hectic last few bars. I don’t think many informed listeners would disagree with my statement that this was not Orff’s intention at all.

Regularity of beat with sharply accented rhythm’s are essential if the work is not to acquire the alien atmosphere of the Bohemian Dance that opens the second act of Bizet’s Carmen. And this distortion is all the more to be regretted because of the very high standard of the singing and playing.

Another point: The sleeve notes state, with some exuberance, that endless care was taken to produce a quadraphonic recording with the conductor—and I presume his audience—surrounded by sound coming from all quarters. “Gift wrapped” Orff, so to speak. And very gaudily wrapped, too. My pressing is in stereo and in terms of sound has its good and not so good features.

But even this aspect doesn’t tempt me to prefer many other recordings of Carmina, especially that of Frühbeck de Burgos for HMV, though it is now just on ten years old. Perhaps the quad version might please those who like listening to some of the music through the back of their necks but I cannot imagine it altering the fundamentally disappointing Thomas reading. The stereo version is spacious, it is a little reverberant, with good separation but lacking in total refinement. And some of Thomas’ exaggerations of tempos and dynamics become, after a while, downright annoying. The work is exciting enough as it should be played without these vulgar attempts to raise the audience’s blood pressure by artificial means.

In my opinion the best feature of this issue is the picture on the sleeve of Hieronymus Bosch’s Garden of Delights with its Playboy-like treatment of sex. And even this is spoiled by much of it disappearing under the poster-sized type in the title!

Simon Boccanegra

VERDI—Simon Boccanegra. Complete revised opera. Piero Cappuccilli (Simon); Ruggero Raimondi (Fiesco); Gian Piero Mastruome (Albini); Maurizio Mazzien (Pietro); Katia Ricciarelli (Maria); Placido Domingo (Adorno); RCA Chorus and Orchestra conducted by Gianandrea Gavazzeni. RCA Stereo ARL3 0564. (Three discs.)

When Verdi revised this opera some 25 years after its composition and added the great Council Chamber scene I wish he had, at the same time, reduced the length of the two final ones. True, anything that comes after the Council Chamber is something of an anticlimax but, even today, Simon still takes an “unconscionable time dying”. But having said that I hasten to add that here is a very beautiful performance indeed, and it is also, for some reason or other, the first recording of the opera to be issued in stereo. And this, despite the fact that you will find many unfamiliar names in the cast. Much of the credit for this splendid set must go to the conductor, Gavazzeni, who, when sufficiently committed can still give a performance comparable only to one given by the very greatest of Italian operatic conductors, Toscanini included. And there is no doubting the extent of his commitment here.

His interpretation is entirely dramatic to which the superb quality of the engineering contributes much. Under his direction the score is full of colour, some of it very forceful but always imbued by typical Italian delight in the sheer exuberance of sound. Yet it is never coarse and, even at its most assertive just fierce. Only one of the principals tends to disappoint—Katia Ricciarelli, who is plainly out of her depth vocally and dramatically among her colleagues. Of these, all of them fine, I choose for reasons of space, Placido Domingo, Piero Cappuccilli, and Gian Piero Mastruome for special mention.

I still have the old HMV mono set with Gobbi, Christoff and de los Angeles, the sound of which still wears very well despite its age—it was issued 17 years ago and has long since been deleted from HMV’s catalogue. Its conductor, Gabriele Santini, lacks Gavazzeni’s sense of urgency. And in this set, too, there was one dud in the cast—tenor Campora as Adorno. Interestingly with this set is a short note on interpretation by Gobbi in which he proclaims Simon as his favourite role. I have been very happy with this set for many years and if it were still available would, all things considered—its age, its few faults and many beauties—be in a quandary as to which to recommend. But as things are I plump hesitatingly for the new set. You’ll have to be very hard to please if you don’t agree. Simon Boccanegra is a great opera, uneven perhaps but with sublime moments, its revisions pointing the way to Verdi at his most mature and innovative. It has recently been added to the repertoire of the Australian Opera.

GRIEG—Lyric Pieces for Piano. Played by Emil Gilels. DGG Stereo 2530 476.

These little pieces, 20 in all, are not to be confused with the composer’s Lyric Suite, at one time very popular as Palm Court music. You might recognise a occasional one here and there but I, personally, heard many of them for the first time on this disc, and very charming I found them. I don’t seem to be alone in this experience because Gilels himself, according to the sleeve notes, didn’t hear about them until late in life. The pieces were composed at various stages of Grieg’s creative career, from the very beginning to almost the end. In most cases their effect relies on their simplicity and this Gilels is careful to observe. And
while some might not be in complete agreement with his treatment of a few—a very few—he offers throughout a delicious example of piano playing.

I think it was Debussy who described Grieg's music as "snow wrapped in pink paper". A pity this, if it has put you off listening to some of these enchanting miniatures. The longest of them runs only three seconds over 4½ minutes. Many are less than two minutes long—or short, whichever way you'd like to put it. Try relaxing to this discful of delicious trifles. I did so and felt all the better for it. The piano tone is impressively faithful.

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SCHUBERT—String Quartet No. 14 in D Minor (Death and the Maiden). Quartettsatz (Nr. 12) in C Minor. The Melos Quartet of Stuttgart. DGG Stereo 2530 533.

This is a highly personalised reading by the Melos Quartet of Stuttgart, not to be confused with the Melos Ensemble of London. Death and the Maiden will probably be too well known for readers for me to go into raptures over the delights it offers. As to the playing, some of the accenting in the first movement is rather heavier than one expects to hear in Schubert's chamber music. By the way, the recording is so forward that I found it necessary to turn my gain way down. At normal setting there is a glare on the sound and evidence of slight tonal roughness. And even at a lower level the dynamics are very wide for this type of work.

Throughout this quartet I had an uneasy feeling that the emotion here and there sounded a little forced, as if it were applied from the outside, not growing there sounded a little forced, as if it were applied from the outside, not growing. I mean that at times it sounds closer to Bach than to Gounod. The concluding Rigadoon is as merry as all get out with the slower middle section supplying just the right contrast to the rest. This disc is strongly recommended to those with a liking for Grieg's music in the Holberg Suite on the reverse side, something that happens only too frequently even when performed under some of the most famous batons nowadays. The neat Prelude is followed by an elegantly phrased Sarabande. The Gavotte is discreetly accentuated without plodding over-emphasis. The Andante Religioso is reverent, but free from sickly piety. By that I mean it sounds closer to Bach than to Gounod. The concluding Rigadoon is as merry as all get out with the slower middle section supplying just the right contrast to the rest. This disc is strongly recommended to those with a liking for the lighter type of good music. And once again I recommend this brilliant young conductor, who shares the conducting of the Netherlands Chamber Orchestra with Simon Goldberg, to the notice of the ABC as a possibility for an Australian tour. I am sure he would be well liked.

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Zinman firmly refuses to miniaturise Grieg's music in the Holberg Suite on the reverse side, something that happens only too frequently even when performed under some of the most famous batons nowadays. The neat Prelude is followed by an elegantly phrased Sarabande. The Gavotte is discreetly accentuated without plodding over-emphasis. The Andante Religioso is reverent, but free from sickly piety. By that I mean it sounds closer to Bach than to Gounod. The concluding Rigadoon is as merry as all get out with the slower middle section supplying just the right contrast to the rest. This disc is strongly recommended to those with a liking for the lighter type of good music. And once again I recommend this brilliant young conductor, who shares the conducting of the Netherlands Chamber Orchestra with Simon Goldberg, to the notice of the ABC as a possibility for an Australian tour. I am sure he would be well liked.
Devotional Records

SONGS FROM THE INNER COURT. Pat Boone, with orchestra, organ and chorus. Stereo, Lamb and Lion LL-1016 (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

A phrase borrowed from the Inner Sanctuary of the traditional Jewish Temple, the title nevertheless describes a collection of traditional hymns which speak of the most intimate relationship between an individual Christian and his God. The titles, all well known, will make the intention clear:


Just before you set off to buy your copy, I think I should sound a word of caution. The arrangements, the recitative passages and the whole presentation is designed to emphasise the emotional aspect and, while this has been the clear intention, it will also heavily restrict the numbers of those who will enjoy the "tarry meeting" atmosphere. Definitely one that should be sampled personally before buying. (W.N.W.)

HEAVY ORGAN AT CARNEGIE HALL.


This is the second of two albums recorded in December 1973 by Virgil Fox in the Carnegie Hall, using the Rogers Touring Organ. Performed before a predominantly youth audience, and to the accompaniment of psychedelic lighting, the occasion seemed to generate the excitement of a pop concert, except that the music was that of Bach, and the artist a classical organist. If the audience applause anticipates the final bars of each item, it is for you to decide whether the enthusiasm is offensive or exhilarating.

