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Electronics Australia

MARCH 1986
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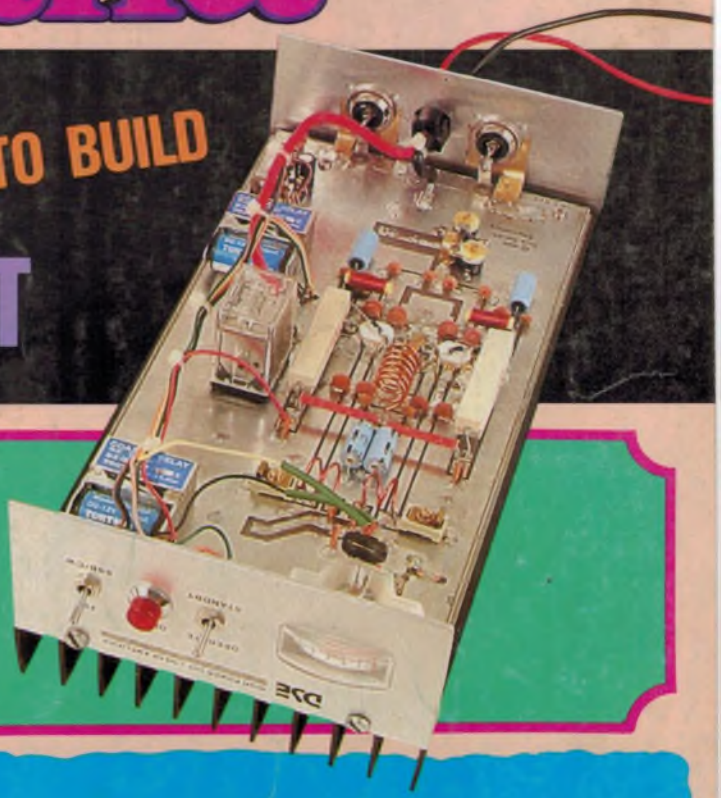

100 W LINEAR AMPLIFIER

REVIEW SONY STEREO AM/FM TUNER

AM STEREO

SPECIAL FEATURE ARTICLES

If they started the FM revolution without you, make sure you don't miss out this time when AM goes stereo.

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All of which adds up to another first for Sansui.

As well as another revolutionary first for you.

Sansui

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DPS&L VAN 3

Volume 48, No. 3

Electronics Australia

March 1986

THIS MONTH'S COVER

This month, we place special emphasis on AM stereo. There's a review of a Sony stereo AM/FM tuner, a complete stations list, and a special feature article starting on page 59.

Features

Entertainment Electronics

Projects and Technical

News and Comment

Departments

100W VHF linear amplifier

This new VHF linear amplifier puts out 100W and is easy to build and align. It's the most powerful 2-metre amplifier currently available in kit form. Details page 18.

What's coming

Missing SBS television? Next month, we intend to describe a low-cost UHF/VHF downconverter. See page 119 for further details.

Digital strobe to build

Looking for an adjustable strobe with a digital readout? Try this unit for size. It will let you monitor rotating machinery operating at up to 20,000rpm. Details page 42.

Letters to the editor

Poor response to Inventors' Contest

Considering the amount of exposure given to the inventors' contest in *Electronics Australia* and through the Australian Inventors' Association, the response was quite disappointing. Geoff Poole of Posch Marketing Pty Ltd has issued the following statement:

The judges of the Posch Inventors' contest wish to advise all entrants that, after due consideration, they found that none of the entries met the necessary criteria for potential commercial development. While some of the inventions reflected innovative input, the sponsors have deemed that no prizes can be awarded.

The sponsors wish to thank all participants for their involvement. All entries shall be returned to the senders. It is hoped that a contest at a later date, along similar lines, will yield prize-winning inventions.

Marcus Herman, Managing Director, Rede Pty Ltd, Brighton, Vic.

Simple cure for melody door chime

I am writing to relate a recent close encounter with a berserk door chime.

This particular chime is branded "Melody" or "Charm Melody" and is sold by K-Mart for around $15. It is a magic little unit which plays fifteen different tunes (on 3V). However, they are prone to go off at odd times, mostly at night. Mostly, they will start up if a fluorescent light is switched off, or sometimes when the refrigerator stops.

After a lot of calls to the front door to find no-one there, and the kids waking up at all hours of the night (loud penetrating chimes), this particular customer was ready to throw the offending item out. I tried various schemes over a period of two weeks before coming up with the solution.

The unit contains only one IC (MA-710901E). The cure is to fit a 4700pF ceramic capacitor between pin 5 and ground. I found that there is just enough room under the board to solder onto the copper tracks directly. The board can then be re-mounted in its original position, without having to modify the case in any way.

I strongly suspect that many of these units have been submitted to local servicemen for correction. In my case, a lot of time was involved in to-ing and fro-ing to the customer's house (and bench testing), so the above information may save other servicemen a lot of inconvenience.

Unfortunately, the general public expect results, regardless of difficulty. If my customers are any indication, we are also expected to cure coughs, colds and other ailments, among other things. Failure to fix a seemingly simple fault, such as the above example, causes loss of confidence, hostility and often several hundred dollars, because the customer does not return.

I must also point out that the above hostile attitude reflects on the entire electronics industry, whether justified or not. Perhaps you could launch an exchange page for faults and cures in commercial units and kits etc, with reader contributions invited. We must give the industry a better image; from the feedback I get, it certainly needs it.

K. Howe, Wynnum, Qld.

Electrical wiring standards

I have just finished reading "The Serviceman" column in the December 1985 edition of EA, which described a colour computer monitor which had a potentially lethal power supply.

It is obvious the set in question would never meet the requirements set down by the SAA board of the SEC. But, the problem does not stop there.

Recently, I have noticed more and more electrical equipment being classified as double insulated. Most of these items display the concentric squares symbol and yet examination of the standard of wiring and insulation quite often casts a shadow of doubt over the item's safety rating.

This has become very evident in recent audio, video and domestic items such as clock-radios and, at the same time, is not limited to the lower-priced sector of the market. I recall a review of a top-name CD player having a price tag in excess of $2000 where the reviewer commented on the apparent lack of sufficient insulation.

Also, a lot of these domestic appliances are only rated for 220VAC and get very hot when powered from 240-VAC mains. Yet it is these very same appliances which are normally left energised for 24 hours a day. It seems a good recipe for a fire hazard.

I have noticed that a lot of equipment has readily visible internal mains wiring which is uninsulated and extremely close to the case. This problem is even more dangerous when the case is made of metal and, being considered a double insulated device, the metal parts have no direct connection to earth apart from the unwary operator!

Another problem appearing more and more is that of true switch ratings. Toggle switches are a prize example of this. Recently, I went down to my local parts store to purchase a small toggle switch which was advertised as having a rating of 240VAC at 5A. Close examination of the switch body, however, revealed the rating to be 125VAC at 10A.

Now while the VA ratings may be the same mathematically, the insulation is still none the less considered safe up to 125VAC. If 240VAC is applied to the switch, it will work satisfactorily in some cases, but may arc or breakdown if used to switch inductive loads (such as transformer primary windings).

Clearly, this "near enough is good enough" attitude is just not good enough, especially when damage to property, or people, is likely.

I feel it's time the relevant authorities got their act together. Why don't the powers that be insist that all equipment is safe to use on 240VAC, that it meets certain safety standards as set down by the appropriate authorities, and that a label is attached confirming compliance with the rules?

This would force a lot of manufacturers to pull themselves into line. Also the consumer could tell at a glance whether or not the appliance is made to correct levels of safety. In the USA, products often display tags claiming the item to be tested and listed with the UL, CSA, or other testing associations.

The public is told not to buy child restraints or safety helmets that do not show the ASA symbol so why shouldn't electrical products come under the same ruling. It makes me wonder.

S. McBride, Townsville, Qld.

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Editorial Viewpoint

AM stereo vs the knockers

This month we are making a big effort to bring you the latest information on the AM stereo scene in Australia. When stereo AM broadcasting began back in February 1985, there were relatively few receivers on the market and those few were not widely available from the stores. Now, there is a considerably larger range of products on sale and quite a lot more are expected this year. Quite a few of the products listed in our major feature article beginning on page 59 of this issue are only just being released this month, so the scene is changing rapidly.

Naturally, with any new development, there are the knockers and AM stereo seems to have had its share. For example, there have been suggestions that AM stereo was doomed from the start because of the extreme use of "processing" by most AM stations. Now it is true that most, but not all, AM stations use audio processing to a greater or lesser extent but to say that AM stereo sounds lousy because of it is a leap in the dark. It is the sort of statement that could only be made by a person who hasn't bothered to actually listen to AM stereo broadcasts via a good wideband tuner.

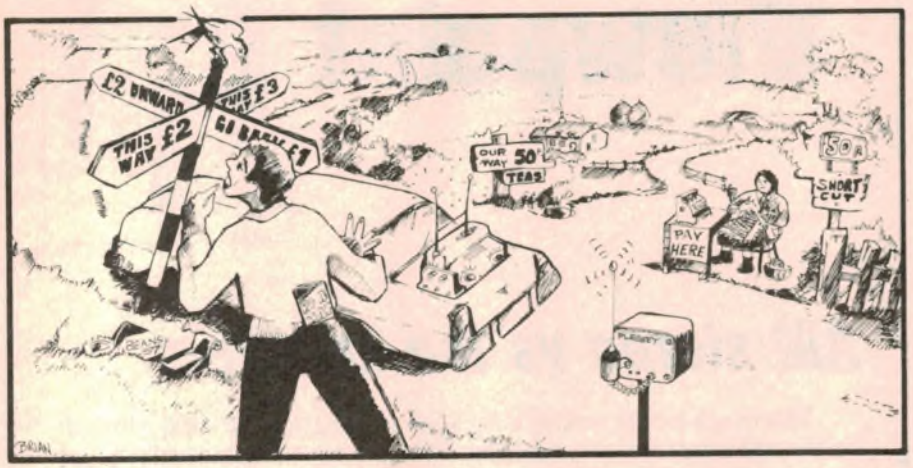
We *have* listened. Since we have been deeply involved in the development of our high performance Playmaster stereo AM/FM tuner we have had to listen long and hard. We *know* that AM stereo sounds good. In fact, some of the AM stations appear to have a good deal more stereo spread in their programming than some of the commercial FM stations. This is in spite of the greater problems that AM stations have in meeting the conflicting demands of stereo broadcasting and audio processing. Furthermore, the comparison between AM stereo and FM stereo is subjectively so close (say between 2BL on 702kHz and 2ABC-FM) that the listener's judgment will more likely be determined by the quality of the program rather than the medium itself. In simple language, with the right program on a wideband tuner, AM can sound as good as FM.

Sure, most stations can improve their signal quality by modifying their processing and strictly speaking, FM does have a quality advantage over AM. But it's early days yet. Over the next few years there will be considerable refinement of the AM stereo technique both as far as transmission and receiver design is concerned. AM could end up being the more popular "quality" radio medium.

On a different note, we are disappointed to report that the Inventors' Contest announced in the August and September issues last year was a fizzer (see the letter on this subject opposite). And the budget 2-way loudspeakers we described in our September 1985 issue have not been put on sale because Magnavox (Australia) Pty Ltd have gone into receivership. We still hope that an alternative speaker source can be arranged.

Leo Simpson

News Highlights



Taking a toll of British motorists

Moves are afoot in the UK to charge car owners a toll for driving on the country's roads and highways.

Plessey, one of the UK's largest electronics companies, recently patented an electronic device capable of logging the movements of individual vehicles for later billing. A similar scheme already in use in Hong Kong involves fitting the car with something akin to an electronic bug.

Plessey's new scheme envisages the use of a sealed module containing two antennas and a transmitter. The first antenna would provide power for the module while the second antenna would transmit an identifying code.

Roadside receivers would log the coded transmissions and transfer data to a central computer for processing.

Of course, the scheme could have other uses. Timing a vehicle's progress from one receiver to the next, for example, could be used to identify speeders. Police forces could also automatically track-down stolen vehicles.

Whether or not the UK will adopt such a scheme remains to be seen. To some, the scheme smacks a little too much of the proverbial Big Brother.

Satellite earth stations go ahead

Work on new earth stations in remote communities to tap into AUSSAT television transmissions is going ahead at full steam, according to the Department of Communications. The $2.5 million program is being carried out by Telecom Australia under contract to the Australian Government.

In all, 61 new earth stations are to be installed alongside the existing Remote Area Television Scheme earth stations which, for the past few years, have been receiving television transmissions via an Intelsat satellite.

External plant work including foundations, the erection of antennas, and cabling has already been completed at 57 sites and work is continuing on others.

In a related move, the Government recently decided to waive sales tax on earth stations purchased for domestic use. This move represents a potential saving of around $500 per station and is designed to boost sales.

Sanyo launches VHS VCRs

In a surprising move, Sanyo Australia has announced the release of a range of VHS video recorders to complement its range of Beta machines. Three models will be made available initially: the VHR-110, VHR-1300 and VHR-1500.

Mr Mat Matsunaga of Sanyo Aus-

Videodisc forges ahead in Japan

Despite not being able to cut it on the tough US market, the videodisc is rapidly gaining strength in Japan. Some observers predict that sales this year will exceed 400,000 units, with sales next year set to double that figure.

Such optimistic forecasts contrast with the situation in the US where massive losses forced RCA Corp out of the videodisc business in 1984. Consumers in the US were more interested in recording material off-air for later replay and opted for the VCR instead.

In Japan, videodisc player manufacturers have adopted the unusual tactic of marketing their products as audio components — apparently with some success. The idea is that the discs

make an excellent medium for music with accompanying video.

As with the VCR business, two incompatible formats are slugging it out in the marketplace: the laser disc system developed by Philips and Pioneer, and the VHD capacitive system developed by JVC. Most videodisc player prices plummeted by as much as $100 last year, while the number of disc titles has steadily grown to over 2000 titles for each format.

tralia said that the move to add the VHS format came as a result of continuing requests from dealers who were responding to "consumer demand for Sanyo VHS recorders".

Sanyo has been producing VHS-format VCRs under the Fisher brand name for some time. With VHS winning the format sales war the company's latest move simply reflects commercial realities.

Is the vacuum tube on the way back?

Electron tube devices as small as transistors and with comparable integration have become a possibility due to the development of conventional IC technology over the last 20 years. What's more, these so-called "vacuum ICs" would be temperature insensitive, could provide fast transit times, and would show improved radiation hardness for space applications.

Because of these properties, the devices could eventually find their way into the US Strategic Defence Initiative (SDI).

Two major processing techniques are being used. The first, developed at the US Naval Research Laboratory, uses conventional silicon-processing technologies which includes electron-beam lithography to create field-emitter vacuum ICs.

The second approach, developed at the Los Alamos National Laboratories, involves fabricating thermionic ICs by depositing cathode, grid, and anode materials on sapphire substrates using optical lithography. These devices will operate at over 800°C.

Fuzzy Logic rules — maybe!

The fascination with robots and the concept of artificial intelligence continues at many levels. The most recent development at Bell Laboratories in the US is a "fuzzy logic" chip which can approximate the faculty of reasoning.

Using 2.5μm chip-layout design rules,it can accommodate 16 so-called fuzzy-logic rules and can process 16 inferences simultaneously, or 80,000 inferences per second. In one test, the new chip processed expert-system inferences approximately 100,000 times faster than a conventional device.

Bell Labs plan to interface its new chip to a personal computer to control robotic motion.

Beware of the dog

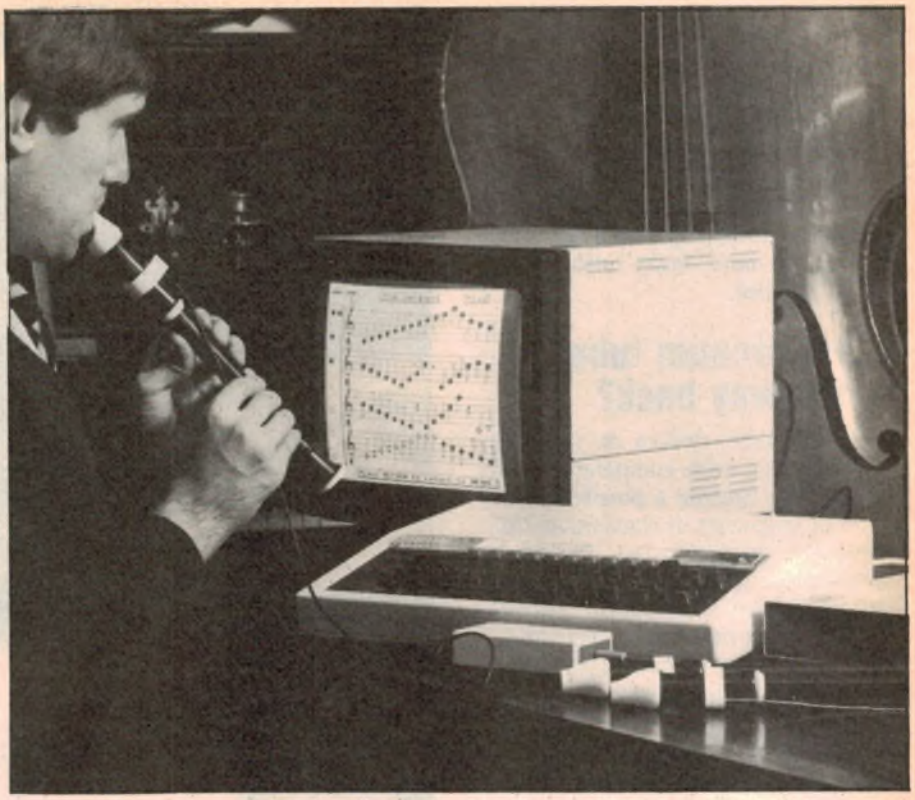
The most effective burglar deterrent is a dog . . . preferably one with a loud and ferocious bark. But what if you don't own a dog or can't, for reasons outside your control? The answer to your problem lies in a British invention which can program a terrifying bark onto a microchip.

The deterrent value of dogs has been recognised before. Indeed, there have been alarm systems that activated a tape-recorder to play back a pre-recorded barking sequence. The problem has been that they eventually give themselves away because the barking is on a repeated loop of tape.

Enter Barney the Springer Spaniel and Martin Kaye, an electronics engineer. The two combined to develop a new dog alarm that provides a digitally-recorded dog 'vocabulary'. This vocabulary is prompted by a microchip program that varies the persistence of the barking according to the noise made by the would be intruder, altering its pitch, style and volume accordingly.

The eight seconds of noise can be recombined, broken up and modulated in infinite variations. It adds up to a bark that should frighten off any burglar. (OEM Electronics, Massey House, 169 Albert Rd, Farnworth, Bolton, England.)

News Highlights



The doh re me VDU

Bridging the chasm between the creative inspiration that produces a new piece of music and the laborious job of translating it into the thousands of crotchets and quavers of musical notation is a new pitch recognition system that writes each note as it is played, stores what it "hears" and will play it back on command.

Developed at Cardiff University Industry Centre, the system combines a microphone, signal processor and versatile graphics software. The first two programs are designed for the descant recorder. One is essentially an introduction to the instrument, while the other is a more sophisticated tutorial program.

Initially aimed at schools and colleges, the device also has applications outside music. It could be adapted as a security device — only allowing access when it recognises a specific sequence of notes — or even used to monitor the performance of machinery by signalling changes in the pitch of electrical motors.

Les false choppers a la computer

Mon Dieux, mes dents! A French dentist has designed a computer-controlled (CAD) system which can cut a set of dentures to measure in far less time than the old handcrafted method could ever hope to achieve.

Having mapped the patient's mouth using an optical probe, the system translates the three-dimensional image into digital information. This is then used to drive a high precision milling machine which produces a new set of teeth in less than 30 minutes.

As well as saving the patient physical pain and discomfort, the system is also being trumpeted as far less painful for the wallet. The precision of the machine makes for better fitting dentures, thus eliminating the need for expensive adjustment visits.

It is also hoped that the system will be able to use lower cost materials than the expensive high-quality porcelain which is the current denture standard.

The system has attracted sufficient venture capital to go into production later this year.

Japan pushes for silicon self-sufficiency

Polysilicon, the staple diet for the semiconductor industry, has traditionally been largely supplied to the Japanese by foreign companies. These suppliers are now under direct threat from a new Japanese initiative aimed at achieving silicon self-sufficiency.

The move has yet to cause serious alarm among foreign suppliers, however. Most independent observers agree that silicon self-sufficiency will be difficult for Japan to achieve.

Japan's Ministry of International Trade and Industry (MITI) has been the prime initiator of this drive towards self-sufficiency. According to MITI, if foreign domination of the ever-expanding silicon market continues unchecked, the country will very quickly reach the point of no return.

A number of major Japanese companies have already expressed interest in moving into the field. The New Japan Steel Corporation is one of the first of the new players and, teamed with Hitachi Ltd, hopes to be in operation by 1987.

SIEMENS

RFI PROTECTION COMPONENTS

Five ranges of components to counter problems of electrical interference . . . outside the lab.

Because there is no one solution to radio frequency interference (RFI), Siemens makes 5 main ranges of interference suppression components. From these, additional equipment can be customised to cope with your RFI problems.

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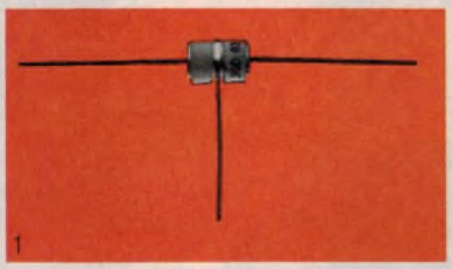
2. Varistors . . . for lower energy spikes. Also useful as secondary back-up behind gas arrestors; and can be used directly across mains wiring to remove spikes riding on the 50 Hz waveform.

3. RFI Filters . . . used on the mains outlet to keep out the most notorious interference; and also to prevent your equipment interfering with others.

4. Ceramic Capacitors . . . to be scattered over circuits and across all the input/outlet lines on data communication points.

5. Specialised Components . . . including X capacitors, Y capacitors, current compensated chokes and micro chokes.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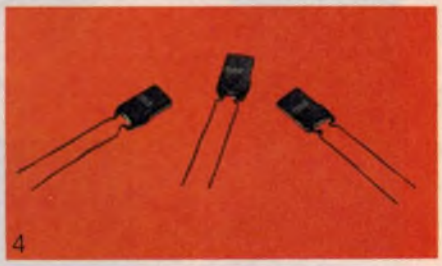
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HIFI STEREO

For the newcomer to high fidelity, the first step is to gain an appreciation of the term itself and others such as mono, stereo, frequency response, noise, distortion, etc. In this chapter, we discuss the history, philosophy and technology of "hifi".

by NEVILLE WILLIAMS

It may come as a surprise to realise that sound recording and reproduction in the home dates back less than 100 years, to around the turn of the century, when the first primitive domestic phonographs (or gramophones) were introduced by Edison, Berliner and others.

At the time, people were captivated by the sheer "magic" of hearing the sound of the human voice, and of everyday musical instruments, being reproduced by a machine. It mattered little that the sound was scratchy and "metallic", as from the inside of a metal drum; the words and the tune could be recognised and that was the wonder of it!

By the mid '20s, the best — and the most expensive — phonographs were capable of very satisfying reproduction by the standards of the day and it was about then that the British technical writer H. A. Hartley is said to have originated the term "high fidelity" to describe their superior performance, relative to less pretentious, economy models.

Whether or not Hartley invented it, the term "high fidelity" has been used since about then to describe sound reproduction which is plainly above average for any given period.

Radio or "wireless"

Eventually, emerging radio technology rendered the traditional phonograph (or gramophone) effectively obsolete, with electrical recording and reproduction taking over from the mechanical system and offering a further marked improvement in sound quality. By the mid '30s, a modern radiogram and an appropriate record collection had become a status symbol.

Hifi components

In the fierce competition for market share, it was common practice for component manufacturers to include in their range special "high fidelity" components, which would hopefully contribute to a standard of sound reproduction better than from those of average quality.

Loudspeaker manufacturers, for example, would offer a range of competitively priced models, of various shapes and sizes, intended for use with ordinary mass-produced radio receivers or amplifiers. But, at the top of the range, would be one or more premium quality models — "high fidelity" loudspeakers — boasting better than average all-round performance, and much more expensive both to produce and to purchase.

In fact, the '30s saw the emergence of quite a few manufacturers, notably in Britain, specialising in high fidelity components and amplifiers.

As often as not, with constantly evolving technology, their performance would be rivalled by the next wave of standard components but, by then, a new generation of high fidelity designs would have appeared.

In that sense, successive generations of hifi enthusiasts might be seen as people engaged in an ever-changing, never-ending, but none-the-less rewarding pursuit of the ultimate in sound quality.

What's in a name?

Initially, the description "high fidelity" was respected throughout the industry and a prospective buyer could reasonably assume that a product so designated would be of premium quality, more expensive but capable of better than average performance.

It would have made life more simple if things had remained that way but, in fact, the designation can no longer be taken for granted.

Indeed, it has even been adopted into the language as a noun, such that some-

What it means in simple terms Pt 2

body's expressed intention "to buy a new hifi" means simply that they plan to buy new domestic sound equipment, often without any special implications about size, cost or quality.

Hifi lives on . . .

Confusion about terminology notwithstanding, there is certainly no lessening of present-day interest in what one might call true high fidelity. On the contrary, any amount of equipment is currently available to high quality sound enthusiasts, which significantly outperforms ordinary competitively priced receivers, disc players and tape players.

For lack of a better term, manufacturers and distributors still have to describe it as "high fidelity", relying on its quality and finish, its performance specifications and their own reputation to set the product apart from others which, publicity and superlatives notwithstanding, have been built down to a price.

Equally, enthusiasts and would-be enthusiasts have to learn to question the high fidelity label and exaggerated claims made by non-technical promoters for otherwise ordinary equipment.

For common-sense economic reasons, there is a definite link between quality and price and, while an astute buyer may occasionally pick up a "clearance" or other such bargain from a hifi supplier, it will inevitably still be priced well above standard portable players and "Ghetto blasters".

That word "stereo"

These days, the term "stereo" is so commonly associated with "high fidelity" that it might seem that the two belong together. While they certainly complement one another in the context of modern sound equipment, they do have quite different meanings.

High fidelity (often abbreviated to "hifi") has to do with the quality or purity of sound. "Stereo" has to do with a sense of dimension or "spread" imparted to reproduced sound by two separate channels of signal information handled by two separate amplifier channels.

Let's explain this in greater detail.

All early forms of sound reproduction used what is best described as a single-channel technique. Irrespective of the number of microphones or other sources used to create the original program, their electrical outputs were ultimately merged into a single channel to be conveyed to the point of reproduction.

While this was the only practical approach in the early days of sound reproduction, it resulted in a signal which lacked any real sense of dimension and spread. One might indeed capture the sound of a large orchestra but, as reproduced in the home, it all seemed to emanate from a very limited area in the immediate vicinity of the loudspeaker system.

It was often likened to listening to a symphony orchestra through a "hole in the wall" of the concert hall — at worst, a hole about the size of a loudspeaker cone!

Various techniques were tried with amplifiers, loudspeakers and enclosures to lend a sense of spread to the sound with indifferent success. True dimensional information, it was realised, could only be conveyed to the listener by the use of multiple signal channels — at least two, possibly more.

Indeed, there is an immediate parallel to this in the fact that our own sense of dimension and direction depends on two slightly different information streams reaching the brain through two eyes or two ears.

Stereo sound

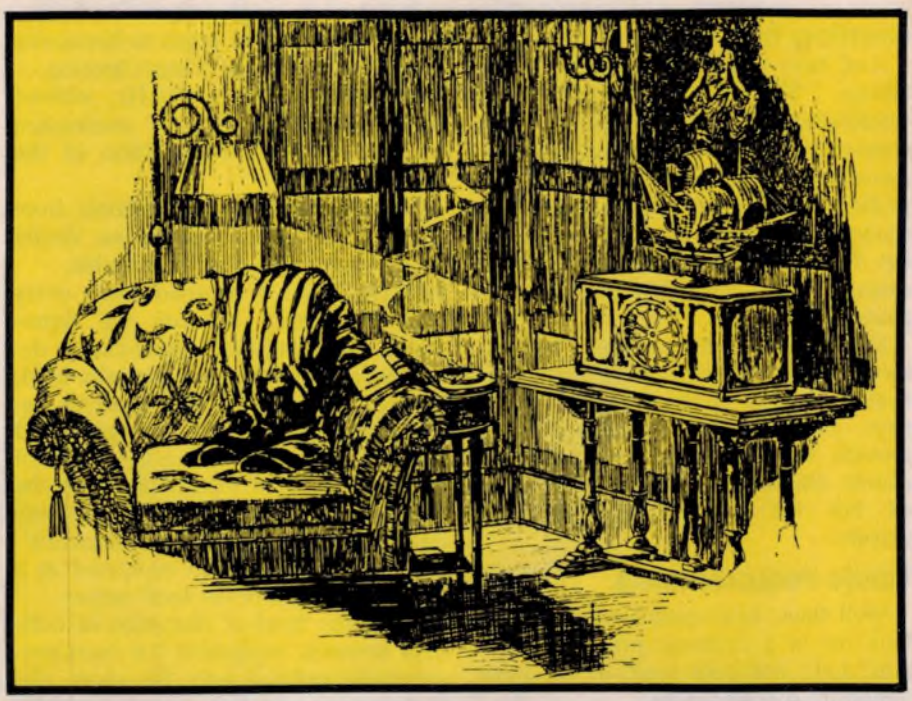
Multi-channel sound was demonstrated in the '30s and subsequently featured in big budget movies such as Disney's "Fantasia".

For in-home sound, the breakthrough into multi-channel reproduction came in the late 50s, when record manufacturers introduced a technique for recording two distinct audio signals within the one record groove — developed in Britain by A. D. Blumlein around 1930.

Some tightening of audio standards was involved but, superficially, the new "stereo" discs looked and played like ordinary single-channel microgroove recordings.

The main difference was that the groove now contained two slightly different versions of the original sound, collected by two separate microphones or groups of microphones.

By recovering the two signals with a suitably designed phono pickup, passing them through separate amplifiers and into separate loudspeaker systems placed two or three metres apart, a vital sense of direction and spread was (and is) imparted to the reproduced sound, adding tremendously to its ultimate realism.



In 1925, about the time the term "hifi" first emerged, this "Ultradyne" radio receiver was being credited by the makers, Phoenix Radio Corporation, with "superb reproductive qualities". Boasting a "quiet manner and eloquent tone", it was advertised in an American magazine for $135.

HIFI STEREO — what it means

Beloved of teenagers and others who like to have a radio around, this Akai AM/FM stereo cassette-radio typifies dozens of similar models. Portable, versatile and adequate for casual listening, they nevertheless fall well short of hifi standards.

Coming to terms

And here a few words about terminology. "Stereo" is a contraction of "stereophonic" which, in the present context, signifies multi-channel (not just two-channel) sound reproduction. To be pedantic, one should really specify two-channel stereo or four-channel stereo but for present-day domestic systems, stereo almost invariably means two-channels.

The complementary term "mono", short for "monophonic", signifies a conventional single channel system. These days, just about all records and tapes provide stereo signals as a matter of course, and are reproduced in stereo by all but the simplest and cheapest players.

Basic requirements

Well then, what qualities should one look for in a domestic hifi stereo system? Let's nominate some of the more important considerations:

FREQUENCY RESPONSE: A true hifi system should be capable of reproducing the full range of sounds from the deepest notes of the organ to harmonics at the upper limit of human hearing — from around 20Hz to 20kHz; without noticeable accentuation or attenuation of frequencies in any portion of the spectrum.

In short, the frequency response from signal source to audible output should be as "wide" and "flat" as possible.

DISTORTION: In a broad sense, every tiny discrepancy between the reproduced signal and the original can be described as distortion. As normally used, however, it has to do with spurious signal components which are generated within the equipment, as a byproduct of its operation, and superimposed on the original signal. As such, it is commonly described as "total harmonic distortion" or simply "THD", and expressed as a small percentage of the total output.

While the level of distortion in ordinary domestic equipment has been progressively reduced over the years, the performance of a hifi system should be markedly better, adding negligible audible distortion to the signal, even as judged by a critical listener.

POWER OUTPUT: To qualify as high fidelity, a stereo sound system must be capable of re-creating the highest level of sound likely to be required, again without generating audible distortion; in short, without running into "overload" or "clipping".

To meet this requirement, the amplifiers must be able to deliver a substantially higher level of power than is available from ordinary domestic equipment. How much power depends on the loudspeakers, the size of the listening room, the expectations of the audience, and the nature of the program.

The power output of an amplifier is quoted as so many watts (per channel) before the onset of overload.

NOISE: All reproducing equipment introduces some background noise of its own into the ultimate sound — hiss or clicks or rumble from the signal source, hum from the power mains or power supply, hiss from the amplifier circuitry, and so on.

In a high fidelity system, the inherent system noise should be inaudible during very soft passages, to listeners with good hearing, seated in a quiet living room, with the volume set for normal overall program level.

Noise within the system can be assessed more critically by leaving everything set for normal listening and simply switching off the disc or tape drive. Ideally, no sound whatever should be audible from the loudspeakers, even from close up.

In equipment ratings, the noise level is specified in terms of signal/noise ratio, expressed in decibels.

AMPLIFICATION or GAIN: The two words have a similar meaning and express a very practical requirement: the amplifier must be capable of boosting the smallest signal likely to be fed to it from a signal source (tuner, disc or tape player, etc) to a level necessary to produce the required power output.

Its ability to do so is commonly expressed as its *sensitivity*, or the number of millivolts of signal which must be fed to the various amplifier input channels (Phono, Tuner, Aux, etc) to produce the rated level of power output.

WOW & FLUTTER is a periodic variation in the pitch of a signal, commonly caused by speed variations in playback equipment. Record turntables are most likely to cause a low frequency variation, described as "wow", which is

particularly noticeable on sustained piano chords. Turntables may also exhibit some degree of mechanical "rumble".

Tape equipment is more prone to fairly rapid fluctuations, described as "flutter", noticeable on sustained, high-pitched tones.

While virtually all conventional disc and tape players produce some degree of wow and flutter, neither effect (or rumble either) should be apparent in a modern hifi system.

Almost invariably, true hifi equipment carries manufacturer's ratings and warranties in respect to these and other characteristics, which will be covered in later chapters. Such ratings need to be interpreted in relation to individual requirements. Some listeners have the aural acuity to appreciate the tiny differences between the good and the best; others don't. Some can readily justify the purchase of luxury equipment; others can't.

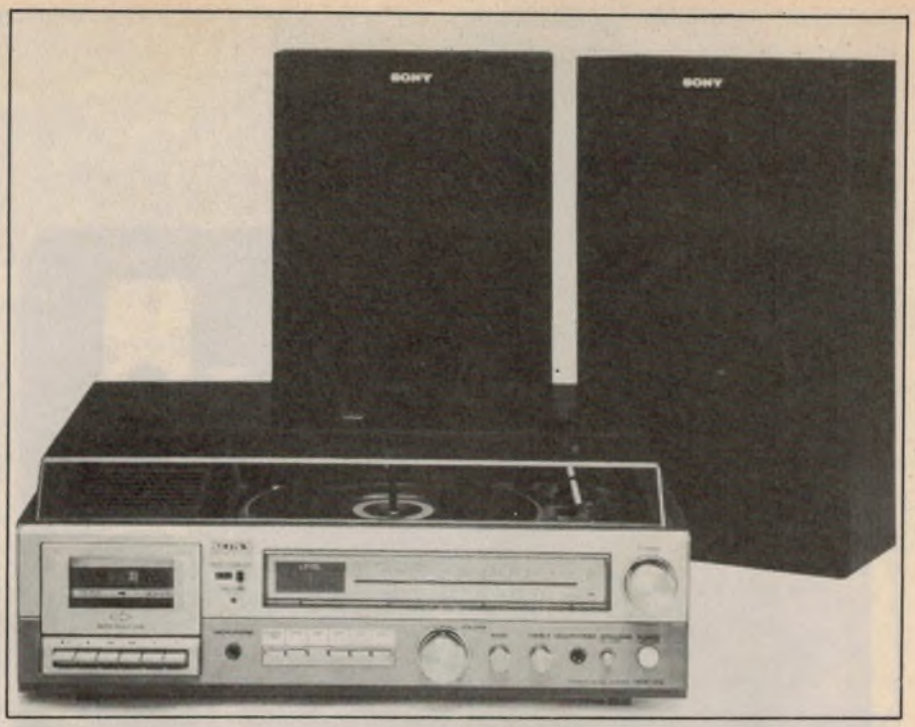
The "bottom line" is that all enthusiasts ultimately must determine their own compromise between what their musical perception warrants, and what their home and their budget can accommodate.

What's on the market?

Still keeping the discussion on a general plane, how does typical present-day sound reproducing equipment measure up in terms of fidelity?

At the bottom are "music centres", varying in price from about $250 to $500.

Most are intended to be accommodated on shelves and are popular in flats and home units where space is strictly limited.



For those on a budget, this music centre from Sony includes a cassette player, turntable, tuner/amplifier and two bookshelf loudspeakers.

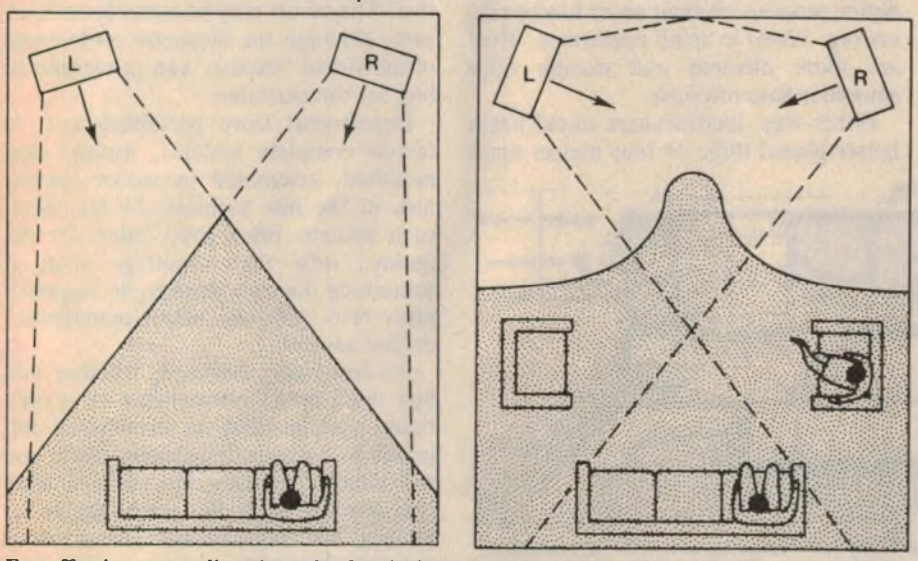
They usually have a tuner/amplifier plus the disc and tape players in a compact central cabinet, with the loudspeakers placed separately on the same shelf, if they are small enough, or otherwise on the floor.

Then there are small but usually more expensive non-integrated systems, with a choice of style-matched units that can be stacked or arranged in various ways to take advantage of the available space.

And there are even budget priced units intended for rack mounting, along with space for records and tapes, in the manner of more expensive systems.

Together they form a "grey" area, with equipment quality and performance ranging all the way from the "pleasant but ordinary" to low-end hifi.

Equipment of this kind is undoubtedly able to satisfy the needs of the not-too-critical budget-conscious buyers, looking mainly for "pleasant" sound. But it is not for someone who takes their music more seriously and who should really be aiming for something more ambitious from, say, $1000 upwards.



For effective stereo listening, the furnishings in a room may need to be rearranged. The set-up at left is the simplest and most obvious. Where a greater seating area has to be covered (shown shaded), angling the loudspeakers as at right may give better all-round results.

True hifi systems

Because hifi fidelity sound is an interest that tends to develop with time, it is wise to start with selected basic but good components, with the idea of adding others as funds become available. The alternative of buying a whole array of cheaper components to start with can all too easily result in a system that will always be mediocre.

At the heart of any hifi system is the amplifier, which should offer a power output of at least 35W RMS per channel, flat over the full audible range and with low distortion. It should have provision for multiple inputs, typically: tuner (AM and FM stereo), phono (magnetic), auxiliary (eg. compact disc) and maybe two tape cassette decks with dubbing facilities.

It will obviously need a volume and

This top-quality rack-mounting system from Pioneer incorporates a 100W per channel stereo amplifier, a 7-band graphic equaliser, a stereo AM/FM tuner, a turntable, a double cassette deck, a timer and two 4-way loudspeaker systems.

HIFI STEREO — *what it means*

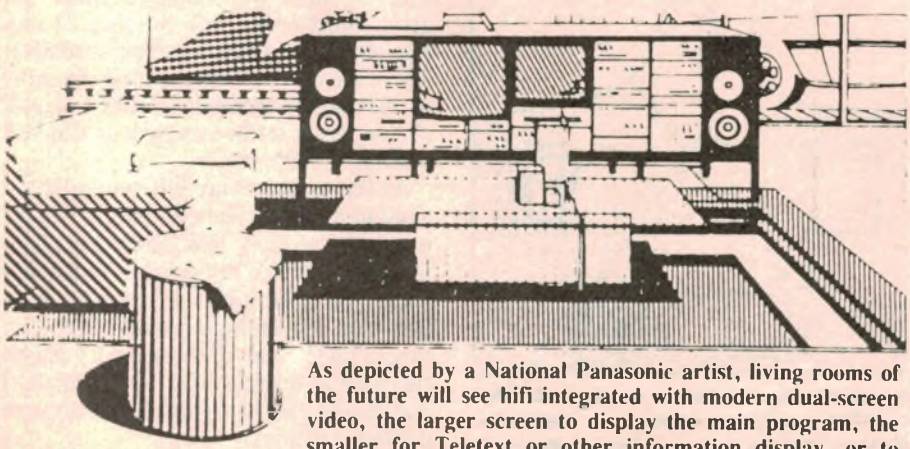
stereo balance control and provision to select the desired input, plus a socket for stereo headphones. Bass and treble controls and an output level indicator are also useful but be cautious about buying too many panel gimmicks at the expense of basic performance.

Some amplifiers have an in-built AM/FM tuner, being then described as hifi "receivers". These days, with wide-band stereo AM emerging, it may be better to plan for a separate, high performance tuner.

Perhaps more than any other component, the loudspeakers determine the sound of a modern system, so don't skimp in this department. Other things being equal, large (25cm dia.) good quality loudspeakers in large, properly designed enclosures (eg. 75 litres) are a better proposition than small loudspeakers (eg. 12cm) in small enclosures. They are more efficient and usually offer smoother bass response.

Either way, loudspeakers sound much better placed three or four metres apart in a large, carpeted room than closer together in a small, crowded room. So hifi sound does make demands on living space and, if this leads to some difference of opinion, it boils down to whether the hifi equipment is to be listened to or looked at!

As for the signal sources, a high quality turntable, an AM/FM-stereo tuner and a cassette deck were once automatic choices in about that order but newcomers to the art may now logically opt for a compact disc player as the first option. For as little as $500-odd, it will provide sound quality unequalled by any of the others, although you may certainly want to add them later, as the opportunity and inclination arises.



As depicted by a National Panasonic artist, living rooms of the future will see hifi integrated with modern dual-screen video, the larger screen to display the main program, the smaller for Teletext or other information display, or to keep track of a second program being recorded.

Audio/video systems

It should also be mentioned here that, with high quality stereo sound now available on some TV broadcasts and from hifi video recorders, it makes sense to interconnect video and audio equipment, such that video sound can be enjoyed through the hifi audio system. This is something that should be kept in mind when planning for the future.

And planning is certainly necessary. Don't be in too much of a hurry. Read about hifi; talk about hifi; take any opportunity to form a judgment by listening to it in friends' homes; see what's on offer in specialist hifi centres and the better stocked department stores.

In hifi centres, they frequently recommend systems assembled from a variety of different-brand components, perhaps from experience or a sense of hifi "mystique", possibly even with a profit motive! The result may be entirely satisfactory, although the disparate preferences of individual "experts"can prove unsettling for the customer.

Department store personnel tend to favour complete systems, usually rack mounted, assembled by major companies in the hifi business. In the main, such systems offer good value for the outlay, with the advantage that, if something does go wrong, the responsibility rests with one major manufacturer, not several.

By and large, however, whether you buy multi-brand components or a one-brand system from an established hifi centre or a major department store, you will almost certainly end up with what you pay for, with the price largely reflecting the facilities and the merit of your purchase.

Companies which offered twice the value for half the price, or vice versa, have long since fallen by the wayside!

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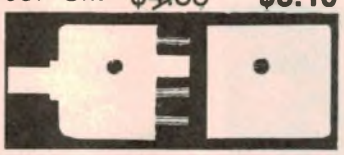

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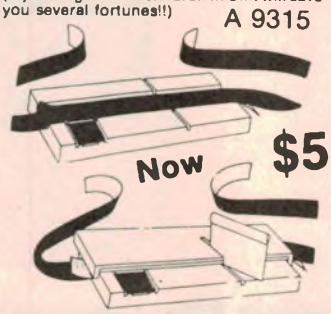

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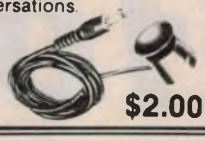

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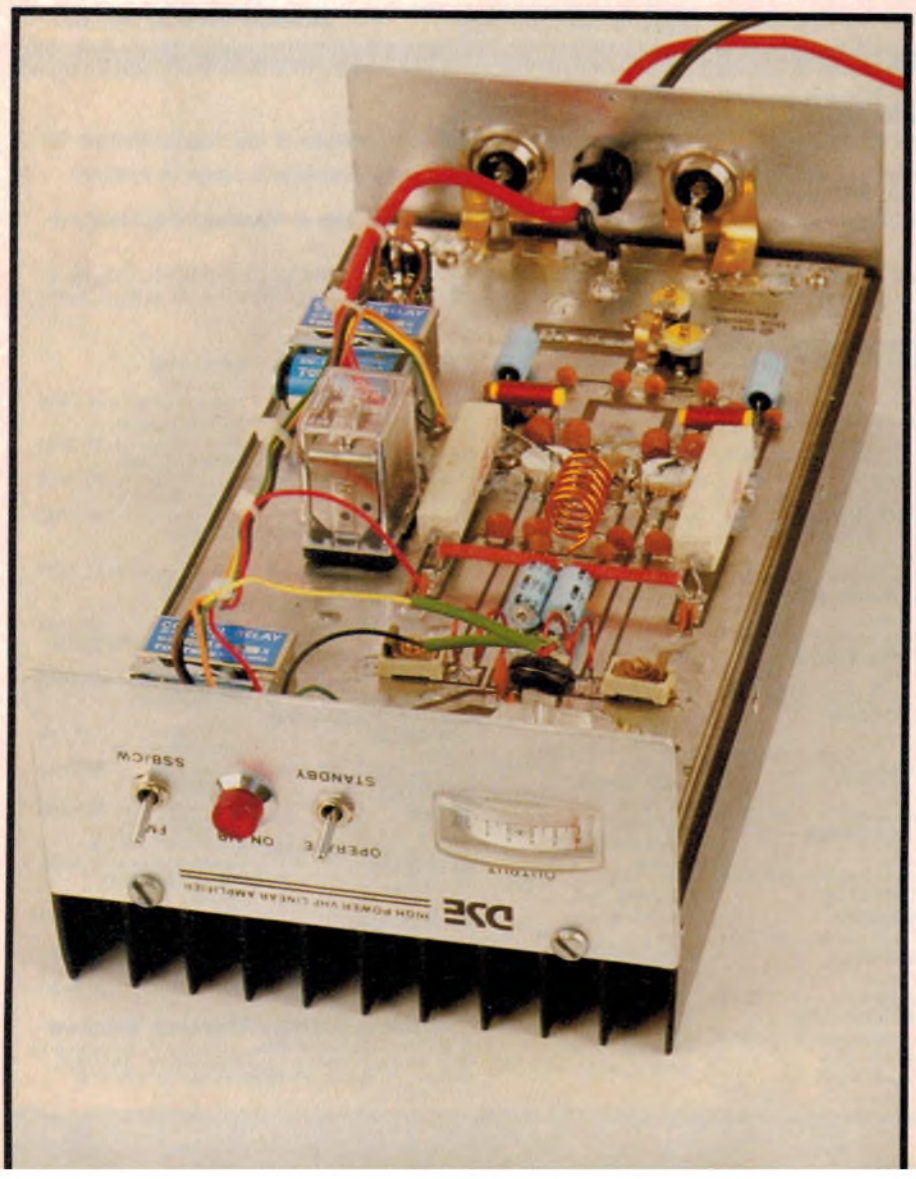


Most VHF amateur band transceivers for mobile use feature power outputs of between 2W and 15W. That's fine for most situations, but how many times have you wished for more power to trigger a distant repeater or to put out a more readable signal?

If that's the case, then this new 100W 144MHz linear amplifier is the answer. It's available from Dick Smith Electronics as a complete kit of parts, boasts 120W continuous output power (15W input), and is easy to build and align.

In use, the amplifier is interposed between the transceiver and the antenna. There are just two front panel controls: a switch to select between FM and SSB/CW operating modes; and an operate/standby switch.

An on-air lamp and a relative output meter complete the front panel line-up. The back panel carries the input and output sockets.

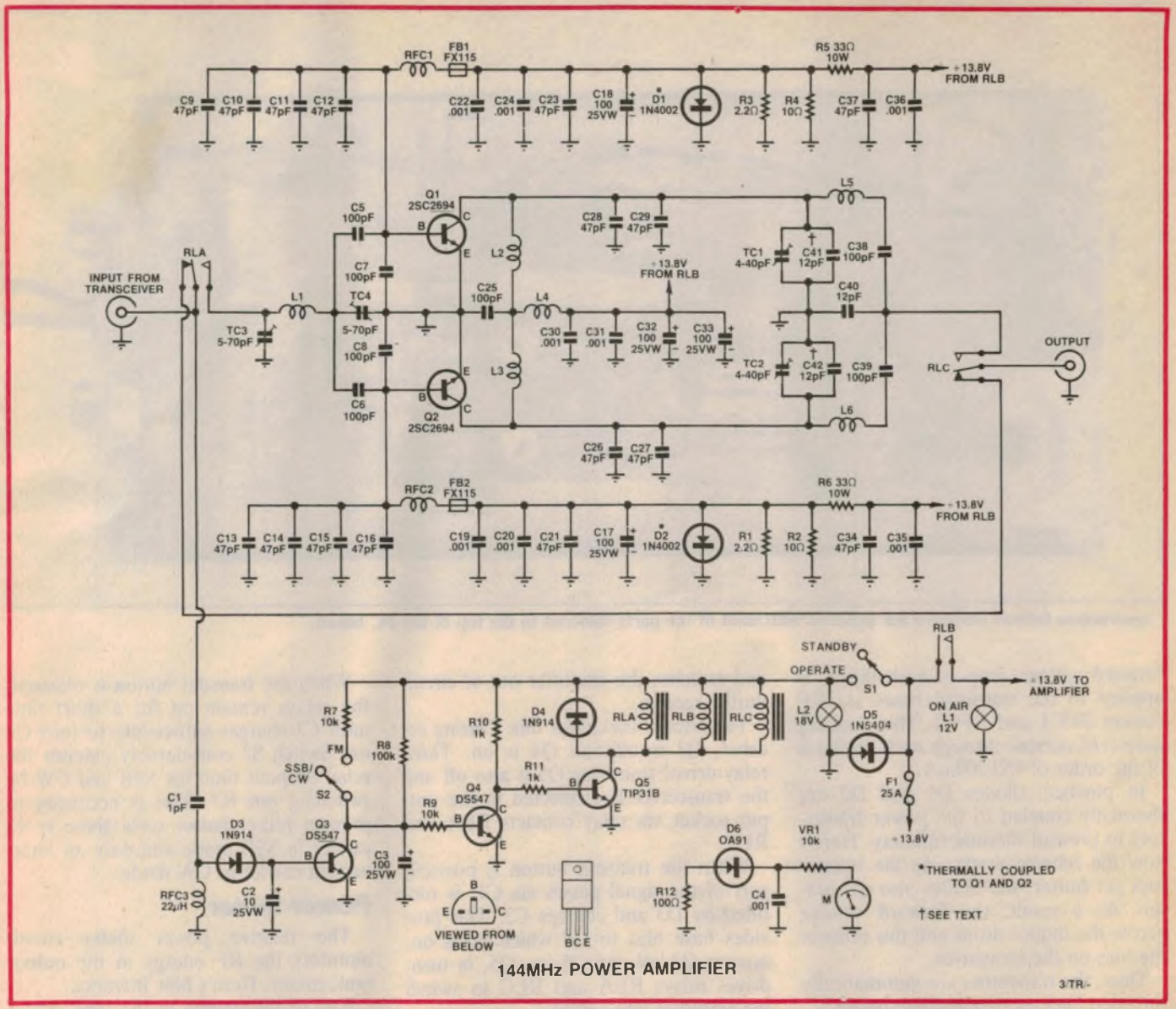
The operate/standby switch basically functions as an on/off switch. In the operate position, the amplifier is switched into circuit whenever the PTT button on the transceiver is pressed.

When the PTT button is released, the amplifier is switched out and the transceiver is connected to the antenna socket (on the back of the amplifier) via internal relay contacts.

In the standby position, the amplifier is switched off and the transceiver is connected, via the relays, to the antenna socket for both receive and transmit. This operating mode is handy for making local contacts, or in other situations where the high output power of the amplifier is not required.

Unlike some commercial units, this unit uses low-loss coaxial relays for RF switching. These keep the insertion loss in standby mode to just 0.6dB over the range 144-148 MHz.

By contrast, many commercial units exhibit an insertion loss of 1.5dB or



The circuit uses two parallel RF transistors, Q1 and Q2, operating in class B mode. Q3-Q5 provide relay switching.

more due to the widespread use of cheap relays. This plays havoc with noise figures on receive and equates to about 7W out for 10W in when operating in standby mode.