Virgil Fox encourages the audience involvement with a spoken introduction to each item, presenting Bach as a man of fervour, a musical giant—"the red-blooded Bach".

To this remark one is compelled to add: a red-blooded performance also, on a red-blooded instrument! Maybe this is the smaller brother of the big Rogers which was permanently installed shortly afterwards in Carnegie Hall, but my tip is that you'll tend to forget its electronic soul as you listen to the ultimate sound. Electronic, acoustic? Merely the means to an end!

After all that, I'd better mention the track titles: We All Believe In One God—Rejoice Beloved Christians—Prelude & Fugue in E Minor—Toccata & Fugue in D Minor—Passacaglia & Fugue in C Minor. In short, a record well worth a hearing—provided you don't mind exchanging some of the traditional formality for virtuosity and exuberance. (W.N.W.)

PETER & THE WOLF (Prokofiev);

YOUNG PERSON'S GUIDE TO THE ORCHESTRA (Britten). Narrated by Will Geer. English Chamber Orchestra conducted by Johannes Somary. Stereo, Astor VSD-71189.

The number of similar albums released over the years attests the popularity of this particular coupling.

"Peter And The Wolf" is a simple tale of the countryside, which serves to highlight various instrumental sounds and to illustrate how they may be used to develop a mood or a story line.

"Young Person's Guide To The Orchestra" is more directly tuitional and is a natural follow-on to "The Wolf". It nominates and describes various families of instruments, while weaving their sound into what is virtually a continuous pattern of sound.

If not by name, you will certainly recognise Will Geer from his photograph as grandpa in the TV serial "The Waltons". To my mind, however, Grandpa is not an ideal choice in Australian ears for "The Wolf". His accent is heavy and his efforts to dramatise a tale for the young'uns tends to dominate rather than interpret the music. His "Guide To The
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**Orchestra** is much more successful.

As for the orchestral sound itself, I have no criticism. It exposes individual instruments or groups as necessary, while always ready to assert the orchestra's full weight and authority. Individual reactions will really centre on that one aspect, narration of "The Wolf" (W.N.W.)

**THE CLASSICAL GUITARS OF LOS INDIOS TABAJAROS. RCA Victor. Stereo. CPL1-0668.

Los Indios Tabajaros are a very polished pair of guitarists-there is no doubt of that. Forget the fact that they originally came from the Brazilian jungles. On this album, they perform pleasant renditions of light classical tunes and in so doing create a charming Continental atmosphere which is ideal for dining or relaxing. Recording quality is excellent and surface noise on my sample was negligible.

Eight tracks are featured: Valse in A Minor, Op. 34, No. 2 (Chopin) - Fur Elise (Bagatelle in A Minor) (Beethoven) - Recuerdos de la Alhambra (Tarrega) - Hora Staccato (Dimicu-Heiteit) - Valse in A Flat, Op. 69, No. 2 (Chopin) - La Ronde des Lutins (Antonio Bazzini) - Serenata Espanola (Joachim Malats) - Romance de Amor (Vincente Gomez).

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**GOOD MUSIC CLASSICAL HITS. Festival Strings. Festival Stereo L 25206.

I must admit to being dubious about this album from the moment I saw it. You might call it instant disenchantment. The cover portrays three likely lasses in white strapless evening gowns standing in a park setting. Two of them hold a violin each while the third wields the double bass. On this album, they perform pleasant renditions of light classical tunes and in so doing create a charming Continental atmosphere which is ideal for dining or relaxing. Recording quality is excellent and surface noise on my sample was negligible.

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**ROLLERBALL Soundtrack Recording, with The London Symphony Orchestra conducted by Andre Previn. United Artists L-35597. Festival Release.

This record was quite a pleasant surprise, considering that the movie is built around a particularly violent version of the roller game set some time in the next century. With the exception of the third track on each side, an exercise in synthesiser gymnastics, the best definition of the disc would be a high quality sampler of music from Bach, Shostakovitch, Albinoni and Tchaikovsky, played by one of the world's tinnest orchestras. The classical tracks are: Toccata In D-Minor (Bach) - Symphony No. 8 (Shostakovitch) - Symphony No. 5 (Shostakovitch) - Adagio (Albinoni) and another excerpt from Shostakovitch, No. 5. The quality and effective use of stereo is excellent. (N.J.M.)

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**WALTER DE LOS RIOS, OVERTURES. Hispavox L-35486. Festival Release.

Walter De Los Rios is up to his usual tricks in this collection of well known overtures from opera. Each track starts off 'straight' but, after a few bars, a very forward percussion group comes in and everything swings in a way that many obviously enjoy. The overtures given the treatment are: Rosamunde - Romeo and Juliet - Light Cavalry - Die Fledermaus - A Midsummer Night's Dream - Barber Of Seville - Egmont - Don Pasquale. Like other Hispavox records I have heard, the sound quality is superb, with excellent reproduction of percussion. I would like to hear their version of 'Golden Wedding'. (N.J.M.)


It seems a long time since I heard much of 'South of the Border' music and this enjoyable disc certainly brings to mind the popularity of this style of rhythm some years ago. Some of the titles are standards, such as: La Bamba - La Paloma - La Golondrina - La Cucaracha and Cielito Lindo. Other tracks are somewhat more recent: Adelita - Tittacca Lake - Conan Antigo - Tony's Bolero - Guantanamera - Lupita - Conrio Nuevo - Little Flower - Indios Noches.

The quality is really good and, if your popular music taste is becoming a little jaded, try a little touch of Mexico; I think you'll be pleased. (N.J.M.)


This is another rollicking fun record from the Nashville Studios of Monument, with Charlie McCoy on Harmonica and vocals and the longest list of supporting musicians and others I've ever seen on a record sleeve. The titles are: Old Joe Clark - The Twelfth Of Never - City Lights - I Honestly Love You - New River Gorge - Please Don't Tell Me How The Story Ends - Everybody Stand Up And Holler For The! Union - Making Believe - Back Home In Indiana - Sweet Memories - Luke.

The quality is the usual high Nashville standard and this would make a great party record. (N.J.M.)

**KING CRIMSON USA. Island Records L 35520. Festival Release.

This is the final King Crimson album. It was recorded live in June 1974, just before the group was disbanded, at the end of a massively successful American tour. The six tracks are: Larks' Tongues In Aspic, Part II - Lament - Exiles - Asbury.
500 Hz 5,000 Hz

500–5,000Hz and it's almost flat. How's that for about $50 worth!

It's the performance curve of Philips new mid range speakers. That curve is so flat it gives a variation of as little as ± 1 dB over the same frequency spread. And even beyond those levels the drop is gradual on either side. And to think this performance is now available for about the $50 mark. Not bad for a 50 Watt dome squawker speaker. For further information please contact ELCOMA Electronic Components & Materials, Box 50, P.O. Lane Cove, NSW 2066 or telephone 42 1261 or 42 0361. Branches in all States.
Lighter Side


It goes almost without saying that this record should be played loudly. I found the first track to be particularly impressive, with its muscular syncopated theme that rises through a series of crescendos to an excruciating climax. The final track is from the first-ever King Crimson album, possibly their best known work.

Record quality is excellent, although some tape hiss is evident between tracks. (D.W.E.)

* * *

Acker Bilk, His Clarinet and Strings, Astor Quad 1030.

No one can dispute that Acker Bilk can play the clarinet—he can almost make it talk. But he cannot sing (as he tries on one track) and he is definitely better off without string accompaniment. So give us more of Acker Bilk and less of that other nonsense. For those to whom Clarinet and Strings appeal, the recording quality is good.

Track titles are: If I Had A Ribbon Bow—She—that's My Desire—Theme From Swan Lake—Yesterday's Smile—Lone—Someone Who Cares—Bachianas Brasileiras No. 5 Aire—At Twenty One—Summer Flower—The Promise Of Your Eyes—Someone To Watch Over Me—Wandering—Aur Wiedersehen, My Dear. (L.D.S.)

* * *

Steppin' Out With Lenny Dee, MCA Stereo Maps 7639.

Lenny Dee has probably done more to popularise the Hammond Organ than any other exponent and he has certainly been at it for some time now. But he shows no sign of losing the ability to put out lively versions of popular songs. Recording quality on this album is fine and the stereo spread is of the three-channel variety. A good buy.

Eleven tracks are featured: Steppin' Out (Gonna Boogie Tonight)—Bonaparte's Retreat—Room Full Of Roses—If You Love Me (Let Me Know)—You're Having My Baby—Rock Your Baby—Feel Like Making Love—Annie's Song—The Entertainer—I Honestly Love You—I'm Leaving It All Up To You. (L.D.S.)

* * *

If I Only Had Time, John Rowles, MCA Coral stereo COPS 7540.

I could adopt this album as my own theme song but that is not the only reason for approving this disc. The big-voiced New Zealander is a fine performer who puts a great deal of zest and feeling into every song. And this disc is a bonus with sixteen tracks and all of them good numbers. Quality is good. A very good buy.

The sixteen tracks are: If I Only Had Time—I Must Have Been Out Of My Mind—Another Tear Falls—One Room World—Aquarius/Let The Sunshine In—Save The Last Dance For Me—Hush . . . Not A Word To Mary—One Day—All Kinds Of People—A Lifetime Of Love—You've Lost That Lovin' Feelin'—What Are You Doing The Rest Of Your Life—What Greater Love—Where Do I Begin (Love Story)—The Windmills Of Your Mind—In The Name Of Heaven—The Way Of Love. (L.D.S.)

* * *

The Mood I'm In, ABC Records, L35571 Festival Release.

Diana Trask left these shores some time ago to make her name in the USA and, judging by her performance on this disc, she has certainly done this. A number of the tracks are getting a lot of play at the moment, particularly 'Oh Boy' and 'Country Bumpkin'. Other tracks are: A Whole Of Things To Sing About—Fever—Back Home Again—There Has To Be A Loser—I Can Take A Little Heartache—Sunshine—Evil On Your Mind—Alone Again Naturally—I've Been So Wrong For So Long.

There is a sad country theme running through most of the songs but the overall quality is excellent. (N.J.M.)

* * *

Don Williams, You're My Best Friend, ABC Records, L-35556 Festival Release.

If you like a pleasant deep voice in a series of country flavoured songs, give this record a hearing. The tracks are: You're My Best Friend—Help Yourself To Each Other—I Don't Wanna Let Go—Swingin' Is My Business—Love Me Tonight—Where Are You—Promised You—You're The Only One—Reason To Be. It is the backing musicians reveals a number of names that crop on nearly any record that comes from the studios in Nashville. This in itself is a virtual guarantee of musical competence these days. (N.J.M.)

* * *

John Macdonald, Fireside Scottish Accordion Singalong, M7 Stereo MXL 091.

Take a well played accordion, mix it with a piano, organ and percussion backing and you have a sure-fire recipe for a good record like this one. Not all the titles fit in with the Scottish theme of the title, but one can overlook this.

The tracks are: Que Sera Sera—C'est Si Bon—Scottish Soldier—Pub With No Beer—China Doll—Those Were The Days—Volare—Help Me Make It Through The Night—The Old Northern Lights Of Old Aberdeen—I Belong To Glasgow—Moon River—I Get A Kick Out Of You—Mare Mare Mare.

As a party sing along disc it would be hard to beat and the quality is excellent. (N.J.M.)

* * *

Dan Hill & His Mini-Korg Synthesizer, Interfusion stereo L35523.

This album of Moog grunts, whistles, wails and twangs gets the nod in spite of some negative feelings I have for Moog music. Arrangements are big, bright and have the right flavour of the ridiculous. Record quality is good.

Track titles are: Bubble Gum—Show Me The Way—Push Just A Little Bit Harder—Time Is Tight—Any Kind Bazaar—Kleine Nachtgall—Bicycle Morning—Mr Big Stuff—The Happy Frog—What Don't Wanna Make Those Eyes At Me—For—Don't Break This Heart—Why Me—Red River Ride—La La La Love You. (L.D.S.)

Reubert Hayes... "congratulations"

Favourites Of The Forces Sing-Song, Reubert Hayes playing the Rogers Century Organ. Stereo, M7, MLX-094.

It was some time ago that this record by Parker Oakes rang me to say that he'd just taped an exciting performance by his father-in-law, veteran theatre organist, Reubert Hayes. Now I know why he was so keen about it.

With a 3-manual Rogers "Century" electronic organ especially set up in the Civic Theatre in Newcastle, NSW, Reubert Hayes had everything going for him to record a program of the community songs that won him Australia-wide fame during the war, broadcasting from Brisbane's Regent Theatre. Remember them?

Blightly; Anchors Aweigh; Marines' Hymn—Roses Of Picardy—Tipperary; Bless 'Em All; Long, Long, Trail; Lili Marlene; Gundagai; Mexicali Rose; Home Fires—Land Of Hope And Glory. Side 2 contains two more medleys, a well played "Jealousy"... "A Perfect Day" (strongly reminiscent of Jesse Crawford) and Reubert's signature theme "Beyond The Blue Horizon".

Technically, the mic. hasn't quite caught the percussion and the sound is a trifle "middly" but, as compensation, there's none of the acoustic intrusions that so often occur in recording big acoustic instruments. This is a big electronic in a real theatre and, as I listened, I couldn't help feel that it's the record that rival organ dealers might wish had never been made. The organ has the sounds of a traditional theatre instrument and, most importantly, the complex interplay of tones, and the slight variations in loudness of individual notes that make the sound sonically interesting.

Congratulations to all concerned and to M7 who organised its transcription to disc. (W.N.W.)
Development technique

At first sight it may seem inappropriate to review this book here since it is primarily a management text. However it is specifically aimed at those people who are involved in product development in the electronics industry and allied technical fields. Considering the lack of new product development in Australia, by rights it should be a bestseller.

The book is a practical guide to such topics as the establishment of procedures for development projects, planning, budgetting and expenditure control, monitoring of progress, organisational structure and personnel selection. There are several appendices which are also very useful. One on network planning makes mention of techniques such as PERT and CPA and others give specimen target specifications for typical product development programs.

Our review copy came directly from the publisher. (L.D.S.)

All about pictures

A fairly advanced treatise on the fundamental principles of electronic systems designed to process, store or transmit pictorial information. It has been written primarily for communications engineers working in broadcast and cable TV, facsimile, videotelephones, computer terminals, scanning electron microscopes and similar fields, but is also suitable as a text for senior undergraduate and graduate university courses, and as a research reference work.

The material covered is shown fairly
concisely by the chapter titles: 1—The Mathematical Analysis of Images; 2—Properties of the Eye Affecting System Design; 3—Scanning; 4—Reception and Display of Monochrome Pictures; 5—Transmission of Monochrome Information; 6—Displays in Colour; 7—Transmission of Colour Information; 8—Subjective Assessment of Picture Quality. The book ends with an extensive list of references, and a topic index. Although much of the treatment uses abstract mathematics such as Fourier Transforms, many of the basic concepts presented in the text are readily understandable by non-mathematical readers, thanks to the author’s clarity of expression. The book may therefore be of interest and value even to non-specialists.

The review copy came from the publisher, with no advice regarding local price and availability. (J. R.)

Now available

When the Semicon International Transistor Manual (1974 Edition) was reviewed for the April 1975 issue, no details were to hand regarding local price or availability. However we have now been informed that copies are available from Dick Smith (Wholesale) Pty Ltd of 162 Pacific Highway, Gore Hill NSW 2065. The price quoted is $28.00 plus post and packing, where applicable.

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ELECTRONICS Australia, November, 1975 91
HMV 18-inch "Braddon" colour receiver

A recent, and very popular addition to the HMV range of colour television receivers is the "18-inch" "Braddon" model 12613. Manufactured for EMI by the Japanese General Corporation, it conforms in all respects to Australian standards, and is already building up an excellent reliability record.

While obviously aimed at the lower end of the market in terms of price, the "Braddon" is in no sense a "cut corners" design. It is housed in a neat wood-grain finished cabinet, with a front facia of matte black and satin chrome. The rear of the receiver is enclosed by a removable moulded cover, permitting direct access only to the antenna connections, the preset hold controls, and vertical height and linearity. It would obviously be a very suitable receiver for small to medium viewing situations.

Conforming to Australian standards, it offers full PAL-D colour decoding and includes a 13-position tuner covering all existing local VHF channels, with in-built automatic fine tune. However, it also includes a UHF tuner covering channels 21 to 68, against the day when these are put into service in particular areas. As normally received, the UHF tuner feeds in via VHF channel 11 but this can readily be altered by a local technician. It involves reinsetting the channel 11 coil unit, which is included inside the cabinet, and diverting the UHF tuner output to any other available channel.

Controls on the front panel include the VHF channel selector switch, the vernier tuning knob for UHF transmissions, an automatic tuning in-out switch which operates for both bands, and a power on-off. Near the top right hand corner are slider controls for colour saturation, brightness, contrast, and volume.

Aerial input arrangements also offer a maximum of convenience. For normal VHF operation, provision is made for either 300-ohm balanced (terminals) or 75-ohm unbalanced (coax connector), with a slide switch to select the one desired. It can therefore be used with an indoor antenna (where adequate), an existing outdoor antenna, or a completely new installation. Separate terminals are provided for connection to a 300-ohm UHF antenna.