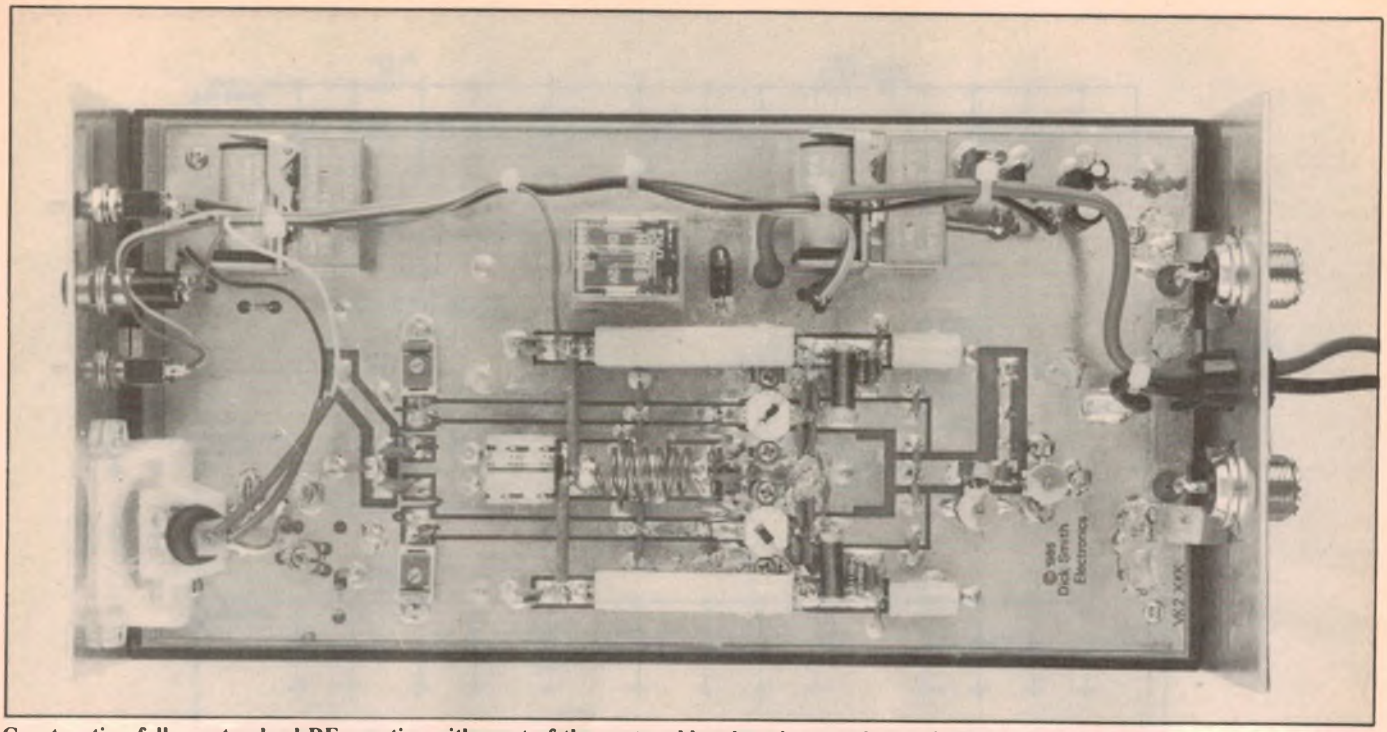
How it works

The circuit is quite straightforward and consists of two parallel RF power transistors, Q1 and Q2, operating in class B mode.

Starting at the input, the RF signal is fed via the contacts of relay RLA to an input matching network consisting of L1 and trimmer capacitors TC3 and TC4. From there, it is capacitively coupled to the bases of Q1 and Q2 which are Mitsubishi 2SC2694 devices rated at 75W each.

Resistors R5 and R6 and diodes D1 and D2 provide bias for the transistor stages. This bias, which is simply the

View of the completed prototype. The large finned heatsink allows the amplifier to be operated continuously at full output.



Construction follows standard RF practice with most of the parts soldered to the top of the PC board.

forward voltage drop of each diode, is applied to the transistor bases via RF chokes RFC1 and RFC2. The resulting quiescent current through each device is of the order of 150-200mA.

In practice, diodes D1 and D2 are thermally coupled to the power transistors to prevent thermal runaway. Here's how the scheme works: As the transistors get hotter, the diodes also get hotter. As a result, the forward voltage across the diodes drops and this reduces the bias on the transistors.

Thus, the transistors are automatically throttled back as they become hotter.

The collector outputs of the transistors are coupled to two tuned circuits consisting of L5, TC1, and L6, TC2. The amplified signal is then fed to C38 and C39, and applied to the output socket via coaxial relay RLC and a 50Ω stripline.

Note that the output tuned circuit also shows capacitors C41 and C42. These are fitted initially but may have to be removed later during alignment.

Coils L2, L3 and L4 and their associated capacitors provide decoupling for the 13.8V supply rail to the collectors of Q1 and Q2. Similarly, C9-C24, FB1, FB2, RFC1 and RFC2 decouple the base bias voltages.

Relay switching

Q3, Q4 and Q5 form the relay switching circuit. This switches the amplifier into circuit between the transceiver output and the antenna socket on transmit, and switches the amplifier out of circuit during receive.

The circuit works like this: During receive, Q3 is off and Q4 is on. Thus, relay driver transistor Q5 is also off and the transceiver is connected to the output socket via relay contacts RLA and RLC.

When the transmit button is pressed, part of the signal passes via C1, is rectified by D3 and charges C2. This provides base bias to Q3 which turns on, turning Q4 off and Q5 on. Q5, in turn, drives relays RLA and RLC to switch the amplifier into circuit.

At the same time, power is supplied to the on-air lamp (L1) via relay contacts RLB. Lamp L2 provides illumination for the power meter and is on while ever S1 is closed. S1 allows the amplifier to be switched to standby mode while D4 protects Q5 from back EMF when the relays turn off.

When the transmit button is released, the relays remain on for a short time until C3 charges sufficiently to turn Q4 on. Switch S2 considerably extends the relay dropout time for SSB and CW by switching out R7. This is necessary to prevent relay chatter since there is no carrier in SSB mode and only an intermittent carrier in CW mode.

Power meter

The relative power meter circuit monitors the RF energy in the output tank circuit. Here's how it works:

Part of the energy in the tank circuit is coupled into the anode circuit of D6 via two parallel tracks on the underside of the PC board. This signal is then rectified by germanium diode D6, filtered by C4 and applied to the meter movement via calibration trimpot VR1.

Note that D6 must be germanium type to ensure low forward voltage.

SPECIFICATIONS

Power Output	120W (max.) CW for 15W input at 146MHz (see Table 1)
Current Consumption	15A (see Table 1)
Insertion Loss	0.6dB from 144-148MHz
Input SWR	less than 1.2:1 from 144-148MHz
Harmonic Suppression	second: −55dB (same as exciter); third: −65dB (same as exciter)
Intermodulation Suppression	better than −35dB at 200W PEP on SSB two tone signal (500Hz & 2400Hz); exciter −38dB (ie, 3dB degradation)

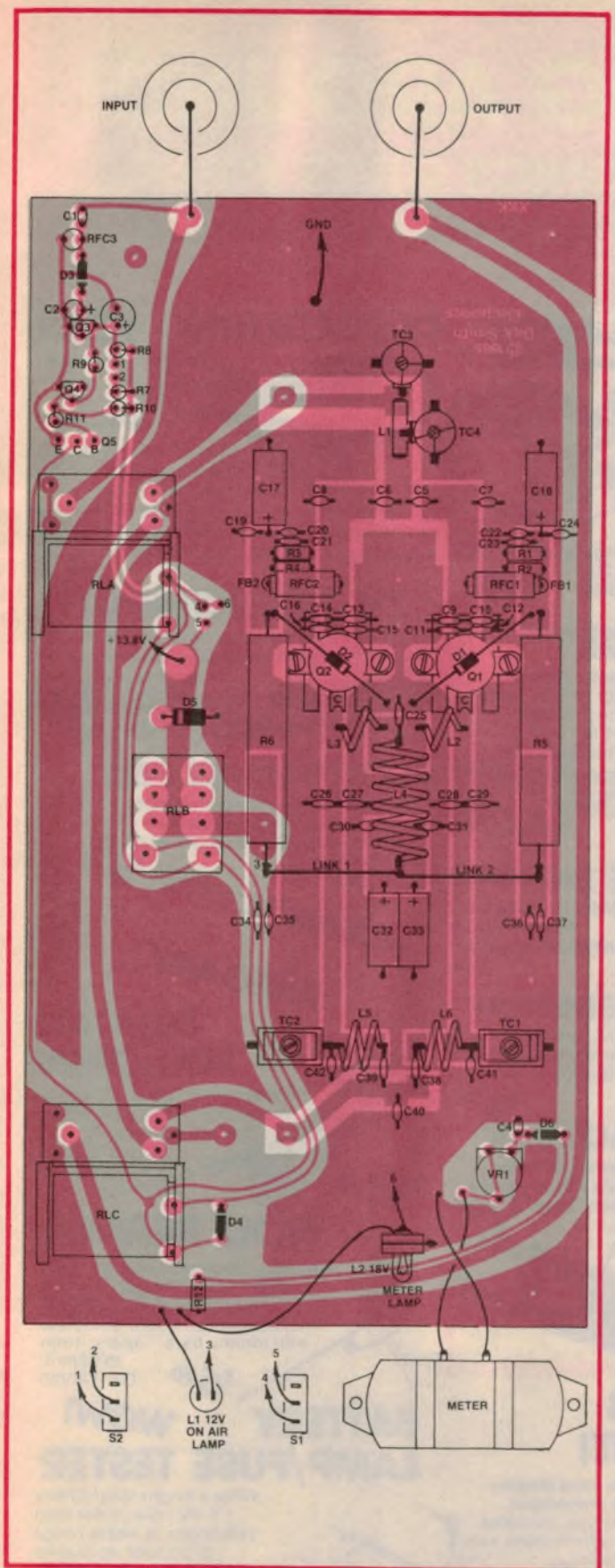


Fig. 1: parts layout and wiring diagram. Follow this diagram exactly when installing the parts and keep all leads as short as possible.

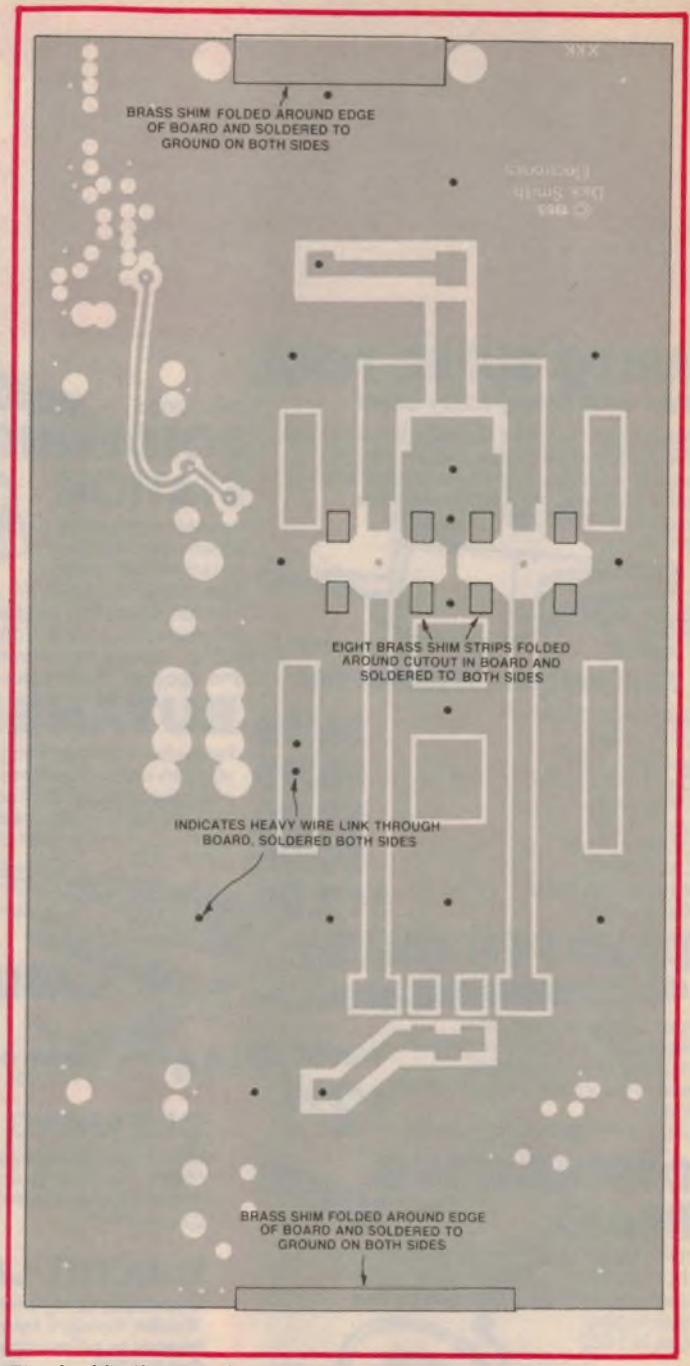


Fig. 2: this diagram shows the locations of the through-board links and brass shims (see text).

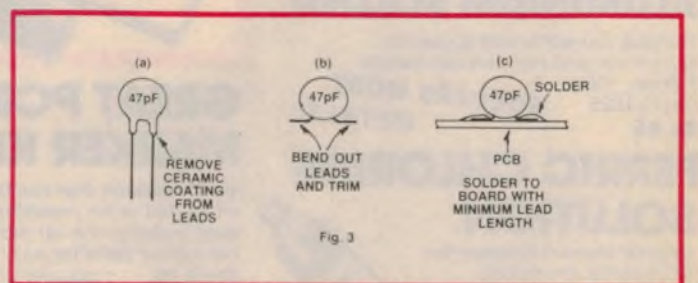


Fig. 3: the ceramic capacitors are all soldered to the top of the board, except for C1 which is mounted in the conventional manner. Trim the leads as shown in the diagram.

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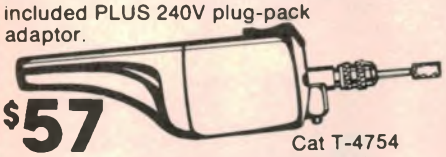

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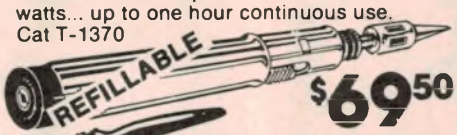

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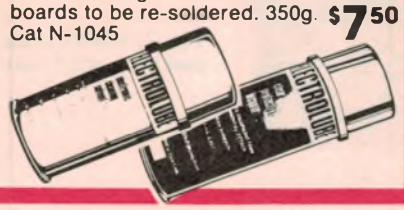

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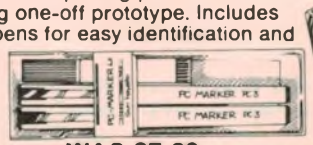

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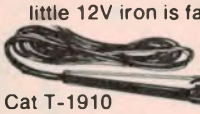

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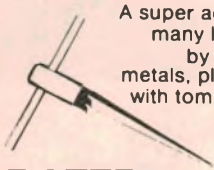

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- **Empty Bloc Set (6 blocks)** Cat K-2618....**$7.95**

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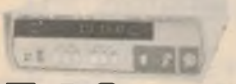

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R-2439	500V ceramic cap 15pF	0.01	0.11
R-2441	500V ceramic cap 18pF	0.01	0.11
R-2445	500V ceramic cap 27pF	0.01	0.11
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R-2485	500V ceramic cap 100pF	0.01	0.11
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R-2496	500V ceramic cap 330pF	0.01	0.11
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Z-4908	74LS08	.55	.70
Z-4910	74LS10	.55	.70
Z-4912	74LS11	.55	.70
Z-4914	74LS14	.55	.85
Z-4920	74LS20	.55	.70
Z-4927	74LS27	.55	.70
Z-4930	74LS30	.55	.70
Z-4931	74LS31	1.25	1.65
Z-4973	74LS73	.80	1.20
Z-4974	74LS74	.55	.70
Z-5010	7400 TTL	.50	.80
Z-5011	7401	.50	.80
Z-5023	7413	.55	.85
Z-5085	7485	1.10	1.40
Z-5030	7420	.50	.80
Z-9206	2513 charactor generator	15.95	24.75
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Z-2005	MJE 2955	1.45	1.25
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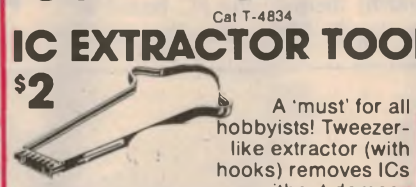

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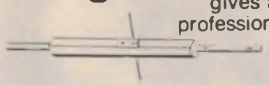

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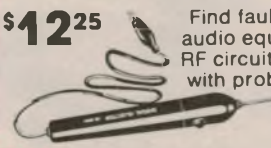

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SEE PAGE 121 FOR ADDRESS DETAILS

100W VHF Linear Amplifier

PARTS LIST

Semiconductors
Q1, Q2 — 2SC2694 RF power transistor
Q3, Q4 — BC547 NPN transistor
Q5 — TIP31B NPN power transistor
D1, D2 — 1N4002 diode
D3, D4 — 1N914 diode
D5 — 1N5404 diode
D6 — OA91 germanium diode

Capacitors
C1 — 1pF 50V ceramic
C2 — 10μF 25V PC electrolytic
C3 — 100μF 25V PC electrolytic
C4, C19, C20, C22, C24, C30, C31, C35, C36 — 0.001μF 50V ceramic
C5-C8 — 100pF 50V ceramic
C9-C16, C21, C23, C26-C29, C34, C37 — 47pF 500V ceramic
C17, C18, C32, C33 — 100μF 25V axial electrolytic
C25, C38, C39 — 100pF 500V silver mica
C40-C42 — 12pF 500V silver mica
TC1, TC2 — 4-40pF trimmer
TC3, TC4 — 5-70pF trimmer

Resistors (0.25W, 5% unless noted)
R1, R3 — 2.2Ω
R2, R4 — 10Ω
R5, R6 — 33Ω, 10W
R7, R9 — 10kΩ
R10, R11 — 1kΩ
R12 — 100Ω
VR1 — 10kΩ horizontal trimpot

Other parts
S1, S2 — SPST toggle switch
L1 — 12V lamp bezel (red)
L2 — 18V meter
M — edge level meter
RFC3 — 22μH RF choke
RLA, RLC — coaxial relay
RLB — Fuji HH62B relay
FB1, FB2 — FX115 ferrite bead

Miscellaneous
PC board, metal work and heatsink, SO-239 sockets, elephantide insulation, 0.1mm brass shim, in-line cable clamp, red and black heavy-duty power cables, 25A in-line fuse, cable ties, rubber grommet, nylon washers, machine screws and nuts, self-tapping screws, enamelled copper wire (0.5, 1, 1.3, 1.6mm dia.).

Construction

Construction is straightforward with most of the parts mounted on a double-sided PC board coded ZA-1661 and measuring 128 x 250mm. This is mounted on a large finned heatsink which forms the top of the case and provides heatsinking for the two RF power transistors.

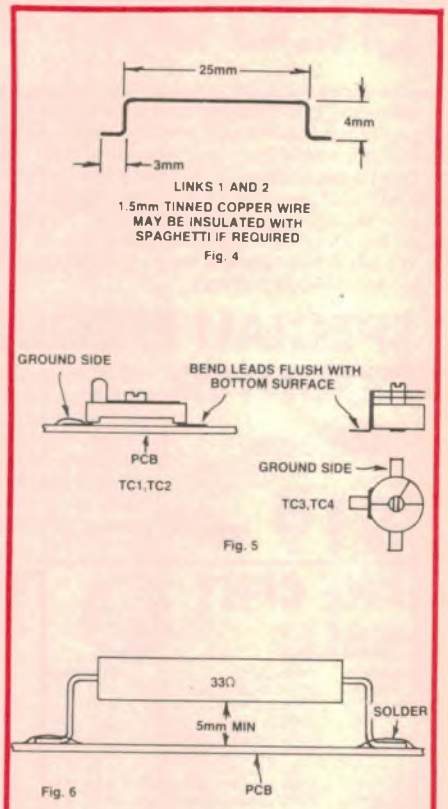
A black anodised base and two end panels complete the case.

To make construction really easy, Dick Smith Electronics will be supplying the metalwork and heatsink predrilled. In addition, the front panel features white screened lettering on a black background to give the unit a really professional appearance.

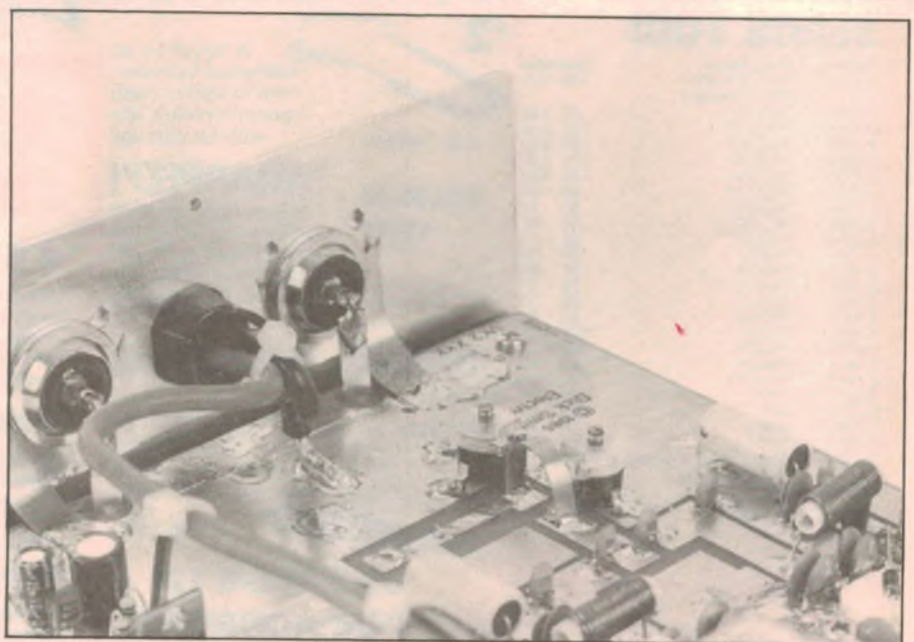
Begin construction by fitting the through-board links to the board as shown in Fig.2. There are 19 through-board links in all and these should be installed using 1.6mm diameter tinned copper wire.

With the links installed, the next step is to fit the brass shims in the positions indicated. These will have to be cut from the 100 x 100mm sheet provided.

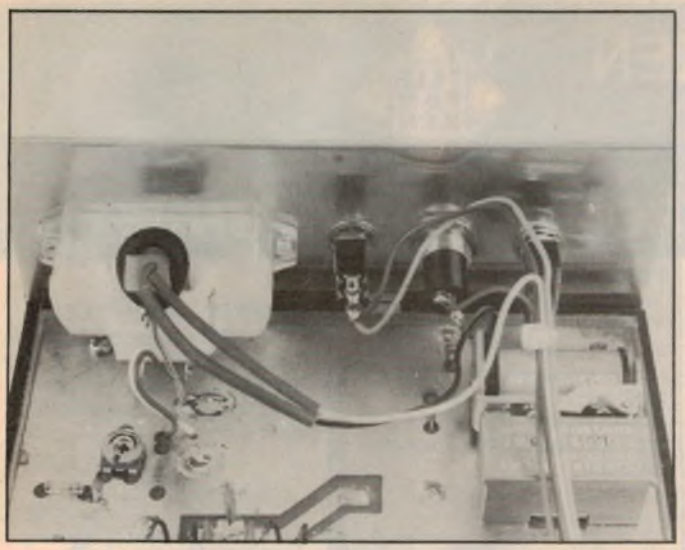
Begin by cutting eight 4 x 12mm strips, one 10 x 53mm strip and one 20 x 40mm strip. This done, fold each strip in half and fit them to the PC board as shown in Fig.2. Note that the shims



Figs. 4, 5 & 6: mounting details for the links, trimmer capacitors and power resistors.



This close up view shows how link L1 and its adjacent trimmer capacitors are mounted. The power cables are secured using a cord-grip grommet.



View of the front panel. Note mounting details for the meter lamp bezel.

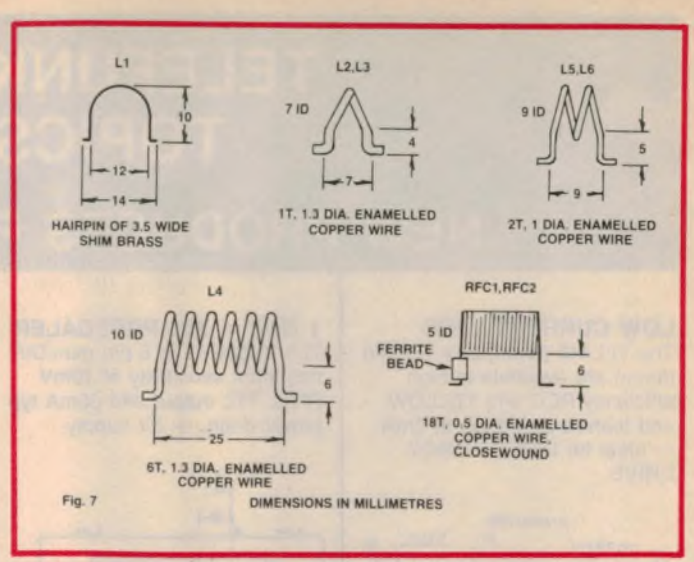


Fig. 7: coil winding details. The coils are all air-wound using metric drill bits as the coil formers.

must be soldered to both sides of the PC board.

The real job of installing the parts on the PC board can now be tackled. Note that because the circuit works at VHF, all leads must be kept as short as possible. For this reason, most of the components are soldered to the top of the PC board.

This means that the layout diagrams must be followed carefully when installing the parts. In most cases, there are no holes to guide the constructor.

Some parts are, however, mounted conventionally. Where possible, their leads must be soldered on both sides of the board.

Fig.1 shows the parts layout on the PC board. No particular order need be followed when assembling the board but we suggest that the resistors, capacitors (but not C9-C16), links and diodes (but not D1 and D2) be installed first. Fig.3 shows how the ceramic capacitors are mounted (except for C1 which is mounted in the conventional manner), while Fig.4 shows the details for Link 1

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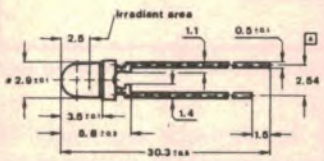

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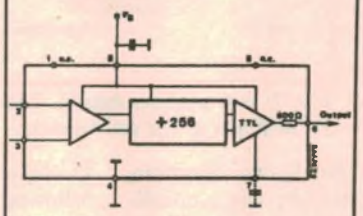
1 GHZ ÷ 256 PRESCALER

The U666BST in 8 pin mini-DIP has input sensitivity of 10mV RMS, TTL output and 65mA typ power drain, + 5V supply.



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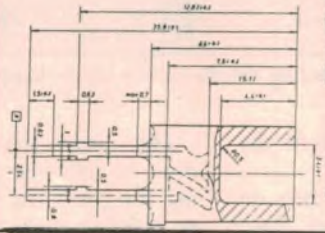
FIBRE-OPTIC LEDS

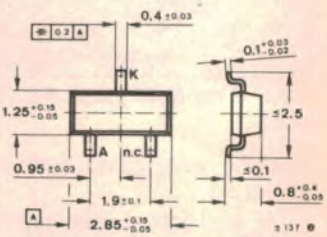
The TLY5200 series in RED, YELLOW and GREEN are similar to 5mm LEDS but are hollow inside with an adaptor bush for 1, 1.5, and 2mm plastic fibres — for remote lighting, signalling and special displays.



Insert B750 on Information Feedback Card

SURFACE MOUNT LEDS

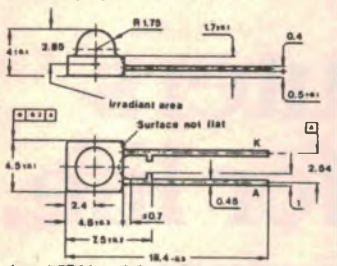
The TLM22 series are available in RED, YELLOW, GREEN and RED/GREEN DUAL in the SOT-23 package for miniature applications.



Insert B749 on Information Feedback Card

SIDE VIEW LEDS

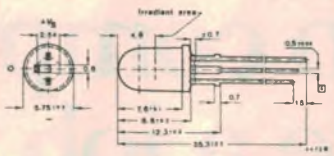
The TLP560 series are available in RED, ORANGE, YELLOW and GREEN very suitable for edge of PCB mounting — even illumination.



Insert B744 on Information Feedback Card

FLASHING/STEADY LEDS

The TLBX5400 are available in RED, ORANGE, YELLOW and GREEN — by lead selection they are off, steady on, or 3HZ flashing.



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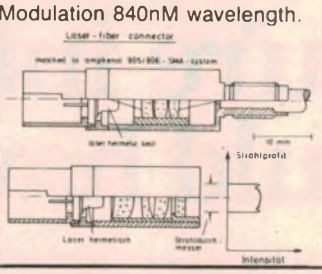
LASER PENS

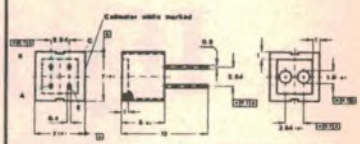
For range finding, communications and Fibre optics, C.W. and pulse to 20mW — extremely tight beam — spot diameter only 30mm at 1km distance (TXCK1203). Fibre coupler TSFK1500 — 300 MHz Modulation 840nM wavelength.



Insert B753 on Information Feedback Card

REFLECTIVE OPTO-COUPLER — CNY70

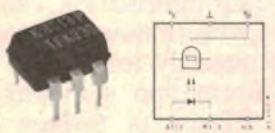
LED/PHOTO TRANSISTOR pair in a miniature housing for tape sensing-finger detector etc.



Insert B751 on Information Feedback Card

HIGH VOLTAGE COUPLER & SCHMITT TRIGGER

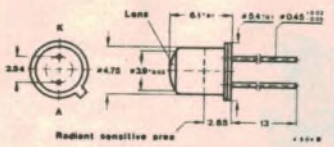
These 5.3KV couplers are useful to 500 Kbit/Sec with inverted output (K8013) or non-invert (K8031) direct TTL/CMOS output — TELECOM APPROVED.



Insert B745 on Information Feedback Card

ULTRA HIGH SPEED PHOTO-DIODE

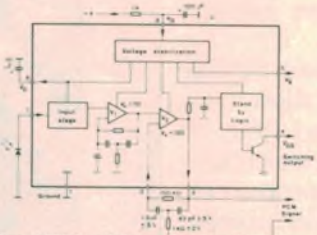
The BPW24 has rise and fall times of 7nSec and high sensitivity of 0.5 A/W at 900 nM — for fibre-optics etc.



Insert B748 on Information Feedback Card

IR PREAMP

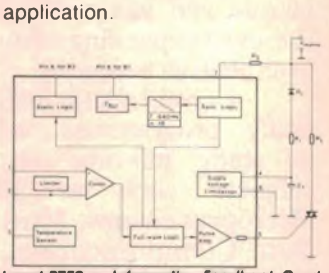
The U2501 takes a photo diode input and amplifies it through a band-pass filter and carrier detector — for use in remote control and signalling — 1mA drain from 6V supply.



Insert B754 on Information Feedback Card

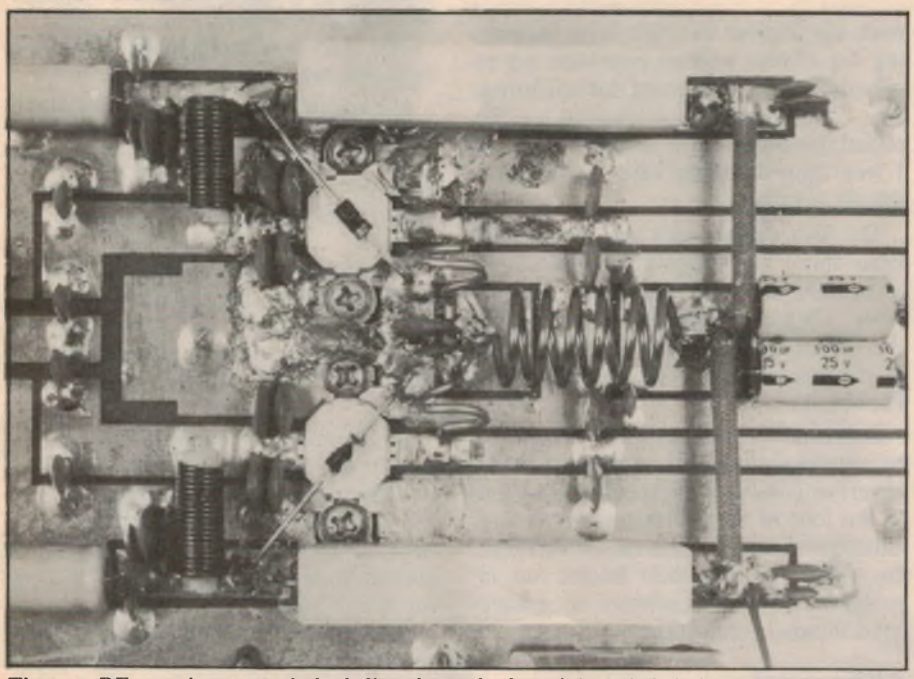
TEMPERATURE CONTROLLER

The U263 has an inbuilt temperature sensor, zero crossing detector and triac driver — very simple application.



Insert B752 on Information Feedback Card

100W VHF Linear Amplifier



The two RF transistors are bolted directly to the heatsink and their leads soldered to the brass shims. Note mounting details for D1 and D2.

and Link 2.

Note that resistors R5 and R6 become quite warm during operation and should be stood off the board by about 5mm (see Fig.6). Capacitors C9-C13 are installed after the two RF power transistors are installed and should be left out of circuit for the time being.

The trimmer capacitors can be installed next. These must be correctly oriented, otherwise the adjusting screws will have high RF voltages on them. Fig.5 shows the mounting details for the two different types of trimmer capacitors.

Installation of transistors Q3-Q5 is straightforward but Q1 and Q2 should be left off the board for the time being. We'll come to those later. Push the transistors down onto the board as far as they will comfortably go before soldering the leads.

Note that the emitter leads of Q3-Q5 must be soldered on both sides of the board. Install Q5 so that its metal tab faces relay RLA.

Coil winding

The coils for the 144MHz Power Amplifier require only a few minutes work. With the exception of L1, they are all wound using various grades of copper wire. A set of metric drill bits can be used as the coil formers.

Fig.7 shows the winding details. Be sure to use the correct grade of wire for each coil and don't forget to install a ferrite bead on one leg of both RFC1 and RFC2. Solder each coil to the PC board as it is wound and secure the windings of RFC1 and RFC2 using epoxy adhesive.

Note: on the prototype, short lengths of spaghetti sleeving were covered with adhesive and pushed into the RFC1 and RFC2 windings.

RF transistors

Installing the RF transistors requires a number of steps involving assembly and disassembly of the PC board onto the heatsink. Here's what to do:

(1) Position the sheet of "elephantide" insulation supplied with the kit on the mounting surface of the heatsink and temporarily secure the board using machine screws and nylon washers. The latter (three per screw) are used as standoffs between the PC board and the heatsink.

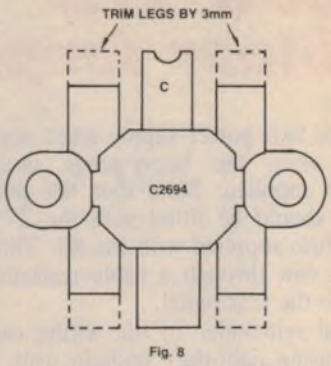


Fig. 8: trim the outside legs of the RF power transistors by about 3mm.

(2) Mark out the transistor mounting positions, then remove the board and make two square cutouts in the insulation material so that the RF transistor cases can make direct contact with the heatsink.

(3) Re-install the PC board on the heatsink.

(4) Carefully trim the four outside legs of the RF transistors by about 3mm (see Fig.8). This done, bolt the transistors to the heatsink and solder their legs to the PC tracks and brass shims. Fig.9 shows the details.

Note that an earth lug must be fitted under each of the four mounting screws. Solder these to the ground plane on the PC board.

(5) Install capacitors C9-C16 and remove the PC board from the heatsink.

Final assembly

Now for the final assembly. This mainly involves installing the remaining hardware and wiring up the front and rear panels (see Fig.1). Secure the meter to the front panel using epoxy adhesive.

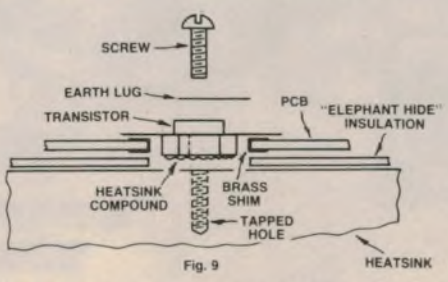


Fig. 9: mounting details for the RF transistors.

100W VHF Linear Amplifier

The two power supply leads must be run using the heavy-gauge insulated cable supplied. Note that the positive lead should be fitted with the 25A in-line fuse supplied with the kit. The two leads exit through a cable restraint fitted to the rear panel.

The remainder of the wiring can be run using light-duty hookup wire. This should be bound into a wiring loom using cable ties as shown in the photographs. Note that one of the leads to S1 must be soldered on both sides of the PC board.

With the wiring completed, smear heatsink compound on the underside of the RF transistors and re-install the PC board on the heatsink. The two end panels can now be secured to the heatsink using the large self-tapping screws supplied and the meter lamp mounted in position.

The accompanying photograph shows how the meter lamp is mounted. It is pushed into a rubber grommet and supported by a short length of tinned copper wire which is soldered to the PC board. The lamp is positioned over the meter by bending the copper wire.

Connections between the PC board and the rear panel sockets should be made using the brass shim and short lengths of tinned copper wire.

The input and output connections each use a piece of brass shim measuring 4 x 15mm, with an extension lug to go through the PC board for soldering. The other ends are connected to the socket terminals with a short piece of 1.5mm tinned copper wire, as shown in the photograph.

The two earth straps are made from brass shim. The straps should be cut so as to clear the input and output connections. They are secured to the panel by the socket flanges, while the other ends of the straps should be soldered to the PC board.

Construction can now be completed by installing diodes D1 and D2. Apply a generous coating of heatsink compound to the tops of the RF transistors before soldering the diodes into circuit. Arrange the diodes so that their bodies are in contact with the transistors to ensure good thermal conduction.

Alignment

This is quite a straightforward process but you do need access to some test equipment: (1) a multimeter, (2) a 100W dummy load (eg, DSE Cat. No. D-7030); (3) an SWR meter; (4) a 0.5-1W VHF transceiver: and (5) an RF power meter (optional).

Before commencing the alignment, there are a few precautions that must be observed. First, always use an insulated alignment tool when making adjustments. Second, keep your fingers away from the coils and the PC pattern to prevent RF burns. And third, do not initially apply full drive to the amplifier, or damage may occur.

The step-by-step alignment procedure is as follows:

(1) Connect the output of the amplifier to the dummy load.

(2) Connect the amplifier to a 13.8V 15A power supply (eg, the VK Powermaster, EA, March 1984 or a car battery).

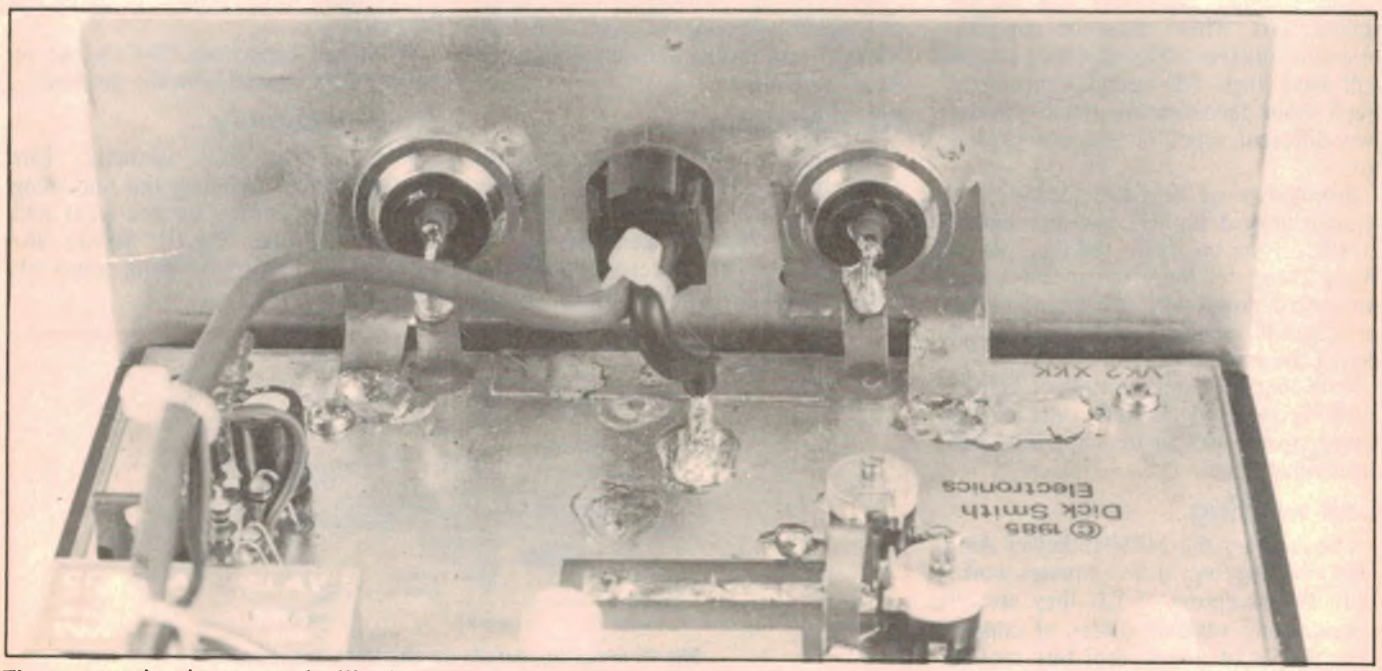
(3) Switch the amplifier to operate mode and FM. The relays should turn on and then drop out. Check that the current consumption is about 50mA at this point (due mainly to the meter lamp).

(4) Temporarily connect the +13.8V supply rail to the cathode of D3 (base of Q3). Check that the relays all operate and that the current consumption rises to about 1.2A. If the current is greater than 2A, switch off and check for wiring errors.

(5) Remove the power supply connection to D3 and set trimmer TC4 to half mesh.

(6) Connect the 0.5-1W 2-metre transceiver to the amplifier input with the SWR meter in series. Note: do not use a transceiver with a larger output at this stage.

(7) Set the transceiver to 146MHz (ie, to the centre of the band), operate the PTT switch and adjust TC3 for lowest reflected power (SWR). This done, adjust TC4 for lowest SWR and check the



The rear panel sockets are "wired" using the brass shim material and short lengths of 1.5mm tinned copper wire.

SWR at the band edges.

Repeat the adjustments until the SWR is less than 1.2:1 over the entire band.

(8) Remove the SWR meter and connect the transceiver directly to the amplifier unit. Where available, connect an RF power meter to the output. Note: keep the dummy load if the meter is not a terminating type.

(9) Screw the adjusting screws of TC1 and TC2 down until they are finger-tight.

(10) Operate the transceiver PTT switch and alternatively back off TC1 and TC2 a fraction of a turn each for maximum reading on the power meter. The idea here is to get the two output tank circuits to resonate with TC1 and TC2 set to about the same value.

Initially, C41 and C42 should be in-circuit. Remove them if TC1 and TC2 cannot be conveniently adjusted to bring the tank circuits to resonance (ie, if the adjusting screws become loose).

(11) If no RF power meter is available, use the output meter built into the amplifier. Use VR1 to adjust the meter sensitivity if the reading is initially too low to register.

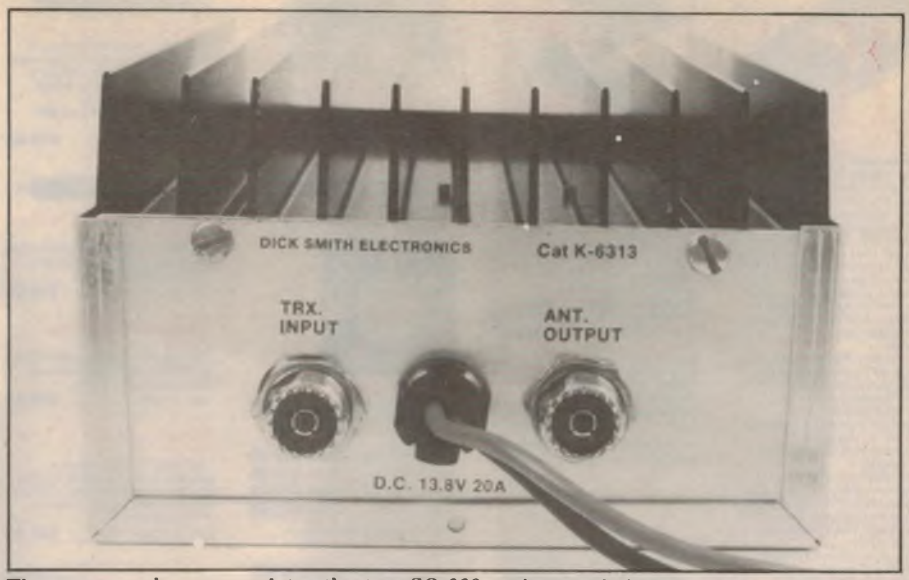
(12) Connect a 5W 2-metre transceiver to the input, operate the PTT switch and re-adjust TC3 and TC4 for maximum output. This done, re-adjust TC1 and TC2 but make sure that their values are kept as equal as possible.

Note: a 10-15W transceiver can be used for this step, provided that you proceed with caution. Operate the PTT switch for short periods of time only (a few seconds) when making adjustments to prevent damage to the amplifier.

(13) Remove the drive and check that the current consumption drops to around 50mA when the relays drop out.

(14) Switch the amplifier to SSB and apply drive (ie, a carrier) until the relays pull in. Remove the drive and check that the current consumption drops to around 1.2A before the relays drop out, then to about 50mA.

(15) Connect a 10-15W transceiver and repeat step 12 to ensure maximum output. Adjust trimpot VR1 so that the amplifier meter reads full scale at maximum drive. That completes the alignment.



The rear panel accommodates the two SO-239 sockets and the cord-grip grommet. Use good-quality 50Ω coax for all input and output connections.

Operation

The amplifier can be driven by any 2-metre transceiver with an output power of up to 15W. Do not apply more than 15W of drive, otherwise the RF power transistors will be over-driven and may burn out.

Similarly, the RF transistors may also burn out if the amplifier is driven into mismatched loads (SWR greater than 2:1). Check the antenna SWR before connecting up the amplifier and always use good-quality 50Ω coaxial cable for the input and output connections.

Finally, it is normal for the output power of the amplifier to drop by about 10% after a few minutes of continuous operation due to the action of the compensation diodes (D1 and D2).

Where to buy the kit

This project was developed by the Research and Development Department at Dick Smith Electronics Pty Ltd. It is being marketed as a complete kit of parts and can be obtained by mail order or from your nearest Dick Smith store.

The kit comes complete and includes anodised and screen-printed metalwork (supplied pre-drilled), a fibreglass PC board, and a detailed construction manual. The cost is $249 plus postage and packing charges where applicable.

Mail orders should be sent to: Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. Phone (02) 888 2105.

Table 1

Input power (watts CW)	Power output (watts CW)	Current consumption (A)
2W	43W	9A
3W	55W	10A
4W	66W	11A
6W	85W	12A
7W	90W	12.5
8W	98W	13A
9W	100W	13.2A
10W	110W	14A
15W	120W	15A

Table 2

Frequency (MHz)	Power output (watts CW)	Current consumption
144	110	14.0A
145	110	14.0A
146	110	14.0A
147	110	13.5A
148	110	13.5A

Note: all readings in Table 1 and Table 2 taken with 13.8V supply.

METEX 3800 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch
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- Automatic over-range indication with the "1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS

Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

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QUALITY MOMENTARY (RED BODY)

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CORDLESS RECHARGEABLE SOLDERING IRON

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Size: 4" x 10 1/2"
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Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm
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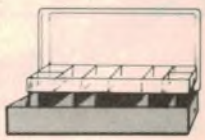
Size: 3" x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
Cat. C92084 **$29.95**

Dealers, OEM's, etc., phone (03) 543 166 for wholesale prices.



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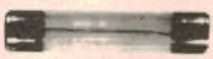

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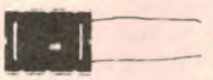
1-99	100-999	1000+
8¢ each	6¢ each	5¢ each



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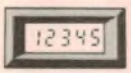

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- **High Count Rate**

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SPECIFICATIONS:
Supply Voltage: (5.5V Abs. Max.) 7.5 - 15V
Typical Current Consumption: 1mA
Maximum Count: 19999
Max. Counting Rate: 10MHz
Typical (Schmitt Trigger) Count Input Level: VTH 2.5V VTL 2V
Min. DC Input Level: 0V
Max. DC Input Level: 5V
Operating Temp. Range: 0 - 50-C
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Q10510	MU45 0-5A	12.50
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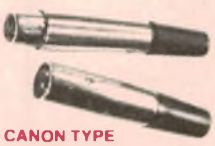
Q10520	MU45 0-1A	12.50
Q10525	MU45 0-20V	12.50
Q10530	MU52E 0-1A	14.50
Q10533	MU52E 0-5A	14.50
Q10535	MU45 VU PMetre	14.95
Q10538	MU65 0-50uA	16.95
Q10540	MU65 0-1mA	16.95
Q10550	MU65 0-100uA	16.95
Q10560	MU65 0-20V	16.95



CANON TYPE CONNECTORS

Cat. No.	Description	Price
P10960	3 pin line male	$3.90
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Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 195mm.
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Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 165mm.
Cat. T11251 **$15.95**

DELUXE DESOLDERING PUMP

Light weight, non conductive, powerful suction, ceramic long life tip. One of the best in the business. Length 210mm. replacement tip HT3C ceramic.
Cat. T11261 **$22.95**

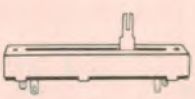
WELLER WTCPN SOLDERING STATION

The WTCPN Features:
- Power Unit 240 V AC
- Temperature controlled iron 24 V AC
- Flexible silicon lead for ease of use
- Can be left on without fear of damaged tips!

The best is always worth having.
Cat. T12500
R.R.P. $129 **Our price $109**

JOINABLE PCB MOUNTING SCREW TERMINALS (BLUE)

2 Way	1-9	10+
Cat. P10520	$0.75	$0.65
3 Way		
Cat. P10521	$0.95	$0.85



LOG SLIDES POTS

We ordered log instead of linear for the graphic equalizer, so take advantage of our mistake!

1-9	10+	100+
$0.65	$0.60	$0.50

SUPER HORN TWEETER

- Requires no crossover and handles up to 100W
- Sensitivity: 100dB/0.5m
- Frequency Response: 3kHz - 30kHz
- Impedance: 8 OHMS
- Size 96mm diameter

Cat. C12102 normally $17.95
On Special at $14.95

SUPER HORN

- Wide dispersion tweeter handles up to 100W
- Sensitivity: 105dB/0.5m
- Frequency Response: 3kHz - 30kHz
- Impedance: 8 OHMS
- Size: 145x54mm

Cat. C12103 normally $17.95
On Special at $14.95

NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:

Cat. H10450 190x120mm **$12.95**
Cat. H10455 256x185mm **$21.95**
(measurements are approx. only)

RITRON 19" RACK CASE

Tremendous Value! Dimensions 480(W) x 134(H) x 250(D)mm.
Cat. H10415 **Normally $44.95**
SPECIAL PRICE $39.95

PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance.
- All aluminium construction.
- Removeable top and bottom panels.
- All dimensioning conforms to the International Standard.
- Natural or black finish.
- Ventilated lid.
- Deluxe brushed finish anodised front panel.

	1-4	5+
H10401 Natural	$49.50	$44.50
H10402 Natural	$59.50	$53.50
H10403 Natural	$69.50	$62.50
H10411 Black	$55.00	$49.50
H10412 Black	$65.00	$58.50
H10413 Black	$75.00	$67.50

BULK CABLE 100M ROLLS

Cat. W11222 3C2V 75 OHM **$22**
Cat. W11224 5C2V 75 OHM **$35**
Cat. W11219 4 Core Shielded **$49**

DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, local length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce! Spare fluoro tubes are available from electrical outlets. If you have trouble with fine PCB work or component identification but still want both hands free, this is for you.

TECHNICAL INFORMATION
Illumination: 22W Fluorescent
Weight: 81.6Kg
Lateral Extension: 254mm
Vertical Extension: 254mm
Fixing: Heavy table base (grey) with two chrome plated flexible arms.

Cat. C92700 **$179**

UNIVERSAL BATTERY CHARGER AND TESTER

Save money on expensive batteries with this universal battery charger. Features include meter tester, and provisions for D, C, AA, AAA, N, button and cell batteries, 9V and 6V (square types). Comes complete with detailed instructions.
Cat. M23533 **$27.95**

UHF/VHF/FM ANTENNA AMPLIFIER AND 2 WAY SPLITTER

Covers all Australian frequencies. Suitable for use in houses, caravans, boats etc.
- 1 x 75 ohm input
- 2 x 75 ohm output
- Gain 2 x 6dB
- Maximum output 2 x 96dBuV

Cat. L15041 **$39.95**

UHF/VHF MAST HEAD AMPLIFIER

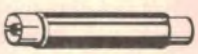
SPECIFICATIONS:
Gain: 40 - 160MHz 30dB (rejection 7.5dB at 94MHz)
170 - 230MHz 40dB
470 - 900MHz 15dB
Max Output: 100dB uF V
Noise Figure: VHF 6.5dB UHF 7dB
Input Impedance: VHF (75/300 ohm) UHF (75/300 ohm)
Output Impedance: 75 ohm
Power Supply: 12V DC 100mA

Cat. L15046 **$89.95**

UHF/VHF CONVERTER

SPECIFICATIONS:
Input (Channel 36): 75 ohm x 1
Output (Channel 1,3,4): 75 ohm x 1
Gain: 12dB
Power Supply: AC adapter 240V AC 50Hz/12V DC, 100mA, DC Plug

Cat. L15051 **$89.95**



TV INTERFERENCE FILTER

Cuts CB/Ham signals interference.
Cat. L11048 **$5.95**

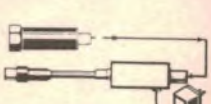
OUTDOOR ANTENNA DIPLEXER

Cat. L11044 **$14.95**

UHF TO VHF TUNEABLE DOWN CONVERTER

Suits all TV's and allows VHF sets to watch and listen to SBS Channel 28
- Has built in amplifier to ensure no signal loss.
- Tuneable UHF band 4/5 to VHF channel 1.
- Power supply 12V DC 100mA (included).
- Allows TV without UHF to recieve on-air UHF signal or use VCR, Video Game, Computer, etc.

Cat. L15021 **$99**



10dB IN-LINE COAXIAL AMPLIFIER

Reduces loss from splitters and long cable runs. Suitable for use with antennas, coaxial feed lines and VCR's. A/C adaptor included.

SPECIFICATIONS:
Frequency Range: 5-900MHz
Gain: 10dB
Power Requirements: 12V A/C Adaptor (included)
Input Impedance: 75 ohm
Output Impedance: 75 ohm

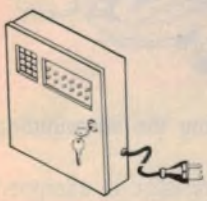
Cat. L15043 **$44.95**

NEW! NEW! NEW! NEW!

an entire page full of NEW products! from Rod Irving Electronics!