The "Braddon" receiver uses a standard delta mask picture tube. Magnetic shielding plus automatic degaussing render the set relatively insensitive to external magnetic fields. HMV's normal procedure is to unpack and prepare each receiver at local distribution centres and, in particular, to make sure that purity and convergence are correct. They are then installed in buyers' homes, normally with attention only to the more superficial aspects: sitting, aerial, AGC adjustment and, of course, general performance.

Of some note is the fact that the picture tube is a 90-degree type rather than 110-degree, as favoured by some manufacturers. It means that the overall depth of the receiver is greater (D-471mm, W-631mm, H-435mm), the rear of the tube protruding behind the main cabinet woodwork by more than would otherwise be the case. This would be of no consequence where the receiver is across a corner but could be a consideration where it had to stand on a shelf or against a wall.

HMV (and the General Corporation) stress, however, that the 90-degree tube has special advantages of its own. Convergence is more easily optimised but, more importantly, much less deflection power is required to drive the 90-degree tube. This shows up as less stress on the deflection devices and a very significant saving in power consumption, and therefore heat dissipation within the cabinet. HMV see this as an important factor in the reputation for reliability which the receiver has built up already since its release on the Australian market.

Except for the picture tube itself, the circuitry is entirely solid-state, involving 4 IC's, 42 discrete transistors and 55 diodes. Of special interest is the colour decoding circuitry, which is really a spin-off from pioneering work by the General Corporation in connection with single-gun colour tubes. Instead of the more usual phase-locked 4.33MHz sub-carrier oscillator with phase sensing and switching, the "Braddon" receiver has two phase-locked oscillators, one at 4.33MHz and the other offset by half the line frequency. By a process which would defy description in anything but a long article the receiver did exhibit good whites although our own judgement would have been to nudge the blue gun up a trifle. There was some suggestion of chroma shift on a test pattern but it was not evident on program material. In fact, colour performance on program was excellent.

On a station-to-station basis with a quite average outside antenna, behaviour was completely satisfactory with the automatic fine tuning obviating any obligations on that score. The sound was clean at all times, with no suggestion of hum or frame buzz.

In short, the "Braddon" receiver should be an excellent proposition for any situation requiring a nominal 18-inch or 43cm (viewing diagonal) screen.

Recommended retail price for the receiver is $579, a figure which includes delivery and installation, 90 days full warranty, and 12 months warranty on the colour picture tube. Normal service contracts can be arranged with HMV retailers to cover the period beyond warranty. The distributors are aware that the "Braddon" may be offered at less than the recommended retail price and this is now quite legal and ethical. However, they stress that customers should make sure that they receive all the entitlements that are covered by the recommended figure.

Further information on the "Braddon" receiver can be obtained from HMV retailers, EMI branch offices or from EMI Australia Ltd, 10 Parramatta Rd, Homebush, NSW 2140. (W.N.W.)
Antenna rotator for colour TV, radio amateurs

In some areas, satisfactory TV reception in either colour or monochrome can only be achieved on all channels by using an antenna rotator. The Stolle type 2010 is an automatic unit very suitable for both TV and amateur radio antennas.

Made in Western Germany, the Stolle 2010 antenna rotator has been designed to give accurate positioning of both TV and amateur radio antennas. It will cope with antennas ranging in size up to a standard 3-element beam for the 14MHz or "20 metre" amateur band, so that it can easily cope with the largest VHF TV antennas.

In contrast with a simpler "memo-matic" unit in the Stolle range, the 2010 is described as "automatic". Positive synchronisation between the control unit and antenna positions is ensured by means of a balanced-bridge servo circuit. As a result the two cannot get "out of step", and do not require periodic resetting.

The antenna drive unit is housed in a very sturdy casing of cast aluminium alloy, which is fully waterproof. The drive shaft is also a casting, with the final gear an integral part of the casing so that it cannot come loose. The shaft is hollow, and designed to take antenna masts up to 38mm (1¾in) in diameter. It is also double-ended, to allow the rotating mast to be clamped at both top and bottom of the drive unit for greater resistance to the various forces exerted by windage.

Inside the drive unit the rotator uses a worm drive for the final transmission, to minimise windmilling. The motor also has a positive disc brake system, to prevent coasting overshoot. The reduction gear chain features an overtravel clutch to allow the motor to gain momentum before the load is engaged.

The control unit is housed in an attractive case moulded from impact resistant plastic. It has the position command knob as its single control, turning through an angle of approximately 270 degrees—but calibrated for the full 360 degrees of rotation provided by the drive unit. The direction of antenna rotation is indicated by indicator lights, which extinguish when the antenna reaches the position dialled. Time for a full 360 degrees of rotation is approximately one minute.

The motor shaft bearings of the drive unit are lubricated for life. Motor drive voltage is a nominal 42V, so that the cable between the control and drive units carries no dangerous voltages. Total power consumption of the system is 60W.

The Stolle 2010 comes with four toothed mast clamps, two for attaching the drive unit to the main mast and the other two for attaching the rotating mast using two U-bolts supplied also.

Cordless iron from scope

Designed and manufactured by Scope Laboratories in Melbourne, this new cordless soldering iron uses the same heating element, tip and barrel as their well-known Superspeed irons. Operating from two internal nickel-cadmium D cells, it is claimed to perform from 100 to 400 joints on one charge, with recharging in about 14-16 hours from a car battery, optional power supply or an existing "Scope" iron transformer.

The iron uses a trigger switch, and provides 60 watts of tip heating. The case is designed to counterbalance the two relatively heavy batteries, for convenience and minimum operator fatigue.

The Scope Cordless 60W iron comes complete with a spare tip and element, and an instruction book. Distributed by IRH Components, a division of Natronics Pty Ltd, it should be available from electronic wholesalers and retail outlets together with major hardware stores.
NEW ALL-TRANSISTOR STEREO AMPLIFIERS
ULTIMATE IN DESIGN—LONG DEPENDABILITY
Using all silicon transistors 50 WATTS—RMS

SPECIFICATIONS
POWER OUTPUT
25 watts per channel R.M.S. Total output 50 watts R.M.S.
8 ohms

FREQUENCY RESPONSE:
20 cycles to 40,000 cycles 5dB
HUM & NOISE:
AUX: 70dB Mag. 60dB
INPUT SENSITIVITY:
Mag. 7.2mv Aux. 250mv
EQUALISED:
Mag. RIAA
TONE CONTROLS:
Bass 50 c s ± 13dB Treble 10kc s ± 15dB
HARMONIC DISTORTION:
Less than .05 per cent
LOUDNESS CONTROL:
50 c s ± 10dB

SCRATCH FILTER:
(high filter) at 10kc s 5dB
RUMBLE FILTER:
(low filter) at 50 c s 5dB

PROVISION FOR TAPE RECORDER:
Record or playback with din plug connector

SPEAKER SWITCHING:
Two sets of speakers can be connected and selected by
switch on front panel. they can also be driven together

INPUT SENSITIVITY:
May be 7088 Mag. 60dB
HEADPHONES:
MAY RIAA

EQUALISED: Headphone lack is situated on front panel

FREQUENCY RESPONSE:
20 cycles to 40,000 cycles 1/2dB

RECORD OR PLAYBACK WITH DIN PLUG CONNECTOR

HUM & NOISE:
SPEAKER SWITCHING:
Aux 7088 Mag 60dB

SPEAKER KIT (less cabinet) consisting of 1830 speaker
CABINET AVAILABLE

CABINET EXTRA PLUS FREIGHT

PROVISION FOR 4 CHANNEL. All units wired with
sockets & control for simulated 4 channel only requires the addition of two extra speakers.

NEW MAGNAVOX-PHILIPS 3 WAY SPEAKER SYSTEM
FREQUENCY RESPONSE 35Hz TO 25KHz POWER HANDLING CAPACITY 30 WATTS R.M.S.

DRIVE UNITS:
Magnavox 8-30 High Performance 8 in. Bass Unit &
Magnavox 6J-6 in. Mid Range Speaker Philips High
Fidelity Dome Tweeter

SPEAKER KIT (less cabinet) comprising 1 B 30 speaker. 1

DJ speaker. 1 Philips dome tweeter. 1 1mm inductance. 1
B Milid. 8 & 1 4 milid. polyester condenser. 1 33 & V 1 6" tube, innaloid & speaker silk. plans for cabinet.

142.00 REG. POST & PACKING $1.50 Extra.
CABINET AVAILABLE

NEW A.M. TUNER & MANTEL RADIO
Six transistor A.M. tuner with a variable output suitable for use with any amplifier or tape recorder. Inbuilt
audio amplifier & speaker enable this unit to be converted to a mantel radio at a flick of a switch.
Supplied in attractive wood grain finished cabinet 240v A.C. operation. Suitable for local stations only.

$15.00
Post & packing $2.00 extra

GENESONICS 10 SOLID STATE PORTABLE
This sensitive & selective pocket radio using 6 transistors & 4 diodes
is suitable for most local & country areas. Fitted with a 2 1/4" speaker
and supplied in attractive & durable plastic cabinet. Earphone supplied.
Operates on 2 1.5V pen cells.