CODE KEY PAD
- Telephone type digital keypad.
- Four digit, changeable code.
- Over 5000 possible combinations.
- Power consumption: 5mA standby 50mA alarm.
- Two sector LED and 1 arm LED.
- Wrong number lockout.
- 12V DC operation.
- Relay output.
- Panic button.
- Normally open tamper switch.
- Dimensions: 145 x 100 x 37mm
- ACP3 compatible.

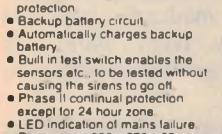
Cat. A13014 **$69.50**



BURGULAR ALARM CONTROL PANEL
A complete six sector alarm control panel suitable for both commercial and residential use. Has all the features of larger units in a compact tamper proof metal cabinet. Inbuilt 240V - 50Hz power supply.
- Armed and Disarmed with digital keypad.
- Six independent supervised zone inputs.
- Will accept N/O or N/C sensors.
- Each is supervised with end of line resistor.
- LED indicator for each sector plus LED indicators for zone violation.
- May be either delayed or instant zones.
- Separate zones may be disabled for service etc.
- Two 24 hour zones. One is N/O for panic or fire alarm, the other is N/C for motion detector or siren box. Both are supervised with end of line resistors.
- Built-in Anti tamper switches.
- N/C tamper switch on front and rear.
- Audible alarm status indicator.
- Internal buzzer sounds for exit/entry delays.
- Internal buzzer for low battery and testing.
- Built-in siren driver output circuit.
- External horns have wire cut protection.
- Relay outputs.
- Timing relay - dry contact output (SPDT).
- Timing relay - 12V DC output.
- Latching relay - 12V DC output 500mA.
- Regulated 12V DC output (1 amp maximum) for passive or active detectors. Short circuit protection.
- Backup battery circuit.
- Automatically charges backup battery.
- Built in test switch enables the sensors etc., to be tested without causing the sirens to go off.
- Phase II continual protection except for 24 hour zone.
- LED indication of mains failure.
- Dimensions 300 x 270 x 80mm.

Mail Order Only

Cat. S13013 **$269**



TELECOMMUNICATIONS AUSTRALIAN TO U.S. ADAPTOR CABLE
- Australian socket to U.S plug.
- Length 5 metres.

Cat. Y16017 **$7.95**

2 WAY MID SIZED SPEAKER SYSTEM
Designed specifically for compact disc. Excellent bass response to fully utilize the output capabilities of a compact disc. 16" high, woodgrain finish cabinet with brown cloth grille.

SPECIFICATIONS:
Speakers: Woofers 6 1/2" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz damped with ferro fluid.
Power Input: 40 watts rms 85dB w/m
Impedance: 8 ohms
Frequency response: 50-20,000Hz
Size: 250 x 400 x 240mm
(AVAILABLE MAIL ORDER ONLY)

Cat. C10762 **$299**

2 WAY MINI BOOKSHELF SYSTEM
Designed specifically for compact disc. This 2 way bass reflex system offers incredible audio performance for its size (9.5"). Woodgrain cabinet allows it to slot in with any audio or video system.

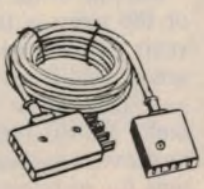
SPECIFICATIONS:
Speakers: Woofer - 4" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz magnet, damped with ferro fluid.
Power Input: 30 watts rms 82dB w/m
Impedance: 8 ohms
Frequency response: 80-20,000Hz
Size: 150 x 240 x 160mm
(AVAILABLE MAIL ORDER ONLY)

Cat. C10760 **$179**

ARLEC "DISCO LITE" CONTROLLER
Give your parties a professional touch with the arlec "Disco Lite". Simply plug your light(s) into the "Disco Lite" and you've instant party life!

3 DIFFERENT MODES!
Music Mode: Place the "Disco Lite" in range of the speakers and it flashes the lights to the beat of the music!
Strobe Mode: Simply adjust to desired speed! Great for mime or theatre! The christmas season or advertising!
Dim Mode: Allows you to dim the lights to create moods, effects etc.

Cat. M22003 **$49.50**

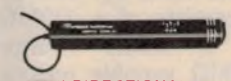


TELECOMMUNICATIONS AUSTRALIAN STYLE ADAPTOR CABLE
- Australian socket to plug/socket
- Length 10 metres

Cat. Y16015 **$15.95**

WIRELESS INTERCOM
This quality 2 way handset type FM wireless intercom, automatically calls the other phone the moment the handset is picked up. Simply plugs into any 240V wall outlet and can be wall or bench mounted. Features LED indicators for transmit and recieve, and P.L.L. circuitry to ensure reliability. Carrier frequency 95.125kHz.

Cat. A11506 **$139**



OMNI-DIRECTIONAL WIRELESS MICROPHONE
Tuneable: 92 - 104MHz
Freq. Response: 50 - 15kHz
Range: Over 300 feet in open field.
Modulation: FM
Power Source: 9V Battery
Type: Electret Condenser.
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

Cat. A10450 **$19.95**

CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER
MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation.
Power Supply: 9V Battery or 9V DC power adapter
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams

Cat. A10452 **$89**

ECONOMY 4 CHANNEL MICROPHONE MIXER
Its size and simplicity makes this mixer very portable and easy to operate.

SPECIFICATIONS:
- 4 low impedance 600 ohm microphone inputs.
- Individual gain control for each microphone.
- Master volume control.
- Power on LED.
- Inputs/Outputs - 6.3mm mono sockets.
- DC operated (9V battery only).
- Input impedance 600 ohm.
- Output impedance 1.5kohm.
- Signal/noise ratio 55dB.
- Frequency response 20Hz to 20kHz plus or minus 2dB.
- Weight 320 grams.
- Dimension 148 x 46 x 86mm.
- Torque variable range 1-22dB.
- Input sensitivity 1mV.
- Output level 90mV (at input 5mV).
- T.H.D. 0.01%

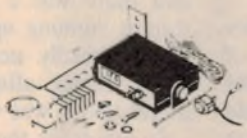
Cat. A12001 **$39.50**

3HR VIDEO TAPES from only $6.95!
Rod Irving Electronics has made a sensational scoop purchase of quality Kyoto video tapes at unheard of prices!

1-9	10-24	25+
$8.95	$7.95	$6.95

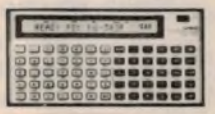
CHANNEL 28 TO CHANNEL 0 CONVERTER
If your TV doesn't have UHF, don't despair! With one of these high quality, specially made converters you can have Channel 28 UHF converted to Channel 0 VHF

Cat. L15052 **$129**



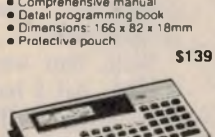
DIGITAL SPEEDO/ DIGITAL TACHO/ SPEED ALERT
- Digital readout (LED) for both tacho and speedo.
- Alarm with sound at variable preset speed.
- Audible beeper and visual indicator.
- In built light indicator for night illumination.
- Designed for 12 volt negative earth electrical systems.
- Speedo: 0 - 199kph
- Tachometer: 0 - 9900kph
- Speed alert: 40 - 120kph
- Complete with mounting hardware.

Cat. A15064 **$69.50**



CASIO FX702P BASIC PROGRAMMABLE POCKET COMPUTER
- Maximum steps: 1680 (26 memories)
- Maximum memory: 226 (80 steps)
- Alphabetical keyboard
- 19 digit display
- Comprehensive manual.
- Detail programming book.
- Dimensions: 166 x 82 x 18mm
- Protective pouch

$139

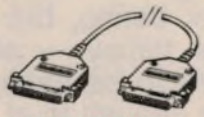


CASIO FX720P PORTABLE PERSONAL COMPUTER
- One Key Functions.
- Qwerty Keyboard.
- 11 digit display.
- Dimensions: 163 x 82 x 15mm.
- Protective pouch.
- Options: Character printer, Cassette interface, RAM card.

$159

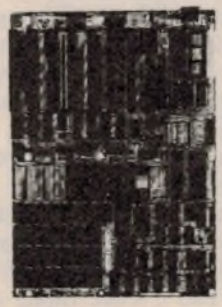
INLINE SWITCHING BOX
- 25 pin "D" plug to 25 pin "D" socket (RS232)
- DIP switches allow easy switching of internal wiring.

Cat. P00000 **$32.95**



COMPUTER LEAD
- 25 pin "D" plug to 25 pin "D" plug (RS232) DIP switches in each plug allow many combinations of internal wiring, making this a truly universal lead.
- Mylar shielding against RF interference.
- Length 2 metres.

Cat. P19031 **$59.95**



IBM* COMPATIBLE MOTHER BOARD
XT compatible mother boards. 8 slots, room for 256K RAM.

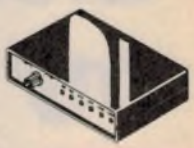
Cat. X18020 **$295**

ARLEC ELECTRONIC DOOR CHIME
- Quick easy installation.
- Variable tone control.
- "Ding - Dong" chime sound.
- Complete with pushbutton switch, 9 metre connecting wire and fixing screws.
- Runs approximately 12 months on one battery.
- Uses 9 volt transistor battery (Not supplied).
- 2 year guarantee.

Cat. A11950 **$25.95**

WIPER DELAY CONTROLLER AND LIGHT ON REMINDER
- Triggers if lights are left on and ignition is turned off.
- Has both an audible and visible alarm.
- Allows windscreen wipers to be delayed for up to 20 seconds.
- Underdash or on dash mounting.
- Designed for 12 volt negative earth electrical systems.
- Complete with mounting hardware.

Cat. A15070 **$24.95**



RS232 DATA SWITCH WITH TESTER
- 25 pin RS232 "D" connectors 2 in, 1 out or 1 in, 2 out.
- Ideal for 2 computers to one peripheral or 1 computer to 2 peripherals.
- No power required.
- Six dual coloured LED indicators showing certain flow status:
  T.D. Transmit Data
  R.D. Recieve Data
  R.T.S. Request To Send
  C.T.S. Clear To Send
  D.S.R. Data Set Ready
  D.T.R. Data Terminal Ready
- Housed in heavy duty metal cabinet.
- Size: 200(W)x68(H)x150(D)mm

Cat. X19110 **$149**

CENTRONICS DATA SWITCH WITH TESTER
- 36 pin gold plated female Centronics connectors.
- All other specs as for RS232 Data Switch with Tester.

Cat. X19115 **$169**

PC BOARD HOLDER
Better than an extra pair of hands! A must for all PCB work.

Cat. T12442 **$7.95**

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Registered Post for orders over $200 included "free".

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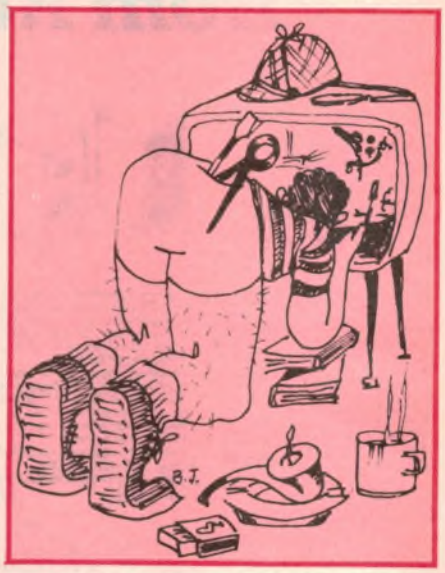
MasterCard VISA

Errors and Omissions Excepted.

The Serviceman

Elementary, my dear Watson!

As I may have mentioned in these notes before, a serviceman's lot is not all Sherlock Holmes and Dr Watson stuff — we'd all have gone broke long since if it was. Most jobs are routine, almost boring, but they are the ones that keep the bank manager happy — or less miserable (bank managers are not allowed to be happy). But a few, while basically routine, are novel enough to at least break the monotony.



So let's start off with a couple in that category. The first concerns a Rank Arena 2201. It belongs to a family that I had not served before but who had apparently been recommended to me by one of my regulars. The lady of the house rang me and, after identifying the make and model of the set, complained of a very poor picture and some "sizzling noises" coming from it.

I interpreted this as a possible tripler fault. We had been having a bout of humid weather and a couple of older triplers had already succumbed. I made an appointment for late that afternoon and made sure I had a spare tripler on hand before I set out.

It was the last call on my rounds for the day and by the time I arrived the husband was home and greeted me at the door. After ushering me into the lounge room he wanted to know what I thought the trouble might be — which really means how much is it going to cost. When I suggested the tripler his face fell.

"We had a new tripler fitted about a year ago. Cost us over one hundred dollars. Should have lasted longer than that, surely?"

I made some non-committal remark about being unlucky, then moved over to the set and switched it on. As soon as it warmed up I realised what the lady had meant when she complained of a poor picture; it was hopelessly out of focus. At the same time, I became aware of the "sizzling", but this was quite faint and didn't really sound like a tripler fault.

I slipped the back off and spotted the trouble immediately. It wasn't the tripler although it was close by. The focussing network consists of a 132MΩ resistor (R571), a 28MΩ resistor (R572), and a 10MΩ variable resistor (VR571), which is the focus control.

Anyway, it was the 132MΩ resistor which was at fault. This is a very large unit which stands vertically alongside the tripler. The outer coating had split and there was a merry little fireworks display running up and down inside the gap. I hardly needed to measure the focus voltage after that, but I did and found that it was virtually zero.

So much for the diagnosis. Now I had to decide how best to correct the situation. The easy way would have been to fit a new tripler but I felt that this would be a bit rough, considering the previous fault. It would be a lot cheaper if I could find an easy way to replace the resistor; something I had never considered before.

Back to the ranch

In any case, this was no job for the lounge room. I bundled the set into the truck and headed for the workshop. I thought about it on and off overnight and next morning began hunting through some old Rank chassis in the hope of finding a spare resistor. As it turned out I was lucky, and found one in short order.

Well, that was part of the problem solved. All I had to worry about now was fitting it. This didn't present any problems in the purely mechanical sense, but I was worried about joining the EHT cable to the top of the resistor without encountering insulation problems. Bare conductors at 25kV have a nasty habit of ionising the surrounding air.

Fortunately, this resistor is equipped with a lengthy rubber cap which fits over the active end and I reasoned I could take advantage of this. I trimmed the cable from the resistor in such a way that I was able to make the joint as close as possible to the end of the resistor, the rubber cap having been slid back along the EHT cable. Then I filled the cap with the old trusty Roof and Gutter Sealant and coaxed it down the cable and over the end of the resistor.

This completely enclosed and hid the joint, so the whole thing looked "just like a bought one", as the saying goes.

More to the point, it behaved like a bought one, with no sign of ionisation or other insulation problems. And, with a normal focus voltage available, it took only a few moments to produce a sharp picture!

And that was more or less the end of the story. I returned the set to the customer, charged a moderate fee, and everyone was happy. What's more, I'm confident I can add another customer to my books.

But one of the most intriguing aspects of the story is the fact that in all the years I have been servicing Rank Arena sets — and I lost count a long time ago — I have never before encountered a faulty 132MΩ resistor. Which only goes to prove, I suppose, that there is a first time for everything.

The faithful K9

The next story concerns another old faithful, the Philips K9. In this case it belonged to one of my long standing customers and, in fact, I have looked after it ever since it was new, over 10 years ago. Not that it has needed much looking after, having been remarkably reliable.

It did fail a couple of years after being installed, the complaint being loss of sound. This turned out to be failure of the module U240 in the sound stage. More specifically, it was the TBA750 IC in this module. This IC often failed, and I adopted a routine of carrying a spare module, swapping it for the faulty one, then fitting a new IC to the latter and using it for the next such fault.

Then, a couple of years back, a 6.8MΩ resistor in the focus voltage divider chain, R510, passed out and had to be replaced. And that was the sum total of service over its 10 years of life. However, on that occasion I had warned the owner that the picture tube might be approaching the end of its life. There was a hint of lost performance, plus the fact that I know he flogs it pretty solidly.

He accepted this verdict quite philosophically.

After that I more or less forgot about the set until the owner pulled up outside the shop with it in the back of his station waggon. He came straight to the point. "Ya remember the other day ya reckoned the picture tube was gettin' a bit sick? Well, I reckon it's had it."

My mind raced madly through any such warning I might have issued "the other day" but drew a blank. Then, as daylight dawned, I tactfully suggested that I had probably said that a couple of years ago. "Well, yair, I 'spose it could be that long."

That much settled, he went on to reiterate that the picture tube had probably "had it". And, if this was so, he was keen to fit a new picture tube and wanted to know what it would cost. There was no problem about quoting him a price, but I felt bound to caution him to think carefully before making such a decision.

After all, the set was now over 10 years old and a new picture tube was going to make a mess of $250. On top of that he had indicated that he intended to buy a video recorder and wanted the set modified for this application, which would add a few more dollars to the bill (May 1984).

Most people, at this stage, welcome an excuse to ditch the old set and put the money towards a new one. And, to be fair, there is some logic in it. If a new tube is going to last another 10 years is the set itself going to survive this long? Or will age take its toll on things like tuners, triplers, other windings, electrolytic capacitors etc, all of which cost money to replace. Worse still, will the more specialised components still be available?

In addition, many new sets offer features — at a price — which simply were not available when the K9 was born. Just how valuable some of these features will prove to be in practice may be debatable, but they certainly cannot be ignored.

But this customer had a different outlook. He liked the set, it had proved to be exceptionally reliable and, by his reasoning at least, any faults which were going to develop should have shown up by now. As he puts it, the set was "well run in".

On this basis it only remained for me to check the set out, clarify the picture tube condition, and assess, as best one can, it's likely life with a new tube. A brief test confirmed that the picture tube was indeed very sick. On the other hand the set was behaving faultlessly in all other respects, with all controls and adjustments performing smoothly.

The inside of the cabinet also looked good. Apart from the usual accumulation of household dust it was very clean. The boards showed no sign of corrosion, as sometimes happens in adverse environments, and which would certainly have sounded a warning had it been obvious. Another thing I look for in such cases is cigarette smoke stains. In an environment of heavy smokers the HT and EHT voltages can attract the smoke and build up a coating of brown gooey tar over vital components. I doubt whether it extends their life.

But there was nothing like this in this set and I had to admit that it was as good a candidate as any for a new tube. At the same time I felt bound to impress upon the customer that I could only say that the situation looked good; I could offer no guarantees. If the set did in a tripler in its first week of service — well, that would be just too bad. He readily accepted this situation.

So I ordered a reconditioned picture tube from my regular supplier and this was delivered in their usual prompt manner. I wish some of my other suppliers were half as efficient. In the meantime I took the opportunity to give the set a general overhaul, paying particular attention to those things which experience has taught me can give trouble in ageing K9s.

Dry joints

One regular problem with early K9s was dry joints, mainly on the power supply board and the line and frame board. I pulled both of these out and, while the line and frame board appeared be to free of any obvious faults, the power supply board was a different matter. I found dry joints on the transformer connections and on the main smoothing capacitors, C178a and 178b. These were easily fixed and I also gave the tuner a routine clean-up.

Then I fitted the new tube and set up the various purity and convergence adjustments; a fairly routine if somewhat lengthy procedure. When it was all done, we had a very nice picture indeed, every bit as good as from a new set. The modern reconditioned picture tube certainly leaves nothing to be desired.

Final checks

I left the set running and went over it with the multimeter, checking important voltages, just in case they might reveal anything else which needed attention. The most important voltage, and one which I check in most cases as a matter of course, is the main HT rail. For the K9 this should be 155V, and normally comes up spot on.

In this case it was slightly high at 158V and, while the difference was mainly academic, I decided I might just as well tweak the appropriate pot and bring it back to normal. This is a 4.7kΩ pot, R186, forming part of a voltage divider between the HT rail and deck. There are two other resistors in the divider: R187 (1.8kΩ) on the HT rail side of the pot, and R185 (6.8kΩ) on the deck side of the pot. The moving arm of the pot goes to pin 11 of module U190.

So all I had to do was adjust R186. Except that when I tried to do so I found that it was already at the lowest voltage setting. This was unusual, because this pot normally sits about mid-position. Fearing that I had uncovered something which might rebound later my first suspect was module U190, having had trouble with this unit in the past.

I had a spare on hand and it took only a moment to plug it in. But the result was exactly the same, 158V. The next suspect was the divider network, with the possibility that either R185 or R187 had drifted substantially.

According to the ohmmeter, R185 was within spitting distance of its designated 6.8kΩ, and R186 was both intact as a pot and similarly close to the correct value. But R187 was a different matter; not because it had drifted, but because it was marked 6.8kΩ rather than the 1.8kΩ it was supposed to be. Nor was it a case of incorrect colour coding — the ohmmeter confirmed that it was 6.8kΩ.

How had this happened? One possibility was that someone other than myself had serviced the set and had, for some obscure reason, bodgied the network to hide a more serious fault. But checking the back of the board ruled this out; the resistor was obviously an original component.

That point clarified I lost no time in reefing it out and replacing it with a 1.8kΩ. Then I was able to adjust the HT rail to exactly 155V with the pot in approximately its mid-position, leaving plenty of scope for adjustment in the future.

So how had the wrong resistor been fitted in the first place — obviously on the production line — and how had it managed to get past final inspection? The confusion over the resistors is perhaps not hard to imagine. Two of the three colours, grey for the "8" and red for the two zeros, would be the same in both cases. Only the first colour, brown for "1" and blue for "6", would differ.

In the hurly burly of mass production, and particularly at the time these sets were made and when all manufacturers were battling to meet the demand, a simple substitution like this is not hard to visualise. Errors of this kind happen regularly, but are normally picked up in the final tests.

So how was this one missed. The simplest explanation would be that the final tester adopted a "near-enough-is-good-enough" attitude and that a mere 3V in 155 was of little consequence. Which may be fair enough on a simple percentage basis, but he should have been alerted by the extreme pot setting needed to get it that close. But then, as I said before, production was probably under some pressure at that time.

A more kindly explanation suggests that the final tester might have actually achieved the required 155V, the precise values of R185 and R187 at that time being such as to permit this. I tend to support this theory because I believe I checked the HT rail on at least one occasion when I serviced the set. It is a routine check I usually make on all sets and had I found an error — even a small one — I would have tried to correct it.

Looking back on this story I realise that, in some respects, it might seem like a storm in a teacup; after all, the

mere 3V probably didn't matter a hoot. But I feel that there are two points worth making about it. One is that faults do occur on production lines and that they can get through the inspection procedures. The other is that any voltage anomally is worth following up. It may reveal only a minor fault, as in this case, but it can also reveal more serious ones.

At a more practical level the finished set was duly delivered to the customer, who had already purchased his video recorder. I set this up for him, confirmed that the prescribed modification was working properly, and made sure he knew how to operate the recorder. The end result was a first class picture, both off-air and from the recorder, and a very happy customer. I just hope the old K9 won't let me down in the next 12 months.

Idler drives

To change the subject, here is a brief

TETIA Fault of the Month

National TC1801A

Symptom. Another National no vertical. This time the vert oscillator is running but there is no drive into or out of the vertical amplifier.

Cure. Both vertical output transistors open circuit. Don't check these in situ because parallel circuitry gives misleading readings. The vertical amplifier shuts down because of the lack of feedback from the output stage.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay, 7015.

comment from a reader, Mr. H. S. of Bulimba, Queensland, prompted by my recent experience with a Sharp video recorder, (September 1985). He writes:

I read with interest the saga of the idler drives on the Sharp VCRs. Excessive friction in similar drives can also cause trouble in audio cassette recorders.

Within the last month I have had trouble with the take-up drives on two units. Both suffered from excessive take-up tension, resulting in chewed tapes. Both had their take-up clutch in the spool carrier.

The first, on an old Sony TC127 deck, was fixed by replacing the compression spring with one having much less tension. The second, a cheap Walkman type cassette player, was fixed by moving the bottom plate down the shaft, thereby reducing the spring tension and friction.

Years ago, Akai reel-to-reel recorders relied on a friction clutch in the feed spool table to provide back tension on the tape to provide good head contact (no pressure pads). After some years the owner would find tapes running slow — invariably due to excess back tension. The stock remedy was treatment with talcum powder.

Thank you H. S. I have no doubt other readers will find your experience interesting, particularly the talcum powder treatment. I need hardly add that such treatment would seem to be inappropriate for VCRs.

The butcher's VCR

Finally, here is another "funny" from my butcher friend, whom I mentioned in the November 1985 notes. On that occasion he was having varying brightness problems with his TV set and tended to blame everything from aluminium power cables to a warning signal on the railway line. The truth is I haven't heard anything more about that problem, which I imagine has been in hibernation for the time being but will likely raise its ugly head again before long.

But he raised another problem a few weeks ago. It seems that he also owns a video recorder — still under warranty fortunately. This had performed quite well at first but started giving trouble recently. First a tape jammed and he was only able to extricate the cassette after a lot of random fiddling with the controls.

It seemed to recover after that and he used it several more times, only to have it jam again, this time so severely that no amount of fiddling around would release it. Finally, in desperation he worked out how to remove the main cover and gain access to the tape and release it.

In the process he was shocked at the sight of the recording drum, even though he had no idea as to its function. As he put it, "There's this drum thing that's been bent over at an angle. I think the kids must have dropped the recorder sometime when I wasn't there, and never told me about it. Of course they reckon they didn't, but y'know what kids are".

As on previous occasions, it took some effort to keep a straight face. Having reasoned with him that recording drums were normally mounted at an angle, and that the kids were probably quite innocent, I used his butcher's paper to draw a couple of simple diagrams explaining how video signals were recorded at an angle across the tape.

I don't know how much of it he understood — and once again I became aware of the large technological gap I was trying to bridge — but at least I convinced him. And I cleared the kids of suspicion.

(I learned later that the unit has been repaired, the fault being described as "a defective takeup motor".)

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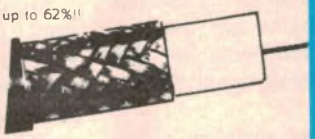

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Short-circuit current (Isc)	400mA
Open-circuit voltage (Voc)	22V

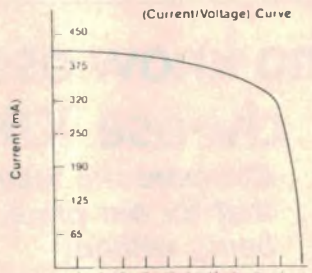
The data on this sheet represents the performance of a typical ZM-9007 module as measured at its output terminals, and do not include the effect of such additional equipment as diodes and cabling.
The data is based on measurements made at Standard Test Conditions:

- Illumination of 1wK/m² (1 sun) at spectral distribution of AM 1.5 (1½ atmospheres)
- Cell temperature of 25°C +3°C

VARIABLES AFFECTING PERFORMANCE

The performance of a typical ZM-9007 module is described by the I-V (current/voltage) curve and Electrical Characteristics Table. Output characteristics of individual modules will vary slightly from typical. The module's current and power output are directly proportional to illumination intensity. At a given intensity, module operating voltage is determined by output current; i.e. as current increases, voltage decreases as demonstrated by the curve.
Temperature also affect performance, with increase in temperature increasing current, but decreasing voltage. The ZM-9007 voltage margin ensures excellent performance in hot climates.

(Current/Voltage) Curve



The ZM-9007 panel measures just 2?5mm wide and 423mm high and is 8mm thick. The cell segments are connected to PCB style Phenolic board, sealed with clear PVC and housed on a sturdy stainless steel frame.

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cat. YT-4506

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FORUM

Conducted by Neville Williams

Do we have Teletext or not?

After being coaxed daily on TV to take advantage of the free off-air Teletext information service, it comes as something of a surprise to discover TV industry personnel in South Australia who appear to know little or nothing about it. Are they just backward over there or are the rest of us being technologically force fed?

The foregoing heading and introduction is prompted by a letter from a South Australian reader. I quote:

Dear Sir,

I am interested in the Teletext facility on TV but several dealers that I called on in both the city and country had apparently not heard of it; didn't even know what it was. So, for want of someone better to ask, I wrote to the Australian Broadcasting Corporation in Adelaide and received this off-putting reply, of which a copy is enclosed.

A further round of inquiries proved more successful, however, producing two shiny brochures from Philips and Sanyo which listed receivers with built-in Teletext decoders, and others to which a decoder could be fitted.

The Philips brochure includes the sentence: "Teletext is broadcast now in many capital and provincial cities and is rapidly expanding across Australia."

The conflicting responses pose certain questions:

Has a standard for Teletext been decided upon without the ABC knowing about it?

Will Teletext receivers being offered now become ineffective if and when another format is adopted?

Is Teletext really up and running as would appear from your August '84 issue, or is it only being vaguely talked about as per the letter from the ABC?

R. B. (Quorn, SA).

The lack of awareness by TV dealers in South Australia can possibly be accounted for, but one would certainly have expected more up-to-date information than was offered by the Adelaide office of the ABC.

To forestall possible confusion, however, let's clarify what we are talking about.

TELETEXT is a free, supplementary information service broadcast to viewers' homes along with the normal TV program signals. The extra information is encoded on to five otherwise unused lines during each field blanking period. It is ignored by ordinary TV receivers but can be sensed and displayed, as required, by receivers fitted with Teletext decoding circuitry.

Teletext is currently being used for two main purposes:

- To carry so-called "closed" captions for deaf viewers. The captions are not visible on ordinary receivers but can be displayed, when required, by Teletext equipped models. As yet, only selected programs are captioned, being indicated in published programs by the symbol (*S), or by the interlocking C logo (for the Caption Centre) on screen, adjacent to the session title.
- In addition, some stations transmit hundreds of "pages" of other information which can be called up and displayed on the screen instead of the normal picture. Included are items such as news headlines, weather, tides, sporting information, stocks and shares, emergency phone numbers, poisons information, airline directory, &c.

VIEWDATA, VIDEOTEX, &c, are video information services quite different from Teletext, and unrelated to TV broadcasting. They are normally accessed by cable or telephone line, plus a computer or dedicated keyboard, which enables the operator to talk back to the source. The information is displayed on a video monitor or a TV receiver adapted for the purpose.

The best known Viewdata service at present is Telecom's "Viatel" which, amongst other things, provides the basic facility for TV banking. (See "Forum", July '85).

With definitions duly disposed of, let's look at the reply from the ABC, over the signature of an Adelaide executive:

Dear Mr B.

Thank you for your recent letter.

The matter of introducing Teletext to Australia has apparently been deferred. There are several different formats available, and as far as I am aware the differing opinions about the merits of the systems has not yet been resolved.

The system that seems to have most support was the one used in France, which I understand has some technical improvements over the system used in the UK.

The ABC conducted some test transmissions in Sydney some time ago, but until such times as the Minister determines the system and makes a date for its introduction, it is unlikely to proceed.

No doubt the interested parties are currently more concerned with the introduction of the Aussat satellite transmissions, so it may be some time before the stations have a further look at Teletext or similar.

The local set manufacturers are unlikely to include the receiving facilities for Teletext until the system has been determined.

Yours sincerely, &c

While, in retirement, I have to rely on memory rather than office files, the above letter had about it a distinctly Rip Van Winkle quality. And, sure enough, when I checked with a TV engineer friend, his immediate reaction was to query the dateline. Said he: "it sounds like something from the early '80s!"

As I recall, it was around 1980 that the then Communications Minister, Tony Staley, gave a provisional ruling in favour of British designed Teletext, as the system to be used by Australian TV stations for the presentation of optional, supplementary information.

Teletext had been researched and ac-

cepted by the BBC (British Broadcasting Corporation) and the IBA (Independent Broadcasting Authority) as the basis for their own respective caption and information services, "Ceefax" and "Oracle".

The Minister's announcement was welcomed by ATN in Sydney and by various other stations, mainly in the Seven network, which had been running test transmissions for some time.

But ABC engineers were not convinced. They maintained that BBC/IBA research had been carried out with an all-UHF TV system in mind, with the attendant advantage of new transmitters and high-gain, highly directive receiving antennas. As such, they believed, the findings might not hold good for an established VHF service, especially involving frequencies towards the low end of the band, commonly allocated to ABC transmitters.

Their reservations were reported in a news item in our May 1981 issue (p7) along with plans to carry out field tests using the French "Antiope" system — claimed to be less prone to character error under typical VHF transmission and reception conditions.

At about the same time, the Canadians were pushing their French-derived "Telidon" system (EA, June 1981) with field trials in the Los Angeles area, aimed at the North American market.

Decision confirmed

The merits of the French/Canadian technology were indeed canvassed in Australia for twelve months or more but progressive refinement of Teletext receivers and decoders had meanwhile obviated most of the anticipated problems and the original decision was duly confirmed.

The article to which R.B., refers (EA, August 1984, p14) specifically mentions upgraded standards for Australian Teletext, with four complete lines in each field blanking period set aside for "magazine" type data, and a fifth line for "closed" captions.

As to its acceptance, a paragraph on the previous page reads as follows:

At present, commercial Teletext services are available in Sydney, Brisbane, Canberra, Newcastle, Wollongong, Wagga and Tamworth. At the same time, the ABC has closed captions for many of its progams (page 7) via Teletext broadcasts from about 60% of the National network."

That was written nearly two years ago and, as per the Philips brochure, Teletext has continued to expand across Australia if only, initially, to cope with closed captions.

So the short answers to R.B.'s questions are as follows:

- Teletext standards for Australia have been agreed upon and are being used by national and commercial TV stations alike. Unfortunately, your man in Adelaide doesn't seem to have caught up with the action!
- Commercial receivers and add-on decoders designed for these standards are not likely to be rendered "ineffective" within their normal service life.
- Teletext is certainly "up and running" although I gather that no South Australian TV station is as yet transmitting a Teletext magazine service. Perhaps that's why TV dealers in your state seemed not to be aware of it. Nevertheless certain members of the EA staff were flabbergasted by the letter from the ABC!

Compulsive technology

The foregoing remarks could possibly be interpreted as a put-down for South Australians but I question whether one can sustain an argument that the availability of a new technology imposes an automatic obligation to adopt it; that any company or person who fails to do so deserves to be classified as backward or "behind the times".

The fact is that not everyone may need a Teletext facility, either as a supplementary source of information, or as an aid to understanding what's being said — particularly when the facility is likely to cost a thousand dollars or more!

It so happens that this observation parallels the theme of a recent article by Stephen Hutcheon in the Sydney Morning Herald's weekly "Guide" entitled: "It may be quick and new but do we really want it?" In the article, Hutcheon questions the ideas of some "forward thinkers" who see the role of newspapers, &c, being taken over by "videotex and other similar computer based information systems".

By way of support, he quotes Author Ian Reinecke, who maintains that such services are unlikely to attract mass market support in Australia or anywhere else. By and large, Reinecke says, their appeal will be limited to about 15% of the population — representing the socio-economic group which has sufficient keyboard literacy to use such a service, and the resources to pay for it.

Trevor Bart, a senior lecturer in media studies at the Swinburne Institute of Technology in Victoria, and author of "The Electronic Estate", is also said to share the view that there is a question mark over the need for more information and new ways of getting it "in a society which is already brimming with the stuff!"

"I just wonder whether we're, in fact, heading for an information overload", he says. "I'm not convinced that people are necessarily going to go searching for more bags of information to solve their problems."

Computer based information services will never gain a broad appeal, according to Bart. "I think they will stay fragmented and specialised."

Yet, despite all that, Telecom Australia is reported to be cock-a-hoot about the response to their computer based Viatel service. Early signs suggest that Australians are responding to it in the same way that they responded to colour television and VCRs: gobbling it/them up at a faster rate, pro rata, than any other western nation.

Does that make us modern and progressive, or merely so keen to appear so, that we are suckers for technological force feeding?

Personal restraint

At an individual level, it calls for a measure of good, old-fashioned restraint to say "no" to the latest "gee-whiz" technology that we don't really need — especially if we're directly involved in the electronics industry. Some do exercise it, nevertheless.

A recent phone call from an engineer friend was prefaced by the remark:

"You know all about VCRs . . ."

"I don't, but go on!"

"I need a VCR to catch the occasional TV program that I miss because of other commitments. Should I go for one of the new hifi stereo models, or settle for a standard model for about half the price?"

In reply, I suggested that a standard model — preferably one with a full function infrared remote control — would allow him to record material or play back prerecorded cassettes with essentially the same picture and sound quality as ordinary off-air programs, under normal, casual viewing conditions.

A hifi model would provide much the same video quality but with the option of recording or playing back high quality stereo sound where this was available, and of compiling very long playing, very high quality audio-only tapes. For the privilege, he would be paying a higher initial price, plus a higher main-

tenance charge if and when the multiple heads needed to be replaced.

He told me later that he had settled for a standard model on the grounds that it would meet his actual need. He already had adequate audio equipment and saw little reason to buy more — mainly for the privilege of owning it!

A CD player or not?

Another friend came up with a similar query about a CD system. I assured him that the purchase of a player and selected compact discs would ensure quieter and better reproduction than from his existing records and equipment.

But when he mentioned that, in practice, he derived much of his listening pleasure from radio. I reminded him of the emergence of stereo AM broadcasting and wideband AM-stereo tuners. Perhaps the money would be better spent in buying or building a new generation tuner, similar to the one introduced in the December EA, 1985 issue.

He hasn't made up his mind yet, but he is certainly questioning his own knee-jerk reaction to the availability of new technology.

In saying this, I am not questioning either hifi VCRs or the CD format. I have been as interested as anyone in the technology on which they are based, and more active than most in writing about it. But both are a refinement of existing facilities that many people currently find adequate.

As such, our acceptance of them at a personal level should be dictated by conducive circumstances and a meaningful assessment of their advantages, rather than mere impatience to be first in our social set with the latest in gee-whiz technology.

Neither am I questioning the current AUSSAT initiative, which aims to provide radio, TV and other facilities to areas of Australia not adequately served at present. The problem with AUSSAT, unfortunately, is not whether the people concerned need the service but whether they can afford the very substantial outlay which the new technology demands.

CD common sense?

Reverting to the matter of CD equipment, I feel that it's about time that certain audio industry personnel quit perpetuating the tedious arguments about the relative merits and demerits of "black" and compact discs, as in a recent press release from the Audio Group of CESA (Consumer Electronics Suppliers Association).

Please, gentlemen, let's have a more positive, down-to-earth attitude and an end to the negative carry-on which, in the long run, can only damage the industry!

Whether we like it or not, the two systems are a fact of life: "black" discs as the culmination of 100 years of stylus-and-groove technology, and compact discs as the leading edge of a totally new order.

No amount of argument is going to change it; it can only lead to confusion and uncertainty, much as it did in the quadraphonic era when consumers backed away, not only from four-channel but from two-channel systems as well.

It is a demonstrable technical fact that the CD system offers sound quality in the home which is a closer and more durable copy of the original master recording than is available from any other system. To me, that appeals as a more likely and logical explanation for the widespread acceptance of the CD system, than to attribute its success to the promotional resources of the "Japanese marketing machine".

With its potential for superb quality and supplementary user facilities, it simply makes good sense for at least the oncoming generations of hifi buffs to invest in the CD format, both to take advantage of modern releases and, in due course, of the best possible copies of older but musically important analog masters.

But, having said this, it is also true that the black disc system contains such a wealth of musical and other talent that its very momentum will see out many senior hifi enthusiasts who have a large investment in existing records, tapes and playback equipment.

Such people can make a perfectly logical decision to stay with the old, without being subjected to emotional and often spurious pressures favouring either format.

Let's face it: we're talking about audio technology, not some emotion-packed racial issue or some religious credo, with its attendant evangelical fervour.

With its feet now planted firmly in both camps, the hifi industry as a whole should be able to step back from the nostalgic and emotional aspects of the subject and concentrate on helping customers to make the wisest choice, according to their individual needs and resources.

I found one paragraph in the CESA release particularly unhelpful, and I quote:

" . . . *one of the claims made by proponents of the compact disc is that the problem with the sound is caused by the recording techniques however let's put this argument to rest straight away. If we are talking recording techniques then we are basically referring to the microphones and to date there is still no substitute for the microphone.*"

If you heard a distinct splash as you read the above, that was the sound of the baby being thrown out with the bath water; possibly the ultimate, determining factor in the sonic excellence of any high-tech orchestral recording being dismissed with a throw-away remark.

With compact discs able to provide domestic listeners with a very close copy of what is actually on the master recording, some of the laxity and shortcomings of accepted recording procedures have most certainly been revealed, forcing a re-think of venue acoustics, and the number, type, placement and control of microphones.

All this is dismissed with a single remark, which I find neither wise nor humorous: "to date, there is still no substitute for the microphone".

I'm not aware that anyone other than a synthesiser nut has ever suggested that there should be. The problem is not with microphones, as such, but the need to use them more intelligently, in the musical sense. And that need exists whether the recording ends up on compact disc, hifi video tape or a digitally sourced black disc.

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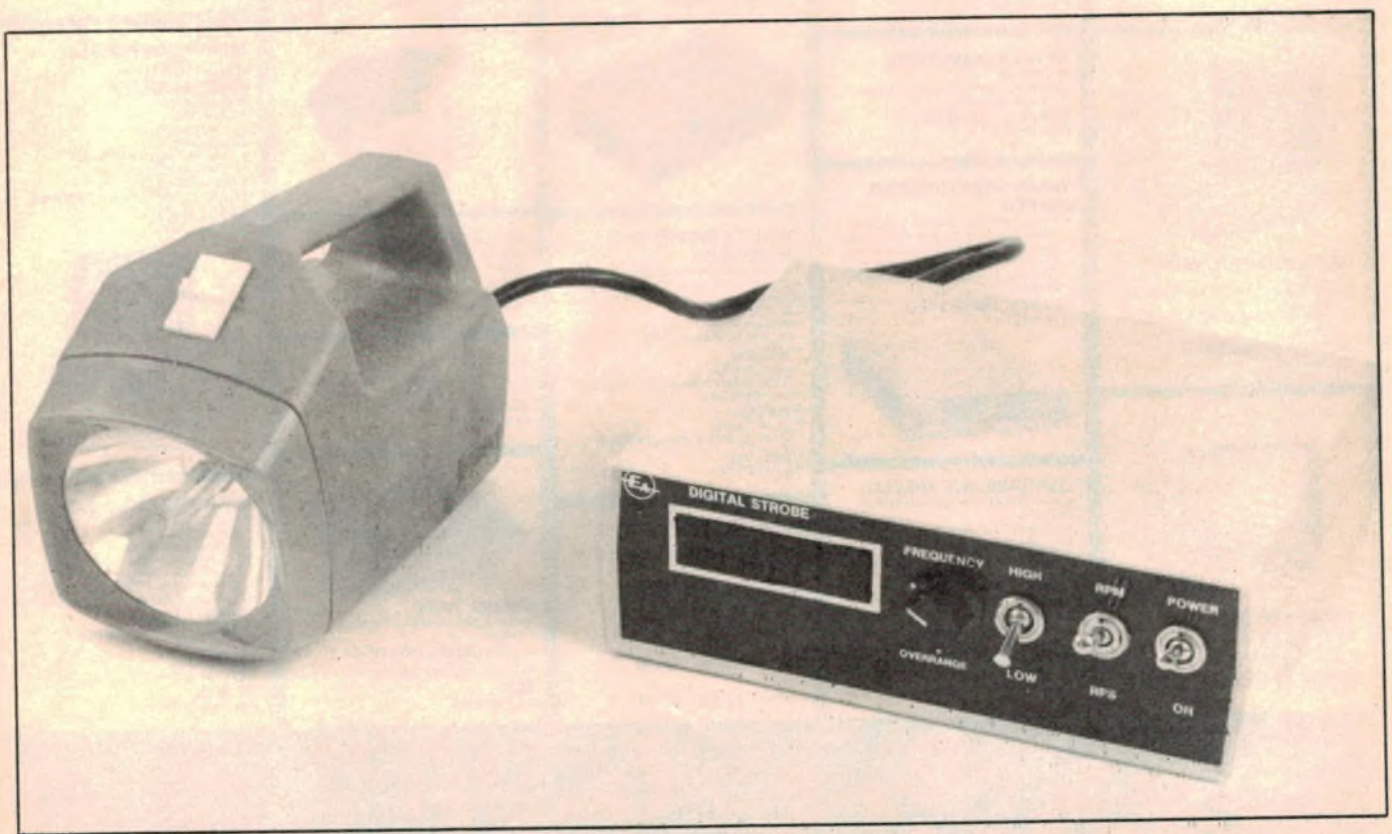
Build this digital strobe

How do you observe and measure the speed of rotating machinery without resorting to high speed photography? The answer is to use a stroboscope. Our Digital Strobe lets you monitor rotating machinery operating at up to 20,000 revolutions per minute and has a digital display.

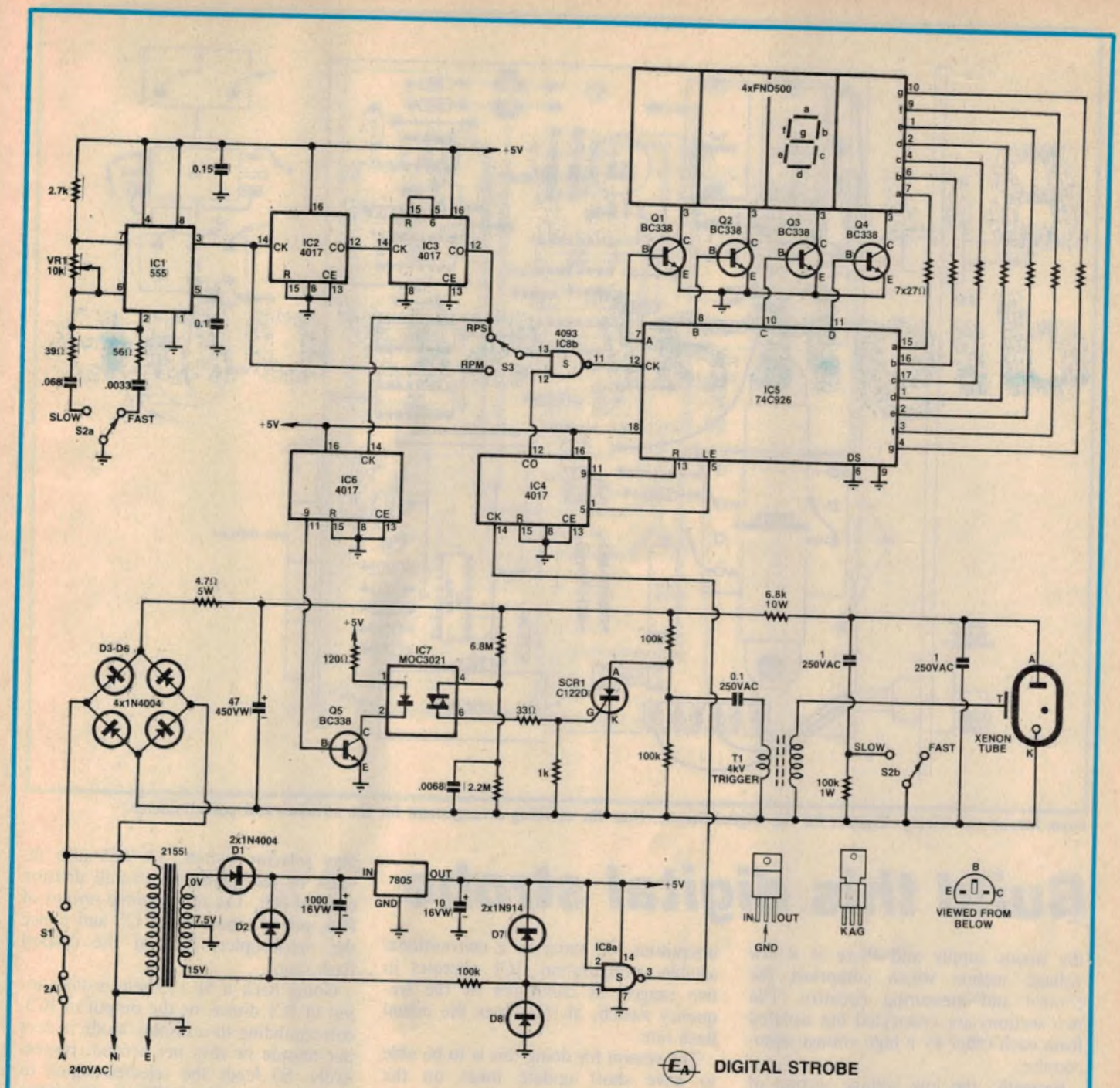
by LEO SIMPSON

These days the most popular use of strobe lights is as a "prop" to blitz the senses of people listening to modern pop groups and to otherwise distract them from the mediocrity of the performance. A more serious use of a strobe light is as a monitoring instrument for rotating machinery.

By synchronising the flashes of light from the strobe, the machine or motor can be made to appear stationary or, by a slight change to the flash rate, to be rotating slowly, either forward or back-



The Digital Strobe has two ranges and is adjustable between 2 and 200 flashes per second.



The high and low voltage sections of the circuit are isolated from each other by a high-voltage optocoupler (IC7).

wards. This makes it easy to observe the precise meshing of gears, the operation of crankshafts and belts and so on.

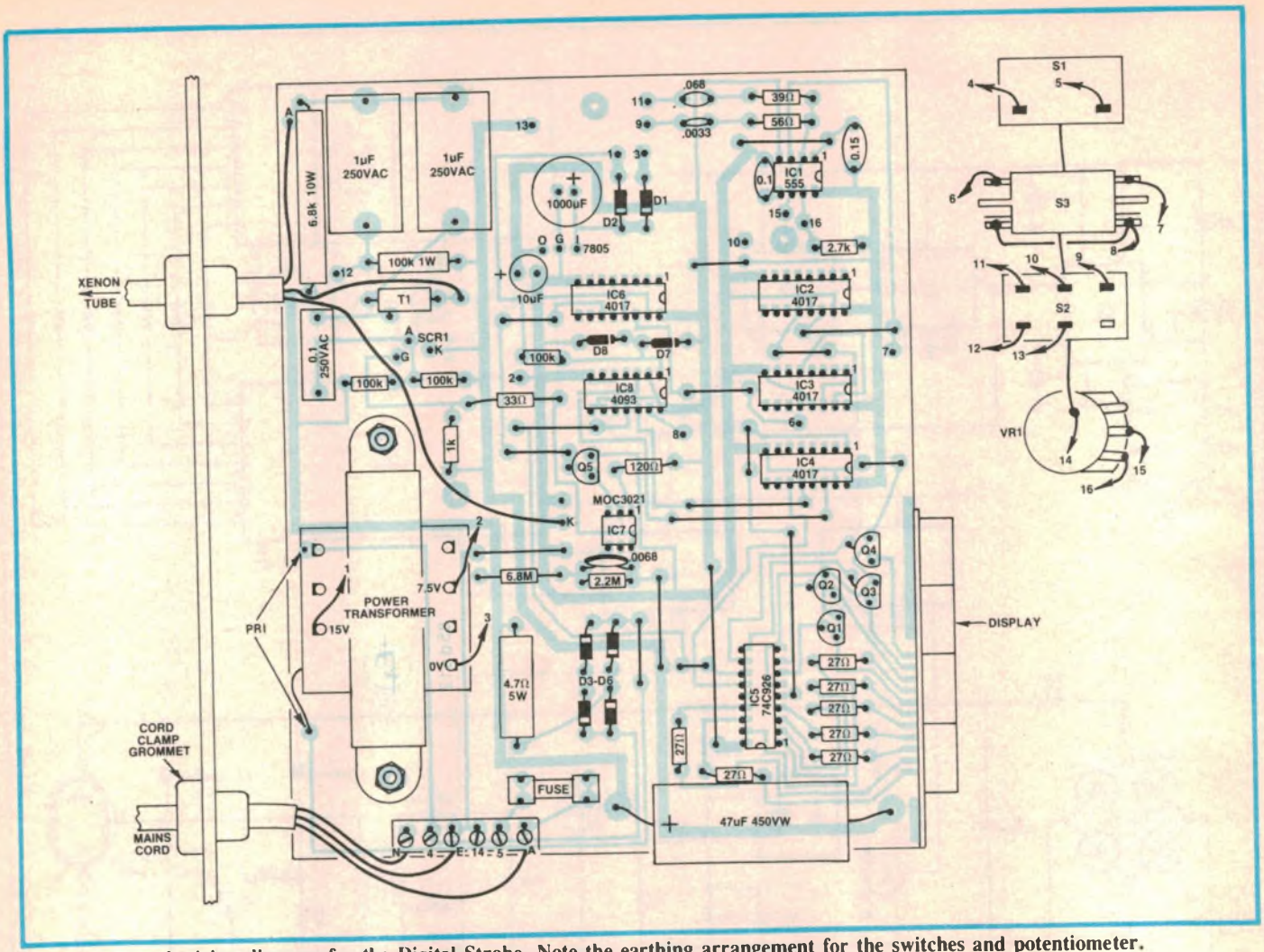
A strobe is also the ideal instrument to measure rotational speed as no connections to the machine are required. And you can use it to set the ideal speed of any motor, be it two-stroke or four-stroke petrol or diesel.

Our new Strobe comes in two parts permanently connected together by a cord. One part is a standard flashlight which houses the Xenon lamp and the other is an instrument case which houses all the circuitry.

On the front of the instrument case is a four digit LED display, a frequency control knob and three toggle switches. The display can be switched to indicate the flash frequency from 2 to just over 200 flashes per second, or switched to display RPM (revolutions per minute). To avoid confusion, this display switch is marked in RPS (revs per second) and RPM. The other switches are for Power and for frequency range: Low, from 2 to 40 flashes per second and High, from 36 to over 200 flashes per second.

Circuit Description

The circuit can be simply divided into two sections. There is a high voltage section which is powered directly from

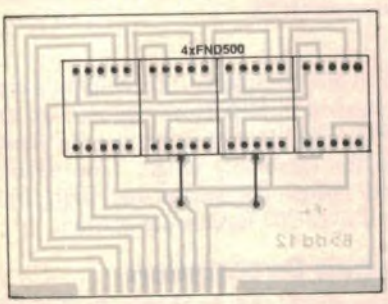


Parts layout and wiring diagram for the Digital Strobe. Note the earthing arrangement for the switches and potentiometer.

Build this digital strobe

the mains supply and there is a low voltage section which comprises the control and measuring circuitry. The two sections are connected but isolated from each other by a high voltage opto-coupler.

Basically, the low voltage section of the circuit consists of an oscillator, a number of dividers and a frequency counter. IC1 is the oscillator and is the ubiquitous 555 timer in a conventional astable configuration. IC1 operates in two ranges, as controlled by the frequency switch, at 600 times the actual flash rate.



Parts layout for the display board. Note that the ribbed edge of each display goes towards the top.

The reason for doing this is to be able to have short update times on the counter. If this was not done, the update time (ie, time between successive readings displayed by the counter) when measuring the relatively low frequencies of the flashing strobe could be a minute or more.

Since IC1 is operating at 600 times the flash rate it cannot be used to control the strobe tube directly; it must be divided down by counter stages IC2, 3 and 6. These are all 4017 Johnson counters which can be set to divide by any number up to ten. IC2 divides by ten and IC3 divides by six, giving an overall division ratio of 60 times.

The output of IC3 (pin 12) is then fed to the clock input of IC6 and to the display selector switch, S3. IC6 also divides by ten, giving an overall division ratio of 600. The ten decoded output of IC6, pin 11, then drives Q5 and hence the optocoupler, IC7, at the desired flash rate.

Going back a bit, S3 selects the output of IC1 direct, or the output of IC3, corresponding to a display mode in revs per minute or revs per second, respectively. S3 feeds the selected signal to one of the inputs of IC8b, a two-input NAND gate. The other input comes from IC4 and is the gating signal. When the gating signal is high, the signals are fed from S3 into the four-digit counter, IC5.

House-keeping signals

The function of IC4 is to provide the "house-keeping" signals for IC5. The three signals in question are the clock gating signal (already mentioned and fed to pin 12, IC8b) plus the reset and latch enable signals. The sequence of these signals is as follows. Consider that IC5 has been reset and is displaying the last value counted which can be any-

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R15725	2.2uF 63V	$0.12	$0.10	$0.09
R15742	4.7uF 25V	$0.11	$0.09	$0.08
R15745	4.7uF 63V	$0.11	$0.09	$0.08
R15761	10uF 16V	$0.12	$0.10	$0.09
R15762	10uF 25V	$0.13	$0.12	$0.11
R15765	10uF 63V	$0.15	$0.14	$0.13
R15792	22uF 25V	$0.13	$0.12	$0.11
R15794	22uF 50V	$0.17	$0.15	$0.13
R15812	25uF 25V	$0.13	$0.12	$0.11
R15815	25uF 63V	$0.17	$0.15	$0.13
R15831	47uF 16V	$0.16	$0.13	$0.12
R15832	47uF 25V	$0.16	$0.13	$0.12
R15835	47uF 63V	$0.22	$0.19	$0.17
R15841	100uF 16V	$0.18	$0.16	$0.15
R15842	100uF 25V	$0.18	$0.16	$0.15
R15845	100uF 63V	$0.27	$0.24	$0.22
R15851	220uF 16V	$0.17	$0.15	$0.14
R15852	220uF 25V	$0.21	$0.18	$0.17
R15855	220uF 63V	$0.50	$0.46	$0.40
R15871	470uF 16V	$0.27	$0.24	$0.22
R15872	470uF 25V	$0.29	$0.27	$0.25
R15873	470uF 35V	$0.75	$0.70	$0.60
R15875	470uF 63V	$0.75	$0.70	$0.65
R15885	1000uF 63V	$0.60	$0.58	$0.55
R15891	1000uF 16V	$0.39	$0.35	$0.30
R15892	1000uF 25V	$0.45	$0.40	$0.38
R15893	1000uF 35V	$0.70	$0.65	$0.55
R15894	1000uF 50V	$0.00	$0.00	$0.00
R15903	2200uF 35V	$1.20	$1.10	$0.90
R15904	2500uF 50V	$1.30	$1.20	$1.00
R15911	2500uF 16V	$0.59	$0.50	$0.40
R15912	2500uF 25V	$0.95	$0.90	$0.80
R15913	2500uF 35V	$1.10	$1.00	$0.90
R15914	2500uF 50V	$1.30	$1.20	$1.00
R15932	4700uF 25V	$1.90	$1.80	$1.60
R15933	4700uF 35V	$2.40	$2.15	$1.90

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	10+	100+	1000+	10K+
6A 400V	1.00	0.80	0.75	0.69
W02	0.24	0.23	0.20	0.18
W04	0.25	0.24	0.21	0.19
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Y11005	2MHz	HC33	2.25	1.95	1.85	1.70
Y11008	2.4576MHz	HC18	2.25	1.95	1.85	1.70
Y11015	3.57954MHz	HC18	1.20	.90	.65	.60
Y11020	4.00MHz	HC18	1.30	.90	.75	.60
Y11022	4.194304MHz	HC18	1.40	.90	.75	.60
Y11025	4.75MHz	HC18	1.40	.90	.75	.60
Y11026	4.9152MHz	HC18	1.40	.90	.75	.60
Y11042	6.144MHz	HC18	1.40	.90	.75	.60
Y11050	8.00MHz	HC18	1.40	.90	.75	.60
Y11055	8.867238MHz	HC18	1.40	.90	.75	.60
Y11070	12.00MHz	HC18	1.40	.90	.75	.60
Y11072	14.318MHz	HC18	1.40	.90	.75	.60
Y11080	16.00MHz	HC18	1.40	.90	.75	.60
Y11085	18.432MHz	HC18	1.40	.90	.75	.60
Y11090	20.00MHz	HC18	1.40	.90	.75	.60

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220nF	$9.50	$8.50
330nF	$12.00	$11.00

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Cat. No.	Description
W11251	13/.12 TND BLK
W11252	13/.12 TLD BROWN
W11253	13/.12 TLD ORANGE
W11254	13/.12 TLD YELLOW
W11255	13/.12 TLD GREEN
W11256	13/.12 TLD BLUE
W11257	13/.12 TLD WHITE

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W11260	14/.20 RED
W11261	14/.20 BLACK
W11265	14/.20 BLUE
W11268	14/.20 WHITE

PRICES PER 100 METRE ROLL

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W11270	24/.20 RED
W11272	24/.20 BLACK
W11274	24/.20 GREEN

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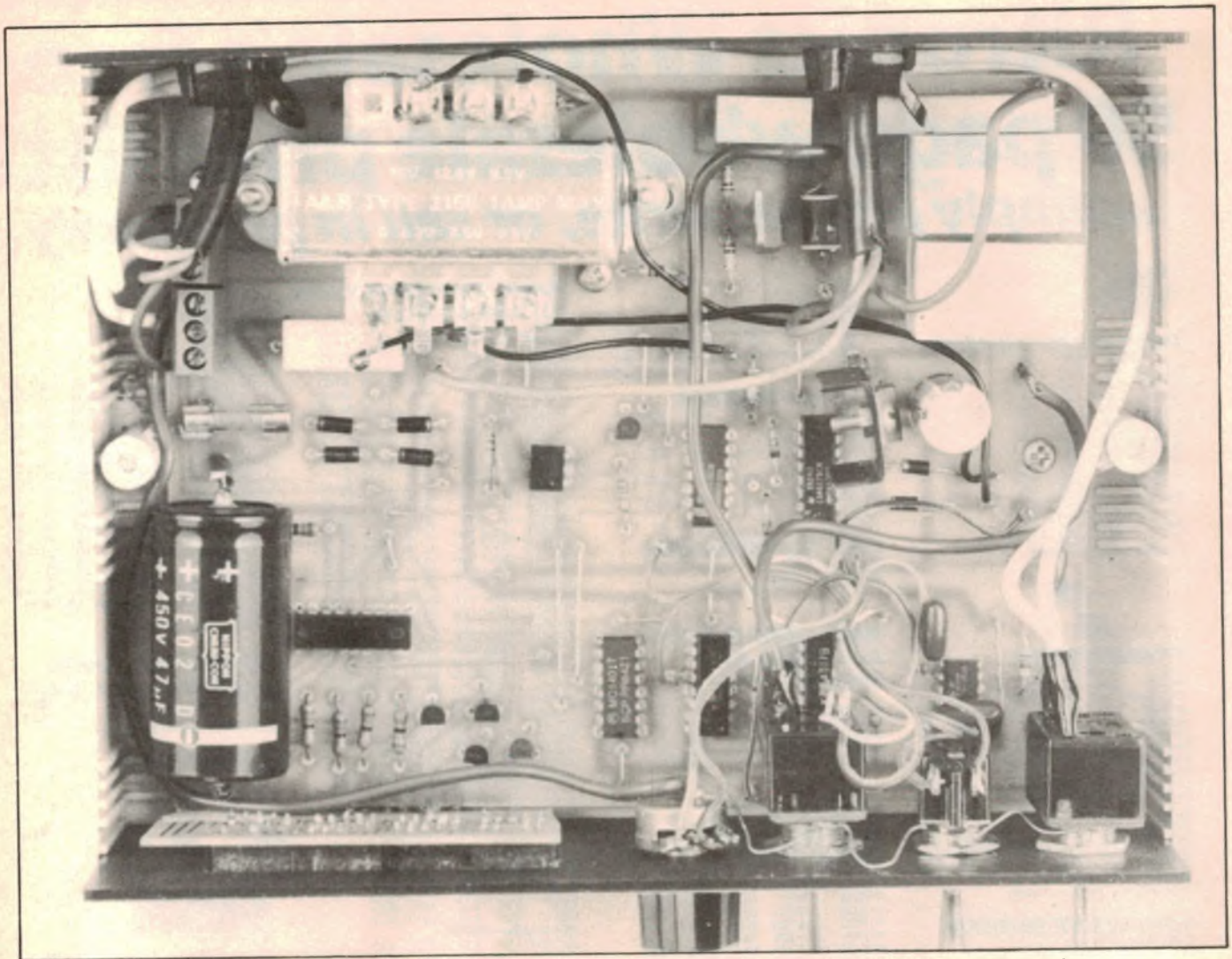

View inside the prototype. Keep mains wiring neat and tidy and use 240VAC 3-core mains cord to connect the flash tube.

Build this digital strobe

where from "0000" to "9999".

Now a high signal from pin 12 of IC4 allows the signal to be counted through IC8 and into the clock input. Then, at the end of the gating period, the clock signals are turned off. Then the value counted by IC5 is fed through to the display latches by a high "latch enable" signal so that the count can be displayed.

Then the four internal decade counters are reset, ready for another count cycle. Note that resetting the counters does not change the value displayed and stored in the latches.

In a frequency counter where accuracy is paramount, these housekeeping signals are normally derived from a crystal oscillator feeding a series of counter stages. Here, though, we do not need crystal accuracy and can rely on the accuracy of the 50Hz mains supply as the timbebase.

Hence the 50Hz signal is fed from the transformer secondary via a 100kΩ resistor to the input of IC8a which functions as a Schmitt trigger to produce a "squared up" 50Hz signal suitable for feeding to the input of IC4. Diodes D7 and D8, in conjunction with the 100kΩ resistor, protect the input of IC8a from being over-driven. They clip the mains sinewave to about +5.6V and −0.6V.

As noted above, IC4 provides all three housekeeping signals, in the following way. A 4017 has ten decoded outputs, each of which go high for their respective clock period, ie, 20 milliseconds. The carry output of the 4017 goes high for the decoded outputs from "0" to "4" and low from "5" to "9".

Initially the carry out is high and gates the clock signals into the counter for exactly 100 milliseconds via gate IC8b. Then the "5" output (pin 1) goes high, allowing the contents of the IC5 counters to be loaded into the display latches.

Finally, the "9" output (pin 11) goes high and resets IC5 via 13.

We will leave the low voltage section of the circuit now although we will come back later to tie up a few loose ends.

High voltage circuit

The high voltage circuitry is a little more straightforward and is similar to a photoflash circuit. The difference is that whereas a photoflash tube is designed for high energy discharge at very low repetition rates, a strobe is designed for relatively low energy discharge at high repetition rates. The limiting factor is the 5W power dissipation rating on the Xenon tube.

Basically, the high voltage circuitry consists of a 340-volt DC supply which is derived directly from the 240VAC mains supply via a bridge rectifier and

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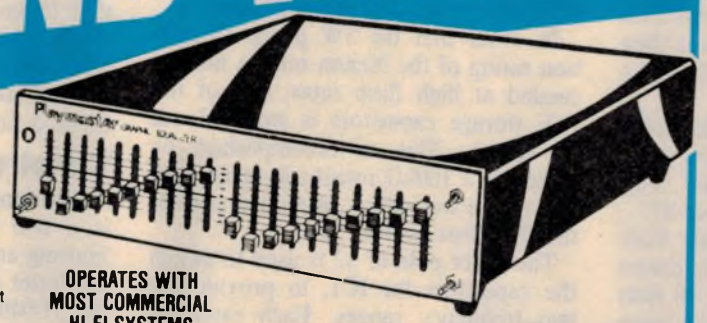

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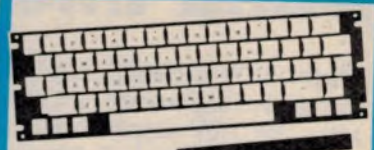

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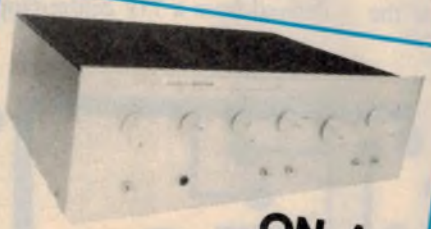

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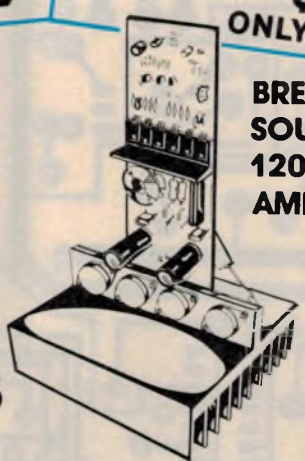

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ADDRESS DETAILS PAGE 121.

Build this digital strobe

47μF/450VW electrolytic capacitor (with current limiting via the 4.7Ω/5W resistor). This 340V supply is then used to charge one or two 1μF capacitors (via the 6.8kΩ/10W resistor) which are then discharged via the Xenon tube to make it flash.

The tube is "fired" and breaks down to a low impedance circuit when it receives a high voltage pulse of 4kV. This is produced by trigger transformer T1.

The circuit operates as follows: Consider that the optocoupler IC7 is driven by Q5 with a signal having a 1:10 duty cycle. Each time Q5 conducts, the internal Triac of IC7 is fired to discharge the contents of the .0068μF capacitor at pin 4 into the gate of SCR1 via a 33Ω current-limiting resistor.

SCR1 then fires and discharges the 0.1μF/250VAC capacitor at its anode via the trigger transformer T1. This produces a 4kV pulse at the trigger electrode of the Xenon tube and fires it.

In order that the 5W power dissipation rating of the Xenon tube is not exceeded at high flash rates, one of the 1μF storage capacitors is switched out of circuit. This is accomplished by switching a 100kΩ resistor in series with one of the capacitors, using one pole of the Slow/Fast Switch, S2.

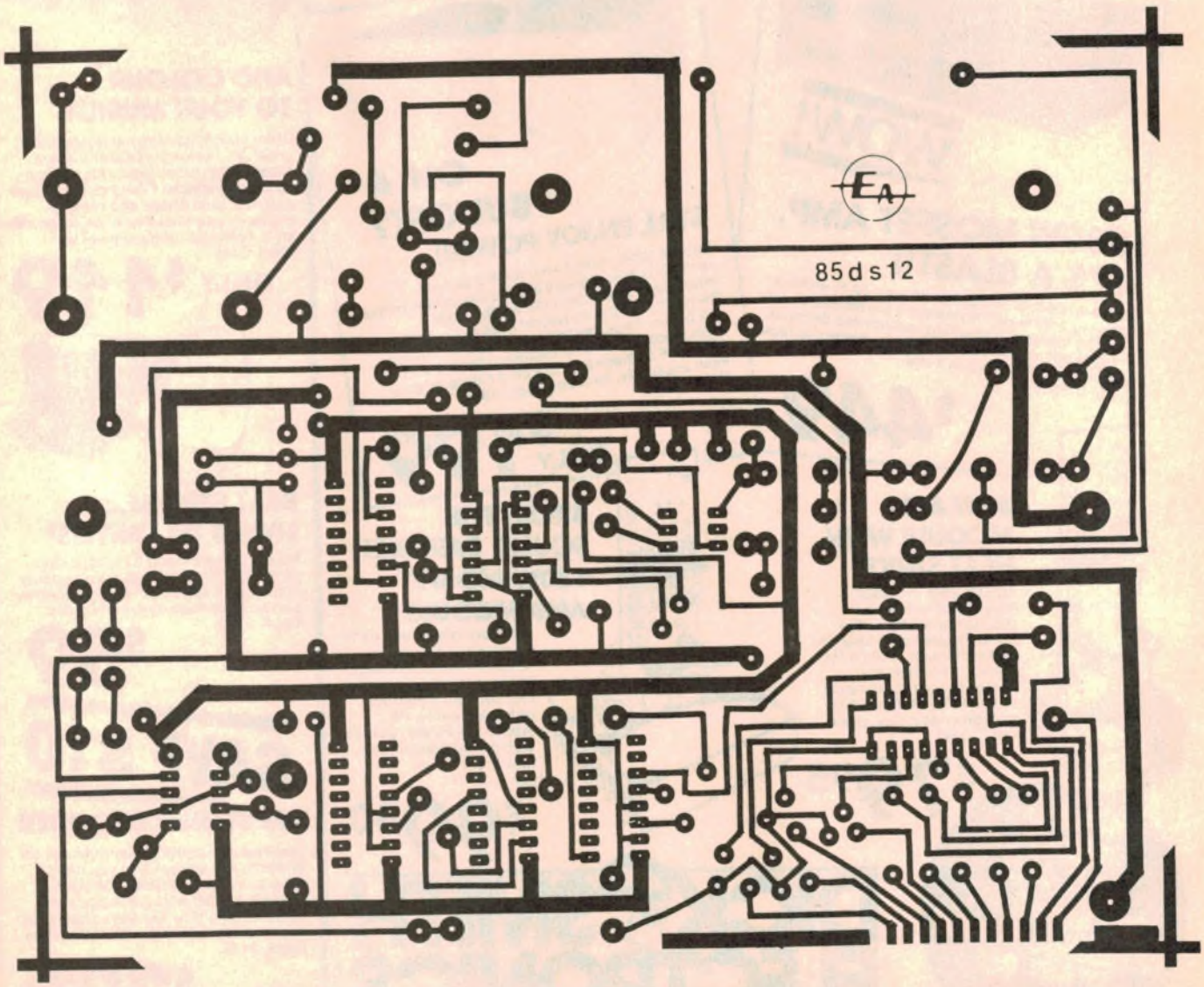
The other pole of S2 is used to switch the capacitors for IC1, to provide the two frequency ranges. Each capacitor has an associated low value resistor with the values selected to ensure that the two ranges overlap.

Power for the low voltage circuit is derived from a 15V centre-tapped transformer driving a full-wave rectifier and 1000μF filter capacitor. This drives a three-terminal regulator to provide a 5V supply.

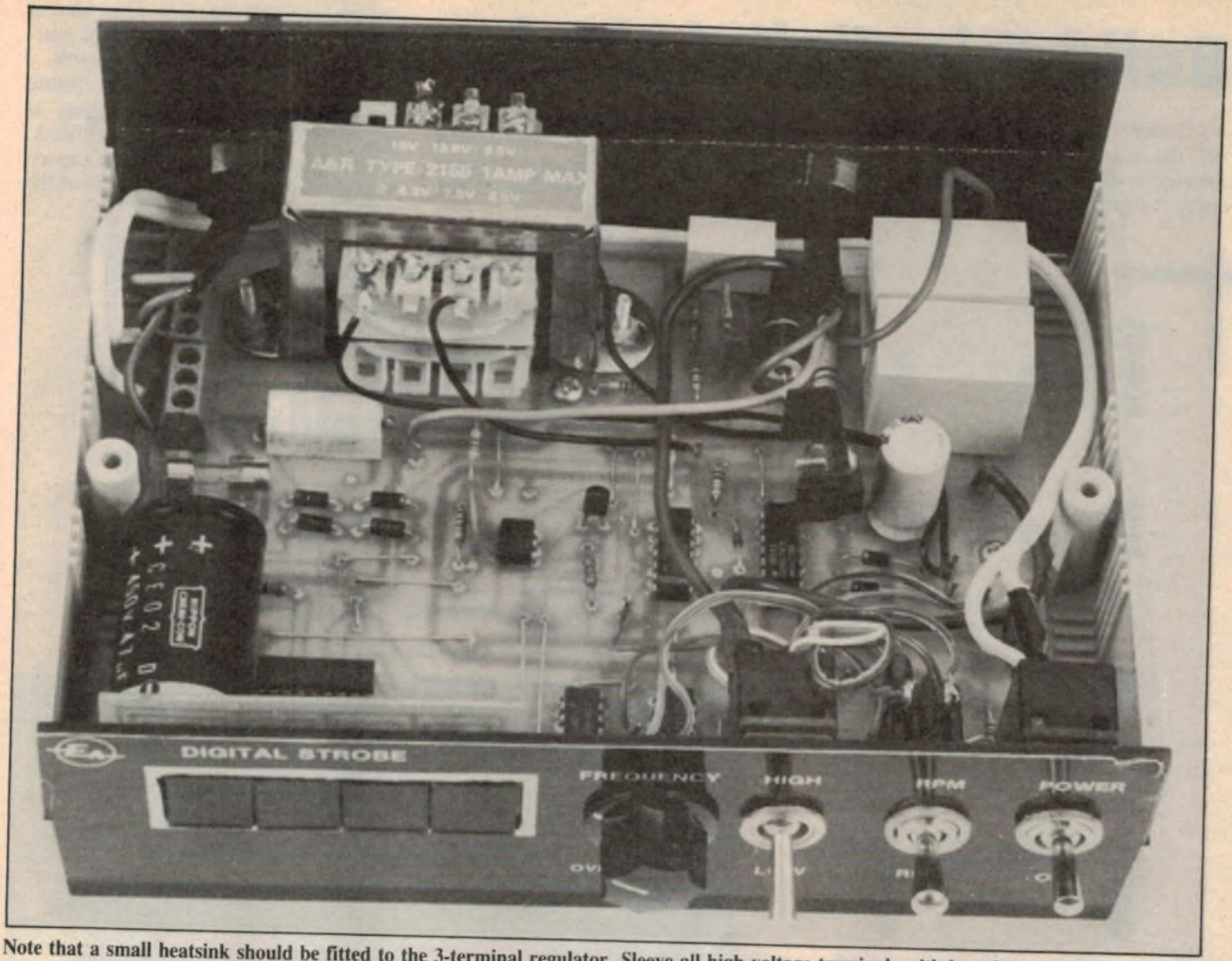
The output of the regulator is bypassed with a 10μF capacitor to ensure a low output impedance which is important to keep the multiplex display currents from interfering with normal circuit operation. The 0.15μF bypass capacitor adjacent to the 555 timer performs a similar function.

Construction

As mentioned above, the new strobe is a two part unit employing a torch housing and a standard instrument case, the latter as supplied by Altronics (Cat. No H-0480). It measures 200 x 160 x 80mm and accommodates two printed circuit boards, one for the LED displays and the other for the rest of the circuit. They are designated 85ds12 (171 x 137mm) and 85dd12 (73 x 56mm).



Here is the actual size artwork for the main PC board.



Note that a small heatsink should be fitted to the 3-terminal regulator. Sleeve all high-voltage terminals with heatshrink tubing.

The main circuit board is arranged to keep the low voltage and high voltage sections of the circuitry essentially separate, the only points where they link up being at the switches and opto-coupler. For this reason (the need for isolation), the switches should be standard 240-VAC toggle types and not of the miniature sort.

Assembly of the boards should not begin until they have been carefully checked for breaks or bridges in the copper tracks and to see that all holes have been drilled.

No special procedure needs to be followed when assembling the board although we suggest installing the small passive and active components first, then the larger capacitors and the transformer, leaving the CMOS ICs until last.

Be careful about the orientation of the semiconductors and electrolytic capacitors when they are being inserted. When soldering the CMOS ICs, use a small iron with the barrel earthed to the negative electrode of the 1000μF electrolytic capacitor and solder the positive and negative supply pins of each IC before soldering the other pins.

Take care when inserting the trigger transformer as the leads are very fragile. The leads should be bent to avoid stressing them when the transformer is being inserted.

Mount the mains transformer with the mounting screws pointing up to allow subsequent easy removal, should this ever be necessary. Note that the mains connections to the board should be via a six-way PC-mounting terminal block.

When mounting the LED displays on their board, make sure they are correctly oriented. The ribbed edge of each display should be at the top. Don't forget the two wire links that are also on the board. The completed board should be checked very carefully now for solder bridges or open circuit tracks as these are the most common assembly faults in a project of this nature.

The two boards can now be soldered together. Set the lower edge of the display PCB to overlap the bottom edge of the main PCB by about 2mm and check that the two are exactly perpendicular to each other. Solder tack the two end strips but do not solder the remaining edge connections at this stage.

If not supplied ready-drilled and cut, the front panel should now be prepared. The Scotchcal label can be used as a template for this job. When the cutout is complete, the panel can be assembled into the case and the printed board assembly checked for fit. The main PCB is secured to three of the integral pillars of the case, using self-tapping screws. If the PCB assembly does fit, the remaining edge connections to the display board can be soldered.

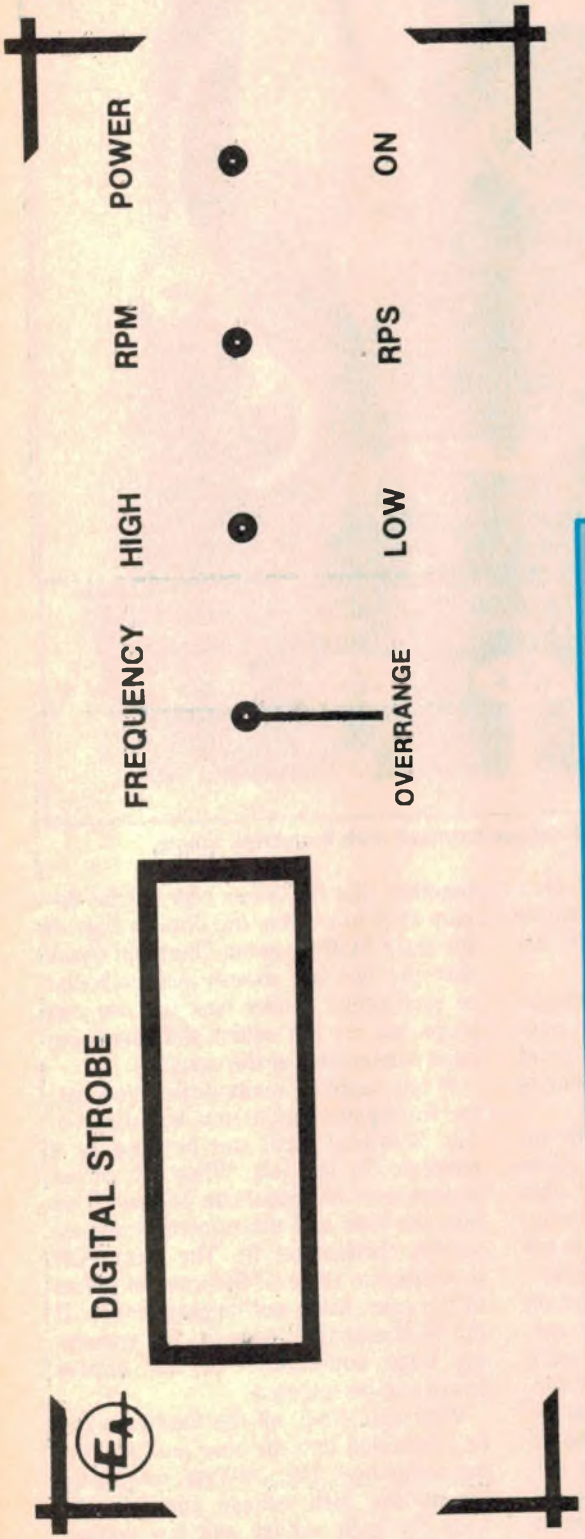
With that done, all the hardware can be assembled into the case and the wiring completed. Use 240VAC-rated wire for all the high voltage circuitry and keep the high voltage and low voltage wiring as separate as possible. The output lead to the flash tube should be 240-

Build this digital strobe

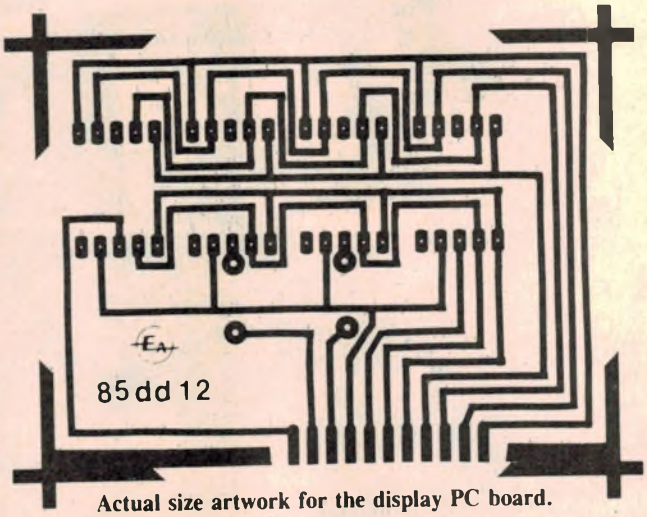
VAC three-core mains cord and both it and the mains input cord should be anchored to the back panel of the case using cordgrip grommets.

The three switches should be mounted flush with the front panel and tinned copper wire should be used to connect each switch flange and the case of the potentiometer all together. They should then be connected via a length of insulated hook-up wire to the mains earth.

To prevent the possibility of electric shock, slip some heatshrink tubing or insulation tape over the mains switch, the terminals of the high voltage capacitor and the high voltage terminals of the



Here is an actual size front panel artwork.



Actual size artwork for the display PC board.

PARTS LIST

1 Plastic case, 200 x 160 x 70mm (W×D×H), Altronics H-0480 or equivalent
1 Scotchcal label
1 PCB, code 85ds12, 171 x 137mm
1 PCB, code 85dd12, 73 x 56mm
1 15V 1A transformer, A&R 2155 or equivalent
1 Xenon flashtube, DSE Cat. No. S-3882 or equivalent
1 4kV trigger transformer, DSE Cat. No. M-0104 or equivalent
1 SPST 240VAC 1A toggle switch
2 DPDT 240VAC 1A toggle switches
1 50cm length of two-core mains cable
1 150cm length of three-core mains cable
1 10cm length of rainbow cable
3 cordgrip grommets
1 six-way PCB-mounting insulated terminal block
1 TO-220 heatsink
1 flashlight
1 2A fuse and fuseclips to suit
1 pointer knob

Semiconductors

4 4017 decade counters
1 4093 Schmitt trigger
1 NE555 timer
1 74C926 4-digit counter
1 MOC3021 optocoupler
1 7805 three terminal voltage regulator
1 C122D SCR
4 FND500 7-segment LED displays
5 BC338 NPN transistors
6 1N4004 1A silicon diodes
2 1N914, 1N4148 small signal diodes

Capacitors

1 1000μF 16VW PC electrolytic
1 47μF 450VW pigtail electrolytic
1 10μF 16VW PC electrolytic
2 1μF 250VAC metallised dual dielectric, Philips MKT-P
1 0.15μF greencap
1 0.1μF 250VAC metallised dual dielectric, Philips MKT-P
1 0.1μF metallised polyester (greencap)
1 0.068μF greencap
1 0.0033μF greencap
1 0.0068μF 630VW ceramic

Resistors (0.25W, 5%)

1 × 6.8MΩ, 1 × 2.2MΩ, 3 × 100kΩ, 1 × 100kΩ/1W, 1 × 6.8kΩ/10W wirewound, 1 × 2.7kΩ, 1 × 1kΩ, 1 × 120Ω, 1 × 56Ω, 1 × 39Ω, 1 × 33Ω, 7 × 27Ω, 1 × 4.7Ω/5W wirewound, 1 x 10kΩ linear potentiometer.

Miscellaneous

Machine screws and nuts, self-tapping screws, tinned copper wire, heatshrink tubing, PCB bins, epoxy adhesive or Super Glue, solder.

range switch.

Virtually any flashlight can be used to house the Xenon tube although it is desirable to use one which has a reasonably large reflector. We used one made by Eveready. Most such flashlights these days have plastic reflectors with vapour-deposited metallisation. These can be easily cut to make a suitable opening for the Xenon tube. It can be fixed in place with epoxy adhesive or "Super Glue".

Be careful not to put finger prints on the reflector surface or spill glue on the plastic lens. The cord should be anchored to the flashlight housing using a cordgrip grommet.

Final checks

Now that assembly is complete, the unit should be very carefully inspected for wiring errors. Then power can be applied. Check that the display is alight and the tube flashes in response to the front panel controls. If the tube is not working, there is probably a fault in the power supply. If this section has to be checked with a multimeter remember that it is all floating at half mains voltage. Take great care.

On the other hand, if there is a fault in the low voltage section, it is possible to make the circuit safe to work on by removing the mains rectifier, diodes D3 to D6.

Assuming that the unit works as it should, all that remains is to correctly position the frequency knob. Rotate the frequency knob so as to give a reading of 166 to 167 on the digital display, with the display selector set to "RPS". Then set the frequency knob so that its pointer is aligned with the overrange marker.

When the knob is rotated clockwise beyond this overrange marker, the display will be in the overrange condition when reading RPM. This means that 10,000 should be added to the reading.

As an example of how the system works, a setting of 180 RPS on the display will give a reading of 0800 on the display when in the RPM mode. Adding 10,000 to the reading gives the correct result of 10,800 revolutions per minute.

For best results when using the strobe, keep the ambient lighting as low as possible, for best strobe visibility. For direct reading of RPM, on say a revolving shaft, place just one marker (using white correction liquid such as "Tippex") on it. For higher shaft speeds, use two markers, equally spaced around the shaft and reduce the resultant display reading by half, for the lowest stationary pattern.

Circuit & Design Ideas

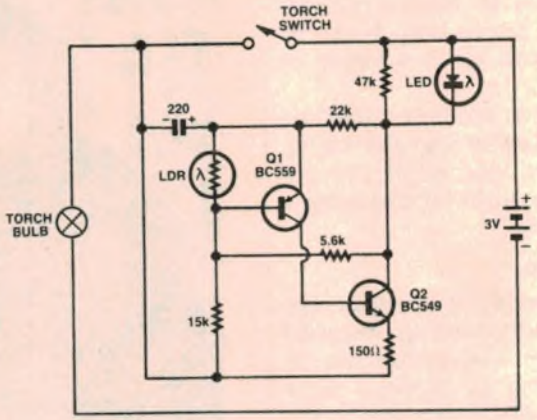
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

LED flasher for torches

Ever tried to locate a torch in the dark while camping? This simple LED flasher will solve your problems. It turns on automatically when the light level drops and, with a little ingenuity, can be built into the torch.

As shown, the circuit is connected directly across the torch switch. Q1 and Q2 form a simple two transistor oscillator with feedback, provided by the 5.6kΩ resistor. When the light level drops, the resistance of the LDR rises, the oscillator is enabled, and the LED flashes.

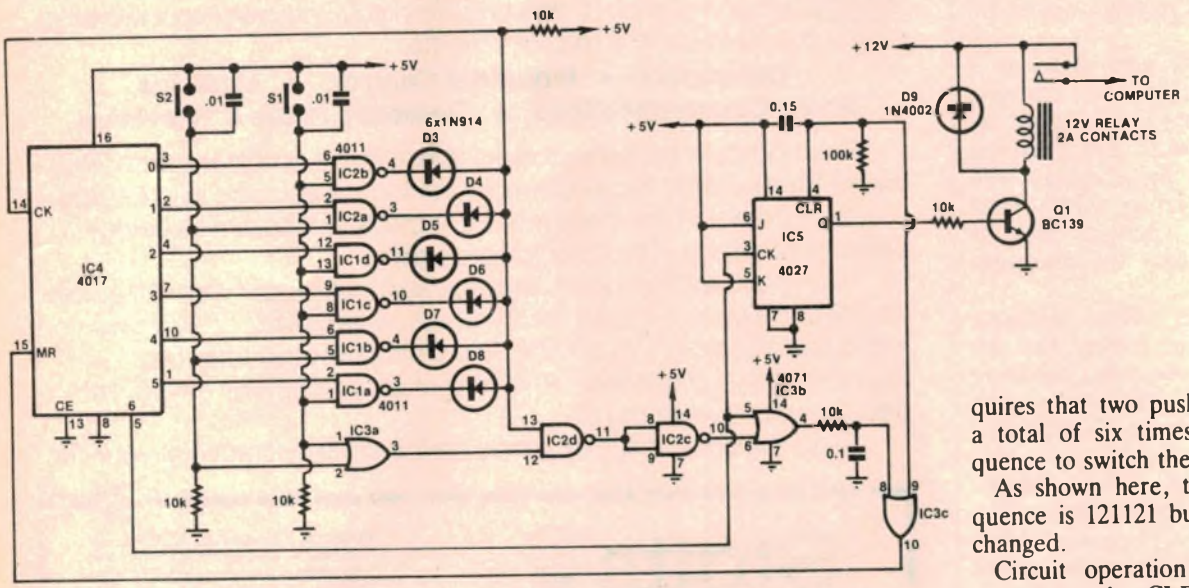
The flasher circuit is effectively short-circuited when the torch switch is activated. Note that the circuit is designed for 3V operation and will operate down to 2.5V.

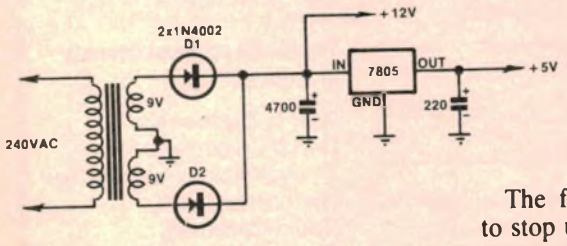


The best type of torch to convert is one using "D" cells and which has plenty of room inside the case. It is also a good idea to use a torch with a lamp reflector made from silvered plastic, as this is an ideal spot to mount the LED and the LDR.

This has two advantages: first, the LED flashes will be more visible; and second, it ensures maximum battery life as the LDR picks up light from the reflector to bias the flasher circuit off.

Lok Man Loong,
Hong Kong. **$15**





Low cost code switch

The following circuit was cooked up to stop unauthorised persons from using my most treasured possession — the computer. It is a code switch which requires that two pushbuttons be pressed a total of six times in the correct sequence to switch the computer on.

As shown here, the correct code sequence is 121121 but this can easily be changed.

Circuit operation is as follows. At power up, the CLR input to the 4027 (IC5) and the MR input to the 4017 (IC4) are pulsed high, setting output "0" on the 4017 high and Q on the 4027 low. Thus Q1 and the relay are off. When the correct button is pressed, the associated NAND gate (IC1a-IC2b) output goes low, pulling the clock input (pin 14) of the 4017 low via a diode (D3-D8). When the button is released, the clock input is pulled high via a 10kΩ resistor.

When the correct code is entered, output "6" goes high and clocks the 4027. The Q output of the 4027 now goes high, turning on Q1 and supplying power to the computer via the relay. At the same time, the 4017 is reset via OR gates IC3b and IC3c.

If the wrong button is pressed, both inputs to IC3d will be high, the output of IC3b will also be high and, after a brief period, IC4 will be reset via IC3c. When the button is released, the reset will go low and the circuit will be ready for another try.

The off sequence is identical except that the 4027 will turn off (ie, Q low) and thus the computer will also turn off.

Changing the code is simply a matter of varying the connections between NAND gates IC2b-IC1a and the button 1 and button 2 control lines to IC3a. To program a "1", connect the input of the relevant NAND gate to line 1; to program a "2" connect the NAND gate input to line 2.

C. Burchall,
Ashwood, Vic. **$30**

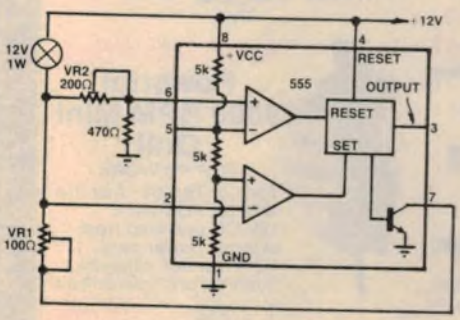
Novel lamp flasher uses no capacitor

This simple lamp flasher circuit uses the thermal time constant of the bulb filament to control the flash cycle.

Measurements of the filament resistance of a 12V 1W bulb reveal a "hot" resistance of around 140Ω, and a "cold" resistance of only 14Ω. (Note: the average multimeter reading is around 50Ω, but this is not a true "cold" reading.)

These resistance changes can be sensed by a 555 timer IC, and used to switch the bulb on and off accordingly.

To help explain the circuit operation, the internal workings of the 555 timer are shown in the circuit diagram. Note that the output (pin 3) is controlled by a flip-flop which can be "set" or "reset" by a pair of voltage comparators.



Pin 7 is an "open collector" output normally used for discharging the timing capacitor, but here it is being used to drive the bulb during the "on" part of the flash cycle.

Assume this is the case: ie, the flip-flop is "reset" and pin 7 is low, drawing current through the bulb via VR1. The filament will warm up, and as its resistance increases the voltage at pin 2 will drop. VR1 is adjusted so that when the filament is hot, the voltage at pin 2 is just low enough (around 4V) to trip the lower comparator. This "sets" the output, pin 7 goes open and the bulb begins cooling down.

The only current now flowing through the bulb is via VR2 and the 470Ω resistor, which is enough to keep the filament warm, but not visibly lit. VR2 is adjusted so that, when the filament has cooled, the voltage at pin 6 will be just high enough (around 8V) to trip the upper comparator. This "resets" the output, and the cycle begins again.

In practice, setting up the "hot" and "cold" trip points is achieved by first setting VR1 and VR2 to maximum resistance then, if the bulb is on, decreasing VR1 until it goes off, then decreasing VR2 until it comes on again. The lamp should now start flashing. If the bulb is initially off, adjust VR2 first.

Note that VR1 can be adjusted to stretch the "on" time, and VR2 the "off" time. Periods of up to five seconds can be obtained, although the circuit will be somewhat sensitive to supply voltage changes. When set for a faster flash rate, say 1.5Hz, the circuit will flash reliably for supply voltages between 9V and 15V.

For use as an automotive "alarm" indicator, the following adjustment procedure is recommended. Connect the circuit to an adjustable regulated power supply and set the voltage to 12V. Adjust VR1 and VR2 for a comfortable flash rate, then reduce the voltage to say 11V. The lamp may now be stuck "on", so readjust VR1 so that it only just starts flashing again. Now set the voltage to say 14V and adjust VR2 so that it just stops flashing.

The circuit will now double as a battery condition indicator. The lamp will be off for voltages above 14V, flashing for normal battery voltages, and continuously on for low battery voltages.

Bulb wattage is limited to 1W maximum, chiefly due to the 100mA current limitation of pin 7 of the 555. The average current drain will be around 30mA.

S. Payor,
Kogarah Bay, NSW. **$30**

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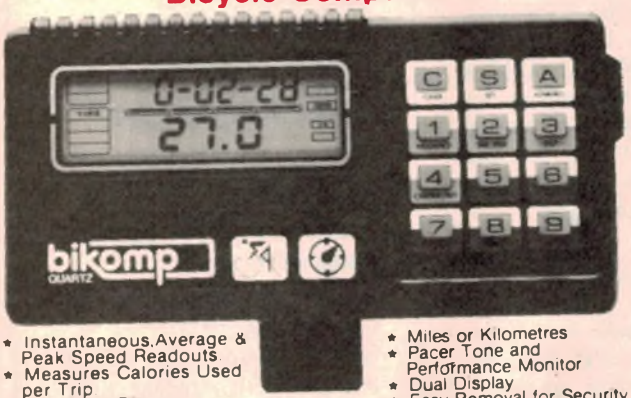

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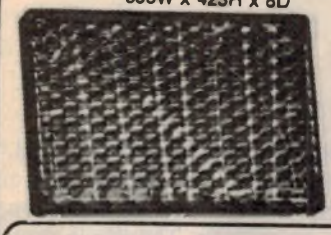

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Superb Printer/Display Calculator for the Office

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Our **COMPEX** Printing/Display Calculator is just the shot for the office. The feel and response of the keys is both light and positive, an essential characteristic in our view. More than favourably compares with others costing $50 or $60 more.

X 1070

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Amazing Price

• 10-Digit LCD printing calculator • 9 Entry key buffer memory • Adding machine calculation • Chain and mixed calculation • Full memory calculation • Round-off/down calculation • Percent key with add on/discount calculations • Use normal paper (57.5 mm width) • **Size:** 193x172 x35 mm • **Weight:** 480g

Uses 4 x AA Batteries or Altronics Adaptor M 9001 **$9.95** Additional

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Heart disease strikes down many people in their early 40's (or even 30's). The tragedy remains that had such victims been alerted, remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health.

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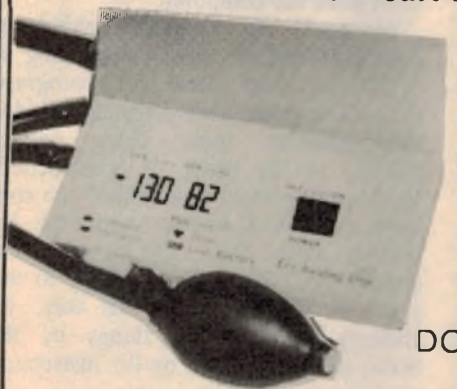

Features:
- Non-Microphone Measurement System
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Monitoring the cardiovascular system of every member of your family is now an easy and affordable necessity with the X 3055 Digital Blood Pressure Monitor. A built-in microcomputer and the microphone-free measurement system guarantee that all readings are highly accurate. The LCD panel shows readings in large numerals for confident measurements. Special symbols to guide you in operation and clear error messages make it easy for every member of the family to use the X 3055. A built-in miser circuit automatically shuts off power to conserve your battery if the unit is not switched off after use. Inflation by the conventional rubber squeeze bulb and deflation by the pre-settable valve make this unit familiar and easy to use daily. Put the X 3055 in your family's health plan — it's a modest investment in your invaluable health.

BLOOD PRESSURE MONITOR SPECIFICATIONS:

Measuring Method	: Oscillo-Metric Method
Measuring Range	: 0-300 mmHg Cuff Pressure : 40-150 Pulse/Min. Pulse Rate
Acuracy	: Pressure ± 3 mmHg (Confirmed A. A. M. I.) : Pulse Rate ± 5% of Reading
Pressure Build-Up	: Squeeze Bulb
Deflation Method	: Pre-Settable Exhaust System
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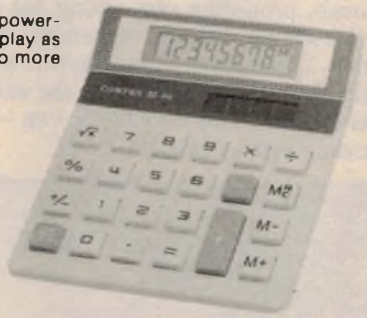

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X 1060

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With positive feel Push Button rubber keys and never needs Batteries.

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A delightful calculator to use - "Positive feel" keys allow quite rapid operation when compared to standard credit card size pocket calculators. **Should last you a Life Time**

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SPECIFICATIONS:

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DCV Accuracy	0.5% + 1DGT
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Ranges	4 (2V, 20V,200V,750V)
ACV Accuracy	0.75%+5 DGTS
Input Impedance	10M Ohm Min.
DC CURRENT	
Accuracy	20mA—0.75%+1DGT 10A-1.50%+5DGTS

For Order Despatch Details and Dealer List See Page 17

Algernon: Pt. 2

a low cost robot for any 8-bit computer

Here are the constructional details for Algernon, the low cost robot for 8-bit computers. Previewed in our January issue, Algernon has a unique structure fabricated from copper clad phenolic board, the raw material for printed circuit boards.

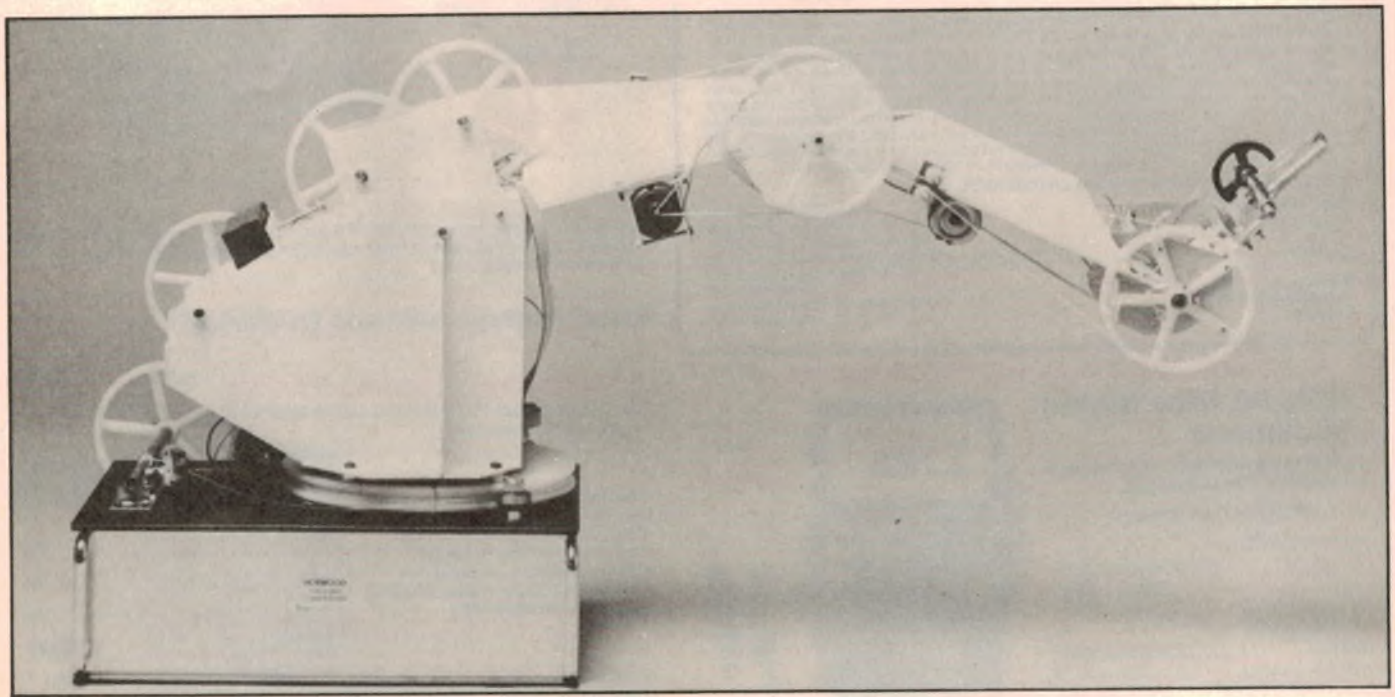
by COLIN DAWSON

Using sections of printed circuit board to provide the rigid structure of a robot arm is certainly a clever idea and one that we are surprised has not arisen before. It really does work well though, producing very strong but light arm sections with an economical triangular cross-section. Fabrication is essentially just a matter of joining the various bits together with a soldering iron — no special tools are required at all.

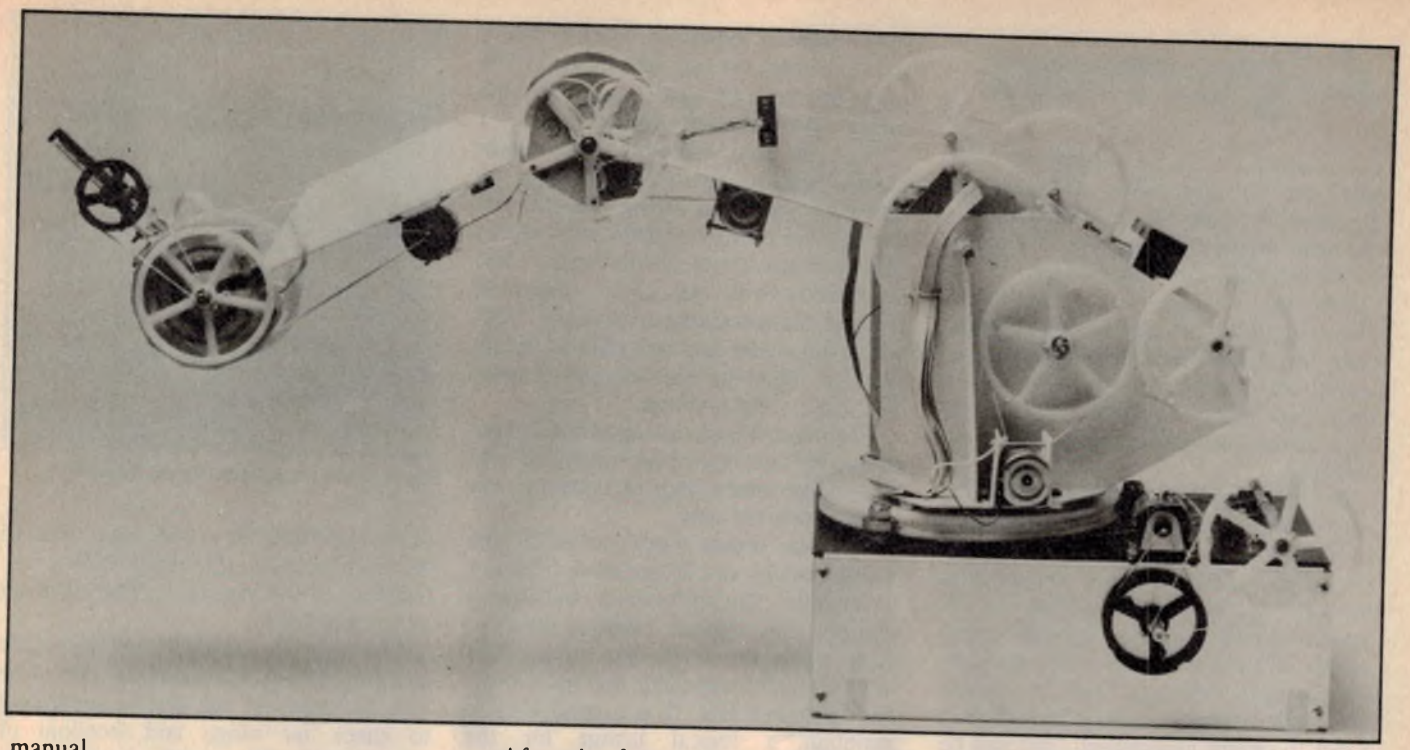
We were so interested in the concept of Algernon (we just couldn't help giving him a name) that we decided to go through the whole process of assembling one from scratch, using the comprehensive kit supplied by Jaycar. The various components of this kit were described and illustrated in the first article and they include precut sections of copper clad board, dial drives, sensor discs, drive motors, an arm balance weight and comprehensive assembly manual.

Transforming a box full of bits and pieces into a robot is a big job though — make no mistake. The whole project will engross you for two or three weekends and that's just in the assembly. Much more fun will be involved in making it go through its paces, via instructions from the computer.

We really put ourselves behind the eight-ball by immediately unpacking all of the bits and pieces to photograph them. The parts were originally divided into sub-kits, these being packed roughly in the order of construction. Having completely randomized the contents, we were forever searching for various parts. Since the normal constructor will not have any need to unpack the whole kit in this way, we strongly advise doing things by the book; in other words, by the instruction



This view shows the completed mechanical assembly, before installation of the electronic control circuitry.



manual.