$5.95
Post & Packing $1.20
(All spare parts available)

CLASSIC RADIO
245 PARRAMATTA RD, HABERFIELD 2045
PHONES 798 7145, 798 6507

NEW PRODUCTS

Cordless PC drill

Designed for convenient drilling of PC boards for prototype and small-scale production work, the Mini Drill model D2 is a hand-held unit operating from four internal penlight cells (type AA or UM3). It weighs 270 grams including the cells, and measures 181mm long by 41mm diameter.

Nominal drill speed is 2500rpm, and the collet-type chuck will take drills from 0.6 to 1.5mm in diameter.

Motor torque is only modest, but is quite adequate for drilling both phenolic and glass laminate PC boards. The D-2 is also suitable for aircraft modelling, detail engraving, jewellery, etc. It comes complete with a combination centre punch and chuck tightening pin, and a 1mm drill, for $15.75 plus 75c post and packing where applicable.

Optional accessories include a mains power pack adapter and a small bench stand (type STD-50). The stand is priced at $8.50, again plus 75c post and packing where applicable.

Available from Dick Smith Electronics Pty Ltd, 176 Pacific Highway, Gore Hill, NSW 2065.

Mini slide switches

These new miniature slide switches for PC board mounting are designed primarily for programming or test switches.
They feature a low profile case, epoxy sealed terminal pins and gold flashed contacts and terminal pins. Top and side lever versions are available, in both SPDT and DPDT configurations. Namco Electronics, 239 Bay St, North Brighton, Victoria.
Balanced mixer

Designed for mass usage applications such as TV tuners, FM tuners, mobile radio and CATV converters, the Hewlett-Packard model 5082-9200 printed circuit balanced mixer covers the range from DC to 1200MHz, with a local oscillator range of 100MHz to 1200MHz. Conversion loss is 6.5dB; isolation is 45dB at 200MHz, 25dB at 900MHz. The 2nd order distortion intercept is +38dBm, and its 3rd order intercept is +23dBm.

The mixer contains two Schottky diodes and a PC transformer. It costs less than $2 in 100k quantities. Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Victoria and branches in each state.

DIP connector

A new series of solderless one piece DIP plug connectors is designed for terminating flat cable to DIL sockets. Both 14 and 16-pin versions are available, from Ansley Electronics division of Thomas and Betts, PO Box 91, Brookvale NSW 2100.

Low profile relay

A new range of low profile PC board relays, series 1005, offer rugged construction and trouble free operation. The contacts may be wired to provide either a double make double break or SPDT configuration. Coil sensitivity is 900mW. The contact rating for resistive circuits is 1200VA, with a voltage rating of 240V AC or 125V DC, and a current rating of 6A. Overall size with dust cover is 35.6 x 16.5 x 10.8mm.

The relays are manufactured by Hi-G D'Italia SPA, and available in Australia from A. J. Ferguson Electronics, 29 Devlin Street, Ryde NSW 2112.

Mercury keyswich

The new M-5 version of the well known Mercatron keyswich uses a small can-operated actuator to provide more precise and reliable operation than previous versions. The switch operates in any position, is absolutely bounce free, and is rated at 200mA/24V DC with a rise time of less than 10 nanoseconds. A complete line of keyboards in all levels of complexity is available using the M-5 switch, which is available in either single or double pole and NC or NO versions.

Made by Mechanical Enterprises, Mercatron switches are available here from General Electronic Services of 99 Alexander St, Crows Nest, NSW 2065.

Semiconductors

Paradio Electronics announce that they are now sole Australian agents for Best Semiconductors Ltd of Hong Kong, and can offer good stocks of a wide variety of silicon transistors and diodes assembled in Hong Kong from US chips. Devices include BC147-8-9, BC157-8-9, BC127/337, BA222 and other low power devices. Trade enquiries are welcome. Paradio Electronics, of 7a Burton St, Darlinghurst, NSW 2010.
### TAPE RECORDER DECK

- 7 inch reel to reel, complete except head and face plate: $10

### TV CHANNEL CHANGE

- and fine tuning
- Knobs 75c a pair

### TV TUNERS NEW

- in valve type or transistor $10 each

### SPEAKER SPECIAL

- 6½ inch Dual Cone
- 4 ohm $5

### PORTABLE 4 SPEED RECORD PLAYER

- 240 volt, solid state $19, pack and post $2.00 interstate, NSW $1.50.

### SUPER SPECIAL B.S.R. RECORD CHANGER

- 12 inch turntable balanced arm cueing device etc.: $35, pack and post $1.00
- Interstate $2.50

### LEVEL AND BALANCE METERS

- 1200 Ohm
- 100 microamps $2

### SPEAKER CABINETS

- 10 x 7½ x 4 $3.50

### POWER TRANSFORMERS

- 240V, 300 mil
- 225V a side
- 6.3V windings $8.

### GARRARD MINI-CHANGER

- Stereo: $19.00
- Pack and post $1.00
- Interstate $2.50

### BSR 4 SPEED 240 V GRAM

- Motor and Pickup $7.95

### SPEAKER SPECIAL

- 6½ inch Dual Cone
- 4 ohm $5

### SPECIAL GRAMMO MOTOR

- and pickup, complete with base & perspex top: $12.50
- Pack & post $1.00
- Interstate $1.50

### LEVEl AND BALANCE METERS

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- and pickup, complete with base & perspex top: $12.50
- Pack & post $1.00
- Interstate $1.50

### PHILIPS TV TUNERS

- NT 3014, NT 3011 $12

### IF TRANSFORMERS 455kHz

- $1.00

### TRANSISTOR 7 RADIO

- Complete with 3½ inch speaker
- No cabinet: $3.95

### WAFER SWITCHES

- 2 position: 50 cents

### WAFER SWITCHES

- 4 position: 75 cents

### TV HOR

- OSC COILS
- $1.00

### 96 ELECTRONICS Australia, November, 1975
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<tr>
<th>SPEAKERS!</th>
<th>BARGAINS!</th>
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<tr>
<td>12 UAC 8 ohm 30 Watts RMS</td>
<td><strong>Slide switch</strong></td>
<td>½ Meg Double Pole Switch Pots 50 cents.</td>
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<td>12 TACX in 8 or 15 ohm 10</td>
<td>3 position 50 cents</td>
<td>Coaxial TV Feeder Cable 75 ohm 30 cents yard</td>
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<td>Watts</td>
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<td>Jack Plugs 6.5mm 50 cents</td>
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<td>8 TACX 8 ohm</td>
<td>50ohm Pots ideal for ext. Speakers 50 cents. Transistor and Driver Speaker Transformers $1.00 pair. Ferrite Rods 6½ x ¾ inch 50 cents</td>
<td>R.C.A. Plugs 25 cents</td>
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<td>6 x 9 in 8 or 15 ohm</td>
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<td>Battery Saver 240 to 6·7-5·9 Volt. 6 Volt/300mA. 9V 200 mA. $10</td>
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<td>5 x 7 in 8 or 15 ohm</td>
<td>Pots 30 mixed values including ganged and concentric $5</td>
<td>Hook Up Wire 30 mixed colours lengths $1 bag.</td>
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<td>6½ inch 8 or 15 ohm</td>
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<td>Speaker 4 pin plugs 15 cents</td>
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<td>8 x 4 8 or 15 ohm</td>
<td>In Line Fuse Holders 20 cents</td>
<td>25 mixed 5 and 10 Watt resistors $2.00</td>
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<td>6 x 4 8 or 15 ohm</td>
<td>Stereo Speaker Wire 12 cents yard</td>
<td>250 mixed screws. BSA. Whit self-tapper bolts. nuts. etc. $1.25 bag plus 40c post</td>
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<td>5 x 4 15 ohm</td>
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<td>BSR Stereo Player Model P-128 $52 pair and post $1.50 Interstate $2.00</td>
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<td>4 inch 8 ohm</td>
<td>2 Meg Double Pole Switch Pots 50 cents.</td>
<td>TV Aerials Complete Range Hills Colour $12 to $60</td>
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<td>3 inch 3.5 ohm</td>
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<td>Car radio aerials. lockdown. top quality extended 1600 mm $4.50</td>
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<td>5 inch Tweeters 8 ohm</td>
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<td>Electros 3-in-one 20, 400, 450, 10, 400, 450, 75, 50, 65 $1.00</td>
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<td>6 inch Dual Cone Tweeters</td>
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<td>AWA 11 inch P.I. TV EHT transformers $5.00</td>
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<td>5 x 3 80 ohm</td>
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<td>Car Converters. 12 volt to 6·7-5·9 volt 500 MA $6.00</td>
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<td>5 inch Magnavox dual cone 8&quot; 27 ohm</td>
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<td>Microphones—Dynamic 10k $3.50</td>
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<td>8 inch National built in Tweeter</td>
<td>Tape Recorder Heads Transistor Top quality suit most recorders $5.00</td>
<td>Valve Sockets 7 or 9 pin 10 cents. Octal 10 cents</td>
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<td>Rola custom kit 63G x Tweeter</td>
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<td>Speaker Transformers. 6 Watt 7000 to 8 ohm: $2.50. 3½ Watt 7000 to 15 ohm $1.75. 6 Watt 7000 to 1k $2.50. 500 to 27 ohm 50 cents.</td>
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<td>C60 woofer cross over and pot $19.00</td>
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<td>Ferrite Rods 6 inch 50. 9 x ½ 75 cents</td>
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<td>MSP 2½ inch 8 ohm</td>
<td>3.5 to 3.5 Jack Plugs 7 ft. Shielded Cable 75 cents</td>
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<td>6.5 to 3.5 Jack Plugs 7 ft. Shielded Cable 75 cents</td>
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<td>Mixed Tag Strips 50 cents for Dozen</td>
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<td>Sharp TV Flyback Transformers 8FT 604 $7.00</td>
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<td>Miniature Speaker Transformers. drive and output $1.00 pair</td>
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<td>Shure M 75/6 Magnetic Pick up Cartridge $11</td>
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<td>Pioneer midrange 5 inch</td>
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<td>Heat Sinks. 4 x 2 ½ ⅛ $1.50</td>
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<td>MSP 8 inch Woolers 8 ohm. 30 Watt</td>
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BSR STEREO
RECORD CHANGERS