According to the manual, the method of construction is to first fabricate the various sub-assemblies. It then progresses to the final assembly and wiring. Diagrams are included in each section.

The sections in the manual are: (1) Build the gripper; (2) Assemble the wrist joint; (3) Put together the forearm; (4) Put together the upper arm; (5) Join upper arm to forearm; (6) Assemble the base module; (7) Mount the motors; (8) Base drive gear; (9) Put on the dial cords; (10) Put in the wiring loom; and finally (11) Add the motor drive and interface boards (separate data sheets supplied with each PC board kit).

Our robot kit was a preliminary version. Since it was put together, there have been a number of design changes but the overall design is still very similar to the version we assembled.

Soldering iron

One small problem which the constructor has to face almost immediately is the soldering iron. Bare copper clad board is a very efficient heatsink and standard irons with a rating of 30 to 40 watts will have difficulty doing the job. We used a 90 watt Scope iron and we would suggest that an equivalent high powered iron is a sensible minimum.

Although the first item in the construction manual is the gripper, we decided to leave this as there was a slight delay on one of the parts. Instead we turned to the forearm which is quite straightforward.

After the forearm was complete, we attached both of its axle assemblies. In fact, in a burst of enthusiasm, we assembled all of the axles at this stage. This diverges somewhat from the recommended procedure, and we admit to being a little carried away. We rationalised that it was sensible to do so since we had so many components spread across the work bench and they might have started wandering.

Sensor discs must be mounted on some of the axles, but they have to be drilled first. All of the sensor discs need to have the central (axis) hole drilled — some of them also need holes for retaining screws. Hole positioning and sizes for the axis holes are given by a series of concentric circles etched into the copper pattern. The inner circle is used for small discs and the outer circle for the large one.

Not indicated on the baseplate sensor disc (for the waist joint) was the positioning for the retaining screws. We had the advantage of being able to inspect the prototype robot to determine their approximate positions. We have suggested that the manual could be updated to provide this information.

The other sensor discs are soldered in place and probably should not be mounted until later. This will avoid the possibility of tearing them off during final assembly.

Several of the pulleys are fixed to the arm by means of triangular mounting plates. The plates are attached to the pulleys by pins which are fashioned from garden-variety nails; to wit, jolt-heads, 16-gauge, suitably shortened. Each nail must be cut off at about 5mm from the head.

Holes are then drilled through the spokes of the pulleys and the mounting plate, so that the nail can pass through both. The nail head stops the nail from passing through the pulley and is fixed to the triangular mounting plate by soldering.

A couple of points should be made with respect to the nail method of mounting. Firstly, the mounting plates are undrilled. To ensure that the holes are accurately lined up, the plate can be taped in place and drilled at the same time as the pulley. Secondly, the nails are difficult to solder — flux should be used to ensure long term reliability. Also, take care with the soldering, otherwise the spokes of the nylon pulleys may be melted.

Soldering the mounting plate of the largest pulley to the arm is a tricky operation. Using a large iron like the Scope makes it even more difficult — the tip and barrel would not fit onto the joint without fouling the pulley. Fortunately, one of the nearby plates has a hole cut in it to feed the wires through. This can also be used to permit access to the joint for the soldering iron.

Waist assembly

This is the largest single assembly of the robot and is fairly straightforward to construct, although an assistant would be a big advantage. Said assistant could hold the vertical plates while they are tacked in place. In any case, the vertical

plates should only be tacked on until both are in place. We checked the alignment by inserting the waist axle — this also provides a measure of rigidity to the assembly during soldering.

Note that a large wiring access hole has to be drilled or punched in the base plate and this should be done before assembly of the waist unit. One other small hole can also be drilled at the back of the base plate, to terminate the dial cord.

The base module is likely to be the most labour intensive part of the robot. It consists of a number of parts fixed to the lid of a standard metal box which is supplied as part of the robot kit. A number of holes have to be drilled and details of these are given in the manual. Of the three bearings used to support the whole assembly, one is mounted in a slot to permit adjustment. This can be made by a combination of drilling and filing.

One other large hole has to be cut in the metal plate to provide clearance for the aforementioned wiring loom. We used a 25mm hole punch for this job. The alternative would be to drill a series of holes around a circle and then file the cutout smooth.

The manual shows a motor mounted to the base plate by a fibre board bracket. The motors supplied in the kit already have a mounting bracket fitted, so we elected to use this instead. The same bracket can also be used for the motor mounted on the forearm.

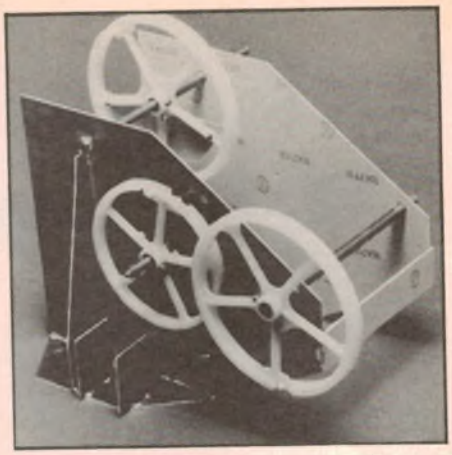
Prior to final assembly, the sensor blocks have to be drilled. Drilling dimensions are given in the manual. Accuracy is a prime requisite here as the pins in these sensor blocks have to line up exactly with the three concentric rings of the associated sensor disc. Still, with a little care and attention to detail, and by following the manual closely, this is not a big problem.

The sensor blocks are then assembled, each with four brass pins which are held against the sensor rings by rubber bands — primitive but neat.

With the sensor blocks in place, the wiring harness can be installed. This is a reasonably straightforward but fairly tedious task. Ribbon cable is used for each of the three separate busses. The largest is a 16-way cable for the motors and limit switches. It is a good idea to maintain a logical layout for the harness.

The method outlined in the manual seems practical, but since the ribbon cable was not colour coded we decided to break it up into several smaller cables. Kits supplied to readers will have rainbow cable which will make the job much easier, both for the actual wiring and then checking.

The last area of assembly is fitting the elastic bands and dial cords for the various drive pulleys. Although fiddly, this is not difficult. The cords may need to be retensioned a few times before the backlash in the system is reduced to an acceptable level.

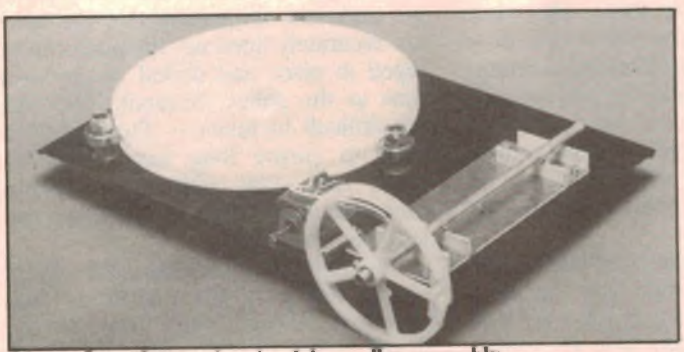


View of the completed waist assembly.

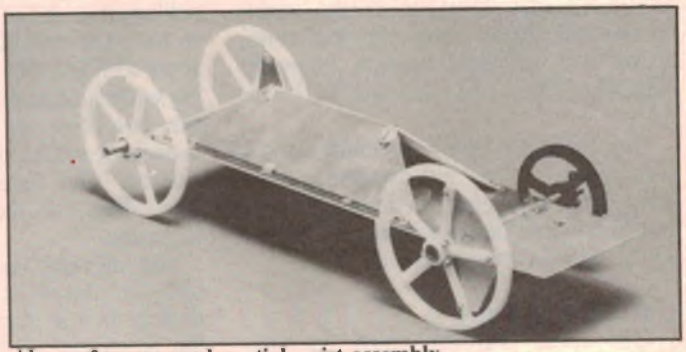
Although the control and interface circuitry is not yet installed, we were able to hard wire the motors separately to check for range and freedom of operation. In this regard, our robot appeared to be satisfactory.

The foregoing article has really only highlighted some of the more tricky aspects of the construction but readers should not jump to the conclusion that the whole project is difficult. It is not. It's quite a satisfying exercise seeing all those ordinary bits and pieces being gradually transformed into a robot.

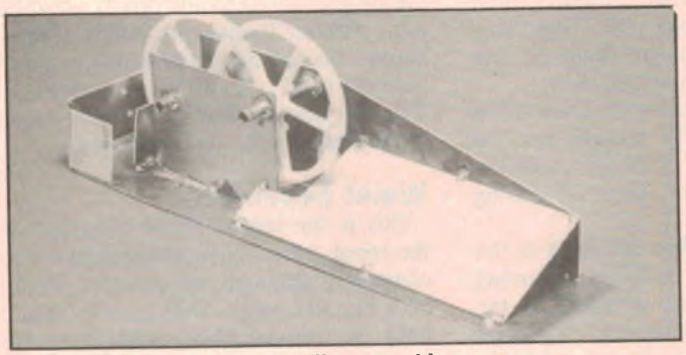
Next month we will describe the interface and motor drive boards.



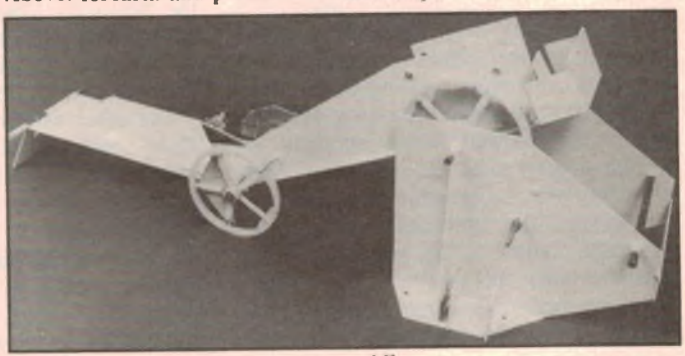
Above: baseplate and waist drive pulley assembly.



Above: forearm and partial wrist assembly.



View of the upper arm and pulley assembly.



The integrated waist and arm assemblies.

AM STEREO

It's now one year old

Stereo AM broadcasting is now just over one year old in Australia. We can be proud that this country was the first to standardise on the Motorola C-QUAM system for AM stereo broadcasts and that we have shown the way for the rest of the world.

by LEO SIMPSON

At last count, some 64 AM stations throughout Australia were already broadcasting in stereo or were on the point of commencing. That represents an enormous investment by the stations concerned and is a very positive statement of faith in the new medium.

Equally encouraging, there are now some 40 different models of stereo AM receiver to choose from, whether they be hifi AM/FM tuners, portable radios, or car sound systems. That too, represents a large investment by the manufacturers in the new medium and is an indication that all manufacturers will soon be making high quality AM stereo receivers.

We think it's an exciting development, for the broadcast industry, the receiver manufacturers, and most importantly, the radio listeners. This feature article is a comprehensive survey of the AM stereo scene. It describes the new method of broadcasting, discusses the problems involved for stations and prospective listeners, gives a list of all the stations now broadcasting in stereo, and lists all the receivers currently available and to be released shortly.

Several years ago, the concept of stereo broadcasting by AM stations was virtually unknown. Most hifi enthusiasts, had they even considered it, would have dismissed it as being impossible. But in fact, broadcast engineers have known for many years that AM stereo broadcasts were feasible. The initial concept was developed by Belar Electronics Laboratory, Inc of the USA and was extensively tested by RCA in 1959, about the same time as the FM stereo multiplex transmission was developed.

At that time though, it was felt that the stereo facility was unnecessary for AM stations which were very strong financially, while the FM stations were in their infancy (in the USA). So FM broadcasting came to be recognised as the "quality" medium and AM stations gradually lost audience share.

Eventually this loss became too much to bear and AM stations (in the USA) began casting about for a way of regaining their previous audience share. Stereo broadcasting was seen as the key and so the National AM Stereophonic Radio committee (NAMSRC) was formed in September 1975. This body proposed and tested a number of AM stereo transmission methods.

Five of these — Harris, Kahn/Hazeltine, Magnavox, Motorola and RCA-Belar — were submitted to the FCC (Federal Communications Commission) which finally decided on the Magnavox system. Subsequent threat of legal challenge led the FCC to set aside

For the hifi enthusiast who doesn't mind building his equipment, the Playmaster fully synthesised stereo AM/FM tuner is one of the best performers currently available. The first article was published in December 1985.

AM STEREO

its decision in March 1982.

The alternative decision, which was no decision at all, was to let the American marketplace decide which system was the best, with four contenders fighting it out. Since then, the Motorola system has clearly come to the fore although it has yet to be universally adopted in the USA.

Australia shows the way

Australia had a much cleaner selection process. We started out with four different systems being used experimentally by 14 commercial AM stations. Finally, after a certain amount of lobbying, the Department of Communications decided in late 1984 that Australia would standardise on the Motorola C-QUAM system.

This was a sensible decision because it has proven to be technically right and in line with what the USA seems to be coming round to. It has also let the stations go ahead and install stereo equipment, in the certain knowledge that there would be no later changes. Officially, stereo AM broadcasts began in Australia, on February 1st, 1985. New Zealand has since followed Australia's lead and there are indications that the market in the USA has taken notice. The tide is running inexorably in favour of the Motorola C-QUAM system.

At first, there were very few stereo AM radios of any sort available and of those, several had multi-standard decoders which were unlikely to give the optimum result that could be expected from a decoder designed especially to suit the Motorola system. In the past year though, quite a few extra models have become available and 1986 promises to see the introduction of even more.

This is very encouraging because most overseas manufacturers were initially very reluctant to make AM stereo radios to suit the relatively small Australian market. This is because our AM broadcast standards are different, in two essential points, from those of the USA.

Australian AM standards

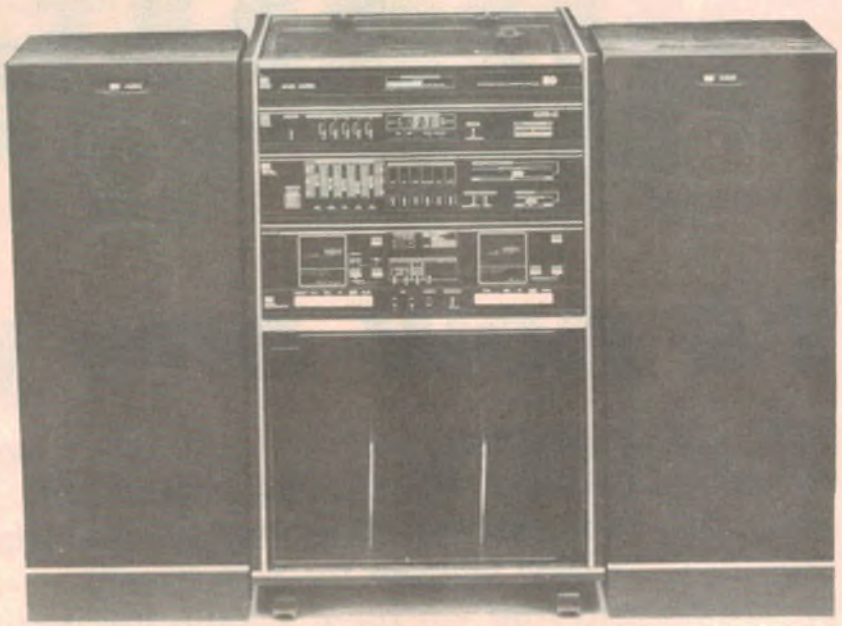
The first is that the nominal spacing between AM stations in Australia is 9kHz, the same as in most of the rest of the world. The USA is virtually the only country to stick with the old 10kHz spacing.

That means that all the synthesised car radios and tuners made for the USA would not tune to our stations and models made for Australia would not tune to American stations (with 12 exceptions, these being 540, 630, 720, 810, 900, 990, 1080, 1170, 1260, 1350, 1440 and 1530kHz. This is because these station frequencies are actually multiples of 9kHz and 10kHz).

Hifi AM tuners also require two whistle filters, one for each channel (for stereo operation), to prevent 9kHz beats between stations becoming audible during night-time listening. Naturally, receivers designed for the USA would require 10kHz whistle filters and would be useless in Australia.

The other relevant point is that US-

Deluxe Music system from Pye



The MZ9553 deluxe music system from Pye is complete with belt drive turntable, stereo AM and FM tuner with automatic search tuning and ten station presets, 15 watt per channel amplifier with graphic equaliser, dual cassette deck and large floor-standing loudspeakers.

Philips enters the AM stereo market

About to be released, this Philips AC788 stereo AM/FM car radio/cassette player has synthesised tuning, liquid crystal display and ten station presets, five for AM, five for FM. Price is $349.

Sony has six AM stereo products

Besides its two well-known portable stereo AM/FM receivers, the SRF-A10 Walkman ($109) and the SRF-A200 ($129) which has two inbuilt speakers, Sony now has another Walkman, the WM-F16, with stereo AM/stereo FM and cassette player at $149. Also available is the ST-JX220A hifi tuner (reviewed on page 72) and two car radio/cassette players, the XR-A33 at $389 and the XR-A740 at $499.

style car radios are generally much larger than the DIN-size units sold on the Australian market.

Audio performance

Having stated that AM stations can now transmit stereo programs, does that mean that they sound any good? After all, most people have the impression that AM sounds universally poor, not a patch on the high sound quality we have become used to from the FM stations.

That unfortunate impression has come about not because the AM stations have been unable to broadcast good quality sound. No, it is because the standard AM broadcast radio is built to such a low standard. Even the AM section of the best and most expensive AM/FM tuners is woeful, with narrow audio bandwidth, typically no more than 3kHz, quite high harmonic distortion, typically 2% or more and poor signal-to-noise ratio of around 45 to 50dB.

By contrast, the typical Australian AM station has always had the capability to radiate programs with an audio bandwidth flat to 15kHz (the same as with FM broadcasts). Harmonic distortion and signal-to-noise ratios have also been potentially quite good and on a par with figures for typical FM transmitters.

Of course, to be realistic, not all stations have had the full 15kHz capability and many more have not taken advantage of it, because most AM receivers have been poor — we had this vicious circle for many years. (Some stations have had their audio bandwidth effectively limited to 10kHz by the telephone lines between their studios and transmitter.)

Even so, in most of the larger cities there has generally been at least one AM station which was notable for its high signal quality. Usually the station or stations concerned have been those of the ABC. Those few people with wideband AM receivers have been able to enjoy signal quality undreamed of by the majority of AM listeners.

Proposed standard

With the introduction of AM stereo to Australia it would have been nice to think that the overseas hifi manufacturers would start turning out tuners with good AM sections. Until recently

AM STEREO

though, it looked as though we would continue to be saddled with the mediocre quality receivers we have always had, albeit now in stereo.

Plainly unhappy with the situation, AM Stereo Australia, a group of the major AM stations in this country, has now promulgated a "minimum recommended AM stereo receiver performance" standard. The particulars of this standard are set out in a table accompanying this article, together with relevant figures for current model AM stereo exciters and AM transmitters.

In brief, the standard proposed is for a medium quality receiver set to the wideband mode. Frequency response is envisaged as being −3dB down at 50Hz, −10dB down at 7kHz and −40dB down, in the notch, at 9kHz. Separation between channels should be better than 20dB over the range from 400Hz to 5kHz and harmonic distortion in stereo mode should be less than 2%.

In other words, it is a minimum standard and one which it is to be hoped will be exceeded comfortably by receivers available in the future. For the record, only a few tuners presently available would come close to meeting the standard and at least one receiver was withdrawn from sale because it was clearly of mediocre performance.

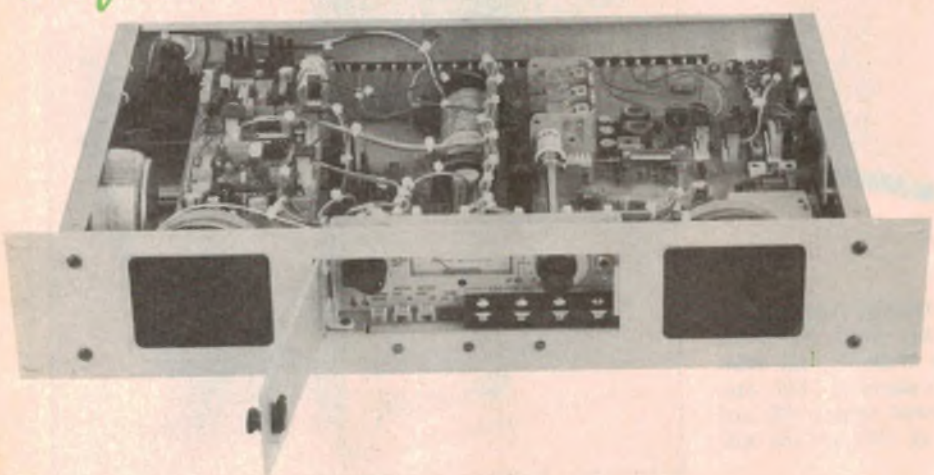
The signs are good though, because this writer knows of at least one local distributor who has held off introducing AM stereo radios because the prototypes sent out from Japan were not satisfactory.

Japan may go to AM stereo

Real progress is likely if and when Japan decides to follow Australia's lead and start broadcasting AM stereo. This could happen quite soon as there has been a committee set up for this purpose by the National Association of Commercial Broadcasters in Japan. It also seems highly likely that Japan will adopt the Motorola system because of its popularity in the US.

When that happens, the Japanese are

Professional modulation monitor



This professional modulation monitor is intended for use by broadcast stations. It has narrow and wide (28kHz) IF bandwidth, digital frequency selection combined and phase lock indicator combined with three-stage manual tuning for ideal RF bandpass characteristics. Made by Potomac Instruments of the USA, it is distributed by John S. Innes, 120 Macpherson St, Cremorne 2090. Phone (02) 90-2793.

	Minimum recommended AM stereo receiver	Transmission system performance			
		DOC specification AM mono Transmitter	DOC specification AM stereo Transmitter Provisional	Typical specification AM stereo Exciter/Monitor	Typical specification current model AM transmitter
MONO FREQ. RESPONSE L + R = 40% mod.	50Hz −3dB 100Hz 0dB 400Hz 0dB 1KHz 0dB 3KHz −2dB 5KHz −4dB 7KHz −10dB 9KHz −40dB	<±2dB 50Hz to 10KHz Ref. 1KHz	<±2dB 50Hz to 10KHz Ref. 1KHz		<±1dB 50Hz to 10KHz
STEREO FREQ. RESPONSE L or R in = 20% mod.	<±2dB of mono rsponse 50 Hz to 7KHz	Not Applicable	<±2dB 50Hz to 7.5KHz	<±1dB 100Hz to 5KHz	
SEPARATION	>20dB 400Hz to 5KHz	Not Applicable	>18dB 400Hz to 5KHz	>35dB 100Hz to 5KHz	
MONO T.H.D. L + R = 95% mod.	<1.5% 50Hz to 7.5KHz	<3.75% 50Hz to 7.5KHz	<3.75% 50Hz to 7.5KHz	<0.25%	<1.00%
STEREO T.H.D. L or R in = 40%	<2.0% 50Hz to 5KHz	Not Applicable	<4.0% 50Hz to 5KHz		
MONO S/N RATIO	>−55dB 50Hz to 10KHz	>−55dB 50Hz to 10KHz	>−55dB 50Hz to 10KHz		−60dB
STEREO S/N RATIO	>−48dB 50Hz to 10KHz	Not Applicable	>−48dB 50Hz to 10KHz		

This table sets out the proposed minimum standard for an AM stereo receiver and gives DOC specifications for AM transmitters for comparison. Many currently available receivers will not meet this specification.

likely to make a big push into producing good AM receivers. If they devote just a fraction of the effort that has gone into the development of FM stereo receivers over the last 25 years, we will see (and hear) very good AM receivers.

Antennas for AM stereo

Even now, some of the better car radios sound just as good on AM stereo as on FM stereo, when the vehicle is on the move. This is because the noisy environment of the car tends to mask the higher frequencies and obscure the lesser signal-to-noise ratio of receivers when in the AM mode. This favourable comparison is not obtained in the typical hifi or car sound showroom though; it is usually just the opposite.

This writer has now seen and heard quite a few demos of AM stereo equipment, both car models and hifi tuners. Almost without exception these have been poorly set up, without any consideration for obtaining the best performance.

The typical showroom is illuminated by fluorescent lights and is surrounded by mains wiring. All of this interferes very badly with even the best AM receivers if they don't have the right antenna connections. The usual result is that AM reception is badly effected by loud buzzing (radiated from fluorescent lamps) right across the band. Paradoxically, the wider the bandwidth of the AM receiver, the worse it will sound.

This means that while AM stereo radios will usually sound quite good in a car, they sound lousy in the showroom, when they have the standard whip antenna connected — it naturally picks up all the interference.

For any wideband AM receiver to audition favourably, it must be connected to a properly designed noise-cancelling loop or rod antenna. For car radios to be properly demonstrated, they too must have a noice-cancelling loop. As soon as this realisation sinks in, with dealers as well as distributors, we will start to hear noise-free AM stereo reception in the stores.

So just as an FM tuner requires a good antenna to perform properly, then so does the AM tuner. From now on, hifi tuners will require two separate antenna inputs; the small hinged AM rod antenna is no longer good enough.

Processing, equalising and all that

One other problem will have to be addressed by the AM stations before the new AM stereo medium will become fully accepted by listeners as being of high quality, equal to FM stereo. This is the question of processing and equalising. Should there be any processing and any equalising? By equalising we mean the shaping of the audio response of the program material. By

Australian-made from Audiosound

These two tuners from Audiosound Laboratories both have AM stereo capability. The T751 Mk II is manually tuned with wide and narrow AM modes and includes FM reception. The AM101 is AM only and has 12kHz bandwidth in the wideband mode. Contact Audiosound Laboratories at 148 Pitt Rd, North Curl Curl 2099. Phone (02) 938-2068.

OK, who's got Stereo AM anyway?

AWA Clarion has it.
Alpine has it.
Audio Sound has it.
Craig has it.
Dick Smith has it.
Eurovox has it.
Marantz has it.
Pioneer has it.
Playmaster has it.
Pye has it.
Sansui has it.
Sharp has it.
Sherwood has it.
Sony has it.
Voxon has it.

Now you can have it, can't you!

WE'VE GOT STEREO AM

2CH	2MC	3BO	4TO
2GB	2NX	3BA	4SS
2SM	2LM	3TR	4AK
2UE	3AK	4BC	5AD
2UW	3AW	4GG	5KA
2WS	3DB	4IO	6IX
2AY	3KZ	4BK	6KY
2BS	3MP	4AY	6PM
2GO*	3UZ	4CA	6PR
2KO	3XY	4CC	7HT
STEREO 97		4GY	8DN

*In Stereo 1986

See (and hear) Stereo AM at car radio specialists and the better 'sound' shops.

For an update on Stereo AM including a comprehensive guide to the great new tuners now available, write to: Promotions Office, Stereo AM Australia, PO Box 513, North Sydney 2060.

STEREO AM

processing, we mean the amount of compression or limiting applied to the program to make it sound louder. Most commercial AM and FM stations have some degree of processing and equalising. Some use lots.

The equalising can be done in two ways, at least as far as music programs are concerned. First, equalising can be performed when records are recorded onto cartridge tapes, for later replay. Second, the signal from the studio can be equalised immediately before it is fed to the exciter and transmitter. For equalisation, commercial FM and AM stations generally apply boost in the bass region between 100 and 200Hz. This gives a punchy sound, particularly on rock music.

That is bad enough, as far as audio purists are concerned but many AM stations usually go one step further and apply considerable boost to treble frequencies above 2kHz. The reason they do this is to counteract the very serious lack of bandwidth of the typical AM radio. It makes the sound brighter and more comparable with the quality of FM stations.

Some stations even go to the point of deliberately tailoring the overall frequency response so that they can produce a "sound" which is immediately recognisable as the listener tunes across the band.

Loud signals & signal coverage

The over-riding reason for using processing is to obtain a loud signal. Broadcast stations have strict limits on the amount of power they can radiate and they seek to maximise the apparent loudness of that signal. By limiting the dynamic range of the signal, the apparent loudness can be greatly increased and the overall sign coverage of the station also enhanced.

But processing can and usually is taken further. By clever design of the processor's circuits, it is possible to limit the negative peaks of the audio signal so that the transmitter is never modulated to the point where the radio frequency carrier is intermittently chopped out (ie, over-modulated). Positive peaks of the audio signal, however, can be allowed to exceed the amplitude of negative peaks by as much as +15%. This allows the transmitter to be pushed beyond its nominal limits and again, put out a bigger signal.

Recent AM stereo releases

This neat music system from Sharp is compact and yet has most wanted features, including AM stereo in the tuner. Also available from Sharp is the fully synthesised RG-7700AM car radio/cassette player shown below.

Dick Smith Electronics has this low cost synthesised car radio/cassette player with LED digital display, ten station memory and automatic search tuning for just $279.

One of the most attractive stereo AM/FM tuners is the ST-251 from Marantz. It has 16 station presets and sells for $449.

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Sansui has big AM stereo range

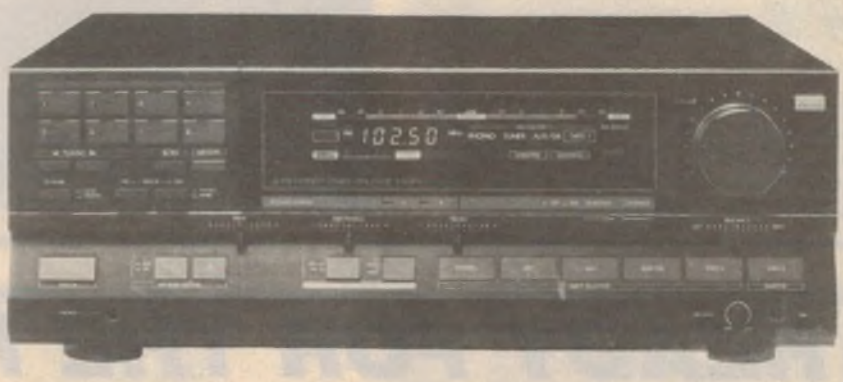
Sansui have no less than eight different AM stereo models to choose from. Pictured above is the S-X1070 55W/ch stereo receiver ($829), while below is the 100W/ch S-X1100 ($1799). Of similar appearance but with 130W/ch is the S-X1130 at $1999. Sansui also have their TU-D99AMX synthesised tuner (winner of a CESA hifi award. See EA, Feb 1986) at $999 and four synthesised car radio/cassette players, the CX-990 at $899, the CX-910 at $799, the CX-900 at $689 and the CX-700 at $579.

Other AM stereo products

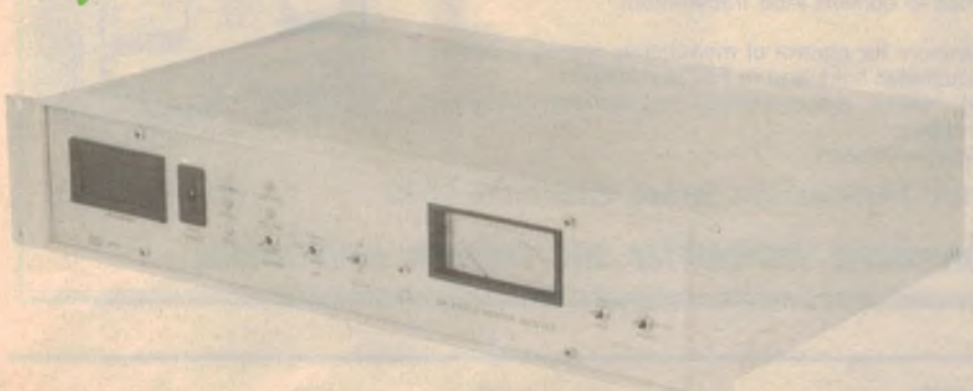
Pictured within these pages are the majority of AM stereo products currently available. However, limits on space have prevented us from featuring products from AWA Clarion, Concord, Voxson and Sherwood. The first three all have stereo AM/FM car radio/cassette players while Sherwood has a hifi tuner. Voxson also have two music systems which incorporate AM stereo reception.

Acknowledgement:

Our thanks to AM Stereo Australia, John S. Innes and Radio Manufacturing Engineers Pty Ltd for their assistance in the preparation of this article.



Professional AM stereo monitor receiver



Made in Australia, this professional AM stereo monitor receiver is specially designed for use in broadcast applications. It can provide up to six individually tuned RF input channels, locally or remotely selectable, and has a crystal locked local oscillator. It also has switchable 9kHz notch and low pass filters for selection of audio bandpass. Contact Radio Manufacturing Engineers Pty Ltd, 30-32 Skarratt St, Auburn 2144. Phone (02) 648-2531.

AM STEREO

Pioneer is prominent in AM stereo

Pioneer have two AM stereo radio/cassette players, the KEA-433AM ($419) and the KEA-633AM ($489) pictured at left which has additional features of auto-reverse and bass and treble controls. They also have three stereo AM/FM tuners, the TX-960A (reviewed in EA, Nov 1985) at $399, the electrically identical but smaller TX-760A and the TX-560A at $259 and a number of complete music systems which incorporate these tuners.

AM stereo receiver from G.M.E.

For those wanting entertainment on the water, there is the GME marinised radio/cassette player which incorporates AM stereo reception. Contact Greenwich Marine Electronics, 6 Frank St, Gladesville 2111. Phone (02) 816-2933.

Compatibility

Well, there is nothing new in this and AM stations have been doing it for years. The problem which confronts this practice is that if the stereo program signal is to have reasonable separation, and more particularly, is allowed to have strong left or right signals by themselves, conventional heavy audio limiting will cause distortion.

In particular, the limiting of the negative audio signal peaks can no longer be as heavy, otherwise there will be very

Altronics AM stereo receiver

Presently the cheapest stereo AM/FM car radio/cassette player available is this $189 pushbutton set incorporating the Motorola C-QUAM decoder and auto-reverse tape playback. It is available from Altronics.

Deluxe receivers from Eurovox

Designed in Australia, Eurovox has a very good reputation for performance and quality. They have two stereo AM/FM car radio/cassette players, the MCC2360, pictured at right, sells for $959 and the MCC2300, priced at $709.

little radio carrier for the receiver's stereo decoder to work with. If the stereo decoder can no longer lock on to the carrier, there is bound to be intermittent distortion.

So there is a mono/stereo compatibility problem for the stations to deal with. If heavy limiting is not used, mono listeners stand to lose apparent loudness of the signal when there are strong left-only or right-only signals. This tends to mitigate against the use of, say, stereo sports broadcasting or stereo interviews.

In the long run, AM stations will have to modify the levels of processing and equalising they use, if wideband AM stereo receivers are to become popular and acknowledged as a high quality program source.

In the meantime, while processing and equalising is a problem in that it can sound unnatural on AM stereo wideband receivers, it's nowhere near as bad a picture as some writers have depicted. If some AM stations are judged by the listener to be using excessive treble boost for example, it is always possible to resort to using the treble control on the amplifier — just cut it back.

Alternatively, if the receiver has a narrow-band mode, use that. The sound will still be in stereo and will still sound cleaner and better, in stereo.

As for the use of hard limiting, it is well to remember that a great deal of popular music does not have a wide dynamic range and so the effects of limiting are generally not apparent to the casual listener.

The fact remains that, even after a year of AM stereo broadcasting, most people have yet to hear the full benefit of a well-designed wideband AM stereo receiver operating with a low-noise antenna system. It really does sound unbelievably good. In fact, the normal reaction of people hearing it for the first time is to ask if it really is FM.

Enough said? EA

AM-FM Australian

This list of AM and FM broadcasting stations is current for March 1986.

Mediumwave AM Stations

kHz	Call	Class	Power (kW)	Location
531	2MC•	C	5	Kempsey
	3UL	C	5	Warragul
	4KZ	C	5	Innisfail
	5UV	P	0.5	Adelaide
	6DL	N	10	Dalwallinu
540	4QL	N	10	Longreach
	7SD	C	5	Scottsdale
549	2CR	N	50	Comnock
558	4AM	C	5	Atherton
	4GY•	C	5	Gympie
	6WA	N	50	Wagin
	7BU	C	2	Burnie
567	2BH	C	0.5	Broken Hill
	4JK	N	10	Julia Creek
	6MN	N	0.1	Mt Newman
	6PN	N	0.1	Pannawonica
	6PU	N	0.1	Paraburdoo
	6TP	N	0.1	Mt Tom Price
576	2FC	N	50	Sydney
	2WEB	P	2	Bourke
594	3WV	N	50	Horsham
603	6PH	N	2	Port Hedland
	7ZL	N	10	Hobart
612	4QR	N	50	Brisbane
	6NM	N	0.2	Northam
621	3AR	N	50	Melbourne
630	4QN	N	50	Townsville
	6AL	N	0.4	Albany
	7QN	N	0.4	Queenstown
639	2CS•	C	5	Coffs Harbour
	4MS	N	1	Mossman
	5CK	N	10	Crystal Brook
648	2NU	N	10	Tamworth
	6GF	N	2	Kalgoorlie
657	2BY	N	10	Byrock
	8DR	N	2	Darwin
666	6LN	C	1	Carnarvon
	2CN	N	2	Canberra
675	2CO	N	10	Corowa
	6BE	N	0.05	Broome
	8KN	N	0.5	Katherine
684	2KP	N	10	Kempsey
	6BS	N	4	Busselton
	8TC	N	1	Tennant Creek
693	4KQ•	C	5	Brisbane
	4KZ-T	C	0.5	Tully
	SSY	N	2	Streaky Bay
702	2BL•	N	50	Sydney
711	4QW	N	10	St George
	7NT	N	10	Launceston
720	2AN	N	0.05	Armidale
	2ML	N	0.4	Murwillumbah
	3MT	N	2	Omeo
	4AT	N	4	Atherton
	6WF	N	50	Perth
729	5CL	N	50	Adelaide
738	2NR	N	50	Grafton
	6MJ	N	5	Manjimup
747	4QS	N	10	Toowoomba
	6LN-T	C	1	Exmouth
	6SE	C	5	Esperance
	8JB	N	0.1	Jabiru
756	2TR	N	2	Taree
	4QA	N	2	Mackay
	6KW	N	0.1	Kununurra
765	2BE	C	3.5	Bega
	2BE-T	C	0.5	Moruya
	4GC	T	0.5	Ghenden
	5CC	C	5	Port Lincoln
	6KA-T	C	0.1	Paraburdoo
	6KA-T	C	0.1	Mt Tom Price
	6CC	C	5	Port Lincoln
	8DN-T•	C	0.25	Katherine
774	3LO•	N	50	Melbourne
	4TO•	C	5	Townsville
783	2KA	C	2	Katoomba
	6VA	C	2	Albany
	8AL	N	2	Alice Springs
792	4QG	N	10	Brisbane
801	4QY	N	2	Cairns
	5RM	C	2	Renmark
810	2BA	N	10	Bega
	6WN	N	10	Perth
819	2GL	N	10	Glen Innes
828	3GI	N	10	Sale
	4SS•	C	5	Nambour
	6GN	N	2	Geraldton
837	3CR	C	0.25	Melbourne
	4RK	N	10	Rockhampton
	6ED	N	1	Esperance
	7QT	C	0.5	Queenstown
846	2CY	N	10	Canberra
	4CA•	C	5	Cairns
	6CA	N	0.2	Carnarvon
855	4QB	N	10	Pialba
	4QO	N	10	Eidsvold
864	4GR•	C	2	Toowoomba
	6AM	C	2	Northam
	7HO•	C	2	Hobart
873	2GB•	C	5	Sydney
	6DB	N	2	Derby
882	3YB	C	2	Warrnambool
	4BH•	C	5	Brisbane
	6PR•	C	2	Perth
891	5AN	N	50	Adelaide
	4AY•	C	5	Ayr
900	2LM•	C	2	Lismore
	2LT	C	5	Lithgow
	7AD	C	2	Devonport
	8HA	C	2	Alice Springs
918	2XL	C	2	Cooma
	4VL	C	2	Charleville
	6NA	C	2	Narrogin
927	3UZ•	C	5	Melbourne
	4CC•	C	5	Gladstone
	4CD-T-	C	0.1	Biloela
	6NR	P	2	Perth
936	7ZR	N	10	Hobart
945	3BO•	C	2	Bendigo
	4HI-T	C	1	Dysart
954	2UE•	C	5	Sydney
	4CA-T	C	0.35	Gordonvale
963	2RG	C	5	Griffith
	4WK	C	5	Warwick
	5SE	C	5	Mt Gambier
	6TZ	C	2	Bunbury
972	2MW•	C	5	Murwillumbah
	2DU-T	C	0.1	Cobar
	5DN•	C	2	Adelaide
981	2NM	C	5	Muswellbrook
	3HA	C	2	Hamilton
	6KG	C	2	Kalgoorlie
	3AB	N	0.25	Albury/ Wodonga
990	4RO•	C	5	Rockhampton
	6PM•	C	2	Perth
	8GO	N	0.5	Gove
999	2NB	N	2	Broken Hill
	2ST	C	5	Nowra
1008	2XX	P	0.3	Canberra
	4IO•	C	5	Brisbane
	6GE	C	2	Geraldton
	7EX•	C	5	Launceston
1017	2KY•	C	5	Sydney
	6WH	N	0.1	Wyndham
1026	3DB•	C	5	Melbourne
	4MK	C	5	Mackay
	6NW	C	2	Port Hedland
1004	2UH	N	1	Muswellbrook
	4WP	N	0.5	Weipa
	5PI	C	2	Crystal Brook
	6BR	N	1	Bridgetown
1053	2CA•	C	5	Canberra
	4EB	P	0.5	Brisbane
1062	4TI	N	2	Thursday Is
1071	3CV	C	5	Maryborough
	4SB	C	2	Kingaroy
	6WB	C	2	Katanning
1080	2MO	C	2	Gunnedah
	4MI	N	0.2	Mount Isa
	6IX•	C	2	Perth
	7HT•	C	5	Hobart
1089	3WM	C	5	Horsham
	2GZ	C	5	Orange
1098	4LG	C	2	Longreach
	6MD	C	2	Merredin
	7LA•	C	2	Launceston
1107	2UW•	C	5	Sydney
1116	4BC•	C	5	Brisbane
1134	2AD	C	2	Armidale
	3CS	C	5	Colac
	6CI	C	2	Collie
1143	2HD•	C	2	Newcastle
	4HI	C	5	Emerald
1152	2WG•	C	2	Wagga Wagga
1161	4MB	C	2	Maryborough
	5PA	N	10	Naracoorte
	7FG	N	1	Fingal
1170	2CH•	C	0.1	Charters Towers

NOTES

T	Translator	H	Horizontal
N	National	V	Vertical
C	Commercial	M	Mixed
P	Public	•	AM Stereo

broadcasting services

kHz	Call	Class	Power (kW)	Location
1179	3KG•	C	5	Melbourne
1188	2NZ	C	2	Inverell
	6XM	N	2	Exmouth
1197	4GG•	C	5	Gold Coast
	5KA•	C	2	Adelaide
1206	2CC•	C	5	Canberra
	2GF	C	5	Grafton
	6KY•	C	2	Perth
1215	2ST-T	C	0.35	Bowral
	4HI-T	C	0.1	Moranbah
1224	2WS•	C	5	Sydney
	3EA	S	5	Melbourne
1233	2NC	N	10	Newcastle
1242	3TR•	C	5	Sale
	4AK•	C	2	Oakey
	8DN•	C	2	Darwin
1251	2DU	C	2	Dubbo
1260	3SR	C	2	Shepparton
	6KA	C	1	Karratha
1269	2SM•	C	5	Sydney
1278	3AW•	C	5	Melbourne
1287	2TM	C	2	Tamworth
1296	4BK•	C	5	Brisbane
1314	2WL•	C	5	Wollongong
	3BA•	C	5	Ballarat
1323	2GO•	C	5	Gosford
	5AD•	C	2	Adelaide
1332	3SH	C	2	Swan Hill
	4BU	C	5	Bundaberg

kHz	Call	Class	Power (kW)	Location
1341	2NX•	C	5	Bolwarra
	3GL	C	5	Geelong
1350	2LF	C	5	Young
1368	2GN	C	2	Goulburn
	4LM	C	2	Mt Isa
1377	3MP•	C	5	Mornington
1386	2EA	S	5	Sydney
	5AA•	C	5	Adelaide
1395	2LG	N	0.2	Lithgow
1404	2PK	C	2	Parkes
	VKW	?	0.1	Cocos Islands
1413	2KO•	C	5	Newcastle
1422	3XY•	C	5	Melbourne
	VLU	?	0.5	Christmas Island
1431	2WN	N	2	Wollongong
1449	2MG	C	5	Mudgee
1458	4LM-T	C	0.1	Cloncurry
	5MU	C	2	Murray Bridge
1467	3MA	C	2	Mildura
1476	2KA-T	C	0.5	Penrith
	4ZR	C	2	Roma
1485	4HU	N	0.05	Hughenden
	5LN	N	0.2	Port Lincoln
	2EA-T	S	0.1	Wollongong
1494	2AY•	C	2	Albury
	—	?	0.05	Lord Howe Island

kHz	Call	Class	Power (kW)	Location
1503	2BS•	C	5	Bathurst
	3AK•	C	5	Melbourne
1512	2NA	N	10	Newcastle
1521	2QN	C	2	Deniliquin
1530	2VM•	C	2	Moree
1548	4QD	N	50	Emerald
1557	2RE	C	2	Taree
1566	3NE	C	5	Wangaratta
	4GM	N	0.2	Gympie
1575	200•	C	5	Wollongong
1584	2WA	N	0.1	Wilcannia
	2BE-T	C	0.2	Narooma
	5MG	N	0.2	Mt Gambier
	5WM	N	0.05	Woomera
	7SH	N	0.1	St Helens
	4VL-T	C	0.2	Cunnamulla
	2EA-T	S	0.1	Newcastle
1593	4SO	N	0.2	Southport
	5MV	N	2	Renmark
1602	2CP	N	0.05	Cooma
	3WL	N	0.2	Warnambool
	5LC	N	0.1	Leigh Creek South
1620	1PHR	P	0.5	Canberra
	7RPH	P	0.5	Hobart
	4RPH	P	0.5	Brisbane
1629	2RPH	P	0.5	Sydney
	3RPH	P	0.5	Melbourne
1692	VL2UV	P	—	Uni of NSW

FM Broadcasting Stations

Freq.	Call Sign	Power (kW)	Class	Location
88.1	2RDJ	0.05	M	Burwood
88.5	2RRR	0.05	V	Ryde
88.7	2BCR	0.1	V	Bankstown
88.9	2RSR	0.04	V	Sydney
89.3	2GLF	0.05	V	Liverpool
89.3	4CRB	16.0	V	Gold Coast
89.7	2RES	0.1	V	Waverley
89.7	2VTR	0.02	M	Windsor Colo
89.7	5PBA	0.25	M	Elizabeth
90.1	2NBC	0.1	V	Narwee
90.5	2BBB/T	0.1	M	Dorrigo
91.5	2NSB	0.08	V	Chatswood
92.1	5ABC	10.0	H	Adelaide
92.1	6UVS	5.0	M	Perth
92.1	7THE	3.0	H	Hobart
92.3	2ARM	0.1	H	Armidale
92.3	2MCE	1.0	V	Bathurst
92.3	3EON	10.0	M	Melbourne
92.5	2NCR	3.0	M	Lismore
92.5	4ABC	50.0	H	Maryborough
92.9	2ABC	50.0	H	Sydney
92.9	5EBI	4.0	M	Adelaide
92.9	6NEW	0.25	H	Newman
93.1	2ABC	10.0	V	Orange
93.3	6ABC	60.0	H	Bunbury
93.3	7ABC	120.0	H	Launceston
93.5	2ABC	50.0	V	Dubbo
93.7	2MWM	0.1	M	Manly Warringah
93.7	3MBS	4.0	H	Melbourne
93.7	4ABC	50.0	H	Rockhampton
93.7	5MMM	4.0	M	Adelaide
93.9	7ABC	27.0	H	Hobart
93.9	—	0.1	M	Norfolk Island
94.5	6ABC	50.0	M	Albany
95.1	6ABC	5.0	M	Geraldton
95.3	7RGY	0.01	V	Geeveston
95.5	2YOU	0.2	M	Tamworth
95.5	6ABC	1.5	M	Kalgoorlie
96.1	6NOW	10.0	M	Perth
97.5	6ABC	50.0	M	Perth
98.9	6ABC	50.0	H	Northam/York
100.5	8KIN	0.4	M	Alice Springs
101.5	4ABC	65.0	H	Townsville
101.7	4ABC	50.0	M	Mt Isa
101.9	2ABC	50.0	V	Canberra
109.9	3FOX	10.0	M	Melbourne
102.1	4ZZZ	6.0	M	Brisbane
102.1	8CCC	0.125	V	Alice Springs
102.3	3ABC	100.0	H	Mildura
102.5	2MBS	5.0	M	Sydney
102.7	3RRR	10.0	M	Melbourne
102.7	4DDB	2.0	H	Toowoomba
103.2	2CBA	5.0	M	Sydney
103.3	4MBS	6.0	M	Brisbane
103.3	7HFC	1.5	M	Hobart
103.5	3GCR	0.05	M	Churchill
103.5	3MBR	0.5	V	Murrayville
103.7	2ABC	2.5	M	Broken Hill
103.7	2NUR	3.0	M	Newcastle
103.7	8KIN/t	0.02	V	Ali-Curung
103.7	8KIN/t	0.225	V	Hermannsburg
103.7	8KIN/t	0.02	V	Santa Teresa
103.9	3CCC	2.0	V	Castlemaine
103.9	4TTT	0.05	M	Townsville
104.1	2CHY	0.04	V	Coffs Harbour
104.1	2DAY	35.0	M	Sydney
104.1	4MMM	6.0	M	Brisbane
104.1	5ABC	150.0	H	Mt Gambier
104.1	8TOP	10.0	M	Darwin
104.3	3ABC	50.0	M	Albury/Wodonga
104.9	2MMM	35.0	M	Sydney
105.1	5ABC	95.0	V	Loxton
105.3	3ABC	50.0	H	Ballarat
105.7	2ABC	100.0	M	Bega
105.7	2ABC	50.0	M	Wagga Wagga
105.7	2JJJ	10.0	H	Sydney
105.7	3ABC	50.0	H	Melbourne
105.7	5GTR	0.25	M	Mt Gambier
105.7	8ABC	10.0	M	Darwin
105.9	3ABC	50.0	V	Swan Hill
106.1	2ABC	25.0	H	Newcastle
106.1	4ABC	50.0	H	Brisbane
106.3	3ABC	100.0	M	Bendigo
106.3	3RPC	0.035	M	Portland
107.1	2AAA	0.2	M	Wagga Wagga
107.1	3ABC	100.0	H	Traralgon
107.3	2BBB	0.4	M	Bellingen
107.3	5RRR	0.3	M	Woomera
107.5	2ABC	50.0	M	Griffith
107.5	2SER	4.0	M	Sydney
107.5	3ABC	70.0	M	Western Victoria
107.5	5SSA	5.0	M	Adelaide
107.7	3PBS	0.1	M	Melbourne
107.9	2ABC	50.0	M	Taree
107.9	2ABC	25.0	M	Wollongong
107.9	2REM	0.3	M	Albury
107.9	4ABC-FM	50.0	M	Toowoomba

Sony ST-JX220A stereo AM/FM tuner

Our product survey elsewhere in this issue makes one point abundantly clear — there are not many hifi stereo AM/FM tuners available, regardless of the price. Therefore it was with great interest that we approached this review of Sony's easily affordable ST-JX220A.

The ST-JX220A is Sony's first entry into the domestic hifi tuner market although this company has had portable radio models for about 18 months now, well before the official introduction of AM stereo in this country. As such, the ST-JX220A appears to be aimed both at the Australian and US markets, as it can be manufactured to suit 9kHz or 10kHz AM station spacing.

As with most tuners these days, it is a fully synthesised model, which is essential to give the good oscillator stability and precise tuning necessary for good AM stereo performance.

Styling of the Sony tuner is fairly unprepossessing although at least it is not all-black in the manner of most hifi equipment today. It is housed in a slimline case measuring 429mm wide, 251mm deep and 55mm high, including rubber feet, knobs and rear projections. Weight is 2.6kg.

On the righthand side of the front panel are five square push-buttons for station selection, in AM and FM modes, giving ten stored selections in all. Next to these buttons is a small rotary AM/FM mode switch.

Selecting AM or FM is clearly indicated on the backlit green liquid crystal display which is a little unusual considering that most tuners have vacuum fluorescent or LED displays. The Sony display looks a little anaemic by comparison but we have to admit it is easily readable and unambiguous.

As well as indicating the tuning mode, the LCD also shows the station preset number (1 to 5) and the frequency multiplier (MHz for FM; kHz for AM). Not included in the display is some indication of signal strength. Instead, when a signal on the selected frequency is detected, the "Tuned" legend lights up on the display.

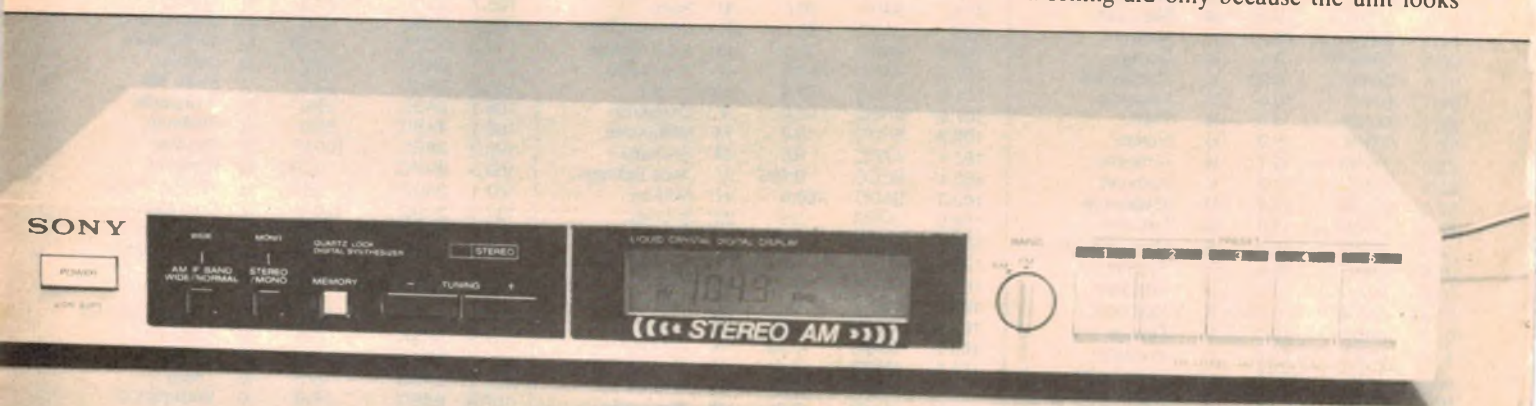
We regard the omission of a signal indicator as unfortunate but recognise that the low price of this tuner means that some features have to be left out.

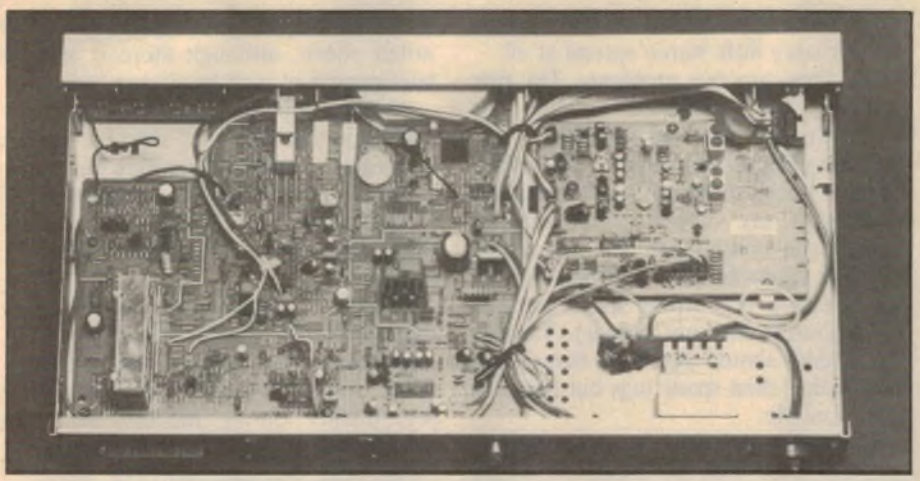
Another facility left out is a "Seek" tuning mode whereby the tuner will latch on to the next signal up or down the band. Again though, it is not really a great loss and most users will be quite happy with the ten preset stations. There is a pair of up/down buttons for manual tuning though, and these step the tuner up or down the AM band in 9kHz steps and by 100kHz steps in the FM band.

Just above the up/down tuning buttons is the stereo indicator LED (for both modes) and to the left of them is the memory button. Pressing this enables the station selection process so that the tuned station can be designated with one of the preset buttons.

Two other buttons in the same black panel area are the wide/normal bandwidth selector for AM reception and the stereo/mono selector which can be brought into play to select mono if noisy reception conditions occur.

One jarring feature to the whole presentation of the tuner is the large "Stereo AM" label plastered below the liquid crystal display. We assume this is a selling aid only because the unit looks





Inside the Sony ST-JX220A. The AM stereo decoder board is on the right but the decoder chip is surface-mounted, underneath.

a lot better when it is peeled off.

At the rear of the case is a pair of RCA phono sockets for the stereo line outputs and a set of four spring-loaded antenna terminals. For FM, 300-ohm ribbon or 75-ohm coax cable can be connected, while for AM, a long wire or Sony's "Wave Catcher layout-free AM antenna". This is a fancy plastic housing containing a ferrite rod antenna with a single coil wound onto it. Sony suggest a number of possible positions for this: clipped onto the back of the case; sitting on top of the case or positioned away from it. More on that later.

Inside the case, the Sony tuner appears to be relatively simple but this is not a correct impression since there is more to it than first meets the eye. It is based on a 64-lead surface-mount microprocessor similar to that in our own Playmaster tuner although this one drives the liquid crystal display directly.

The microprocessor's clock is 7.2MHz and we assume that this is also used to derive a phase lock loop reference frequency (probably 3.6MHz) for the stereo decoder. Station settings are maintained when power is not present by a lithium cell.

Most of the circuitry is accommodated by one large printed circuit board while the AM stereo decoder and associated circuitry is on a smaller board.

Sony does not use the Motorola decoder but has its own 24-pin surface mount IC which automatically senses and decodes all four AM stereo systems presently in use in America (ie, Harris, Motorola, Kahn and Magnavox). In Australia, of course, it need only respond to the Motorola system although there is no suggestion in the service manual that the Australian version may have been optimised in any way.

One good point about the decoder board is the presence of two adjustable filter blocks, evidently for the 9kHz notch filters. These are absolutely necessary in any AM tuner which has any pretensions at all to wideband performance.

Test results

As it happens, the performance of the ST-JX220A is very respectable, for both FM and AM. As the accompanying graphs show, the FM section really performs very well, especially so, considering its reasonable price. Ultimate signal-to-noise ratio was 80dB in mono and 70dB in stereo, while total harmonic distortion at 100% modulation was 0.75% in stereo and 0.38% in mono.

Separation between channels was around 44dB at 1kHz and well maintained across the audio range. The frequency response was also very flat, as indicated on the same graph as for separation.

For AM, the wide and narrow mode frequency responses are shown on one of the accompanying graphs. For the wide mode, the response is reasonably smooth and maintained up to a small peak at about 8kHz, then plunging into a very steep notch at 9kHz. This is a good result.

For a relatively strong input signal, 500 microvolts, the mono signal-to-noise ratio proved to be 50dB, and about 45dB in stereo. This is okay but is not startling. Harmonic distortion in mono was 0.6% and in stereo, around 1.5%. Separation between channels was close to 27dB at 1kHz which is just a little

better than the 26dB at 400Hz claimed by Sony. So overall, the test results are quite good.

Listening tests

Listening to FM showed this tuner to be a good performer, in line with the test results. It is quiet and sensitive.

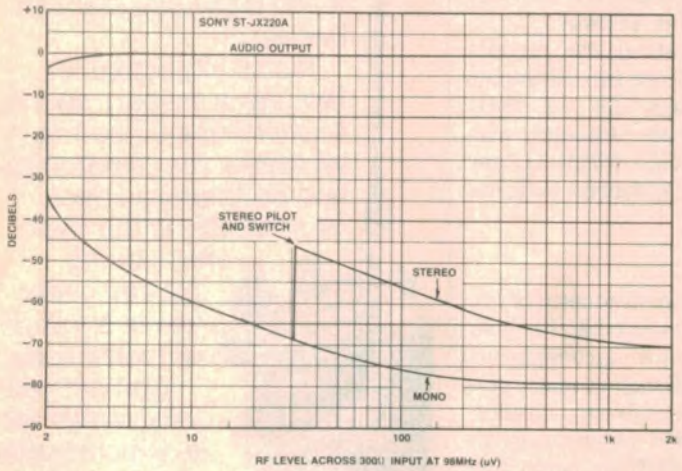
For AM, we had mixed feelings. Certainly, the AM stereo performance is very good with some Sydney stations giving very good stereo spread and commendably clean wideband sound. It is not quite as good as FM but it is surprisingly good all the same, with the listener's judgement more likely to be determined by the quality of the program material rather than the mode of reception. As an aside, some of the program material broadcast on FM appears to have very little stereo spread at all.

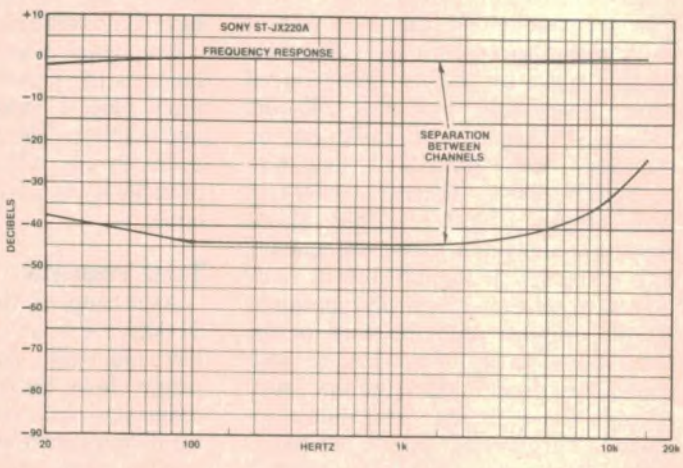
But there are two problems. The first involves the layout-free antenna; its leads are just not long enough to get the best performance from it. The Wave Catcher needs to be well away from the tuner case, say at least a metre or so. Placing the antenna on the tuner case severely degrades the reception (unless you live in a very strong signal area, in which case it does not matter). The antenna leads should also have bared wire ends rather than spade lugs but that is a small quibble.

The other problem is more serious and has to do with the selectivity of the AM front end. Provided you are listening to a strong station, during the day, the sound quality is quite good, as noted above, although there is a slight background of high frequency "frizzle".

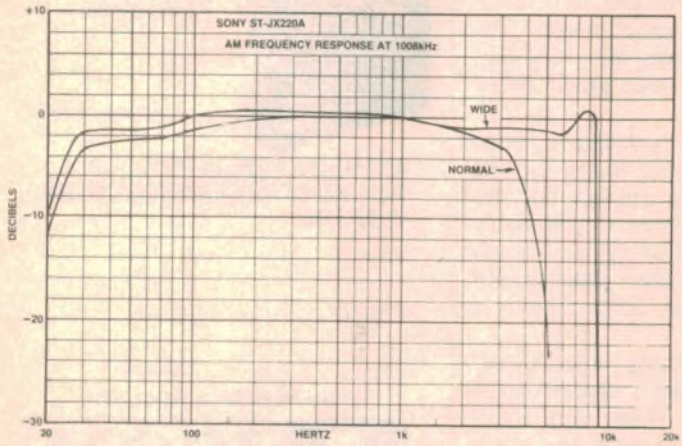
At night, though, it's a different story and "monkey chatter" becomes quite obtrusive — there is nothing for it except to switch to the narrow band mode, whereupon it sounds no better than any other AM tuner, albeit in stereo.

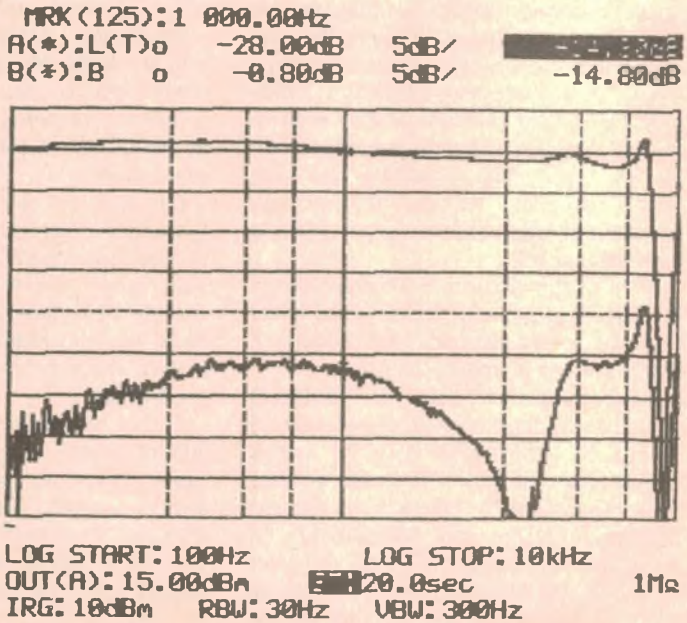
To be fair though, one cannot forget the price of this unit. At only $219 it really is quite a bargain, since it has a good FM section and the AM stereo performance during the day is really quite good, provided you do the right things with the antenna. For anybody on a budget it can be recommended. (L.D.S.)





At left, the quieting performance on the tuner in stereo and mono modes while at right, the frequency response and separation between channels in FM mode.





At left is the frequency response in the narrow and wide AM reception modes while at right is the graph depicting frequency response and separation in AM mode (by courtesy of Radio Manufacturing Engineers Pty Ltd).

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SEE PAGE 121 FOR ADDRESS DETAILS

B.128/JL

All's quiet on the wireless front at Taree

Broadcast studio seal of silence

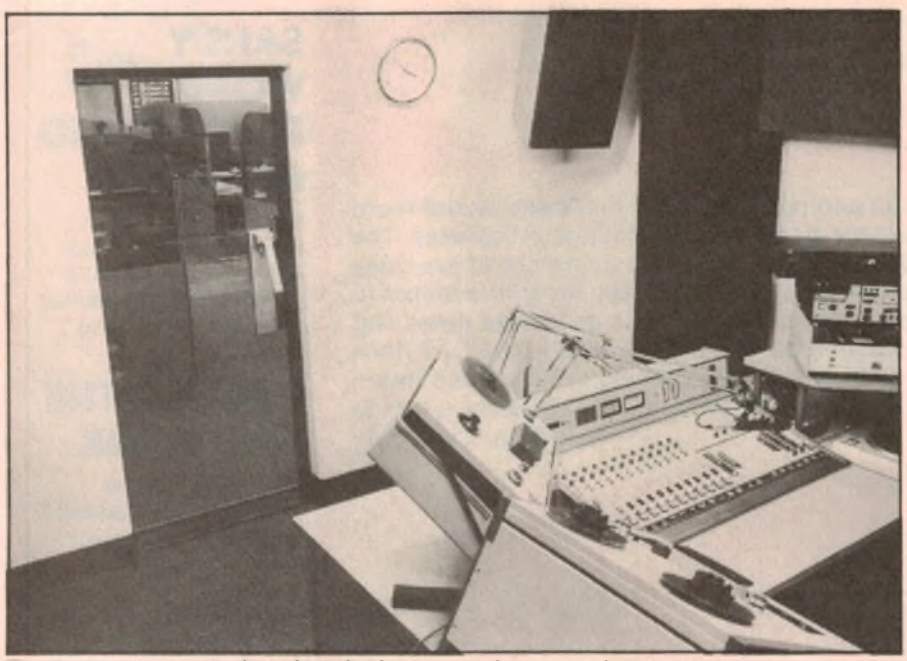
The revolution brought about by compact disc players will raise the quality expectations of radio listeners everywhere, whether or not they are hifi enthusiasts. This is recognised by most radio broadcasters and particularly by radio 2RE in Taree, NSW. They have pioneered an entirely new studio construction technique.

by COLIN DAWSON

Now that many radio stations are using compact discs as the source for at least some of their programming, the difference in sound quality between the various sound sources is becoming painfully obvious. Compact discs have set the standard and by comparison, music recorded on cartridge machines for normal programming sounds poor.

Even worse are commercials and voice announcements made from the station's own studios. The difference in acoustic quality from these various sources is marked.

For the radio stations the only solution to improving sound quality is expensive — rebuild the studios and equip them with all the latest equipment. And the problem which has to be faced first in rebuilding the studios is how to make them much quieter than they have been in the past.



The heavy laminated glass door is the secret of success of the new studio construction technique. It provides a very high degree of acoustic isolation.

Few, if any existing broadcast studios, have a noise "floor" which is comparable with the standard set by compact discs.

Many of the limitations of broadcasting studios are inherent in their design. Generally, the studio is built along much the same lines as the rest of the station building with masonry walls and timber joinery. The aim was to provide a room within a room, with an isolated floor.

Windows were double-glazed and there were separate double-leaf doors with carpet gaskets all round to prevent sound transmission around the edges.

Over a period of time, the sound seal of these double-glazed windows and double-leaf doors deteriorates. Inevitably, timber joinery expands and contracts, glass seals move and become ineffective, carpet gaskets around doors compress and cease to work. It gets to the stage where it all has to be renewed if noise isolation standards are to be maintained.

Radio station 2RE, located at Taree, NSW, recently built an entirely new studio complex. Designed by the Australian company Broadcast Amalgamated Ltd, the new studios are quite a departure from the typical broadcast operation and represent a new standard for Australian radio stations.

Broadcast Amalgamated Ltd has taken an entirely different approach to studio construction. Instead of considering the studios as just more rooms in a larger building, they have designed them from the ground up. Just about every aspect of the new studios has been designed to minimise noise intrusion.

The three new studios are really a massive concrete box with 200mm thick walls. The box has three compartments each of which constitutes a self-contained studio. Each has the absolute

minimum of cutouts in its walls, to minimise construction cost and maximise sound isolation.

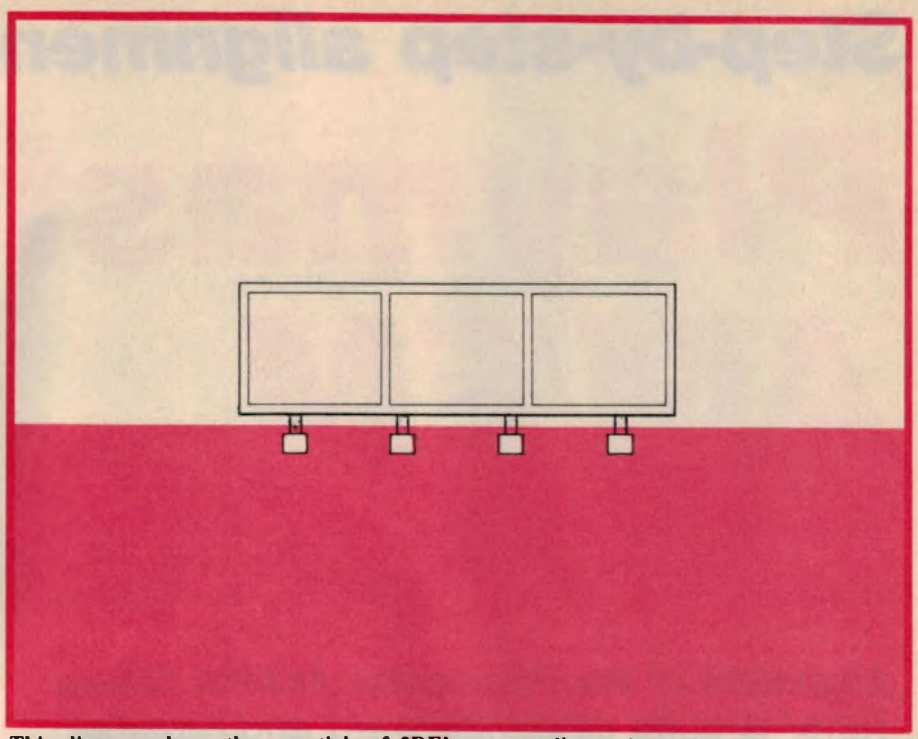
In fact, for each studio there are only three wall cutouts: one for the door and two smaller ones for the air-conditioning inlet and exhaust. The traditional double-glazed viewing window has been dispensed with — the only viewing access is through the massive glass door.

The glass is no less than 19mm thick and is laminated from two layers each of which have different resonant frequencies. The result is a door which has no major resonances throughout the entire audio spectrum.

Special hinges have been designed to carry the massive weight of the glass doors. Since drilling holes in them would compromise their sound isolating properties, the new design uses a cradle type hinge. A locking lever pulls the door closed with a 20 kg force against double rubber seals.

The effectiveness of this door and seal combination has to be heard to be believed. One moment the sound from the studio (when monitoring records) can be at bedlam level and then as the door snicks shut, the sound is cut, as though it had just been switched off.

The heavy glass doors and massive concrete construction are not the only unusual features of the new studio design. Whereas a normal studio may only have a cushioned operator's console, or perhaps the whole floor, Broadcast Amalgamated have mounted their whole studio complex on a common foundation with a special rubber suspension.



This diagram shows the essentials of 2RE's new studios: a heavy concrete box divided into three compartments and mounted on special footings.

So that ground vibrations are not transmitted to the complex, special attention has been given to the foundation layout. The mounting points are claimed to be out of phase with the building, minimizing the chance of mechanical resonance.

With the air-tight door closed, each studio is all but isolated from its surroundings. Its only connections are through the rubber suspension and the 60-metre long air-conditioning ducts. Even the wiring follows a circuitous path before being fed in through the air-conditioning vents.

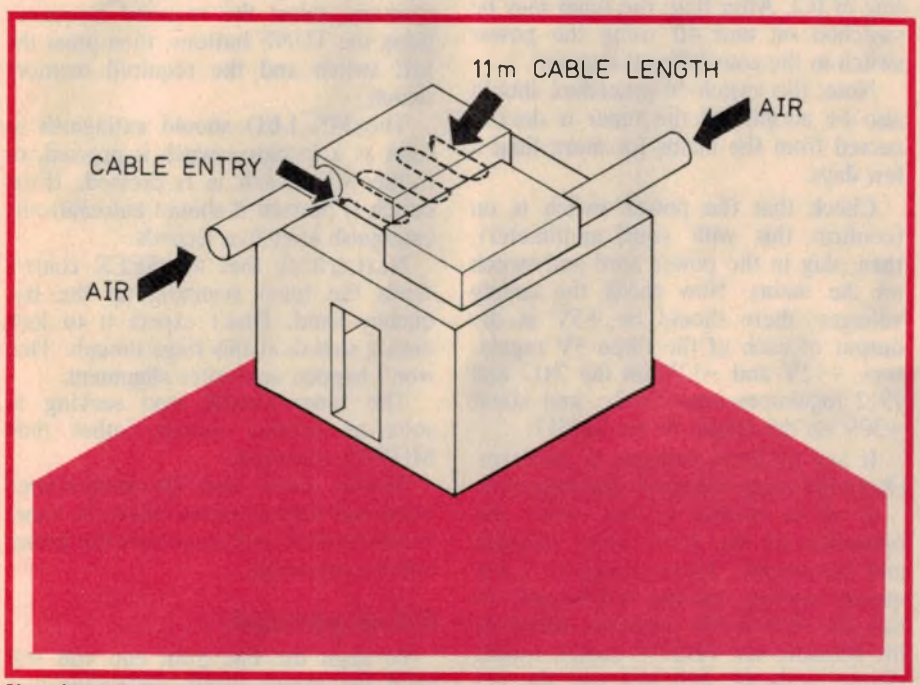
Each studio's room resonances are controlled by diaphragmatic absorbers at key points on the walls. At the same time, each studio is designed to have a reverberation time of 0.3 seconds. This is regarded as a good compromise between intelligibility and "ambience" — an ideal radio studio should not sound like an anechoic chamber. The audio consultant's report indicates that the design objectives for the studio have been met admirably.

As a result of the new design approach, each of the three studios has a noise floor substantially below that recommended by Australian Standard 1269 and sufficiently low to meet the stringent BBC standard for a Class 1 recording studio.

A postscript to the acoustics report on the new studio at 2RE noted that, while the acceptance tests were in progress, jackhammers in the adjacent building structure were completely inaudible.

As a first step towards raising the overall quality of radio broadcasts, 2RE's new studio complex is an impressive achievement.

Acknowledgement: Our thanks to Broadcast Amalgamated Ltd for their assistance in the preparation of this article.



Very long ducts have been provided for the air-conditioning inlets and outlets and for the cable entry, to provide a very low level of noise in the studios.

Step-by-step alignment details

Playmaster AM/FM stereo tuner Pt.4

Alignment of the Playmaster AM/FM Stereo Tuner is quite straightforward and requires only a few simple tools. The procedure mainly involves adjusting the various tuned circuits in the RF, IF and local oscillator stages on a step-by-step basis.

by JOHN CLARKE

While most readers will be unfamiliar with the alignment of superheterodyne tuner circuits, the procedure is really very simple. You don't need a lot of fancy tools and instruments either. The only tools required are a small screwdriver, a plastic alignment tool, a tuning wand and a multimeter.

An audio signal generator and a digital frequency meter would also be handy for adjusting the 9kHz and 19kHz notch filter circuits, but are by no means essential.

An unusual but necessary tool is the coil tuning wand, which you will have to make yourself. It consists simply of a short length of plastic tubing with a piece of brass (a brass nut or screw) in one end and a piece of ferrite (coil slug) in the other. You can use the F16 slug from coil L16 to make a temporary wand.

The tuning wand is used when making adjustments to the FM front end.

The plastic alignment tool is used for adjusting the coil cores and trimmer capacitors and can be purchased from your kit supplier. Do not use a screwdriver or other metallic object, as these will affect the circuit operation and give incorrect results.

Switch on

Initially, the tuner power switch must be switched on before mains power is applied. This is to ensure correct resetting of IC1. After that, the tuner may be switched on and off using the power switch in the conventional manner.

Note: this switch-on procedure should also be adopted if the tuner is disconnected from the mains for more than a few days.

Check that the power switch is on (confirm this with your multimeter), then plug in the power cord and switch on the mains. Now check the supply voltages: there should be +5V at the output of each of the three 5V regulators, +12V and −12V on the 7812 and 7912 regulators respectively, and about +30V on the output of the LM317.

If any of these voltages is incorrect, check the input voltage to the regulator.

If all is correct so far, check the operation of the front panel switches and the display. There should be a frequency reading on the display and either the AM or FM indicator should be lit. Pressing the AM/FM switch should change both the indicator and the frequency reading.

Next, check that the +12V rail is switched to the AM circuit when AM is selected, and to the FM circuit when FM is selected. For AM, check for +12V on pin 6 of IC4; for FM, check for +12V at pin 17 of IC2.

Assuming all is well, operate the TUNE buttons and check that the AM display ranges from 522 to 1611kHz in 9kHz steps. Similarly, check that the FM display ranges from 87.9 to 107.9 MHz in 100kHz (0.1MHz) steps.

Each memory LED should light when its respective switch is pressed. Initially, all the memories will probably be set to the same frequency. To program each memory, select the required frequency using the TUNE buttons, then press the ME switch and the required memory switch.

The ME LED should extinguish as soon as a memory switch is pressed, or if the ME switch is re-pressed. If no switch is pressed it should automatically extinguish after five seconds.

Next, check that the SEEK control sends the tuner scanning up the frequency band. Don't expect it to lock onto a station at this stage though. That won't happen until after alignment.

The tuner should stop seeking as soon as another button (other than MONO) is pressed.

Finally, check that the programmed memories remain intact when the tuner is switched off and on at both the power switch and mains.

FM alignment

To align the FM front end you will need the tuning wand, alignment tool and multimeter.

The first step is to set the local oscillator range which must be from (87.9 + 10.7)MHz to (107.9 + 10.7)MHz. This is easily achieved by measuring the varicap voltage. The procedure is as follows:

(1) Select FM by pressing the AM/FM switch, then adjust the white 3-11pF trimmer capacitor associated with L13 to about half-setting. Note that the trimmer is at minimum capacitance when the pointer faces the flat side of the trimmer, and at maximum setting when it faces away from the flat side.

(2) Measure the output voltage from the LM317 regulator (between ground and the metal tab of the regulator) and write it down.

(3) Connect your multimeter between the link marked "varicap voltage" and ground (use the tinplate shield for ground), and set the display on FM to read 87.9MHz. Adjust the spacing between the L13 coil windings for a reading of about 3V.

Note that opening the coil decreases both the inductance and varicap voltage. Conversely, closing the coil increases the inductance and the varicap voltage.

Note also that the above conditions are only valid when the local oscillator is locked at the frequency indicated by the display plus the 107.9MHz offset. If the oscillator is not locked, the varicap voltage normally stays at around 28V.

(4) Once the varicap voltage at 87.9MHz has been set, set the display to 107.9MHz by pressing the TUNE down button. This done, adjust the 3-11pF trimmer capacitor (white) for a reading that is 2.5V less than the LM317 output voltage. Normally, this will be about 27V.

Note that the alignment tool may affect the FM local oscillator, so always read the voltage with the alignment tool out of the trimmer.

(5) Check that the varicap voltage at 107.8MHz is lower than at 107.9MHz. If not, readjust the trimmer for a slightly lower varicap voltage reading at 107.9MHz and check again.

(6) The new trimmer capacitor setting will have altered the voltage at 87.9MHz. This means that L13 will require further adjustment. Set the display to read 87.9MHz and readjust L13 for a reading of about 3V.

(7) Return to 107.9MHz and readjust the trimmer as in steps 4 and 5. Repeat the above process until both voltages are correct.

RF filters

The next step is to align the RF filters so that they track with the local oscillator. This requires two good off-air signals, one near 90MHz and the other around 106MHz. (A complete list of station frequencies appears elsewhere in this issue.)

Note that if there are no local stations near these frequencies or if there is only one FM station, then alignment accuracy will suffer. Where there is more than one station, choose two that are widely separated.

If only one station is available, alignment can only be achieved for that station. When another station begins transmission, the RF stage will require further adjustment.

Alignment of the RF filters requires use of the tuning wand. Here's how it works:

When the ferrite end of the wand is inserted into the coil, it increases the inductance. If the signal level increases, the coil needs to be made more inductive and this is achieved by compressing the coil.

Similarly, when the brass end is inserted into the coil, the inductance is decreased. If the signal level increases, the coil should be made less inductive by opening up the coil windings.

When the coil is adjusted so that the signal level goes down or does not change when the ferrite and brass ends are independently inserted, the coil is correctly tuned. Here's what to do:

(1) Connect an FM antenna to the 75-ohm input. This can be a dipole, an FM Yagi or log periodic (wide band) TV antenna. If the antenna is for a 300Ω termination, a 300-75Ω balun transformer will be required.

(2) Adjust each of the 4.2-20pF trimmers (red) associated with L9, L10 and L12 to about half setting.

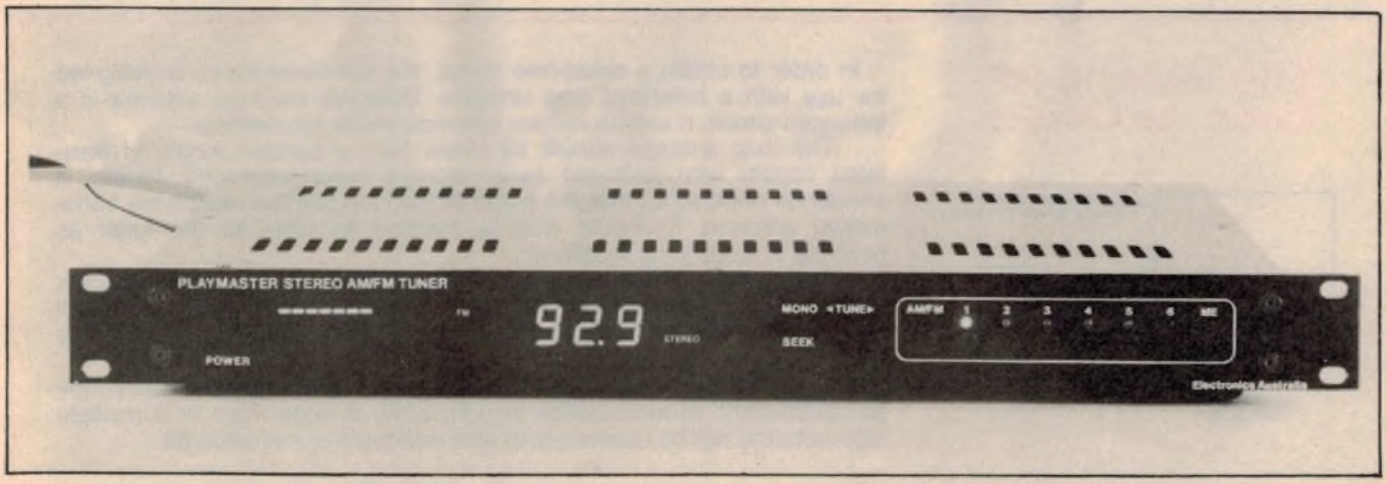
(3) Connect a multimeter between ground and test point TP1, and select the station near 90MHz. Program this station into memory 1 (press ME and memory 1).

(4) Using the tuning wand (see above), adjust L9 and L10 for maximum signal reading on the multimeter. Note that the signal from L9 couples inductively to L10. Do not attempt to alter the 4mm edge to edge spacing between them as set by the PCB hole positions.

During this entire procedure, make frequent checks of the AGC voltage at pin 18 of IC2. If it drops below +5V, temporarily short the AGC line to ground until the adjustment is complete.

(5) Tune L12 for maximum reading with the multimeter connected to TP1. Don't forget to check the AGC. (Note: it would be nice to have two multimeters, one to monitor TP1 and the other to monitor the AGC).

(6) Select the station near 106MHz and program this into memory 2. Ad-



Our new Playmaster tuner offers stereo AM performance matching that of professional studio monitors.

Playmaster stereo tuner

just the 4.2-20pF trimmer capacitors (red) with the alignment tool for a maximum reading (meter on TP1). Note: always check the reading after the tool has been removed from the trimmer.

(7) Return to the memory 1 frequency and re-align the coils again using the tuning wand. Re-adjust the trimmers at the memory 2 frequency. Repeat this procedure until the coils and trimmers both peak without further adjustment.

(8) Adjust L15 for a maximum signal when receiving either the memory 1 or memory 2 frequency.

(9) Impregnate the coils in the FM front end with wax. This is to prevent the coils from vibrating and producing microphonics in the resulting audio.

Quadrature coil

(1) Remove the F16 slug from the tuning wand and screw it into the L16 IF coil.

(2) Tune to a station that gives at least a level six reading on the signal level meter. Connect the multimeter across TP2 and TP3 and adjust L16 for 0V.

Seek adjustment

By now the FM tuner should operate on Seek. The level of signal at which the tuner stops is set by trimpot VR4. Rotate the trimpot until the tuner only stops at stations that give more than level 5 on the signal level display.

This setting stops the tuner at stations that will produce a noise free signal in stereo. You can of course set this control so that the tuner stops at any level of signal desired.

Blend adjustment

The blend adjustment at VR5 sets the signal level below which blending occurs. We opted to keep the stereo signal-to-noise ratio above 40dB. This is shown in the quieting curves published in January 1986.

(1) Connect your multimeter between the wiper of VR5 and ground. Tune to a station that gives level 5 on the signal strength meter.

(2) Adjust VR5 for a reading of 0.8V.

If you cannot find a station that provides a level 5 signal, try adjusting the antenna until the correct signal level is indicated (eg, try using a short length of wire).

Stereo decoder

VR6 must be adjusted so that stereo decoder IC3 can lock onto the 19kHz stereo pilot tone. This can be achieved in one of two ways:

(1) Set the mono/stereo switch to stereo mode.

(2) If a frequency meter is available, temporarily connect a 15kΩ resistor between the 19kHz output at TP4 and the positive supply. Note that there are two PC stakes provided for this. Connect the meter to TP4.

(3) Disconnect the antenna, tune to a vacant spot on the band and adjust VR6 for a reading of 19kHz on the frequency meter. Remove the 15kΩ resistor.

Note that the circuit diagram shows TP4 at ground potential. This is an error — TP4 should go direct to pin 16 of IC3.

(4) If no frequency meter is available, tune to a station and adjust VR6 for stereo indication on the front panel. Rotate the trimpot clockwise and find the position where the stereo switches off. Now rotate the trimpot anti-clockwise and find the position where stereo ceases.

The correct position for VR6 is midway between these two locations.

19kHz filters

The 19kHz notch filters are tuned by adjusting coils L18 and L19 and trimpots VR7 and VR8. This requires an audio signal generator. If no audio signal generator is available, ignore this step.

(1) If a frequency meter is available, set the output frequency of the audio generator to exactly 19kHz.

(2) If no frequency meter is available, the following method will allow the audio generator to be set to give a highly accurate 19kHz signal. It requires an audio amplifier and a loudspeaker.

Switch off the tuner and solder a 15kΩ resistor between TP4 and the adjacent PC stake for the positive supply of the FM tuner. This done, connect a 22kΩ resistor between TP4 and the input to the amplifier.

Finally, connect a 100kΩ resistor between the audio generator output and the same input of the amplifier.

Switch on the tuner and tune into a station broadcasting in stereo. The 19kHz output from TP4 will now beat with the audio oscillator output and this can be heard via the loudspeaker. Adjust the frequency of the audio generator until no beat note is heard.

The audio generator frequency will now be within about 20Hz of 19kHz.

(3) Alternatively, if a dual trace oscilloscope is available, compare the 19kHz output at TP4 with the audio generator frequency. Use the XY position on the timebase control to display a Lissajous figure. Both frequencies are the same when the trace does not rotate.

(4) Now cut the input link to IC3 (as marked on the overlay diagram) and apply the 19kHz signal from the audio generator to the IC3 side of the link.

The Balanced Loop Antenna

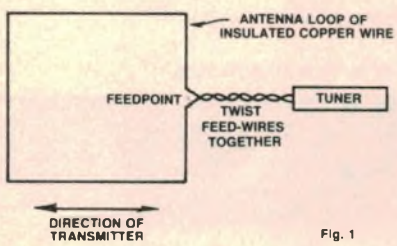


Fig. 1

In order to obtain a noise-free signal, the AM tuner circuit is designed for use with a balanced loop antenna. Because the loop antenna is a balanced circuit, it acts to reduce common mode interference.

The loop antenna should be made from a suitable length of insulated copper wire arranged as an upright rectangular loop. Ideally, it should be oriented so that the plane of the loop points towards the transmitting antenna. It should also be located as close to the tuner as possible to avoid long feedwires.

The pickoff point should be half way up one vertical side of the loop, preferably the side furthest away from the transmitter. The two feedwires should be twisted together and run to the antenna inputs of the tuner as shown in Fig.1.

In strong signal areas, a small loop which surrounds a window may be satisfactory. In most cases though, a much larger loop or a multiple loop antenna will be necessary to give adequate signal strength.

SERIES 5000

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WHILE OUR CURRENCY IS DEVALUING PRICES WILL RISE, SO BE QUICK!

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POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER....

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- Alumimium case as per the original article.
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SPECIFICATIONS: 150 W RMS into 4 ohms.
POWER AMPLIFIER: 100W RMS into 8 ohms (+ = 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0= 0.4 dB 2.8Hz to 65KHz, +0 = 3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100W ouput.
HUM: 100 dB below full output (flat).
NOISE: 116 dB below full output (flat, 20KHz bandwidth).
2nd HARMONIC DISTORTION: -0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + = 56V SUPPLY rated at 4A continues -0.0003% for all frequencies less than 10KHz and all powers below clipping.
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W. (50Hz and 7KHz mixed 4:1).
STABILITY: Unconditional.

Cat. K44771 **Will be $359, limited stock available at $339**
Assembled and tested $549
packing and post $10

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- Specially imported black anodised aluminium knobs.

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good!)

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz = 130KHz +0 = 1dB
Low-Level input-conforms to RIAA equalisation + = 0.2dB
DISTORTION: 1KHz -0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V)-92dB flat -100dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected -86dB flat/92dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200uV input signal: -71dB flat -75dB A-weighted.

Cat. K44791 **Will be $319, limited stock availble at $299**
Assembled and tested $599
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz
NOISE: -0.008mV, sliders at 0, gain at 0(=103dB0).
20KHz BANDWIDTH DISTORTION: 0.007% at 300mV signal, sliders at 0, gain at 0, maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12Hz = 105KHz, +0, = 1dB, all controls flat
BOOST AND CUT: 14dB

Cat. K44590 1 unit: **will be $219, limited stock availble at $199**
2 units: **will be $429, limited stock available at $194**
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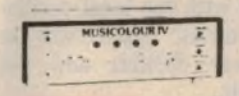
SERIES 4000 SPEAKERS

8 Speakers On	**$349**
8 Speakers with Crossovers	**$579**
Speaker Boxes (assembled with grill and speaker cutout)	**$349**
Crossover Kits	**$249**
Complete kit of parts (speakers, crossovers, screws, innerband boxes.)	**$899**
Assembled, tested and ready to hook up to your system	**$995**

Errors and Ommissions Excepted

ELECTRIC DUMMY LOAD

With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests.
(ETI Oct '80) ETI 147
Cat. K41470 **$129**

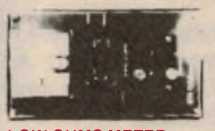


MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.
(EA Aug '81) 81MC8
Cat. K81080 **$99**

PH METER KIT

Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3 1/2 digit liquid crystal display and resolution to .01 pH units, making it suitable for use in the laboratory as well.
(EA Dec. 82) 82PH12
Cat. K82123 **$135**



LOW OHMS METER

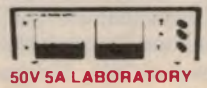
How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms.
(ETI Nov. 81) ETI 158
Cat. K41580 **$39.50**

EPROM PROGRAMMER EP1

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.
(EA Jan. 82) 82EP1
Cat. K82013 **$79.95**
(Including Textool Socket)

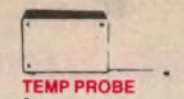
PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov. 83) 83MA11
Cat. K83110 **$14.95**



50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
(Ea May-June 83) 83PS5
Cat. K83050 **$169**



TEMP PROBE

Can measure temperature from -50 to 150-c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1-c resolution of 0.1-c.
(ETI June 83) ETI 153
Cat. K41530 **$26.95**

LOW BATTERY VOLTAGE INDICATOR

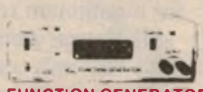
Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure and makes a handy beginner s project.
(ETI 280, March '85)
Cat. K42800 **$7.95**

DUAL TRACKING POWER SUPPLY

Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages up to 2A. In addition the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway.
(EA March 82) 82PS2
Cat. K82030 **$109.00**

MODEL ENGINE IGNITION SYSTEM

Get sure starts every time and no more glow plug burnouts on your model engines.
(ETI June 83) ETI 1516
Cat. 55160 **$49.50**



FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting.
(EA April '82) 82AO3A/B)
Cat. K82040
Cat. K82041 **$109**

CAR IGNITION KILLER

Most car burgular alarms are easily circumvented, but not this cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable -- a sure deterent to thieves! (EA Feb. 84) 84AU1
Cat. K84010 **$19.95**
(Our kit includes the box!)

CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Cudlipp can be used to bug your home, office etc! Great fun! (EA Feb. 82) 82EG2
Cat. K82022 **$12.95**

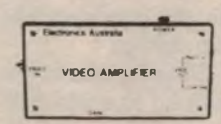
MICROBEE ENHANCER 1

This amazing kit for the Microbee is a must for all Microbee owners! Most expansion units up to this time offered at best only one or other features, and this made it impossible to run, for example, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit.
The Enhancer 1s many powerful features inlcude:

- Two ATARI/COMMODORE/ COLECO/SEARS type joystick inputs.
- Two TRS COLOUR COMPUTER type joystick inputs.
- Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trakballs, Mice, temperature senors, lights level sensors, transducers, etc, etc!!
- A 4 voice music/sound effects sythesizer.
- A real time clock.
- Unlimited vocabulary speech synthesizer (option).
- Parallel printer interface (option).
- A built-in speaker with volume control.
- Listings of all necesary routines for use.
- An impressive demonstration program package.
- Compatible to all Microbees.
- Digital recording and playback of speech and sound.
- An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
- A digital to analog converter with selctable resolution from 1 8 bits.
- Allows automatic data acquisition and logging.
- 5 digital input lines, 4 digital ouput lines.
- A voice input channel.
- A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital ouputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your HI FI), 3 high resolution voltage comparators, DAC output etc.

The amazing Microbee Enhancer is available exclusively from Rod Irving Electronics.

$149



VIDEO AMPLIFIER

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.
(EA Aug. 83) 83VA8
Cat. K83081 **$18.95**

BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188,288, 82S23 & 82S123 etc.
(ETI June 83) ETI 688
Cat. K46880 **$49.50**

HUMIDITY METER

This project can be built to give a readout of relative humidity either on a LED dot-mode display or a conventional meter. In addition it can be used with another project as a controller to turn on and off a water mist spray in a hothouse, for example. (ETI May '81) ETI-256
(Includes humidity sensor $19.50)
Cat. K52460 **$29.50**

12-240V DC-AC INVERTER

INLCLUDING 300 WATTS TRANSFORMER

This EA inverter is capable of driving mains appliances rated up to 300VA and features voltage regulation and full over load protection.
(EA June '82) 82IV6
Nominal Supply: Voltage 12V DC
Output: Voltage see table
Frequency: 50Hz - .005%
Regulation: see table
Maximum Load: 300VA
Current Limiting: 30A (primary)
Efficiency: see table

Resistive Load Watts	Output Voltage (RMS)	Input Current (A)	Efficiency (%)	Battery life 40Ah-20h Rate (minutes)
0	210	1.2	0	-
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

P&P $10.00 Anywhere in Australia
Cat. K82062 **$195**

NAIL FINDER

Essential for electricians and handymen. The Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces, as well as locating pipes and wiring behind walls. (EA Oct. '83)
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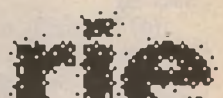

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Errors and Omissions Excepted

Note that the signal level from the generator should not exceed 3V RMS. If the generator cannot supply this amount of signal, set the level to maximum.

Use your multimeter to monitor the resulting 19kHz left and right audio outputs. This should be set to AC millivolts. Note that most digital multimeters will not measure at 19kHz, so it will be necessary to resort to a standard moving coil meter. Alternatively, use an oscilloscope.

(5) Adjust the tuning slug L18 for a null in the left channel. This done, adjust VR7 for best null. Similarly, adjust L19 and VR8 for the right channel.

(6) Switch off, remove the 15kΩ and 22kΩ resistors, and remake the link to IC3.

AM tuner local oscillator

As with the FM tuner, alignment of the AM tuner begins with adjustments to the local oscillator.

(1) Select AM by pressing the AM/FM switch.

(2) Connect a multimeter between ground and the emitter of Q4 and adjust trimpot VR1 for a reading of 1.6V. This sets the output level of the local oscillator.

(3) The next step is to set the local oscillator range which must be from (522 + 450kHz) to (1611 + 450kHz). As for the FM tuner, this is achieved by measuring the varicap voltage.

Rotate the green 3-30pF trimmer capacitor associated with L5 to about half-setting.

(4) Connect a multimeter between ground and the link marked "varicap voltage". Set the AM display to read 522kHz and adjust the slug in L5 for a voltage reading of 1.2V.

(5) Press the TUNE down switch to select 1611kHz on the display. Adjust the trimmer capacitor for a reading of about 27V.

Note that the alignment tool may affect the oscillator, so always check the voltage after the alignment tool has been removed.

(6) Tune to 1602kHz and check that the varicap voltage is lower than at 1611kHz. If not, readjust the trimmer for a slightly lower varicap voltage at 1611kHz and check again.

(7) Repeat steps 4 and 5 and continue until the voltages at each frequency are correct.

Note that if you cannot arrive at the correct voltages, the oscillator level should be slightly re-adjusted and the procedure repeated.

RF filters & IF stage

The RF filters must now be aligned so that they track with the local oscillator. Two strong off-air signals will be required, one near 603kHz and the other near 1395kHz.

If local stations are not near these frequencies, choose the two that are furthest apart. The low frequency station can be as low as 531kHz, while the high frequency station can be anywhere above 1206kHz.

To receive these, you will need to construct a balanced loop antenna. This should be connected as shown in Fig.1.

(1) Adjust the two trimmers associated with L1 and L2 to about half setting. Also, adjust the slugs in L1 and L2 so that they protrude slightly from the metal can. This will very roughly align the front end.

(2) Connect the multimeter between ground and the AGC point at the 100kΩ resistor (near D8) as indicated on the overlay diagram.

(3) Select the station near 603kHz and program this into memory 1. Adjust the slugs in L1 and L2 for a minimum reading on the meter.

(4) Tune the station near 1395kHz and program this in memory 2. Adjust the trimmers associated with L1 and L2 for a minimum reading on the meter.

(5) Repeat steps 3 and 4 and continue until the coils and trimmers require no further adjustment.

(6) Tune in any station that provides good signal strength. Adjust the slugs in L3 and L4 for a minimum reading on the meter.

Checking tracking performance

The AM section is now aligned at two frequencies; ie, those programmed into memories 1 and 2. At other frequencies, however, the alignment may not be satisfactory. This can be checked by selecting six stations which are spread evenly from the low frequency end of the band to the high frequency end.

(1) Program the six selected stations into memory.

(2) Select each station in turn and rotate VR1 slightly in either direction from its set position. Check that the AGC level is close to a minimum for each station — ie, within about 0.25V. Return VR1 to its original setting after each station has been checked.

If tracking is good across the band, you can skip the next section and proceed straight to the stereo decoder. On the other hand, if the alignment is out for some stations, the oscillator and RF stages will require further adjustment.

This will involve adjusting the varicap voltage range for the local oscillator and retuning the RF stages.

The main tracking problem is likely to be at the low frequency end of the AM band. To cure this, the maximum capacitance of the varicaps should be reduced by increasing the varicap voltage at the low frequency end of the band.

(3) Disconnect the multimeter from the AGC and reconnect it between ground and the link marked "varicap voltage". Now select 522kHz and increase the voltage from 1.2V to 1.7V by adjusting the slug in L5.

(4) Repeat steps 5, 6 and 7 in the section "AM tuner local oscillator". Note that VR1 may require further adjustment to accommodate the new range of varicap voltage.

(5) Retune the RF coils as described above under the heading "RF filters and IF stage". Check again for correct tracking and repeat this process until tracking performance is satisfactory. Note, however, that it is impossible to obtain perfect tracking right across the band.

Seek control

(1) Press the SEEK control and check that the tuner stops on the next local station higher up the frequency band.

(2) In most cases, the sensitivity of the SEEK control will be satisfactory for local stations. To increase the sensitivity, increase the 33pF capacitor at the base of Q3 and vice versa.

An alternative here is to replace the 33pF capacitor with a yellow 6.8-48pF Murata trimmer capactor. The trimmer can then be adjusted to provide optimum sensitivity for the SEEK control.

Stereo decoder

(1) Tune in a station (either stereo or mono) and measure the voltages at pins 10 and 19 of IC4 (MC13020P). These should both be about 4V with respect to ground.

9kHz notch filters

The left and right channel notch filters comprise L6 and VR2 for the left channel and L7 and VR3 for the right

channel. These require adjustment to null out the 9kHz tone generated by adjacent stations.

(1) If a frequency meter is available, set the output frequency of the signal generator to 9kHz.

(2) De-solder the positive ends of the 1μF capacitors at pins 7 and 8 of IC4. Connect the signal generator output to each filter input in turn and monitor the corresponding audio output with a moving coil multimeter set to AC volts.

Note that up to 3V RMS can be supplied to the filter inputs. If the generator cannot supply this level, then set it for maximum output.

(3) Adjust L6 for a null in the left channel, then adjust VR2 for maximum null. Repeat these adjustments, then adjust L7 and VR3 for the right channel.

(4) If no frequency meter is available, the filters will have to be adjusted by ear. This should be attempted at night when distant stations 9kHz away from the local stations will cause loud 9kHz whistles.

Connect the left output of the tuner to your stereo amplifier, tune to a station with a loud 9kHz whistle and adjust the slug in L6 for minimum whistle. This done, adjust VR2 to eliminate the whistle completely.

(5) Connect the right output of the tuner to the amplifier, disconnect the left, and adjust L7 and VR3 to null out the whistle.

That completes the alignment of the Playmaster Stereo AM/FM Tuner.

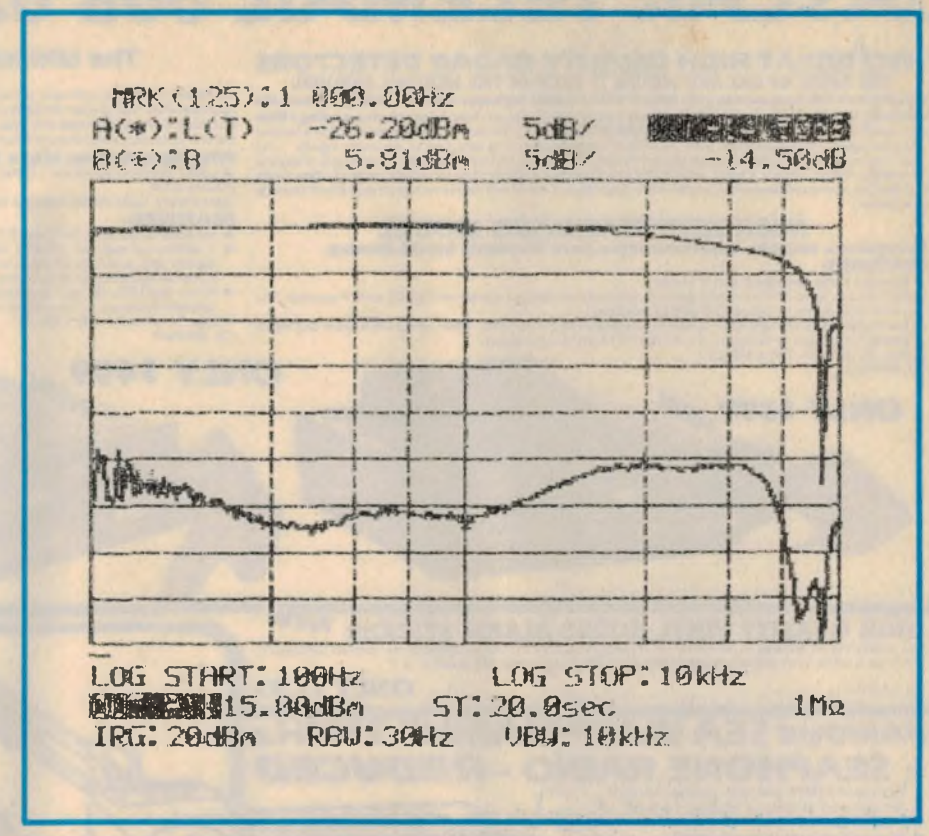
AM bandwidth

Some readers may be keen to experiment with a wider AM tuner bandwidth. This can be obtained by altering the response of the audio output filters, IC7a and IC7b.

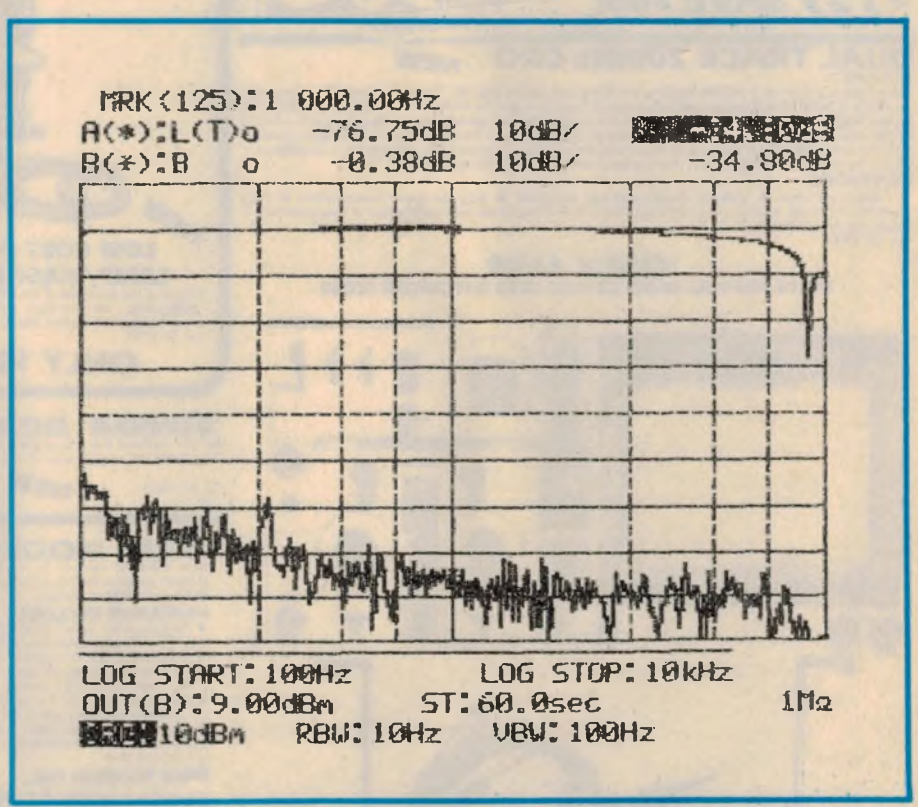
For example, if the .0018μF capacitors are changed to .0082μF, the 18kΩ resistors to 5.8kΩ, the 22kΩ resistors to 8.2kΩ and the 12kΩ resistors to 3.3kΩ, an overall response that is only 2dB down at 8kHz and 6dB down at 10kHz can be obtained.