Improve your hi-fi system with one of these top quality low cost model guaranteed turntables.

STANDARD MODEL: 3 speed, auto manual, ceramic cartridge, diamond stylus, cueing $115.00
C 141 as above plus player spindle, larger turntable, stylus pressure adjustment. $141.95
C 142 as above plus 4 pole shielded motor, fully adjustable tone arm, counterweight, anti-ske 11.524 and bias control $149.95
DELUXE C 142 as above plus heavy weight, antiskate and bias control $41.95

SONATA TT-200
All silicon solid-state Hi-Fi Stereo Amplifier. 10 watts RMS per channel. Each channel has separate Bass Treble controls. Inputs for magnetics ceramic cartridge, crystal microphone, radio, tape—tape out. Black colored R7070, 16 ohms, instruction booklet, circuit supplied. Timber cabinet. Dimensions: 14 1/2" x 8" x 4" $178.95
P. P. NSW $11.70 V. O. S. T 13.50 WA $15.40

MUSIC COLOUR II
Magical Colour Organ operates in conjunction with your home stereo or PA system—simple to connect and operate. 3 channels, 1,500 watt max load per channel. Complete kit of units $25.00 each. P. P. NSW $15.90 Other States $15.95
P. P. NSW $2.50 Other States $3.50

BSR STEREO PLAYER
MODEL P-128

MAGNAVOX WIDE RANGE TWIN-CONE SPEAKERS
8-16 OHMS 30-16,000Hz $16.80
8WR MKS 12W RMS $11.75
8WR MKS 16W RMS $11.50
10WR MKS 16W RMS $13.50
12WR MKS 16W RMS $15.50
P. P. NSW $11.00 Other States $12.00

MULTI-CELLULAR HORN TWEETER
2-1/8" x 30 Watts 8 ohms $12.95
P. P. NSW $11.50 Other States $12.50

SANYO BATTERY CHARGER
FOR NICKEL CADMIUM BATTERIES
Will charge 4 penlight or 4 type C or 2 D type continuously. Complete with sturdy battery holder case and data. $25.95
P. P. NSW $11.50 Other States $2.75
Rechargeable Ni-Cd batteries
Type A 11.70 4 for 16.00
Type C 12.90 4 for 10.50
Type D 13.65 2 for 16.00
P. P. NSW $11.00 Other States $17.75
Stereo magnetic Cartridge
Freq. response, 15,000Hz to 15,000Hz 1/2" mounting Diamond stylus. Only 15.95

10 - IN -1 MINIATURE MACHINE SHOP
emco - unimat
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ELECTRONICS Australia, November, 1975
The establishment and use of repeaters on the amateur bands has provided a technical challenge as well as a useful means of communication.

Since the use of amateur repeaters was first permitted on the 144MHz to 148MHz band in 1968, there has been many arguments among various individuals and groups about the frequencies to be used. However, during the past eighteen months the situation has stabilised and the frequencies used, with two exceptions, are in unison with the WIA band plan.

Both the exceptions are awaiting:
(a) A decision on the change to television channel 5A is required before the repeater.
(b) Official approval to change from the existing frequencies in use.

To overcome difficulties caused by overlapping services, the WIA and the ARDC have agreed that the same channels be used as the original allocation has, in some cases, been necessary. Also an increase in the number of channels originally planned, may be necessary in some areas to give adequate coverage and to cope with the increasing traffic.

Technically, development of the repeater systems has involved relatively few amateurs in the design, construction and maintenance of the units. In most cases the task has been undertaken or coordinated by groups within clubs. There has been a gradual decrease in the modification of disposals units and an increase in construction using solid state components and techniques.

Unlike the majority of repeaters overseas, the repeaters in Australia offer “free access” to anyone with the appropriate crystals. The use of a coded signal is not required to activate the repeater. The latter method is designed to limit repeater access to members of the group or club who own the installation.

Another point of interest is that, in accordance with a recommendation by the licensing authority, applications to install a repeater are made through the WIA.

Although it has been emphasised that the main objective of the repeater system was to assist mobile operation, DX working between home stations is also an object of the repeater system. The reason is that the range of the repeater circuit is potentially much greater and is therefore the logical channel for increasing traffic.

The table lists the principal details of Australian repeater facilities.

The following table has been prepared from information supplied by George Francis, VK3HV, publicity officer; Victorian Division WIA repeater committee; and several other sources. The information was that known at 21st September, 1975. However, details of any additions or amendments will be appreciated and included in future notes.

To celebrate the Royal Australian Corps of Signals 50th anniversary, members of the 2nd Signal Regiment will install and operate an amateur station at the Watsonia Barracks, Melbourne, from November 3 to 10. Picture shows (L to R) Major Darryl Slade, Corporal Robert Linton and Sergeant Barrie Edwards planning the location of aerials for the station. (Story P101)

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 direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

SUGGESTED WIA UNDERTAKING

The future of amateur radio societies, in particular the WIA, and the financial difficulties they have been experiencing, has sparked at least one amateur, Don Watson, VK4DZ of Townsville, Queensland, to put forward a sound proposal.

Extracts from a letter he wrote to the Council, Qld Div, WIA (copies to WIA Federal Executive, all federal councillors, and the editor of "AR") are given here, as to quote Don, "... the proposal must have the widest possible spread among the amateur fraternity in Australia. This includes non-members of the WIA.

"I have read with interest and concern the various reports in QTC and "AR" on the state of the Institute's finances."

"The problem, being a national one, is considered on a national scale rather than a divisional one. The problem itself is a simple one - the WIA has a deficit of some $16,000. The cause is equally simple - the WIA exists to provide a service for its members' (AR May 1975)."

"The effects of inflation cannot be countered by operating on a fixed budget drawn up some eight months before the Institute's financial year. This can only be done if, in any trading organisation, ..."
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AMATEUR BANDS

increasing costs are passed on as they occur. In its present form the WIA has nowhere to pass these costs, other than to its members in the form of increased subscriptions or levies. The only profitable side of the Institute's activities has been the sale of publications. It would be pretty unreasonable to expect this facet of operations to be able to cope with a $16,000 deficit, nevertheless the lesson should be sufficient to bring home the fact that the Institute can only hope to meet the costs of the services sought by members if it can increase its income by means of a trading subsidiary.

"I doubt that the investigation to be undertaken by VK3ZEB into the whole of the systems and services of the Institute from top to bottom' will arrive at any worthwhile recommendation for reducing expenditure, and agree with the comment in the Executive Annual Report 'that if the office is to provide the service to the Institute that council expects of it then there is a limit to the economies which we can apply'.

"With this in mind, therefore, it is suggested that the WIA implement the incorporation of a wholly owned trading subsidiary. If the proposal is contrary to the WIA constitution, then amend the constitution to provide for it."

"At present the WIA has a membership of some 4500. There are some 6850 licensees. The advent of novice licensing will probably raise this number to 8000 within twelve months. The WIA serves the interest of all licensees, whether members or not, yet it gains no financial benefit from the business generated by these licensees. I recollect a survey undertaken some four or five years ago (or was it longer?) which indicated that each amateur spent an average of $15 per head per year on miscellaneous equipment (excluding one major purchase such as transceivers). No doubt the figure would be higher due to the effect of inflation, but $50 x $15 gives a sales potential of $120,000 per year, plus major equipment. It would be foolish to suggest that the whole market could be captured by anyone, but nevertheless there is room for the Institute to enter the market, and to gain some financial benefit from the activities of its members.