Be warned, however, that the wider frequency response will result in high frequency monkey chatter becoming quite noticeable at night, particularly in poor signal areas. In most cases, the original values will provide the best overall compromise.

That's all on the new Playmaster tuner for now. We'll take a break for a few months before describing the infrared remote control. In the meantime, settle back and enjoy the results of your efforts thus far.



This graph depicts frequency response on the top trace (including the notch at 9kHz) and stereo separation for the left channel on the lower trace. Separation is better than 30dB at 1kHz. This performance is very closely matched in the right channel.



This graph shows the frequency response (upper trace) and residual noise (lower trace) with respect to 60% modulation. As shown, the signal-to-noise ratio is better than 70dB. These graphs by courtesy of Radio Manufacturing Engineers Pty Ltd.

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FEATURES:

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- Separate audio alerts for X and K band.
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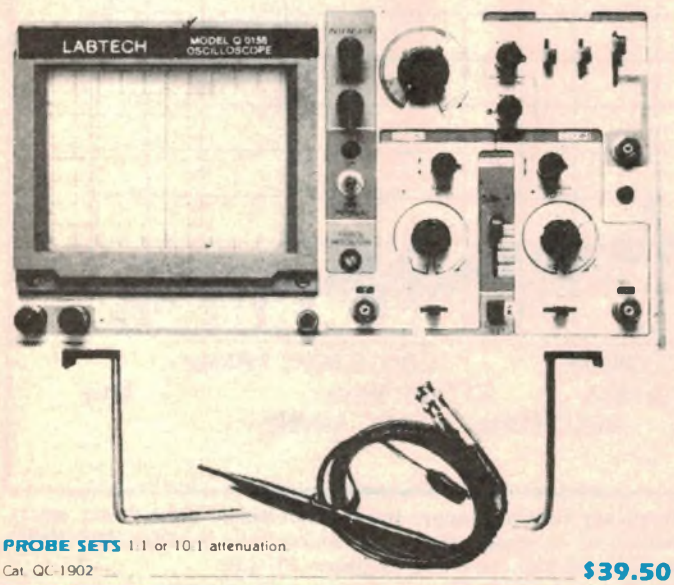

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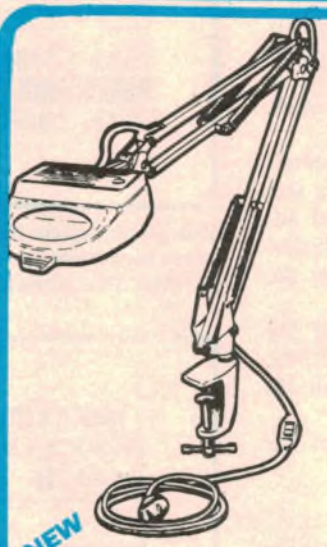

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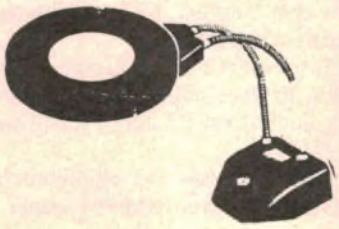

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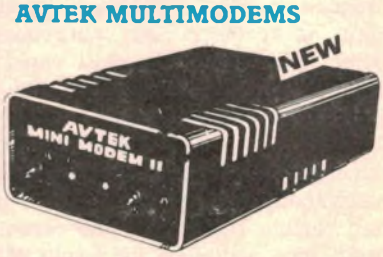

NOT ALL COMPACT DISC PLAYERS ARE THE SAME! NEW

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With this is in mind, Jaycar has concluded an exhaustive technical evaluation of models suitable for inclusion in the 1986 Jaycar Catalogue. We feel that the choice of the **ADC Model CD-100X** player will be welcomed by the technical reader of this magazine.

SPECIAL OFFER - We welcome technical scrutiny of this magnificent CD player. To prove this, we can supply a detailed 40 page technical service manual on the ADC CD-100X. This manual (one of the best we've seen out of Japan) covers theory of player operation, circuit operations, test procedures, test print and waveform illustrations, block diagrams, IC description and schematic diagrams and much, much more!
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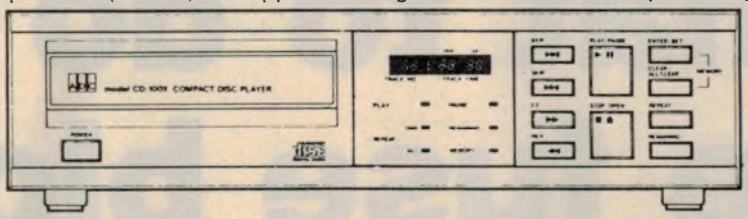

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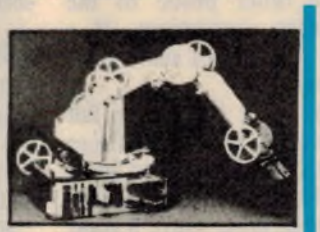

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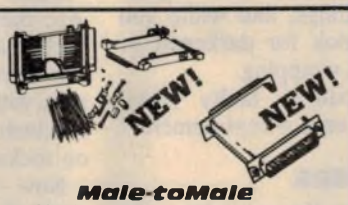

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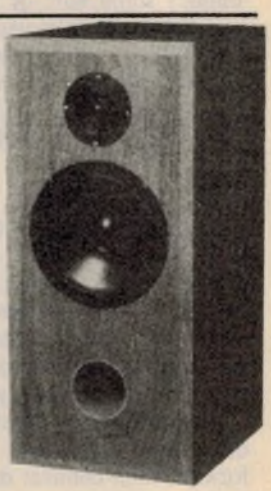

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MAIL ORDER VIA YOUR PHONE

A practical approach to Electronics PART 6

What to do when the fuse blows

You've just completed and checked over your latest kit. With some trepidation, you plug in the power cable and switch on. The fuse blows, or the project won't work properly. Here's what to do.

by KINGSLEY HOWE

First, we will consider what to do if the fuses keep blowing. This usually implies some sort of catastrophic fault and the problem is usually quite easy to find. There are two types of fuses: primary fuses on the mains side of the transformer; and secondary fuses, on the secondary side of the transformer.

Primary fuses

A fuse blowing on the primary (240V) side indicates a wrong connection or a short circuit. On double-pole switches you may have wired the active and neutral leads to the same side. This will place a direct short on the supply when the switch is operated.

To check the primary side for faults, disconnect *both* leads from the transformer, then connect one probe of your multimeter to chassis. Hold the 3-pin mains plug in one hand, set the meter to low ohms range, and place the other probe on the earth pin. The meter should read less than one ohm.

Switch the meter to the high ohms range and test the other two pins (active and neutral) in turn. There should be no meter movement. If there is a reading, the fault may be in the plug, the switch, or there is a wire from the mains terminal block in contact with the chassis.

Rectify the fault, if any. Now reconnect the wires from the transformer. Leave one probe in contact with chassis and connect the other probe to the transformer primary connections. If a reading is found you have a short from this winding to earth.

Perhaps you have let hot solder fall from the iron into the windings. There is no mistaking the smell of burnt insulation from transformer windings, so the next test is with your nose. Have a good sniff near the windings, and while you are down there, look for darkened or distorted insulation wrapping.

You cannot repair a faulty transformer — the only cure is replacement.

Secondary fuses

A fuse blowing on the secondary side indicates excessive current flow.

Remove the transformer secondary leads from the board and connect them to the multimeter probes. Set the multimeter to AC volts and make sure that the probes are not touching each other. Now switch on and note the AC voltage reading. It will probably be 10 to 15% higher than the rated voltage. This is normal and is called the *open circuit voltage;* it will be lower when powering the circuit (ie, under load conditions).

If the reading is found to be lower than the rated voltage, you have shorted turns in the secondary winding. The most important check is now to be made. Remove the mains plug and set the meter to the high ohms range. Leave one meter lead connected to the secondary winding and place the other lead on one of the primary leads.

Any reading here indicates a primary to secondary short. This is potentially lethal. Remove the transformer and cut off all leads to render it unusable.

The transformer is the only isolation between you and the mains. If it passes all the above tests, move onto the next section.

Checking the board

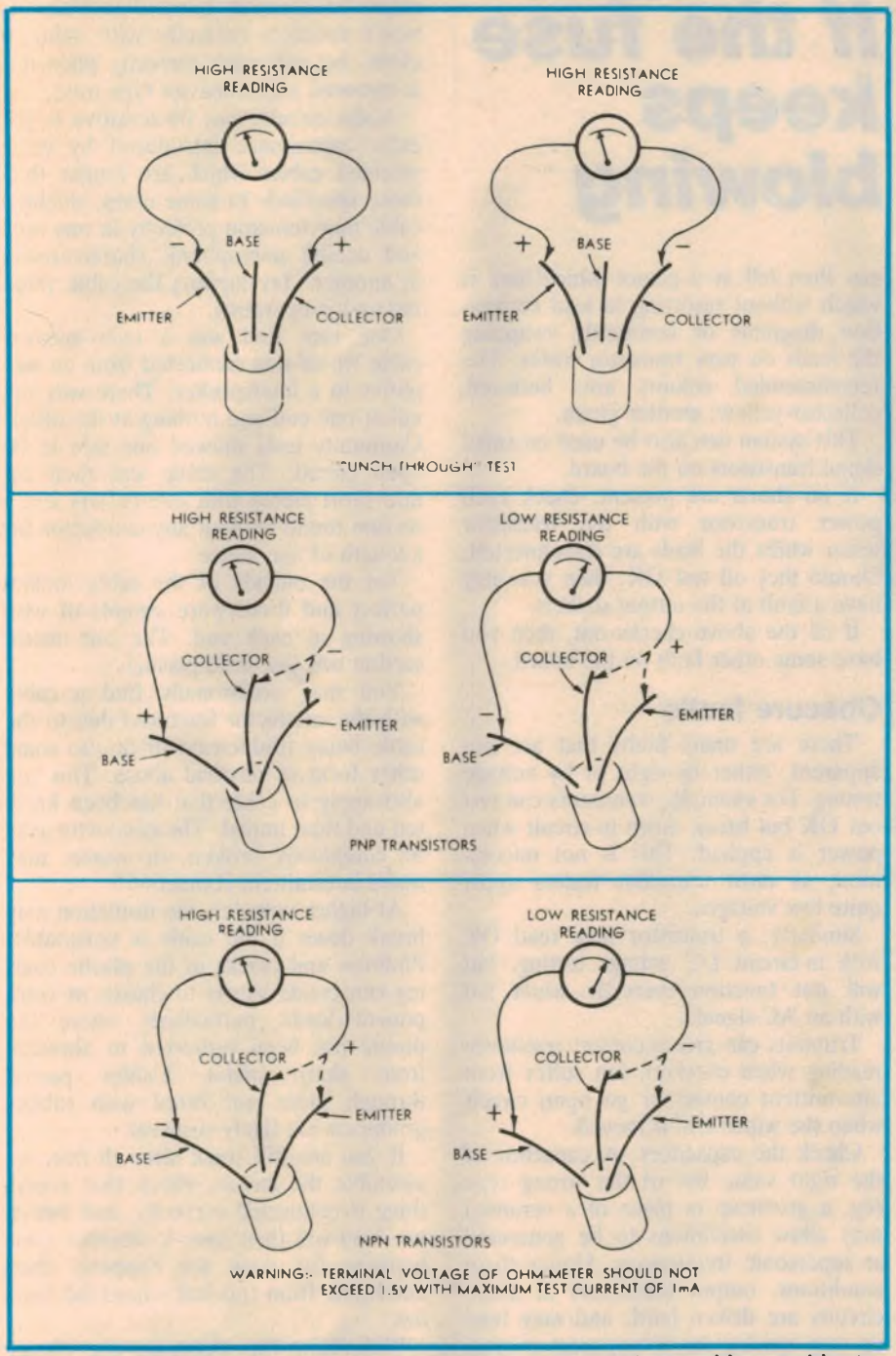
The following procedure assumes that you have checked all components on the PC board as described in previous sections, and are satisfied that all is well.

First, check all leads to the board. Are they in their correct places? Trace each lead away from the board, using the circuit diagram as a guide. Make sure with shielded leads that the centre conductor and shield are not transposed on sockets (input or output).

Now unsolder all earth and shield connections from the board and insulate any that may touch other conductors with tape. Set the meter on high ohms range and connect it between chassis and each of the board supply rails in turn (board pins, etc). There should be no reading.

If there is, you may have a short to chassis, either via a component lead under the board being too long or a path to ground via a screw or nut in the standoff insulators.

If all the above proves clear, head for any power transistors.



These diagrams illustrate a handy method of checking transistors with a multimeter switched to a low ohms range.

Power transistors

To check power transistors, first disconnect all leads. Set the meter to the high ohms range, and check resistance from the collector to the heatsink or chassis. If the needle moves significantly, you have a short from collector to chassis through the insulation washer. This may be due to a burr surrounding the holes, a sliver of metal or solder, or a damaged washer or insulation bush.

If the meter shows a small movement, you may have a short between the base or emitter pins and the heatsink.

It is well worthwhile to cut off short pieces of plastic insulation or spaghetti tubing to slip onto the transistor pins, regardless of how much clearance there is in the heatsink holes. Leave them about 2-3mm shorter than the pins to allow sufficient length for soldering. If the holes are a little off-centre this will prevent the chance of contact.

It is a good idea to establish a colour code standard for transistor connections and to wire the leads to your transistor tester to match this colour code. You

If the fuse keeps blowing

can then tell at a glance which lead is which without resorting to lead connection diagrams or constantly swapping the leads on your transistor tester. The recommended colours are: base-red; collector-yellow; emitter-green.

This system can also be used on small signal transistors on the board.

If no shorts are present, check each power transistor with the transistor tester whilst the leads are disconnected. Should they all test OK, then you may have a fault at the output sockets.

If all the above checks out, then you have some other fault on the board.

Obscure faults

There are many faults that are not apparent, either by sight or by voltage testing. For example, transistors can test out OK but break down in-circuit when power is applied. This is not uncommon, as most transistor testers apply quite low voltages.

Similarly, a transistor may read OK with in-circuit DC voltage testing, but will not function correctly when fed with an AC signal.

Trimpots can give a correct resistance reading when checked, but suffer from intermittent contact or go open circuit when the wiper arm is moved.

Check the capacitors. A capacitor of the right value but of the wrong type (eg, a greencap in place of a ceramic) may allow oscillations to be generated at supersonic frequencies. Under these conditions, output transistors in audio circuits are driven hard, and may heat up very quickly for no apparent reason. It is important to use the exact parts nominated for each section. Substitution can cause a lot of problems.

With small-signal transistors, plastic-cased types can be replaced with metal-cased equivalents. In a majority of cases they will function correctly. However, under certain conditions, metal-cased types such as BC108 etc may exhibit parasitic oscillation.

Sloppy wiring and excess lead length can contribute their own share of problems, so keep the leads neat and tidy, as shown in the circuit layout.

Using cables longer than those specified may cause hum pickup from the mains transformer. Some digital circuits won't function correctly with rainbow cable, but will work correctly when this is removed and a heavier type used.

Audio circuits may be sensitive to the extra capacitance introduced by using shielded cables which are longer than those specified. In some cases, shielded cable may function perfectly in one area and exhibit microphonic characteristics in another. Try tapping the cable when the unit is operating.

One rare find was a twin speaker cable which was connected from an amplifier to a loudspeaker. There was signal at one end and nothing at the other. Continuity tests showed one side to be open circuit. The cable was then cut into short pieces with side cutters and a section found without any conductor for a length of one metre.

Yet the outside of the cable looked perfect and there were strands of wire showing at each end. The one metre section was just solid plastic!

You may occasionally find a cable with the conductor fractured due to the cable being trodden on or due to some other form of physical abuse. This can also apply to cable that has been knotted and then untied. The conductor may be completely broken, or worse, may make intermittent contact.

At higher voltages, the insulation may break down if the cable is unsuitable. Pinholes and cracks in the plastic coating can create shorts to chassis or component leads, particularly where the plastic has been subjected to abrasion from sharp metal. Cables passed through holes not fitted with rubber grommets are likely suspects.

If you are still stuck after all this, reassemble the circuit, check that everything is connected correctly, and switch on. You will then have to observe what happens (or does not happen), then determine from this just where the fault lies.

With ICs, for example, the circuit may work well with some brands, but not others. Although ICs will fall within the specifications stated for a particular type number, this does not mean that they will operate in every application. There are sometimes slight differences due to the manufacturing techniques employed by each maker. Some require a higher amplitude signal, or a faster rise time, or longer pulse duration.

In some cases, a manufacturer will state that his IC will require an external component, such as a resistor or capacitor between pins, or to a supply rail, to enable the device to function. This may apply to only one brand, all other

brands having incorporated these components on the chip.

Other points to watch are with operating voltages. With CMOS ICs, the normal operating range is from 5 to 15V, however AD, AE and AK types will operate from supply voltages down to 3V. If the IC type number contains a 'B', this means that the IC is "buffered" and has diodes for static protection. These buffered types may not work in some circuit applications.

Note: *Electronics Australia* circuits are designed to take IC differences into account, or will specify the exact type or brand of IC. Be sure to use the correct type in such cases and read the text carefully for any special comments.

Audio amplifiers

Before switching on, check that the centre tap from the supply transformer is correctly connected to the board. Do not replace the fuses. Instead, buy two 100mA fuses (in the case of stereo amps) and blow them by connecting them directly across a battery.

Now solder a 100Ω resistor across each fuseholder in place of the fuse wire and fit them to the PC board. This is neater than soldering on to the fuse clips. Just place a blob of solder on each end cap then place the lead on it and apply heat with the iron. If the resistors do burn out, they are easily replaced.

Should the board not be fitted with fuseholders, cut the supply rail, copper track, to each channel with a sharp knife and solder the resistors across the cuts. Do not connect the loudspeakers at this stage.

Now switch on. If the resistors hold out, it is probably safe to insert the correct fuses. If either resistor goes up in smoke, you still have a fault. It is time to seek outside help.

Partly working amplifiers

If an amplifier is partly working, the best approach is to compare voltage readings taken from each channel. If one side is operating correctly, choose several test points and list the voltage at each point. Now measure and write down the voltages at the corresponding points on the faulty channel. Small variations will usually be due to component tolerances and can generally be ignored.

Large differences, however, indicate a definite fault at or near the point where the measurement was made. Sometimes very little difference can be found. In such cases look carefully at the meter. The needle may be wandering about or jittering. You may have a poor connection, a bad transistor, a leaky capacitor or a cracked resistor.

Check all wiring to and from the board. With audio leads, the signal and shield may be transposed on the socket or board. Watch out for faulty potentiometers. These may range from open circuit to intermittent in operation, the wiper not making proper contact with the track. Sometimes tapping the pot with a screwdriver handle will produce a crackling sound.

Overloading an input will cause distortion (eg, feeding a tuner signal into a magnetic phono input).

Other causes of distortion can be located with the aid of a signal tracer. Apply a signal to the input socket, preferably from a music source, and connect the tracer probe to the volume control input.

If you hear a distorted signal, the fault is in the preamplifier; if not, the fault is in the power amplifier section.

Begin at the input of the faulty section and apply the tracer probe to the base of each transistor, moving one stage at a time towards the output. The volume should increase at each stage due to transistor amplification. Be careful not to short out any transistor leads when using the signal probe.

When the signal is found to be distorted, move the probe back one stage, to where the signal is clear. The fault is somewhere between these two points.

Some handy hints

It is a good idea to always discharge the main filter capacitors before probing around inside electronic equipment. This should be done using a discharge lead.

To make a suitable discharge lead, solder two short lengths of hookup wire to a 10kΩ resistor and cover the resistor with plastic tubing or insulation tape. Terminate the other ends of the leads with insulated crocodile clips.

This discharge lead should be clipped across the capacitor terminals and left on for 20-30 seconds to ensure that the capacitor is completely discharged. Never directly short the capacitor terminals together. The resulting heavy current flow could damage the capacitor.

Finally, make sure that you always unplug the power cable when soldering on the PC board. This is both for reasons of personal safety and to prevent component damage due to discharge currents flowing via the soldering iron tip and power cable to chassis.

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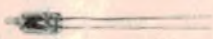

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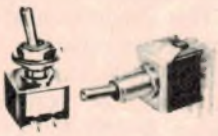

		Were	Now	10 Up
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S 1015	SPDT PCB	2.50	1.85	1.59
S 1020	DPDT	2.25	1.50	1.39
S 1025	SPDT centre off	2.25	1.50	1.29
S 1027	SPDT centre off PCB	2.74	1.80	1.68
S 1030	DPDT centre off	2.75	1.79	1.52
S 1035	DPDT PCB	2.75	1.79	1.52
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Now there's no need to pay $10 or $12 for a circuit breaker. The all new Altronics product is USA Underwriters Laboratories listed (and that speaks for itself) and once again is an Altronics Price Breakthrough.

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- Will trip within 1 hour at 125% of load at 25 deg.C.
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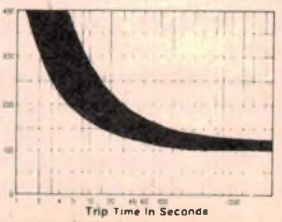

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S 5510	10 amp rated	~~$3.95~~	$3.60
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H 1022	Hex Nut	500	6.50
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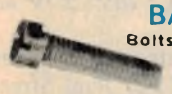

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H 1047	4BA x 6mm	500	6.50
H 1050	4BA x 12mm	25	1.05
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H 1062	6BA x 12mm	500	8.50
H 1070	Nut Hex 4BA	25	1.10
H 1072	Nut Hex 4BA	500	16.50
H 1080	Nut Hex 6BA	25	1.10
H 1082	Nut Hex 6BA	500	13.75
H 1090	4BA S/Proof Washer	50	1.10
H 1092	4BA S/Proof Washer	500	6.60
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Available in two handy sizes.

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H 1710	Tele.cable	50	2.95
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H 1720	Coax cable	50	3.30
H 1722	Coax cable	200	8.95
H 1730	7-9mm cable	30	1.95
H 1732	7-9mm cable	200	9.50
H 1740	10-12mm cable	20	1.65
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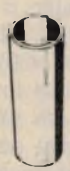
H 1372	12mm	6	1.05
H 1373	12mm	100	12.00
H 1375	25mm	4	1.05
H 1376	25mm	100	16.50



TAPPED 4 BA

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H 1380	9mm	100	10.50
H 1383	12mm	8	1.35
H 1384	12mm	100	13.75
H 1387	25mm	4	1.10
H 1388	25mm	100	19.25

For Order Despatch Details and Dealer List See Page 17

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New Products...

Product reviews, releases & services

Lightweight video camera

Recently released by JVC is the VideoMovie GR-C2 lightweight movie camera with auto-focus and an electronic viewfinder. The new camera uses the compact VHS-C cassette to produce a camera weighing just 2.1kg.

Other features include a 6:1 power zoom lens, an automatic white fader, an automatic gain control and automatic white balance. In addition, VideoMovie automatically rewinds slightly at the end of each recorded segment so that the transition between segments will be smooth and clear of visual noise.

For playback, the VHS-C cassette is simply inserted into an adaptor and then played on a conventional VHS VCR.

For further information contact Hagemeyer (Australasia) B.V., 5-7 Garema Circuit, Kingsgrove 2208. Telephone: (02) 750 3777.

Industry-standard 12-bit A/D converter

Analog Devices has now released the first single-chip version of the industry-standard 574 12-bit analog-to-digital converter (ADC).

The new ADC includes a microprocessor interface, clock and reference on the one chip. Because of the AD574A's high resolution and low cost price, it is perfect for use in data acquisition systems for process control and test applications.

The converter features three-state output buffers for direct interface with 8, 12 or 16-bit buses, and a 250ns bus access time. The ADC's internal reference is trimmed to 10.00V, and the device offers four calibrated input voltage ranges: 0 to 10V, 0 to +20V, ±5V and ±10V.

For further information contact Parameters Pty Ltd, 25-27 Paul Street, North Ryde 2113. Telephone: (02) 888 8777.

Autoranging

Just released by Altronics, the Labtech Q-1075 is a compact, 3½-digit multimeter with full autoranging for voltage and resistance measurements. In addition, it features two user selectable current ranges and has an interesting memory function.

The primary control for the DMM is a large 5-position rotary switch located on the front panel immediately below the display. Initially, range selection is automatic, but manual override can be achieved by means of a small pushbutton to the right.

Two more pushbutton switches select DC/AC volts, ohms/low ohms and the memory function.

Both range and mode selection are accompanied by an audible beep, with the selected mode indicated on the display. The beeper is also available for continuity testing.

The memory function is basically an auto-zero. Once entered, the memory value is subtracted from subsequent inputs. This could be used, for example, to cancel the resistance of long test leads for resistance measurements. This is an uncommon feature for an instrument costing less than $100, but is well worthwhile.

Top-of-the-range stereo cassette deck

TOP DOG IN THE JVC cassette deck range, the DD-VR77B boasts a seemingly endless array of facilities. Features include Dolby B and C noise reduction, provision for metal tape, an auto-reverse direct-drive mechanism, a "Multi-Editor" facility which lets the user automatically fade music in and out, and microprocessor control of search and playback facilities. Recommended retail price is $899.

For further information, contact Hagemeyer (Australia), 5-7 Garema Circuit, Kingsgrove, NSW 2208. Phone (02) 750 3777.

digital multimeter

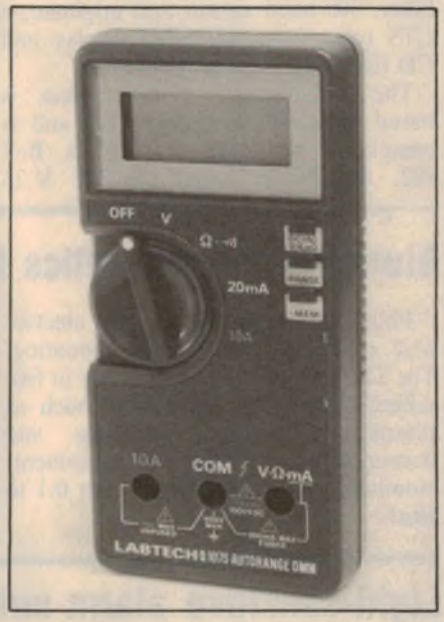
Basic specifications of the Q-1075 are as follows: DC volts — 5 ranges to 1000V; AC volts — 4 ranges to 750V AC; resistance — 5 ranges to 2MΩ and 4 low-power ranges to 2MΩ. Accuracy is 0.5% + 1 digit on DC volts; 0.75% + 5 digits on AC volts; and 0.75% +1 digit for current measurements up to 20mA.

The input impedance is 10MΩ or better. These figures compare favourably with other instruments in the price range.

A relatively minor criticism is that the battery and fuse are only accessible by removing the rear panel. There is no battery compartment as such.

Other aspects of the mechanical construction are commendable. The PCB is uncluttered and should be easy to service. Actually, there is really very little to the circuit other than a surface-mounting 60-pin chip. This has made for a compact unit that slips easily into a shirt pocket.

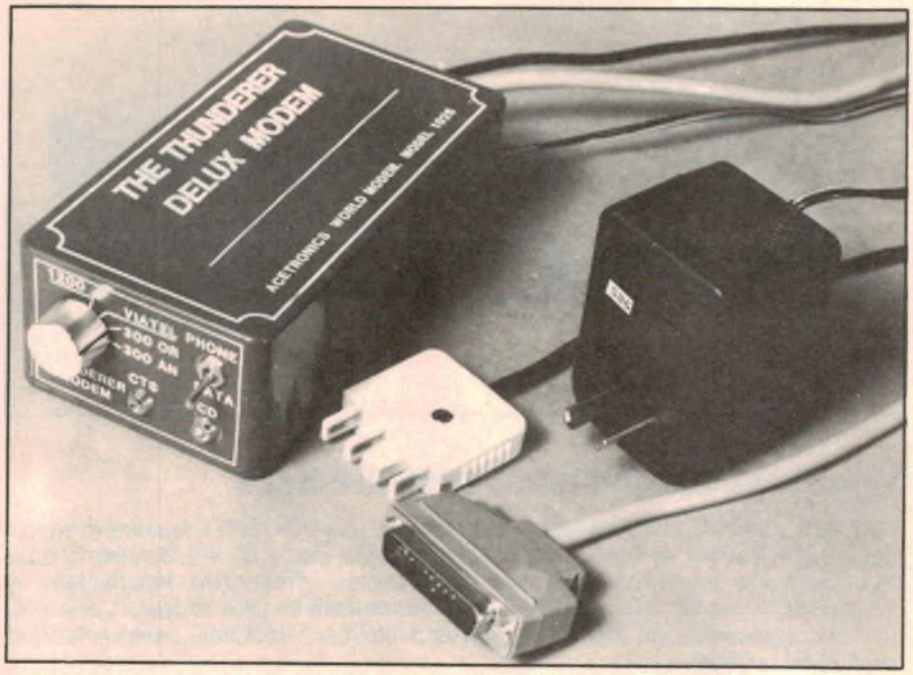
Supplied with the Labtech Q-1075 are a couple of good-quality probes with shrouds to prevent the user from accidental contact with dangerous voltages. Optional accessories include a carry case and a protective rubber holster.



The Labtech Q-1075 is priced at $89.95, which is excellent value for a 3½-digit autoranging DMM. The carry case and holster are available for $9.50 each.

For further information, contact Altronics, 105 Stirling St, Perth 6000. Telephone (09) 328 1599.

New Products...



The Thunderer mini modem

This new modem from Acetronics PCBs offers a number of features not normally accommodated in a unit of this size. These include: 75/1200 Viatel capability, 300 baud answer and originate, a CTS (clear to send) LED display and CD (carrier detect) LED display.

The "Thunderer" mini modem is based on a world modem chip and is compatible with Bell 103/113/108, Bell 202, CCITT V.21 and CCITT V.23 specifications. Dimensions are 150 x 80 x 50mm (L x W x D).

The Thunderer comes with a two year guarantee and is priced at $230 without a telephone, or $250 with a pushbutton/last re-dial telephone.

For further information contact Acetronics PCBs, 112 Robertson Road, Bass Hill, 2197. Telephone: (02) 645 1241.

Aluminium electrolytics for surface mounting

Philips have solid aluminium electrolytic capacitors for surface mounting. The 126-series cases are available in five different sizes for applications such as filtering, smoothing, coupling and decoupling in all types of equipment. Nominal capacitance ranges from 0.1 to 68μF.

The capacitors are encapsulated in blue cases closed at both ends by soldered copper caps. They are available on tape or in bulk.

For further information contact Philips Electronic Components and Materials, 11 Waltham Street, Artarmon. Telephone: (02) 439 3322.

Light-sensitive alarm unit

Recently introduced by Dick Smith Electronics, the "Don't Touch" light-sensitive alarm can be used to secure medical cabinets, kitchen and workshop drawers, or office filing cabinets.

Don't touch features a light-sensitive trigger circuit and sounds an audible alarm when exposed to light for a period of 10 seconds. The device is battery-powered and is available from Dick Smith stores throughout Australia. The price $12.95.

For further information contact Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, 2113. Telephone: (02) 888 3200.

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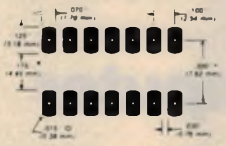
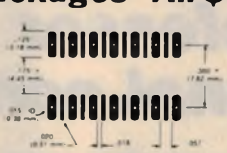


Cut Pad

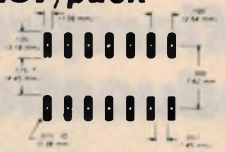
No. of Leads	Qty/ Pkg.	Scale	Catalog Number
14	32	1X	EZ8014
	28	2X	EZ8038
16	32	1X	EZ8004
	28	2X	EZ8109
18	28	1X	EZ8900
	26	2X	EZ8901
24	12	1X	EZ8535
	12	2X	EZ8536
28	12	1X	EZ8003
	12	2X	EZ8904
40	8	1X	EZ8906
	8	2X	EZ8907



Cut Pad With Conductors

• Use where conductor traces must be routed between pads

No. of Leads	Qty/ Pkg.	Scale	Catalog Number
14	32	1X	EZ8760
	28	2X	EZ8761
16	32	1X	EZ8762
	28	2X	EZ8764
40	8	1X	EZ8884
	8	2X	EZ8885



Narrow Cut Pad

• Use where a longer terminal area is desired. Can be used with conductors between terminals.

No. of Leads	Qty/ Pkg.	Scale	Catalog Number
14	32	1X	EZ8013
	28	2X	EZ6071
16	32	1X	EZ8453
	28	2X	EZ8244
40	8	1X	EZ8887
	8	2X	EZ8888

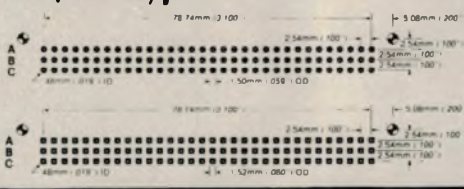
Pre-Spaced Pads $4.37/pack

Center to Center Spacing	Pad Type	Scale	Pads Per Strip	Strips Per Pack	Catalog Number
.100"		1X	40	6	EZ5000
		2X	20	7	EZ5001
		1X	40	6	EZ5003
		2X	20	7	EZ5004
		1X	40	6	EZ5017
		2X	20	7	EZ5018
		1X	40	6	EZ5020
		2X	20	7	EZ5021
.156"		1X	25	6	EZ5014
		2X	13	7	EZ5015

Edge Connectors $4.37/pack

Center to Center Spacing	Patterns shown 1X (1:1) scale. Dimensions shown 1X (1:1) scale for 2X scale, multiply values shown by 2	Scale	Contacts / Strip	Catalog Number	Strips / Pack
.100"		1X	44	EZ8805	2
		2X	22	EZ8809	5
.125"		1X	35	EZ8704	2
		2X	17	EZ8716	4
.156"		1X	28	EZ8708	3
		2X	14	EZ8720	5

DIN41612 Connectors All $4.37/pack



DIN41612 connectors patterns have three row designations A, B and C. Three pattern combinations are available AB, AC and ABC. They are also available with round or square pads.

ROUND PAD

64-Pin Pattern (A-B) Scale	Symbols Per Pkg	Catalog Number	64-Pin Pattern (A-C) Scale	Symbols Per Pkg	Catalog Number	96-Pin Pattern (A-B-C) Scale	Symbols Per Pkg	Catalog Number
1X	2	EZ6869	1X	2	EZ6875	1X	2	EZ6871
2X	2	EZ6870	2X	2	EZ6876	2X	2	EZ6872

SQUARE PAD

64-Pin Pattern (A-B) Scale	Symbols Per Pkg	Catalog Number	64-Pin Pattern (A-C) Scale	Symbols Per Pkg	Catalog Number	96-Pin Pattern (A-B-C) Scale	Symbols Per Pkg	Catalog Number
1X	2	EZ6878	1X	2	EZ6881	1X	2	EZ6884
2X	2	EZ6879	2X	2	EZ6882	2X	2	EZ6885

P.C. Drills

Take your pick of tungsten carbide or high speed steel. Available in 0.8, 0.9, 1.0 and 1.2mm. T.C. drills $5.85 each. H.S. Steel $1.75 each.

Donut Pads

The basic all-purpose PC terminal area for termination of wire or component leads extending through the PC board. ID aids in accurate pad location to grid centers.

E-Z CIRCUIT Tape Donut Pads are unsurpassed for uniformity and accuracy. These photographically opaque terminal areas are accurate to ± .002" (*0.05mm*). E-Z Circuit opaque black pads are only .005" (*0.13mm*) thick.

$3.35/pack

1. Select the largest possible pad. Allow enough room for conductor traces and the physical conditions of artwork preparation and manufacturing of the actual board (MIL-STD-275).
2. A small ID makes registration easy, but may make it difficult to locate pad center after photo reduction.
3. Choose an ID smaller than hole to be drilled. (Drill size for plated-through holes must be larger than final hole.)
4. Use Multi-Pad configurations for multi-pad terminal patterns.

It is much easier, much faster, and much more accurate to lay down a whole pattern printed to specific tolerances than to tediously position individual pads.

STANDARD INCH

OD in.	OD mm	ID in.	ID mm	Cat. No.	Qty./ Pkg.
.080	2.03	.031	0.79	EZD216	96
.100	2.54	.031	0.79	EZD101	96
.120	3.05	.031	0.79	EZD239	96
.125	3.18	.031	0.79	EZD102	96
.150	3.81	.031	0.79	EZD144	96
.156	3.96	.031	0.79	EZD103	96
.160	4.06	.040	1.02	EZD247	108
.187	4.75	.031	0.79	EZD138	108
.200	5.08	.031	0.79	EZD139	108
.250	6.35	.062	1.57	EZD108	128
.300	7.62	.062	1.57	EZD111	112

Precision Slit Tapes

"Super" 201 is a flexible extra-strong photographically opaque, pressure-sensitive precision slit tape with exceptional adhesive characteristics. It will not creep or lift if stretching is avoided during application. "Super" 201 is extremely flexible and has a non-reflective matte finish. Only .005" (*0.13 mm*) thick.

- Precision slit to exacting tolerances to assure highest quality PC artwork and photography
- Manufactured from the same high quality materials as E-Z CIRCUIT PREKUT TAPE SHAPES to insure compatible PC artwork and photography

STANDARD INCH

20 Yds./Roll

Tape Size in.	Tape Size mm	Cat. No.
.020	0.51	EZC3000 $3.05
.026	0.66	EZC3002 $3.05
.031	0.79	EZC3004 $3.25
.040	1.02	EZC3006 $3.25
.050	1.27	EZC3008 $3.25
.062	1.57	EZC3010 $3.35
.080	2.03	EZC3012 $3.35
.093	2.36	EZC3014 $3.35
.100	2.54	EZC3016 $3.35
.125	3.18	EZC3018 $3.35
.200	5.08	EZC3020 $3.46
.250	6.35	EZC3022 $4.57
.500	12.70	EZC3024 $5.70

Accurate Grids

Grids are produced on accurate stable film with 0.1" pattern for maximum accuracy. Matte one sided. .003" thick.

Sheet Size	Catalog Number	
8" X 11"	EZ1463	$2.63
11" X 17"	EZ1466	$4.87

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ICL 7106 CPL	$16.71	ICM 7170 IPG	$18.52
ICL 7107 CPL	16.71	ICM 7209 IPA	8.28
ICL 7109 CPL	26.50	ICM 7211 IPL	2.28
ICL 7129 CPL	38.32	ICM 7216 AIJI	49.39
ICL 7135 CPI	26.50	ICM 7217 AIPI	18.23
ICL 7136 CPL	16.71	ICM 7217 CIPI	18.23
ICL 7611 DCPA	2.27	ICM 7218 CLJI	16.75
ICL 7660 CPA	4.92	ICM 7224 IPL	23.44
ICL 7650 CPD	9.76	ICM 7224 AIPL	23.44
ICL 8038 CC	9.55	ICM 7226 AIJL	66.20
ICL 8211 CPA	3.95	ICM 7227 AIPI	23.44
ICL 8212 CPA	3.95	ICM 7240 IJE	8.57
ICL 8212 CTY	4.95	ICM 7250 IJE	8.57
ICL 7663 BCPA	6.41	ICM 7555 IPA	1.68
ICL 7665 BCPA	7.20	ICM 7556 IPD	2.96
AM 7910 PC		IM 6402 IPL	10.15
World Modem	27.50	IT 1750	6.51

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New Products...

Microprofessor educational computer

Multitech's new Microprofessor is more like a set of building blocks than a computer. That's by design: it's intended as a serious training tool, to introduce the student gradually to the mysteries of programming the 8088.

In addition, the system provides an excellent introduction to the architecture of the IBM PC, without going to the expense of buying a PC or a compatible.

The MPF-1/88 is a single card 8088 machine which also has a keyboard and an LCD screen. The keyboard has the usual qwerty layout with an Alt key and two function keys.

There is an expansion bus connector, a 16-pin Centronics printer port connector and a number of other external connection sockets.

There is no facility for a hard disk of any kind but it contains a powerful ROM monitor and there is room for two additional ROMS and an extra 8525 DRAM chip.

The clock speed is the same as used in the IBM PC, namely 4.77MHz, and it is powered by an external AC/DC adaptor or the optional internal switching power supply.

For further information contact Emona Computers, 1st floor 720 George Street, Sydney 2000. Telephone: (02) 212 4599.

14-bit D/A converters

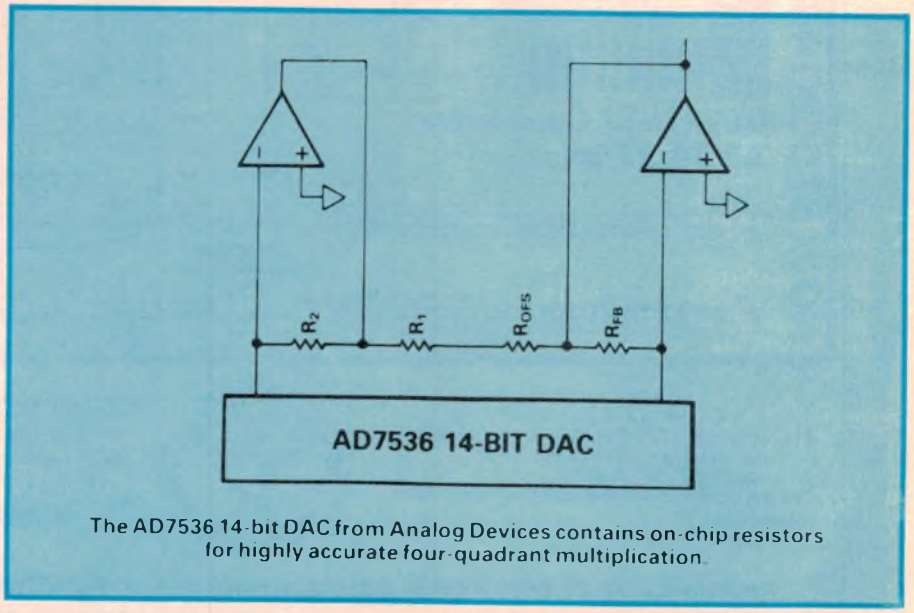
A new 14-bit digital-to-analog converter (DAC) performs high-accuracy four-quadrant multiplication without any external resistors. Instead, the AD7536 contains internal matched resistors to simplify application.

Applications for the new 14-bit DAC include microprocessor-based control systems in high-temperature environments, digital audio systems, precision servo control loops and high-performance, high resolution military applications.

The AD7536 has two double-buffered input registers to facilitate 2-byte loading from an 8-bit bus or14-bit broadside loading from a 16-bit bus. It is speed-compatible with TTL or 5V CMOS logic level inputs, and is protected against "latch-up".

The device is available in a 28-pin ceramic DIP for operation over three temperature ranges and runs from a +12 to +15V power supply.

For further information contact Parameters Pty Ltd, 25-27 Paul Street, North Ryde 2113. Telephone: (02) 888 8777.



The AD7536 14-bit DAC from Analog Devices contains on-chip resistors for highly accurate four-quadrant multiplication.

Full band VHF/UHF receiver

Icom's new IC-R7000 scanning full band VHF/UHF receiver boasts continuous coverage from 25MHz to 1300MHz.

Main features of the new receiver include CPU-based tuning which provides 100Hz steps over the entire range, and a front panel keyboard for direct entry of frequencies that are known to the user. The frequency and mode selected are displayed on a 7-digit dual-colour fluorescent display.

The R7000 uses multi-conversion techniques for reception of FM (both narrow and wideband), AM and SSB (upper and lower). Some 99 memories are available to the user and these can record active frequencies while in the scan mode without disabling the scan.

Scanning can be carried out by mode, programmed scan, full scan, selected scan, memory channel scan, auto-write programmed scan and priority scan.

An optional infrared remote control model will be introduced in the near future.

Further information is available from Icom (Australia) Pty Ltd, 7 Duke Street, Windsor 3181. Telephone: (03) 51 2284.

Multiple-output power supplies

Amtex Electronics has released a range of switching power supplies featuring dual power outputs. They are the Boschert XL 50, 60, 80, 125 and 160 models.

The new supplies have been specially designed to power small computer systems, including microprocessors, CRTs, and disk and tape drives.

Each unit provides four outputs, including special dual output ports providing +12V each, and individual outputs of +5V and −12V each. The dual output is provided so that the disk drive and monitor can be powered independently. The +5V is for general logic functions and the −12V output is the RS232 communications port.

Additional features include overvoltage protection, 110VAC/220VAC user selectable input, and fast transient response.

For further information contact Amtex Electronics, 36 Lisbon Street, Fairfield 2165. Phone: (02) 728 2121.

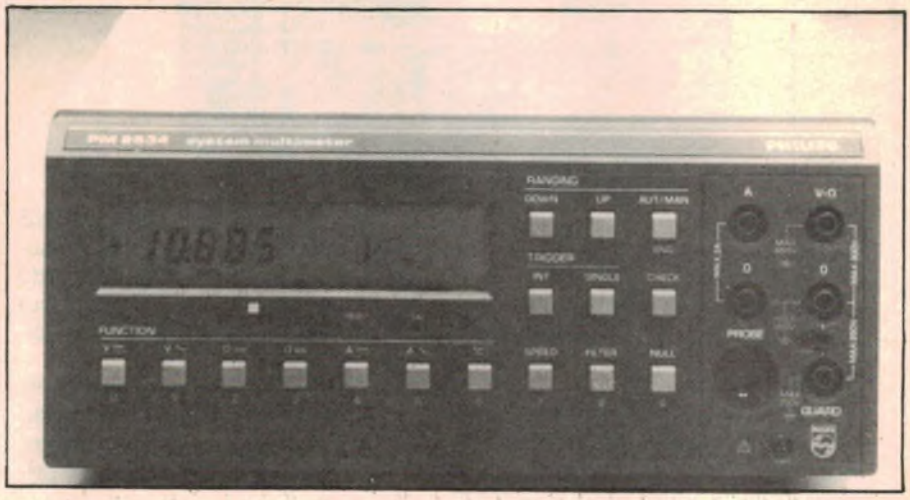
Low cost programmer

A low cost programmer released by Diamond Systems turns your PC or CP/M computer into an EPROM/-PROM programmer. The unit is capable of programming all EPROMs up to the 27256 32K device. This includes personality modules and the common 4 and 8-bit fusible link TTL PROMs.

The EP232 is a compact self-contained unit with its own internal power supply. An RS232 interface ensures compatibility with any computer.

For more information contact Diamond Systems, PO Box 105, Hurstbridge 3099. Telephone: (03) 714-8269.

New Products...



Digital multimeter with scanner option

Guarded 3 to 6 digit sensitivity and up to 100 measurements per second via a standard IEEE 488 interface are features of the new PM2534 system multimeter from Philips Test and Measurement.

Standard facilities include RMS AC measurements of current and voltage; 2 and 4-wire resistance measurements between 1mΩ and 300MΩ; and provision for a temperature probe. Resolution is 100nV and 100nA on DC ranges, with .005% long-term accuracy.

A fully floating guard of the analog input circuitry gives a common mode rejection ratio of more than 160dB. This ensures accurate high-sensitivity measurements, even in noisy environments.

Simple English Commands make the PM 2534 easy to program via the IEEE 488 interface. To facilitate multipoint measurements, the PM2534 can be interfaced to the recently introduced PM2100 scanner units.

For further information contact Philips Scientific and Industrial, 25-27 Paul Street, North Ryde 2113. Telephone: (02) 888 8222.

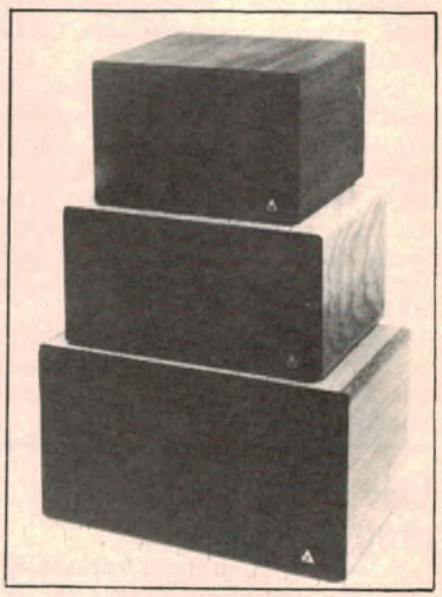
New series of woofer loudspeakers

Three new powered woofer loudspeakers designed to complement existing loudspeaker systems have been released by Audio Reference Technology. Each contains an in-built 70W amplifier and includes a volume control to adjust the bass level to suit the application.

The HSW-100 is the smallest of the series and has a 6½-inch polypropylene driver in an oak or walnut veneer cabinet. It reproduces bass between frequencies 35 and 120Hz.

The middle-of-the-range HSW-200 system uses two 6½-inch drivers in a somewhat larger cabinet. Its frequency response is similar to the HSW-100, but it is rated for a 6dB higher output.

For systems with large full-range loudspeakers, there is the HSW-150. It uses a single 8-inch polypropylene driver and reproduces bass frequencies from 25 to 90Hz.



For further information contact Audio Reference Technology, 519 Brunswick Street, Fitzroy 3068. Telephone: (03) 481 5627.

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INSTALL IT YOURSELF

Deluxe kit illustrated.

2 Kits available–Standard or Deluxe. 4 sector Control with switch selection of its many pre-programmed functions. Quality components for reliability. Comprehensive instructions included.

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15-17 Normanby Rd, Clayton, Vic, 3149
Tel (03) 544 8411. Telex AA35780

248 Johnston St, Annandale, NSW, 2038
Tel (02) 692 0999

31 Phillips St, Thebarton, SA, 5031
Tel (08) 352 2066

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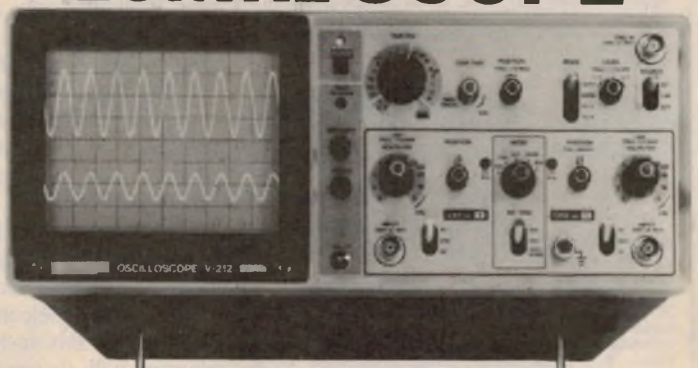

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133 page Detailed Service Manual	$33	$.....
Rugged Plastic Front Cover	$25.20	$.....
Packing Insurance & Delivery within Australia		$ 10.00
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New Products...

Low-cost DMM also checks transistors

This new 3½-digit DMM from Rod Irving Electronics features comprehensive specifications, yet carries a price tag of just $79.95.

In addition to the usual test ranges, the 605 Digital Multimeter also provides for diode testing and for hfe testing of transistors. These are certainly useful features and are not always found on low-cost DMMs.

Like most other DMMs in its price range, the 605 features pushbutton selector switches. Good colour coding makes mode selection fairly straightforward on this instrument, but rotary switches will always be a simpler means of selecting ranges.

Basic specifications are as follows: DC/AC volts — 200mV, 2V, 20V, 200V and 1000V DC (750V AC); DC/AC current — 2mA, 20mA, 200mA, 2A and 10A; resistance — 200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ and 20MΩ.

DC volts accuracy is quoted as 0.5% + 1 digit, AC volts accuracy as 1% + 4 digits, and DC current accuracy as 1% + 1 digit. Overrange measurements are indicated by blanking all but the MSD decimal point and the polarity sign.

Physically, the 605 is well constructed and even includes a fold-out rear panel hinge which enables the unit to be propped up on the workbench. A good-quality set of shrowded test probes and a useful zip-up soft carrying case are supplied as standard.

A pleasing trend for multimeters — even for low-cost units — is the quality of the documentation. The 605 rates well in this respect. The instruction booklet includes a selection on re-

calibration of the instrument, as well as a circuit diagram and component overlay.

Battery life is quoted as 200 hours — the same as most other DMMs in this price range.

Overall, the 605 is a practical, robust instrument. It provides all the features most likely to be needed for both hobby and service work and is very favourably priced.

For further information, contact Rod Irving Electronics, 425 High St, Northcote, 3070. Telephone: (03) 489 8866.

New range of soldering equipment

The West German company Zevatron is to distribute its range of soldering equipment in Australia through Alfatron Pty Ltd.

The equipment encompasses large wave soldering installations, such as the MPS-300 series down to solder baths, dip pots and hand held irons.

One item that the company expects to be of interest is the MPS-200 series of modular soldering machines. These are specifically designed for use with surface mount devices.

For further information contact Alfatron, 1761 Ferntree Gully Road, Ferntree Gully 3165. Telephone: (03) 758 9000.

GO BACK TO HOME BREW

It's the affordable amateur radio!

With the dollar so weak against overseas currencies, imported amateur products are out of many amateurs' reach. Consider the benefits of home brew:

- You supply the labour - so you save!
- You sharpen up those old skills: soldering, construction, etc.
- You catch up with the latest technology: otherwise you could get left behind!
- And best of all, you're keeping alive one of the basic reasons for being an amateur in the first place: you have the skill to do it yourself!

HF TRX KIT

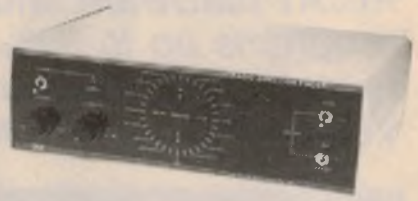
80m version supplied — other bands available soon.

Cat K-6330

Ideal for the novice — or the old timer. 12V operated, so it's a great mobile too. Any 500kHz band between 3 and 30MHz 30 watts SSB output and CW or SSB operation. Digital frequency display, complete kit including deluxe moulded case.

$349

DIGITAL RDF KIT



Here's a great new kit to build — and it will give you a real edge in fox hunts, field days, etc. Uses digital techniques to plot and display direction of any signal. Use in conjunction with virtually any FM receiver (or transceiver). Operates over 50 to 500MHz range (with suitable receiver).

Cat K-6345

Ideal for locating 'jammed' transmitters!

$139

Try these latest kits from DSE:

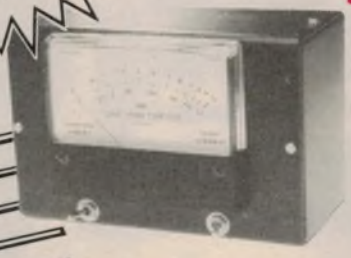
DSE NO 1 FOR KITS

VZ-200/ 300 RTTY DECODER

The low cost way to go RTTY. Use your VZ-200 or VZ-300, add this decoder, and you're ready for RTTY decoding. Simply plugs into computer's expansion port. Suitable for both amateur and commercial standards.