"It is realised that the proposal may run contrary to the vested interest of those divisions which undertake a form of trading activity, and indeed contrary to the interest of quite a few members themselves. Nevertheless, the financial future of the Institute is equally as important as that of divisions and individual members, and any argument to the contrary should not be allowed to sway a decision."

"The project will need capital. This could be raised by the sale of shares to members and or by debentures. If 4500 members were to contribute an average of $20 per head in shares or debentures this would raise $90,000. Easily said, not so easily raised. The idea would need to be sold to members on the basis that a successful operation would allow a reduction in the present annual subscription rate, as well it could. Better an investment than a yearly contribution.

"The project, if it is to get off the ground, would need to be able to compete with other dealers and indeed offer incentives to members or shareholders by way of discounts. This would induce further membership from non-members, thus contributing to Institute revenue.

"The WIA, by virtue of its connections, should be able to arrange agencies for sale of almost every brand of equipment, and whilst at the outset activities may be limited to amateur radio lines, it should be the aim to extend generally into the field of electronic equipment. This in fact would be highly desir able even at the outset, as it would be difficult to hold and defend a small segment of the electronic market when competitors have advantages accruing from profitable volume sales in the whole field."

"Without a commercial means of revenue the Institute faces bankruptcy in the foreseeable future. With this in view, it is considered that there is scope for the WIA to participate in the market which it serves to protect, and to compete profitably to such an extent that the cost of services provided to mem-

ELECTRONICS Australia, November, 1975
The 50th anniversary celebrations of the Royal Australian Corps of Signals will be held throughout Australia from 3rd to 10th November, 1975. Members of the 2nd Signal Regiment will install and operate an amateur radio station at Watsonia Barracks, Melbourne during that period. A display of army signals equipment will be open for public inspection on the 8th and 9th November. The station will be part of an amateur hookup of signal corps divisions throughout the world.
The success of the Radio South Africa External Service, which was opened in 1966 with four transmitters of 250kW, has been such that three further transmitters of 500kW are to be installed.

Radio South Africa has announced that the South African Broadcasting Corporation (SABC) has authorised the installation of three additional 500kW transmitters at the HF Verwoerd Transmitting Station. Extensions to the buildings will be necessary to accommodate the new equipment, and new antenna arrays for the transmitters will be erected. The project is in its preliminary stages and thus far, no date has been set for the transmitters to become operational.

At present Radio South Africa uses four transmitters of 250kW, which were opened May 1, 1966. They are located at the HF Verwoerd Transmitting Station at Bloemendal, some 45km south of Johannesburg. The transmitters are operating with programs for 156 hours a week and broadcasts are carried in 10 languages.

As well as serving Africa, transmissions are beamed to Europe and North America. A service to Australia and New Zealand operated for four years, but was withdrawn due to the difficulties providing a reliable signal into this area. Several transmitters of 100kW are also located at Bloemendal and these carry the internal programs for reception in Southern Africa. The tropical bands are used for this purpose.

We visited the transmitting site in 1969 and found it to be one of the most modern in the world. At that time a huge new studio building was being built at Auckland Park, a Johannesburg suburb, and this now completes and houses the radio and television services.

The SABC has 19 different program services which cover English, Afrikaans, and the Bantu languages. Some 86 stations operating on FM provide most of the service.

**VOICE OF MALAYSIA**

A powerful signal from the Voice of Malaya at Kuala Lumpur has been heard on 15275kHz with an English transmission to 0100GMT. The broadcast is on the air from 0625GMT to 15275kHz and 16175kHz. According to the closing announcement the transmission continues in Indonesian on 0625GMT up to 16175kHz. Our reception on 15275kHz has included the interval signal up to 0900GMT and then a program in Indonesian. It is understood that a new high-powered 50kW transmitter has been installed in Sahab, and this could be the reason for the stronger signals on this frequency.

**NEW BOGOTA FREQUENCY**

Radio Nacional at Bogota Colombia has been heard on 15335kHz with a relay of the National program around 0200GMT. This frequency, previously active for some months, is giving good reception in New Zealand until close down at 0400GMT. On Mondays the program consists of classical music with a third hour Chinese at 0200GMT and full station announcement.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summer time. 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

**INDONESIAN NEWS**

The interest in signals from Indonesia is shown by the reports of many readers who are hearing stations from this part of the world. RRI Kupang, Timor has been heard on 3356kHz after 1400GMT when the Papua-New Guinea station Radio East New Britain leaves the frequency. RRI Palangkaraya, has been heard by Craig Tyson, Wembly, WA, with station identification at 13330kHz on 3955kHz. Our reception of this time showed the station to be carrying a program of light classical music on Sundays.

RRI Fak Fak, using 8749kHz has station announcement at 0951GMT. RRI Siberut, is reported on 586kHz in "Down Under DXers," as operating on 5985kHz and 6005kHz from 1000-1600GMT. RRI Pakanbaru, has been heard on 5886kHz closing at 1550GMT. The same program is carried on 5205kHz and the schedule is 1000-1600GMT.

**MEDIUM WAVE NEWS**

**PHILIPPINES:** The new 250kW transmitter of the Far East Broadcasting Company at Iba, Zambales, in Northern Luzon has been heard on 1470kHz at 1400GMT. This station broadcasts to Hong Kong, South China and South East Asia. The signal at our location was fair, but we are receiving it on the back of the beam, and as well there is considerable interference from Chinese and Taiwanese stations on the same frequency. The program consisted of recorded Gospel music with announcements in Chinese. Reports should be sent to the Far East Broadcasting Company, PO Box 2041, Manila, Philippines.

**QATAR:** According to the BBC Monitoring Service the new station in Qatar on 9525kHz uses the power of 750kW. Reception is possible around dawn. The station is located at Al-Gurah in the northern part of the country.

**AUSTRALIA:** Further expansion of medium-wave and FM services in Australia was recently announced, and this includes plans for nine FM stereo stations in medium-wave cities. The new FM stations are to be licensed to universities and other institutions of learning on a twelve month experimental basis, according to DX Post of Adelaide.

**GERMANY:** According to "Sweden Calling DXers," broadcasts from RIAS Berlin, on 605kHz are now from two different transmitter locations at 0325-1730GMT from a 25kW transmitter in West Berlin, and at 1730-2130GMT from a new transmitter in Munich. This change took place recently. Reception reports are requested, and will be verified by a card with a picture of the station.

**LISTENING BRIEFS**

**EUROPE**

**MALTA:** Broadcasts from Malga on 9755kHz have been heard at 2150GMT on Saturdays. These are beamed to the United Kingdom, using the transmitter of Deutsche Welle. The station was also heard to carry several interesting series, including one on foreign institutions of learning on a twelve month experimental basis, according to DX Post of Adelaide.

**GERMANY:** According to "Sweden Calling DXers," broadcasts from RIAS Berlin, on 605kHz are now from two different transmitter locations at 0325-1730GMT from a 25kW transmitter in West Berlin, and at 1730-2130GMT from a new transmitter in Munich. This change took place recently. Reception reports are requested, and will be verified by a card with a picture of the station.

**THAILAND:** Radio Thailand, Bangkok has been heard on 9555kHz with standard announcement at 1024GMAT prior to commencing their external service. Craig Tyson, of Wembly, WA, reports fair reception of this transmission.

Recently we reported reception of a Korean signal opening at 0900GMT on 634kHz, with news at 0000GMT. This signal was first noted by Steven Greener, of Invercargill, according to a listener in New Zealand, and the station is now heard regularly in the evening. It has no connection with the former Korean Army Station 'Voice of Hope,' and is presumed to be broadcasting from South Korea. The present schedule is 0200-0500GMT, 0900-1200GMT, and 1230-1530GMT, all on 634kHz.
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LOUDSPEAKERS. The deck input and output are con-
oscillation, accompanied by a type of buzz from the
CASSETTE DECK: I have had some problems arising
readers interested in SSTV.
Thank you for your information, B.G.G., which
(B. G. G., Napier N.Z.).
I have one on order so cannot at the moment com-
It contains 248 pages and covers all facets of SSTV.
publication by Don Miller W9TNP and Ralph Taggart
Club and interested in SSTV. The book
concerning SSTV.

PLAYMASTER No 1: Early in the sixties I put together
a stereo radiogram using a Dual automatic tunable and
a Playmaster amplifier and separate tuner. For
the latter two units I used assembled items. As the
turntable had to be replaced I have invested in a
Pioneer PL-12R stereo unit. The amplifier and tuner
are operating very well and I see no reason to replace
them at this juncture.
My problem, as I am not a radio or electronics
expert, is how to connect the tunable to my
amplifier so that I can get some stereo music. Beyond
supplying you with the enclosed sketch I am unable to
identify, the Playmaster amplifier. I have tried as
many combinations of connecting the amplifiers as I
can think of but to no avail. Your advice would be
appreciated. Is the PL-12E compatible with this
Playmaster amplifier? (I. D., Strathfield, NSW.)

Your last question is the crux of the matter, I.D.,
and the answer is no. From your sketch, it seems very
likely that your amplifier is a version of the Unit
Playmaster No. 1 published in April, 1960. This
amplifier was designed to work with cartridges and
does not have anywhere near enough gain for your
new turntable which uses a magnetic cartridge. If you
wish to continue to use your old amplifier you will
need to build or buy a suitable preamplifier. The
"Low Noise Preamplifier" published in September,
1971 (File 1/PRE/26) is suitable and quite economical.

SSTV MONITOR: Today I picked up a copy of the
October/1974 issue of EA and noticed in the Informa-
tion Centre a letter from G.G. of Lake Heights, NSW,
concerning SSTV.
I am a member of the British Amateur Television
Club and interested in SSTV. The book
recommended to me covering this subject is the 1973
publication by Doug Miller W9NNP and Ralph Taggart
W9DDQ1 called "Slow Scan Television Handbook". It
contains 248 pages and covers all facets of SSTV.
I have one on order so cannot at the moment com-
ment on it.
I hope this will be of interest to you and "G.G."
(B. G., Napier N.Z.)

Thank you for your information, R.G.G., which
we are sure will be of much interest to any of
our readers interested in SSTV.

CASSETTE DECK: I have had some problems arising
from the Playmaster 144 Cassette Deck (August and
October 1974, File 1/KA/30.31).
Firstly, on playback when I advanced both the level
controls to about halfway (trying to get meter indica-
tion on playback) the meters and the LEDs go into
oscillation, accompanied by a type of buzz from the
loudspeakers. The clock input and output are con-

In the second paragraph it says 230 turns. It also has 230 turns on the
circuit. Which one is correct? Have there been any changes or mods to the circuit? (A. B., Ross-
mayne, W.A.)

The correct number of turns is as indicated on the
Circuit diagram, 230 turns. The only modification we
were trying to improve was the output of the converter.
This was intended to dampen the spike from the
transistors but in practice it seems to have little effect.

PHILIPS 6658R PRINTER: Would the Philips 6658
mosaic printer be suitable for reception of RTTY sig-
nals? I am sure that other SWLs would be interested
in using it for this purpose, if you could describe it as
a project. Incidentally you didn't mention the price
of the printer in your article on connecting it to the
EA microcomputer. Finally, what is a "panoramic
adapter"? (G.M., Bunbury, W.A.)

Because of its narrow paper format, its use of
ASCII encoding and "line at a time" operation, the
6658R printer is not directly suitable for teleprint-
work. However it may be possible to adapt it for such
use and we intend looking into this shortly. As the
printer costs around $500, it may not be as attrac-
tive to SWLs as you think, however. A panoramic
adapter is a piece of equipment which connects to a
communications receiver, and by means of sweeped
frequency techniques displays the amplitude of all
incoming signals in the vicinity of the signal actually
tuned. The display is usually on a cathode-ray tube,
with frequency corresponding to the horizontal axis
and signal amplitude the vertical axis. The vertical
centreline is usually arranged to correspond to the
signal frequency being received, so that the display
shows any signal for say 200kHz either side.

CASSETTE DECK: I am now building the Playmaster
stereo cassette deck and after studying the frequency
response given (80Hz to 9kHz), I was wondering if
it could be improved by using the crossover technique as
used for loudspeaker systems.
Perhaps an extra stage of amplification could come
in at frequencies below 10kHz and this would not
compromise them because it would be an extra stage
for frequencies above 10kHz another extra stage
would be required using some other method of can-
celling noise. The above suggestions are only tenta-
ive at present but maybe some of your readers or
staff could examine the possibilities. (R.B., Mount
Claremont, W.A.)
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INFO CENTRE

- Your idea of improving cassette frequency response might be revolutionary were it not for the fact that only one tape head is used for record and replay, whereas loudspeaker systems generally use more than one loudspeaker to cover the spectrum. It is possible that a noise reduction system using dynamic filtering could be used to extend the useful bandwidth, however, and we plan to look into this shortly. Thanks for the comments.

BIONICS: For some time now, my colleagues and I have been interested in the fascinating hybrid science of bionics, the design and construction of automata based on biological examples. Unfortunately, source material on this new subject is very difficult to obtain, especially practical circuits of electronic animals. When material of this sort is available it usually comes from the U.K. in such magazines as Practical Electronics and Practical Wireless.

As Australia's foremost magazine on the subject of electronics, we were wondering if you would consider writing an article, or series of articles on bionics. We are sure that there would be many other interested readers, besides ourselves. (G. Mann, 9 Creekview Close, Rosslyn Bay, AUS 6155)

- Although the subject of bionics is relatively unknown to us, we have had correspondence from some readers in your home state (Information centre, April 1975). For this reason, we have taken the liberty of printing your full name and address, so that interested readers will be able to contact you and your colleagues directly. As this is a fairly specialised subject, we have no plans at the present time to present any articles on bionics, but will keep the idea in mind.

TRAIN CONTROLLER: I have built and used the SCR-PUT train controller described in "Electronics Australia" April 1971 (File 2/MC/9) with great success...
on HO train circuits but I have not had the same experience with a similar controller built for an "N" gauge system. I have used a Motorola 2N4443 SCR but otherwise the circuit is as specified. Voltages are okay but the train operates slowly and throttle has no effect.

I have come to two possible conclusions as to the cause of my problems; one that the SCR operating voltage is higher than that for the C20D, or "N" gauge trains have a different EMI effect to that for which the circuit is designed. (L. D., Auckland, NZ).

- Our conclusions from your letter (which we have condensed), is that the FET is faulty or the 3.9k resistor has been inadvertently replaced with a low value. The different SCR should cause no problems.

CASSETTE TAPE: In the February 75 issue of "Electronics Australia" is a review of the Sony TC177 cassette deck.

To date I have been a reel-to-reel man and presently operate a Revox A77 with which I am very happy. I will shortly be acquiring a Sony TC137 which seems electronically similar to the Sony TC177. This brings me to the point of this letter which is the difficulty, apart from lengthy comparisons, of deciding which brand of cassette tape to use. Leaving aside the complication of Ferrichrome, the point is to choose between chromium dioxide and ferric tape.

FORUM continued from page 63

Are the stockists themselves beyond criticism? I think not. If they decide privately that a particular project won’t take on (and this is part of the judgement they have to exercise) they may not even order the key components until there is a line of customers pounding on the counter. Or they may order conservatively, or advertise prematurely, with much the same result.

If we had another page to spare, we could tell quite a story about situations where we’ve been caught out, other journals have been caught out, suppliers have been mistaken or mislead, or where stockists have misjudged their own market. We might even be able to suggest (in hushed tones) that the Dick Smith organisation is subject to the same human frailties as the rest of us!

But the point is taken and we’re willing to make a bargain: We’ll do the best we can in the future if suppliers (including Dick Smith) will do the best they (or they) can.

Q-METER PROJECT continued from page 73

should now be excellent and the output to the Q-meter is thereafter adjusted only by the Output control R1. The process should be repeated when switching to other frequency ranges.

To measure the Q of a coil, connect it to the "L" terminals, switch the voltmeter to "V" and adjust the oscillator output to give 1 volt exactly at the frequency of measurement. Switch the voltmeter to "Q", tune C2 to resonance and read the Q on the voltmeter scale in terms of indicated voltage X100.

A good earth connection will probably be needed and this should be to an Earth terminal on the Q-meter, located near C2 and connected to it by a short copper-braid pigtail.

The effective Q of other components such as fixed capacitors can also be measured and calculated by appropriate formulae, but these are perhaps outside the scope of this article. They can be found discussed in any good general textbook, such as Terman’s "Electronic Engineer’s Handbook". For such work, standard coils of known high Q and appropriate inductances for the frequency or measurement will be needed as accessories. They can be constructed without trouble by using ferrite pot cores mounted on suitable plug-in bases and preferably wound with Litz wire. The oscillator draws a current of around 3.5 mA from the 9-volt battery with the specified transistors. Drain from the 1.5 volt cell is in microamps and negligible. Should output voltage on the highest frequency range be found inadequate for any reason the supply voltage can be increased safely to 12 or 15 volts.

The MOSFETs come equipped with a tiny shorting spring around their leads to protect against accidental gate insulation breakdown, and these are best left in place until all soldering has been completed.

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