Cat K-6318

$69.50



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HP's Vectra PC: fast & impressive

Hewlett-Packard's new Vectra Personal Computer is directly compatible with IBM PC/AT hardware and software and runs programs up to 30% faster than the IBM. We recently had the chance to have a look at the Vectra and found it an impressive machine.

In its simplest form, Hewlett Packard's Vectra comprises a separate processing unit, monitor and keyboard. There is provision within the processing unit to include two floppy disk drives and a hard disk. Two high resolution monitors are available, one with a monochrome green screen and the other in colour. There are many other accessories to add to the basic system including LaserJet printers, digitisers, mouse, touch accessory, and modems.

Hewlett Packard supplied us with a test Vectra which included 640K of RAM, 5¼-inch drives, a hard disk drive, a 305mm high resolution colour monitor and keyboard. We were also supplied with several software packages, some specifically for the Vectra and others written for the IBM PC/AT.

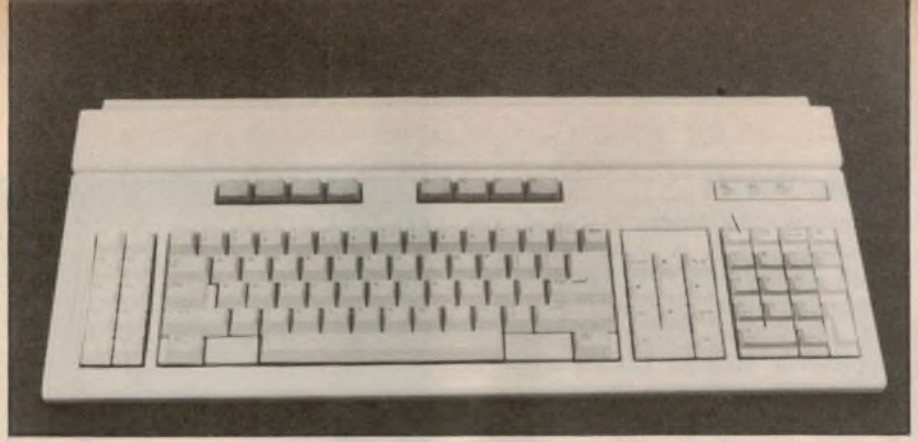
Hardware

The system processing unit is a relatively compact unit measuring 425 x 160 x 390mm (W x H x D). The monitor is designed to sit on top of this and the tilt-and-swivel screen enables a comfortable viewing angle to be easily obtained.

The Vectra is based on the Intel 80286 16-bit mircoprocessor operating at 8MHz. This is the main reason why the Vectra is able to run programs faster than the IBM PC/AT which runs at a 6MHz clock rate. There is provision for an Intel 80287 numeric co-processor to be plugged into the circuit board to give very fast calculation power and the Vectra also includes a system clock and calendar with battery backup.

Disk drives are available for both double sided double density and quad density 5¼-inch floppy disks. These have a capacity of 360K byte and 1.2M bytes respectively. Our machine had one of each type plus a 20M byte hard disk drive. Standard RAM complement is 256K although our sample had the maximum of 640K, as noted above.

An optional key operated security lock located adjacent to the disk drives selects three levels of data security. Position 1 gives free access to all disk



The keyboard has 103 keys in all, including 10 function keys, 11 cursor and screen control keys, and a numeric keypad.

data and allows removal of the top cover. Position 2 still allows access to data, but prevents removal of the top cover. Position 3 prevents access via the keyboard and locks the top cover.

At the rear of the unit is a mains power input socket and switched power outlet for connection to the monitor. There are RCA socket outputs for the Red, Green, Blue monitor signals and an extra socket for connection to the monitor. Expansion ports for a mouse, printer and external disk memory are provided.

The colour monitor has a 305mm (diagonal) screen, featuring 640 x 400 pixel resolution when used in conjunction with the multimode colour adaptor. Text is displayed in 80 columns by 25 rows with each character comprising an 8 x 16 pixel matrix. It also has the capability to display 16 colours simultaneously with a 16-level grey scale.

Controls on the front are an on/off switch and separate brightness and contrast knobs. At the rear are screw adjustments for horizontal and vertical movements. Sockets at the rear are three BNC Red, Green, Blue inputs, an RCA audio tone output and sockets for interconnecting cables from the keyboard and system processing unit.

Our sample monitor included the optional HP touch-screen facility. This consists of a frame bezel surrounding the screen which contains an array of infrared light emitting diodes and phototransistors arranged in an X-Y matrix. These divide the screen into about 230 touch areas. When a finger interrupts the beam, the finger location is interpreted by the computer.

The keyboard is a large slim-line unit measuring 522 x 223 x 20mm. All the top keys have slightly dished tops and the rows are angled backwards for good finger location and typing comfort. Keyboard attitude is adjusted by the tilting bail.

There are certainly a lot of keys on it, 103 in all. As well as the 56 standard typewriter keys, there are 10 function keys, eight control keys, 11 cursor and screen control keys, and the numeric keypad. And there are three LED status indicators, for Caps Lock, Num Lock and Scroll Lock.

Expansion

Expansion sockets provide for a large range of accessories. All the IBM PC/AT hardware accessories can be used with the Vectra and HP have a number of their own accessories which can be used.

Memory can be expanded to 3.64M of RAM and there are a wide variety of disk drives available. They include a dual 710K stand-alone 3½-inch flexible disk drive, stand-alone hard disk drives (20 x 40M byte) and a low cost ¼-inch backup tape system. These are in addition to the 5¼-inch floppy disk drives and hard disk previously mentioned.

Data communication accessories include a serial/parallel interface, dual RS-232/422 interface, IBM 3278 Emulation and internal 1200-baud and 2400-baud modems. Input devices include the touch screen facility already described, a mouse, A-size (A4) digitiser, B-size (A3) digitiser and bar-code wand.

HP printers available are the HP ThinkJet Printer, Letter-quality printer, LaserJet printer and LaserJet PLUS printer. Plotters include two, six and eight pen types.

Documentation

Four manuals come with the Vectra. These are "Setting Up Vectra", "Connecting Peripherals to Vectra", "Using Vectra, DOS Version" and 'Vectra DOS User's Reference". They are very well written documents and provide complete information. Both the experienced user and beginner are catered for by including separate beginner chapters and examples. Experienced users can jump directly to the necessary information using the index and contents pages.

Vectra personal computer

Using Vectra

Whenever the Vectra is started, the operating system is loaded into the RAM. It will copy from drive A (the floppy disk drive), or drive C (the hard disk drive). Once loaded, the Personal Application Manager (PAM) menu is displayed on the screen. PAM is a useful operating system. It allows the user to start an application or program, to set the date and time, and to manipulate application information from the main menu. It also allows the use of MS-DOS commands.

The PAM menu contains three important sections. The MS-DOS command line lets you directly type in system commands that allow you to copy, delete, create and print files. The "Application Labels" allow selection of PAM application programs, the DOS commands, File manager and Setup plus any other programs that you wish to add. Finally, "Function Labels" describe the tasks assigned to the function keys that are located across the top of the keyboard.

We found the touch screen facility very useful when used with PAM. The application labels and selection of the function labels could be achieved by simply pointing a finger at the screen labels; all done without touching the keyboard.

Perhaps the most impressive feature of the Vectra computer is the colour monitor. It has extremely fine screen resolution, bright colours and excellent tonal clarity. It is a startling and precise display which easily outclasses that of most other personal computers.

Keyboard operation is not as impressive. For those who have become used to the very light but noisy IBM PC keyboard for example, the Vectra's keyboard feels dead and heavy.

Software

As noted above, the Vectra is claimed to be fully compatible with the IBM PC/AT. This includes both the software and hardware accessories. We checked the latter aspect on a variety of software packages and found no particular problems. It is a great pity that Microsoft's Flight Simulator, one of the key tests of IBM compatibility, does not have a version to take advantage of the much better graphics capability of the Vectra. It ran without any problems but naturally the screen images were no different from those on a low resolution IBM colour screen.

All IBM PC/AT hardware accessories can be used with the Vectra. Expansion ports for a mouse, printer and external disk printer are provided.

Communication

The Vectra is capable of communicating with many other computers including other personal computers, mini computers and mainframes. These include IBM PC and Portable, HP 3000, 1000 and 9000, IBM 3278 and DEC VT-100.

Conclusion

In summary, the Vectra is a very professional computer which is more powerful and faster than the IBM PC/AT. Directly aimed at the business and scientific community, HP have certainly produced a very strong contender in this competitive market.

There are three basic Vectra models available. The Vectra Model 25, including 256K of RAM and one 360K byte 5¼-inch floppy disk drive costs $6841. Model 35 has 256K of RAM and a 1.2M 5¼-inch floppy disk drive at $7703. These prices include the keyboard and sales tax.

The monochrome monitor costs an extra $806 plus 13.4% tax while the colour monitor is $1860 plus tax. A multimode video adaptor is required for both monitors at $806 plus tax and for the colour monitor the multimode colour adapter is $93 plus tax.

For further information contact Hewlett Packard, 31-41 Joseph Street, Blackburn, Vic 3130. Phone (03) 895-2895. (J.C.).

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BD232	.90
BD233	.90
BD235	.90
BD236	.90
BD237	.90
BD238	.90
BD262	1.20
BD263	1.20
BD437	1.50
BD488	1.50
BD647	1.80
BD648	1.80
BD677	1.80
BD681	2.00
BD682	2.00
BDV64B	3.90
BDV65B	3.90
BDX63	6.50
Y96 (BUX 80)	4.90
BDY97 (BUX 80)	4.90
BF115	1.50
BF167	1.20
BF173	1.20
BF177	1.20
BF180	1.20
BF182	.90
BF183	.80
BF184	.80
BF198	.60
BF199	.60
BF200	1.20
BF245	1.50
BF337	1.50
BF338	1.90
BF458	1.00
BF459	1.00
BF469	1.20
BF470	1.20
BF494	.90
BF495	.90
BFW10	1.50
BFW11	1.50
BFW16	1.50
BFY50	1.20
BFY90	1.90
BFX90	1.50
BU126	2.50
BU208	4.90
BU326	3.90
BUX80	4.90
MFE131	2.90
MFE3001	9.90
MFE3003	6.95
MJ413	5.90
MJ802	7.50
MJ901	4.50
MJ1001	3.90
MJ11011	9.90
MJ11015	14.50
MJ11016	14.50
MJ15003	6.50
MJ15004	6.50
MJ15024	10.00
MJ2501	8.90
MJ2955	2.50
MJ3001	8.00
MJ4032	12.50
MJ4502	6.90
MJE340	1.50
MJE350	1.90
MJE371	2.90
MJE521	2.50
MJE700	3.50
MJE800	2.90
MJE2801	3.95
MJE2955	4.90
MJE3055	3.90
MJE13005	5.90
MJE13007	7.90
MJE13009	12.50
MPF121	2.50
MPF131	2.50
MPSA05	1.00
MPSA06	1.00
MPSA10	1.00
MPSA12	1.00
MPSA13	1.00
MPSA14	1.00
MPSA20	1.00
MPSA42	1.00
MPSA43	1.20
MPSA55	1.00
MPSA56	1.00
MPSA63	1.00
MPSA65	1.00
MPSA92	1.00
MPSA93	1.20
MPF102	.90
MPF103	.90
MPF105	.90
MPF106	.90
MPF109	.90
MPSL01	1.50
MPSL51	1.50
MPSU02	1.75
MPSU52	1.90
MPSU56	1.75
MP131	1.75
MRF221	19.50
MRF237	5.90
MRF238	29.50
MRF245	53.50
MRF455	37.00
MRF475	12.50
MRF603	19.50
MRF641	49.00
MRF646	53.00
MRF901	2.90
MPF131	1.90
TIP31A	.70
TIP31B	.70
TIP31C	.75
TIP32A	.70
TIP32B	.70
TIP32C	.75
TIP41C	1.50
TIP42A	1.40
TIP42C	1.50
TIP49	1.90
TIP50	2.20
TIP53	2.50
TIP111	1.50
TIP112	1.50
TIP116	1.50
TIP117	1.50
TIP120	1.50
TIP122	1.50
TIP125	1.50
TIP127	1.50
TIP145	3.40
TIP2955	1.50
TIP3055	1.50
2N301	4.00
2N697	1.00
2N918	1.00
2N1304	1.00
2N1613	1.20
2N2102	1.90
2N2219	.90
2N2222A	1.00
2N2369	1.00
2N2484	1.00
2N2646	1.20
2N2647	2.50
2N2894	1.00
2N2904	1.10
2N2905	1.10
2N2906	1.10
2N2907	1.10
2N3019	1.90
2N3053	.90
2N3054	1.90
2N3055	1.00
2N3096	1.20
2N3109	1.90
2N3251	1.90
2N3302	1.90
2N3440	1.80
2N3441	2.90
2N3442	3.50
2N3563	.30
2N3564	.30
2N3565	.30
2N3566	.30
2N3567	.30
2N3568	.30
2N3569	.30
2N3638	.30
2N3640	.30
2N3641	.30
2N3642	.30
2N3643	.30
2N3644	.30
2N3645	.30
2N3646	.30
2N3702	1.20
2N3704	1.40
2N3739	4.50
2N3771	5.50
2N3772	5.70
2N3773	5.90
2N3792	6.00
2N3819	1.20
2N3866	2.95
2N3904	1.00
2N3906	1.00
2N4030	1.50
2N4032	2.20
2N4033	2.20
2N4036	2.50
2N4121	1.50
2N4123	1.50
2N4236	1.90
2N4237	1.90
2N4248	.40
2N4249	.40
2N4250	.40
2N4258	.50
2N4355	.50
2N4356	.50
2N4360	1.00
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.90
2N4427	3.90
2N4919	2.90
2N5088	1.00
2N5089	1.00
2N5139	1.20
2N5179	1.20
2N5190	2.50
2N5191	3.30
2N5192	3.10
2N5193	2.50
2N5194	2.95
2N5195	3.30
2N5210	1.50
2N5245	1.50
2N5303	8.50
2N5401	1.50
2N5457	1.00
2N5458	.90
2N5459	.90
2N5461	.90
2N5462	.90
2N5485	.90
2N5486	.90
2N5489	14.50
2N5590	26.50
2N5591	29.50
2N5641	19.50
2N5656	2.50
2N5770	.30
2N5777	1.50
2N5830	.30
2N5831	.30
2N5873	1.40
2N5874	1.70
2N5944	15.50
2N5945	18.50
2N5946	19.50
2N5961	1.90
2N6027	1.00
2N6049	1.90
2N6080	21.50
2N6083	26.90
2N6084	37.90
2N6122	1.90
2N6125	1.90
2N6130	1.90
2N6133	1.90
2N6256	14.50
2N6259	13.50
2N6274	29.50
2N6378	4.90
2N6425	4.50
2N6578	4.90
3N201	1.50
2SA683	1.50
2SC2028	3.95
2SC2029	3.95
2SC2166	4.95
2SC1730	1.95
2SC1969	6.30
2SC1973	3.95
VN88AF	3.95
2SC372	1.95
2SC495	2.95
2SC710D	1.95
2SC73	1.95
2SC900F	1.95
2SC945A	1.95
2SC1014	2.50
2SC1017	4.95
2SC1018	4.95
2SC1061	2.95
2SC1096	2.95
2SC1173	2.95
2SC1226	2.95
2SC1306	6.30
2SC1419	2.95
2SC1449	1.95
2SC1674	1.95
2SC1307	6.90
2SD288	3.95
2SD325	2.95
2SD350A	4.90
2SD525	3.95
2SK45	3.95
2SJ49	7.95
2SJ56	12.50
2SK134	7.95
2SK176	12.50
1N4002	.15
1N4007	.20
1N5404	.30
1N5408	.40
OA47	.80
OA90	.50
OA95	.50
5082-2800	2.95
5082-2811	4.95
HLMP6620	5.95

BRIDGES

1.5 AMP	
W005	.50
W02	.40
W04	.50
6AMP	
BPC602	2.90
KBPC604	3.50
KBPC608	4.50
10AMP	
KBPC1002	4.20
KBPC1004	4.90
35AMP	
KBPC3502	5.80
KBPC35014MD	
A3504	6.90
KBPC3510MDA	
3510	9.90

74

7400	.35
7401	.45
7402	.45
7403	.45
7404	.80
7405	.80
7406	.80
7407	.80
7408	.80
7409	.80
7410	.60
7411	.70
7412	.70
7413	.70
7414	.80
7416	.80
7417	.80
7420	.80
7425	.90
7427	.80
7430	.70
7432	.70
7437	.80
7438	.90
7440	.90
7442	.90
7445	1.00
7446	1.20
7447	1.50
7449	1.20
7450	.90
7451	.90
7473	.80
7474	.70
7475	.70
7476	.80
7485	1.20
7486	1.20
7489	3.90
7490	1.00
7493	1.00
7495	1.00
7497	2.30
74100	1.85
74107	1.20
74109	.90
74110	1.50
74121	.80
74122	.90
74123	1.50
74125	1.00
74128	1.80
74132	1.00
74139	1.50
74145	1.45
74150	1.50
74151	1.20
74154	1.75
74155	1.20
74181	1.20
74163	1.40
74164	1.20
74165	1.20
74166	1.70
74174	1.45
74175	1.20
74180	1.20
74190	1.00
74191	1.45
74192	1.65
74193	.80
74194	1.10
74195	1.00
74197	1.10
74221	1.90
74367	1.50
74368	1.50
75107	2.50
75110	2.50
75150	2.50
75154	2.50
75450	1.50
75451	.90
75452	.90
75453	.90
75461	1.50
75462	1.50
75471	3.00
75472	3.00
75491	2.00
75492	2.00
75493	3.00
8121	5.00
8123	4.00
8130	6.95
8131	5.95
8136	6.95
8303	5.50
8304	6.95
82S23	5.95
82S123	6.95
8311	5.95
8641	5.85
8820	6.95
8830	6.95
8832	6.95
8833	6.95
8834	6.95
8835	5.85
1488	1.00
1489	1.00
81LS95	3.75
81LS96	3.75
81LS97	3.75
81LS98	3.75
8T26	3.00
8T28	3.00
8T30	3.00
8T96	1.80
8T97	1.80
8T13	2.85
8T14	2.85
8080	8.00
8085	9.50
8086	39.00
8088	29.00
8155	6.50
8156	11.50
8185	37.50
8202	52.50
8203	69.50
8212	2.90
8214	4.90
8224	3.50
8226	4.90
8228	5.50
8237	39.00
8238	9.50
8243	8.50
8251	6.90
8253	7.50
8255	5.50
8257	16.50
8259	6.50
8271	89.00
8272	33.00
8273	65.00
8274	42.50
8275	38.50
8276	26.50
8279	8.50
8282	6.90
8283	6.50
8284	8.50
8286	6.50
8287	6.50
8289	73.00
8741	57.50
8748	65.00
8749	58.50
8755	33.50
8035	6.90
8039	7.90
FD1771	19.00
FD1791 (8876)	39.00
FD1793 (8877)	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50
WD2143	14.50
WD1931	22.50
WD1933	34.00
WD1983	14.75
WD1993	59.00
WD2123	26.50
WD8250	16.50
TR1602 (S1883)	8.50
TR1863	8.90
COM8116	24.00
BR1941	23.00
CRT8002A	59.90

74HC

74HC00	.60
74HC02	.60
74HC04	.60
74HC08	.60
74HC11	.60
74HC14	1.40
74HC27	.60
74HC30	.60
74HC32	.60
74HC74	1.10
74HC76	1.10
74HC85	1.40
74HC86	1.10
74HC123	1.40
74HC138	1.40
74HC139	1.40
74HC157	1.40
74HC165	2.50
74HC174	1.40
74HC221	3.60
74HC240	2.50
74HC244	2.50
74HC245	3.90
74HC367	1.40
74HC373	2.90

74F SERIES

74F00	.79
74F02	.79
74F04	.92
74F08	.79
74F10	.79
74F11	.79
74F20	.79
74F32	.79
74F64	.79
74F74	.89
74F86	1.19
74F109	.99
74F138	1.79
74F139	1.79
74F151	1.79
74F153	1.79
74F157	1.79
74F158	1.79
74F175	2.78
74F181	5.98
74F182	2.73
74F189	7.44
74F190	4.86
74F191	4.86
74F194	2.41
74F241	3.72
74F243	4.34
74F244	3.72
74F251	1.93
74F253	1.93
74F257	1.93
74F258	1.93
74F350	4.34
74F352	1.93
74F353	1.93
74F373	4.64
74F374	4.84
74F399	2.78
74F521	1.22
74F533	4.84
74F534	4.84

MEMORY

2101	6.90
2102	2.50
2114	2.95
2708	8.90
2716	6.90
2732	7.00
2764	6.00
27128	8.00
4116	3.95
4164	3.50
6116	5.00
6264	8.00
58725 (6116)	7.00
2101 (5101) (8101)	7.90
5101	7.90
8101	7.90
2532	12.50

OPTO

4N25	1.50
4N26	1.50
4N27	1.50
4N28	1.50
4N29	1.50
4N30	2.00
4N32	2.50
4N33	2.50
4N35	2.50
4N37	2.50
MCT6	2.50
MCT66	6.90
MCT2	1.50
1LD74	5.90
1LQ74	6.50
FND507	2.00
TIL31A	2.95
TIL81A	2.95
TIL306	22.50
MAN72 (DL702)	3.50
MAN74 (DL704)	3.50
BPW50	2.25
HP5082-2811	4.95
HLMP 6620	3.95

LEDS

3mm RED	.25
2mm YELL	.30
3mm GRN	.30
5mm RED	.15
5mm YELL	.30
5mm GRN	.30
5mm ONG	.30
RED RECT	.30
GRN RECT	.30
YEL RECT	.30
RED CHROME BEZEL	1.20
YELLOW CHME BEZEL	1.20
GRN CHRME BEZEL	1.20

VOLTAGE REGS

7805C	.80
7805KC	2.50
7812UC	1.20
7812KC	2.50
7815UC	1.20
7815KC	2.50
7818UC	1.20
7818KC	2.50
7824UC	1.20
7824KC	2.50
7905UC	1.90
7905KC	3.00
7912UC	1.90
7912KC	2.50
7915UC	1.90
7915KC	2.50
7918UC	1.90
7924UC	1.90
78L05	.50
78L12	.50
78L15	.75
78L18	.75
78L24	.75
79L05	1.20
79L12	1.20
79L18	1.20
79L24	1.20
LM309K (7805KC)	1.90
LM317T	2.50
LM317K	4.50
LM317HV	9.50
LM323K	7.50
LM337T	2.90
LM338K	10.50
LM350T	6.50
LM350K	8.50
LM395K	22.50
LM396K	19.50
78H05KC	9.00
78H12KC	9.00
78HGKC	9.50
78P05KC	16.50
79HGKC	16.50
78S40	3.50
MC1496L	14.50

SPECIAL FUNCTION

LM4250	2.45
NE5534N	3.95
NE5534AN	4.95
MC3340	2.90
MC3341	2.90
76477	8.95
76488	8.95
76489	9.95
8038	6.50
OM335	22.50
OM350	10.50
XR2206	7.95
XR2207	7.95
XR2208	6.90
XR2209	6.90
XR2211	7.45
XR2216	5.90
XR2240	6.95
XR2243	7.95
XR8038	7.50
95H90	8.50
11C90	16.50
LM7555	1.90
LM7556	3.50
MC10116L	1.50
LM13600	3.95
LF13741	.80
LF13741H	1.50
DM2502	22.50
DAC0800	4.50
DAC0808	4.50
SAK140	9.50
ZN414	1.95

4000	.50
4001	.50
4002	.50
4006	1.90
4007	.40
4008	1.20
4010	.90
4011	.40
4012	.40
4013	.60
4014	1.90
4015	1.90
4016	.75
4017	1.50
4018	1.90
4019	.90
4020	1.50
4021	1.50
4022	1.50
4023	.75
4024	1.20
4025	.80
4026	2.40
4027	1.20
4028	1.20
4029	1.50
4030	1.50
4031	2.95
4032	2.75
4033	2.75
4034	3.50
4035	1.95
4036	3.25
4040	1.20
4041	1.50
4042	1.00
4043	1.80
4044	1.20
4045	4.90
4046	2.50
4047	1.20
4048	1.20
4049	1.00
4050	1.00
4051	1.50
4052	1.50
4053	1.50
4054	3.90
4055	3.90
4056	4.20
4060	2.50
4063	2.00
4066	2.50
4067	9.90
4068	1.00
4069	1.00
4070	.90
4071	.40
4072	.90
4073	.90
4075	.90
4076	1.50
4077	.80
4078	.80
4081	.40
4082	.80
4085	2.20
4086	2.30
4093	.75
4094	3.35
4095	2.40
4096	2.40
4097	6.50
4098	2.90
4099	3.90
4175	1.60
4194	1.95
4433	2.75
MC14433	13.90
4510	1.50
4511	1.00
4512	1.10
4513	2.65
4514	2.90
4515	2.90
4516	1.45
4517	8.75
4518	2.50
4519	1.90
4520	1.20
4521	3.90
4522	1.90
4526	1.85
4527	2.65
4528	1.15
4529	1.80
4530	1.60
4531	1.65
4532	2.65
4534	8.90
4536	6.50
4539	1.65
4541	1.60
4543	2.50
4544	10.50
4549	7.25
4551	1.80
4553	5.50
4554	2.35
4555	1.10
4556	1.25
4557	7.85
4558	2.25
4559	7.25
4560	3.75
4561	1.80
4562	8.45
4566	3.00
4568	4.25
4569	2.50
4572	.75
4581	3.10
4582	2.25
4583	1.65
4584	.85
4585	2.10

ANALOG/DIGITAL

ADC0800LCN	22.50
ADC0801LCN	23.95
ADC0803LCN	7.50
ADC0804LCN	6.50
ADC0808LCN	14.95
DAC1220LCN	14.95
DAC1020LCN	13.95
DAC0832LCN	5.50

NEW ICS

74LS169	2.50
MCS2400	4.90
AY31050	12.50
WD2791	59.00
WD2793	59.00
WD2795	59.00
WD2797	59.00
LM11CN	2.95
LM1871	5.95
LM1872	5.95
Z80ADART	13.50

CRYSTALS

1MHz	11.50
1.832MHz	7.50
2MHz	6.90
2.3040MHz	6.50
2.4576MHz	6.50
2.7648MHz	4.90
3MHz	4.90
3.5795MHz	3.00
3.93216MHz	4.90
4MHz	4.90
4.194304MHz	3.90
4.433618MHz	4.90
4.44MHz	4.90
4.75MHz	4.90
4.915200MHz	6.90
4.9562MHz	4.90
5.00MHz	4.90
5.0688MHz	4.90
6MHz	4.90
6.14MHz	4.90
6.6670MHz	4.90
8MHz	4.90
8.867238MHz	4.90
10MHz	4.90
10.6445MHz	4.90
11MHz	4.10
12MHz	4.90
14.31818MHz	4.90
15MHz	4.90
16MHz	4.90
18MHz	4.90
18.432MHz	4.90
20MHz	4.90
24MHz	4.90
27MHz	4.90
32MHz	4.90
36MHz	4.90
32.768MHz	4.90

½ PRICE!

During March, we are offering the following semi's at ½ price! ...but be quick!

74LS00	74LS221	7416	74S140
74LS08	74LS240	7445	
74LS10	74LS241	7446	74C74
74LS14	74LS242	7474	74C00
74LS30	74LS243	7475	74C14
74LS42	74LS244	7476	74C96
74LS74	74LS245	74123	74C373
74LS90	74LS247	74154	74C374
74LS138	74LS251	7400	74C912
74LS139	74LS253	7401	
74LS163	74LS109	7409	4001
74LS195	74LS112	7410	4011
74LS257	74LS155	7414	4012
74LS273	74LS156	7420	4013
74LS393	74LS157	7425	4014
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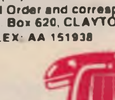

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Bolero; Dances from the Three Cornered Hat; Capriccio Espagnol; Compiled performances.
Decca 411 928-1

Bouquet of Piano Music; Fur Elise (Beethoven); Valse Brillante (Chopin); Valse in A minor (Chopin); Song Without Words (Mendelssohn); etc: A. Schmidt, J-Y Thibaudet, J. O'Conor, J. Rovier, A. Moreira-Lima, pianos.
Denon C37-7150

Brass Splendour: Handel; Bach; Purcell; Richard Strauss; Copland, etc: Philip Jones Brass Ensemble.
Decca 411 955-2

Bravura: Cho-Liang Lin, violin.
CBS CD 39133

Bridge, Bantock and Butterworth: Bournemouth Sinfonietta, N. del Mar cond.
Chandos CHAN-8373

Canon (Pachelbel); adagio (Albinoni); plus— works by Bach, Conporti, Molter: Jean-Francois Paillard Chamber Orchestra, J-F Paillard cond.
Erato ECD-88 020

Canon and Gigue (Pachelbel); Suite No 2, BWV 1067 (Bach); Sonata Op 5 No 4 (Handel); Trio sonata 'La Follia' (Vivaldi): Musica Antiqua Cologne, Reinhard Goebel cond.
Archiv (DDD) 410 502-2

Canon and Gigue—Popular Classics: Adagio (Albinoni); Canon and Gigue (Pachelbel); Minuet (Boccherini); Dance of the Spirits (Gluck); etc: Franz Liszt Chamber Orch, Budapest.
Teldec 8.43 104

Capriccio Italien (Tchaikovsky); Night on Bare Mountain (Mussorgsky); Sorcerer's Apprentice (Dukas); Romanian Rhapsody (Enesco): Dallas Symphony Orch, Eduardo Mata cond.
RCA RCD14439

Cascades: Budapest Brass Quintet.
Bellaphon 690.01.015

Cavatina (Myers); Granada (Albeniz); Maria (Tarrega); etc: Goran Sollscher, guitar.
DG (DDD) 413 720-2

Cello works by Villa-Lobos, Xenakis, Eder, etc: 12 cellists of the Berlin Philharmonic Orch.
Teldec 8.42 339

Chamber music by Galuppi, Telemann, Handel, J. C. Bach; Parnassus Ensemble.
Accent ACC 47806

Chamber Music for Trumpet—works by Corelli, Telemann, Gabrielli; etc: Ludwig Guttler, trumpet.
Capriccio 10.016

Champagne overtures Neumann.
Teldec 8.43 240

Clarinet concertos by Molter, J. and C. Stamitz.
Hungaraton HCD 11954-2

Classical original works for cello and double bass: Jorg Baumann, cello; Klaus Stoll, double bass.
Teldec 8.43 155

Classics Meet Pops—music by Bach, Bernstein, Lennon, etc: the 12 cellists of the Berlin Phil Orch.
Teldec 8.42 957

Colourful Clouds Chasing The Moon—popular Chinese classics: Hong Kong Phil Orch, Jean cond.
Hong Kong HK 8.240102

Concert Royal No 4 (Couperin); sonata No 8 in G major for flute and harpsichord (Leclair); suite in C minor BWV997 for flute and harpsichord (J. S. Bach); sonata in F major (J. S. Bach); , etc: Maxence Larrieu, flute; Robert Veyron-Lacroix, harpsichord.
Denon C37-7069

Concerto for 2 flutes (Stamitz); concertante for flute and clarinet (Danzi); variations for clarinet and orch (Rossini): Nicolet; Brunner; Wurttemburg Chamber Orch, Faerber cond.
Tudor 702

Concertos for Trumpets: Guy Touvron and Bernard Soustrot, trumpets.
Denon C37-7544

Confetti Musicali; works by Marini, Picchi, Fontana, Kapsberger, etc: Musicalische Compagney.
Teldec 8.43 112

Cries of Paris—songs by Janequin and Sermisy: Clement Janequin Ensemble.
Harmonia Mundi HM 90.1072

Dance Music from Hungary (15th-18th century): Benko Consort.
Teldec 8.42 782

Dante Troubadours: Martin Best Medieval Ensemble.
Nimbus NIM 5002

Digital Moonscapes: Wendy Carlos.
CBS CD 39340

Duets for organ: works by Bach, Hesse, Kellner, Merkel, Wesley: Hans Fagius and David Sanger, organ.
BIS BIS CD-273

Duo Recital: En Bateau (Debussy); Intermezzo from Carmen (Bizet); Gavotte (Gossec); Piece for flute solo (Ibert); etc: Maxence Larrieu, flute; Susanna Mildonian, harp.
Denon C37-7301

Eine Kleine Nachtmusik (Mozart); Holberg suite (Grieg); Symphonic Classique (Prokofiev): Berlin Philharmonic Orch, Herbert von Karajan cond.
DG (DDD) 400 034-2

Elgar: Pomp and Circumstance March No.1; Tchaikovsky: Marche Slav; Prokofiev; Mendelssohn; Berlioz, etc: Compiled performances.
Decca 411 954-2

Encore: An Hour with Cantilena—baroque 'pops'.
Chandos CHAN-8319

English Music for Strings: by Holst, Elgar, Warlock, Ireland: Bournemouth Sinfonietta, G. Hurst cond.
Chandos CHAN-8375

Ensemble de Cuivres Guy Touvron—1: Suite in A major (Albinoni); fugue in G minor (Bach); Well-Tempered Clavier Bk 1 (Bach); etc: Ensemble de Cuivres Guy Touvron.
Denon C37-7237

Ensemble de Cuivres Guy Touvron—2: Merle et Pinson (Reynaud); Impression of a Parade (Baron); Tritsch-Tratsch Polka (J. Strauss); etc: Ensemble de Cuivres Guy Touvron.
Denon C37-7238

Everlasting Love—popular Chinese TV and movie themes: Hong Kong Phil Orch, Kojian cond.
Hong Kong HK 8.240171

Famous Adagios—by Khachaturian, Barber, Schmidt, Sibelius, etc: Monte Carlo Philharmonic Orch, L. Foster cond.
Erato ECD-88 103

Famous Waltzes—Tschaikovsky: Sleeping Beauty; J. Strauss: Blue Danube; Waldteufel, Lehar, etc: Compiled performances.
Decca 411 956-2

Famous Waltzes Volume 1; Weber: Invitation to the Dance; Lanner: Die Schonbrunner; Ivanovici: Donauwellen; etc: Orchestra of the Vienna Volksoper; Franz Bauer-Theussl, cond.
Philips (DDD) 400 013-2

Favourite French orchestra music; Berlioz: Hungarian March from La Damnation de Faust; Ravel: Pavane pour une infante defunte; Dukas: The Sorcerer's apprentice; Saint-Saens: Danse macabre; Chabrier: Joyeuse Marche: Academy of St Martin-in-the-Fields, Neville Marriner cond.
Philips (DDD) 412 131-2

Favourite overtures: Die Fledermaus; Fra Diavolo; Morning, Noon, and Night; The Bartered Bride; The Mikado: Academy of St Martin-in-the-Fields, Neville Marriner cond.
Philips (DDD) 411 450-2

Festival In Digital: works by Mussorgsky, Borodin, Ippolitov-Ivanov: USSR Radio Symphony Orch, Fedosejev cond.
Ariola-Eurodisc 880 006-231

Finlandia: Sibelius; Valse Triste; Swan of Tuonela; Greig: Holburg Suite; Peer Gynt Suite; Compiled performances.
Decca 411 933-2

Fireworks In Digital: works by Glinka, Tchaikovsky, Rimsky-Korsakov: USSR Radio Symphony Orch, Fedosejev cond.
Ariola-Eurodisc 880 009-231

For All Seasons: Yehudi Menuhin and Stephan Grapelli, violins.
EMI 747144

Four concertos for violins and recorder: Richard Harvey, recorder. ASV DCA 523

French ballets of the 1920s: L'Eventail de Jeanne; Les Maries de la Tour Eifel; etc: Philharmonia Orch, Geoffrey Simon cond.
Chandos CHAN-8356

French music for violin and cellor, by Ravel, Honegger, Martinu, etc: Eleanora Turovsky, violin; Yuri Turovsky, cello.
Chandos CHAN-8358

Gala Concert — works by Grieg, Smetana, Wagner: Vienna Symphony Orch.
Delta 11.011

Gala Concert — works by Tchaikovsky, Liszt, etc: Vienna Symphony Orch.
Delta 11.002

Gershwin: Rhapsody in Blue; Addinsell:

Warsaw Concerto; Litoff: Concerto symphonique (scherzo); etc: Mascha Dichter, piano; Philharmonia Orchestra; Neville Marriner.
Philips (DDD) 411 123-2

Greensleeves; Kemps Gigue; Packington's Pund; Watkins Ale (anon); Lachrimae; Frogg Galliard (Dowland); chaconne (Bach); Marlborough variations (Sor); etc: Goran Sollscher, guitar.
DG (DDD) 413 325-2

Hear the Light on Philips — compact disk sampler; Beethoven; Chopin; Grieg; Haydn; Mozart; Saint-Saens; Schumann; Tarrega; Vivaldi; etc: Boston Pops; Brendel; Chorzempa; Davidovich; Haitink; Holliger; Levine; I Musici; Romero; de Waart.
Philips (DDD) 412 712-2

Historical organ at St Nikolas Bovenkerk, Kampen: Prelude and fugue (Buxtehude); choral 'Was Gott Tut, Das Ist Wohlgetan' (Kellner); toccata and fugue (Krebs); etc: Jacques van Oortmerssen, organ.
Denon C37-7120

Historical organ at the Heiligkreuz-kirche, Lanzberg: Toccata prima (Eberlin); toccata quarta (Speth); toccata tertia (Eberlin); etc: Hedwig Bilgram, organ. Denon C37-7200

Horowitz at the Met: six sonatas (Scarlatti); ballade No 4 (Chopin); ballade No 2 (Liszt); waltz No 9 (Chopin); prelude in G minor (Rachmaninoff): Vladimir Horowitz, piano.
RCA RCD 14585

Hunting horn concertos by Telemann, Fasch, Heinichen and Neruda: Ludwig Guttler, horn.
Capriccio 10.008

Immortal Classics: Smetana; Moldau; Wagner: Ride of the Valkyries; Mozart; Bach; Beethoven: Compiled performances.
Decca 411 953-2

In an Autumn Garden: Takemitsu.
Varese Sarabande 47211

Invitation to the Baroque Music: Adagio in G minor (Albinoni); Air from orchestral suite No 3 (Bach); Chaconne in G minor for 4 voices (Purcell); etc: Societas Musica Chamber Orch, Jorgen Ernst Hansen cond.
Denon C37-7038

Iranian Music: Chemirani; Kiani; Tala'i.
Harmonia Mundi HM 90.0391

Isaac Stern's 60th Anniversary Celebration: concerto in D minor for two violins and orch (Bach); concerto for three violins (Vivaldi); sinfonia concertante for violin and orch (Mozart): Isaac Stern, Pinchas Zukerman, Itzhak Periman, violins; New York Philharmonic, Zubin Mehta cond.
CBS CD36692

Italian Recorder Sonatas; Bigaglia; Bononcic; Corelli; Mercello; Sammartini; Vivaldi: Michala Petri, recorder; George Malcolm, cembalo.
Philips (DDD) 412 632-2

Italian trumpet concertos — by Torelli, Bobobcini; etc.
Capriccio 10.020

Japanese Melodies for Flute and Harp: Kojo No Tsuki; Chugoku Chiho No Komoriuta; Aka Tombo; etc: Jean-Pierre Rampal, flute; Lily Laskine, harp.
Denon C37-7127

Japanese Melodies: Hamabe No Uta; Komoro Magouta; Aka Tombo; etc: Lily Laskine, harp; Jacque Chambon, oboe; Jean-Francois Paillard Chamber Orchestra, J-F Paillard cond.
Denon C37-7330

Jewels Of The Madonna — Kaleidoscope of Orchestral Works: Intermezzo No 1 — Jewels of the Madonna; Pomp & Circumstance No 1: Skaters' Waltz; Sabre Dance, etc: Tokyo Metropolitan Symphony Orch, Hiroshi Ishimaru cond.
Denon C37-7304

Josef Suk Plays 'Yesterday': Josef Suk, violin.
Supraphon SUP CD7243

Kreisleriana — concert pieces by Kreisler in the style of Beethoven; Boccherini; Couperin; Dittersdorf; Leclair; Martini; Porpora; Pugnani; Tartini: Lola Bobesco, violin; Wilhelm Hellweg, piano.
Philips (DDD) 412 607-2

Kroumata Percussion Ensemble
BIS BIS CD-232

Kroumata Percussion Ensemble: works by Jolivet, Harrison, Cage, Sandstroem: Manuela Wiesler, flutes.
BIS BIS CD-272

L'Histoire du Soldat (Stravinsky); Classical Symphony (Prokofiev); concerto No 1 (Shostakovich): Los Angeles Chamber Orch, Gerard Schwarz, cond.
Delos 3021

La Belle Epoque — Kiosque 1900, plus works by Lehar, Mozart; etc: Maurice Andre, trumpet.
Erato ECD-88 081

Lark Ascending; Fantasy on Theme of Tallis (Vaughan-Williams); Serenade for Strings (Elgar); Fantasia Concertante (Tippett): Academy of St Martin-in-the-Fields, Neville Marriner cond.
Vanguard CD-25 020

Le Parnasse Francais — French baroque chamber music by Marais, Rebel, Couperin, Leclair, Blavet, Corrette: Musica Antiqua Cologne, Reinhard Goebel cond.
Archiv (DDD) 415 298-2

Le Tombeau du Couperin (Ravel); Danses sacree et profane (Debussy); Dolly suite (Faure); etc: Academy of St Martin-in-the Fields, Neville Marriner cond.
Vanguard CD-25 019

Les Preludes; Hungarian Rhapsody (Liszt); William Tell overture (Rossini); Die Modlau (Smetana); etc: Berlin Philharmonic Orch, Herbert von Karajan cond.
DG (DDD) 413 587-2

Liebestraum No 3: Beethoven Moonlight sonata; Chopin, Schubert; Rachmaninoff: Compiled performances.
Decca 411 934-2

Lievestraume — The Most Beautiful Melodies for Harp: Ayakop Shinozaki, harp; Ensemble Lunaire.
Denon C37-7066

Liebestraume, Op 62, 1-3 (Liszt); Lieder Ohne Worte (Mendelssohn); Moments musicaux (Schubert); Daniel Barenboim, piano.
DG (AAD) 415 118-2

Marche Slav (Tchaikovsky); In the Steppes of Central Asia (Borodin); Russian Easter Overture (Rimsky Korsakov); etc: St Louis Symphony Orch, Leonard Slatkin cond.
Telarc 80072

Marimba Sections: Divertimento for marimba and also saxophone (Yuyama); Concerto pour marimba et ensemble a cordes (Miyoshi); Two movements for marimba (Tanaka); etc: Keiko Abe, marimba; Ryu Noguchi, Akiyasu Miyamoto, Hiroshi Koizumi, flutes; Masahiko Tanaka, contrabass.
Denon C37-7294

Mary's Music — songs and dances from the time of Mary, Queen of Scots: Scottish Early Music Consort, Warwick Edwards cond.
Chandos CHAN-8332

Medieval and Renaissance recorder music: Rene Clemencic, recorder; Clemencic Ensemble.
Harmonia Mundi HM 90.0384

Eine Kleine Nachtmusik (Mozart); Serenade from string quartet Op 3 No 5 (Haydn); adagio (Albinoni); Pachelbel: Canon and Gigue; Minuet (Boccherini); Minuet in G (Beethoven); Pina Carmirelli, violin; I Musici.
Philips (DDD) 410 606-2

Music For a Rainy Day: popular piano music by Chopin, de Falla, Scriabin, Beethoven, Stenhammar, etc: Roland Pontinen, piano.
BIS BIS CD-300

Music for Original Hunting Horns; St Hubert's Mass: Munich Perforce Players.
Orfeo ORF C034

Music for Trumpet and Strings: Stephen Burns, trumpet.
ASV DCA 526

Music for wind ensemble: Ensemble Wien-Bien.
CBS CD 39558

Music from the Courts of Mantua and Ferrara.
Chandos CHAN-8333

Music of Ancient Greece: Atrium Musicae.
Harmonia Mundi HM 90.1015

Music of Spain Vol 4: the Classical Heritage: Julian Bream, guitar.
RCA RCD14549

Music of Spain, Vol 8: Concierto de Aranjuez (Rodrigo); Tres Piezas Espanolas; Invocation et danse: Julian Bream, guitar; Chamber Orch of Europe, John Eliot Gardiner cond.
RCA RCD14900

Music of the Gothic Era: Notre Dame period (1160-1250); Ars antiqua (1250-1320); Ars nova (1320-1400); Early Music Consort of London, David Munrow cond.
Archiv (ADD) 415 292-2

Mythomania of Witches, Fairies, etc: Bareen Gaesslin.
Harmonia Mundi 567-1 99 948-2

New Year's Day Concert: Wiener Philharmoniker, Willi Boskovsky cond.
Decca 410 256-2

Nimbus Natural Sound — selections from Nimbus CD range; various artists.
Nimbus NIM 5001

Nimbus Natural Sound Vol 2 — seletions from Nimbus CD: various artists.
Nimbus NIM 5015

O Dolce Vita Mia: works by Gastoldi, Willaert; Canali; Merulo; etc: London Early Music Group.
WEA 79029-2

Ode To Joy — Symphony No 9 — 4th movement (Beethoven); Messiah-Hallelujah (Handel); works by Haydn; Mendelssohn; Mozart; Bach: Compiled performances.
Decca 411 957-2

Opera overtures and intermezzi: La gazza ladra; La Giogonda; Cavelleria Rusticana; etc: Members of the Dresden State Opera Chorus; Dresden State Orchestra; Silvio Varviso, cond.
Philips (DDD) 412 236-2

Organ Concert at Holmens Church: Sonata Sui Flauti III (Martini); Wie Schon Leuchtet der Morgenstern (Telemann); Voluntary in D Major (Boyce); etc: Jorgen Ernst Hansen, organ.
Denon C37-7059

Organ Concert at our Saviour's Church: Fantasia 'Cromatica' (Sweelinck); Prelude and fugue in E minor, BWV 548 'Wedge' (J. S. Bach); Prelude & Fugue on the name B-A-C-H, G260 (Liszt); Choral No 2 in B minor (Franck): Charley Olsen, organ.
Denon C37-7015

Organ Concert at the Stadtkirche St Nikolaus, Frauenfeld: Heinz Ball, organ of Metzler.
Denon C37-7068

Organ music of the Renaissance, by Valderravano, Praetorius, Merulo, Pellegrini, etc: Herbert Tachezi, organ.
Teldec 8.42 587

Organ recital: Michael Murray, Ruffatti organ, Davies Hall.
Telarc 80097

Original works for cello and double bass by Telemann, Haydn, Boccherini, etc: J. Baumann, cello; K. Stoll, double bass.
Teldec 8.42 827

Peach Blossoms Floating in the River — Chinese orch. favourites: Singapore Symphony Orch, Choo Hooey cond.
Hong Kong HK 8.240185

Peter and the Wolf (Prokofiev) — William Buckley, narrator; Toy Symphony (Mozart) — Luxembourg Radio/TV Orch; Nutcracker suite (Tchaikovsky) — Minnesota Orch, Leonard Slatkin cond:
Pro Arte PA-CDD 184

Pictures at an Exhibition (Mussorgsky/Ravel); Pines of Rome (Respighi): Chicago Symphony Orch, Fritz Reiner cond.
RCA RCD15407

Popular French and English dances of the 16th century: Broadside Band, Jeremy Barlow cond. Harmonia Mundi HM 90.1152

Popular piano pieces — works by de Falla, Gottschalk, Liszt, Chopin, etc: Gloria Saarinen, piano.
Sefel SE-CD 5029

Bolero (Ravel); Espana (Chabrier); Capriccio Italien (Tchaikovsky), etc: Staatskapelle Dresden; Neville Marriner, cond.
Philips (DDD) 410 047-2

Recorder concertos: Marcello Vivaldi; Telemann; Naudot: Michala Petri, recorder; Academy of St Martin-in-the Fields, Neville Marriner cond.
Philips (DDD) 412 630-2

Recorder concertos — by Babell, Handel, Baston, Jacob: Michala Petri, Academy of St Martin-in-the-Fields, Kenneth Sillito.
Philips (DDD) 411 065-2.

Renaissance and Early Baroque Dance Music: Elsamer Collegium, Konrad Ragossnig cond.
Archiv (ADD) 415 294-2

Renaissance, Elizabethan and Baroque music by Bach, Coperario, Dowland, etc: American Brass Quintet.
Delos 3003

Romance and Souvenir: Romance (Beethoven); Nocturne (Chopin); Eine Kleine Nachtmusik (Mozart); etc:

Jean-Jacques Kantarow, violin; J. O'conor; etc; New Japan Philharmonic, M. Inque cond.
Denon C37-7149
Romantic Guitar Music: Paul Gregory, guitar.
Meridian ECD-84 092
Romantic organ music; Widor: Franck; Brahms; Mendelssohn, etc; Peter Hurford, organ.
Argo 410 165-2
Romantic Overtures; Light Cavalry (Suppe); Merry Wives of Windsor (Nicolai), Poet and Peasant (Suppe); etc: Tokyo Metropolitan Symphony Orch, Kenichiro Kobayashi cond.
Denon C37-7012
Romantic Violin Miniature: Poeme, Op 25 (Chausson); Zigeunerweisen, Op 20 (Sarasote); Romance in F Major, Op 50 (Beethoven); etc: Jean-Jacques Kantarow, Violin; New Japan Philharmonic, Michi Inque cond.
Denon C37-7005
Russian Piano Music: works by Stravinsky, Scriabin, Shostakovich, Rachmaninov, Prokofiev, Khatchaturian: Roland Poentinen, piano.
BIS BIS CD-276
Salon Music I: Salon Orch Colln.
Harmonia Mundi 567-1 99 946-2.
Salon Music II: Salon Orch Colln
Harmonia Mundi 567-1 99 947-2
Salus Hungaricus: Budapest Baroque Strings.
Hungaraton HCD 12445-2
Saxophone Concerti by Lars-Erik Larsson, Alexander Glazunov and Jorma Panula; Pekka Savijoki, saxophone; New Stockholm Chamber Orch, Jorma Panula cond.
BIS BIS CD-218
Scottish Overtures: Land of the Mountain and the Flood: Scottish National Orch; Alexander Gibson cond.
Chandos CHAN-8379
Seranata — salon music of the 20th century: I. Salonisti.
Harmonia Mundi 567-1 99 995-2
Serenade for string orch (Barber); Serious Song; Lament for string orch (Fine); Elegy (Carter); Rounds for string orch (Diamond): Los Angeles Chamber Orch.
WEA 79002-2
Serenade for Strings (Tchaikovsky); Canon (Pachelbel); etc: St Louis Symphony Orch, Leonard Slatkin cond.
Telarc 80080
Suite No 2 for 2 pianos (Rachmaninov); La Valse (Ravel); Variations on a theme of Paganini (Lutoslawski): Martha Argerich; Nelson Freire, pianos.
Philips (DDD) 411-034-2
Shura Cherkassky in Concert, Vol 1: works by Schumann, Brahms; etc: Shura Cherkassky, piano.
Nimbus NIM 5020.
Shura Cherkassky in Concert, Vol 2: works by Bach, Berg, Beethoven: Shura Cherkassky, piano.
Nimbus NIM 5021
Smoke Gets In Your Eyes: Carmen fantasy (Bizet); Smoke Gets In Your Eyes (Kern); Introduction e tema con variazione (Puccini); Ne Me Quittes Pas (Brel); etc: Paganini Ensemble (Jean-Jacques Kantarow, violin).
Denon C37-7402
Sound of Trumpets — works by Attenberg, Biber, Vivaldi, Torelli, Telemann: Gerard Schwarz, trumpet and cond; New York Trumpet Ensemble; Y Chamber Symphony of New York.
Delos 3002
Star Tracks: Cincinatti Pops plus synthesiser.
Telarc 80094
Stars and Stripes: Frederick Fennell.
Telarc 80099
Suite No 1 in E flat (Holst); Royal Fireworks Music (Handel): Cleveland Symphonic Winds, Frederick Fennell cond
Telarc 80038
Swedish Serenade: works by Wiren, Larsson, Soederlundh, Lidholm: Alf Nilsson, oboe; Stockholm Sinfonietta/Salonen.
BIS BIS CD-285
Tangos II: Cafe Victoria: I Salonisti.
Harmonia Mundi 567-1 69 531-2
Tarantule-tarantelle: Atrium Musicae, Panigua.
Harmonia Mundi HM 90.0379.
1812 Overture; Oriental Fantasy; Polovtsian Dances; In the Steps of Central Asia; Overture — Rusian and Ludmilla, etc: Bavarian Radio Chorus and Symphony Orch, Esa-Pekka Salonen, cond.
Philips (DDD) 412 552-2
Telarc Sampler Vol 1-18 tracks (65 min): artists.
Telarc 80101
Telarc Sampler Vol 2-20 tracks (67 min): artists.
Telarc 80102
Telemannia (Henze); Scarlattiana (Casella); Bachianas Brasilieras No 9 (Villa-Lobos): Berlin Radio Symphony Orch, Albrecht cond.
Schwann SCH 11611
Ten Glorious Organs in Europe: Mein Junges Leben Hat Ein End (Sweelinck); toccata and fugue (Bach); Passacaglia (Buxtehude) etc: Jacques van Oortmerssen; Hans Otto; Heinz Balli; Christoph Albrecht; Helmuth Rilling; J. E. Hansen: Pierre-Yves Asselin; Knud Vad; Charley Olsen.
Denon C37-7180
The Academy — By Request: Academy of St Martin-in-the-Fields, Neville Marriner cond.
EMI 747027
The Arp Schnidtger Organ: Jacques van Oortmerssen, organ.
Denon C37-7492
The Authentic Baroque: Kanon (Pachelbel); Air on a G stringi (Bach); Fanfare from suite in D (Mouret); Collegium Aureum, on original instruments.
Pro Arte PA-CDD 215
The Blue Danube: Music of the Strauss Family: Wiener Philharmoniker, Willi Bosovsky cond.
Decca 411-932-2
The Classical Sound of Chandos: demonstration record of excerpts by Holst, Weber, Tchaikovsky, Stravinsky, etc.
Chandos CHAN-8301
The English Connection: Academy of St Martin-in-the-Fields, Neville Marriner cond.
ASV DCA 518
The French Connection: Academy of St Martin-in-the-Fields, Neville Marriner cond.
ASV DCA 517
The Harmonious Blacksmith (Handel); Passacaglia in D minor (Fischer); Les Baricades Mysterieuses (Couperin); Italian concerto (Bach); Gavotte (Rameau); two sonatas in E major (Scarlatti); etc: Trevor Pinnock, harpsichord.
Archiv (DDD) 413 591-2
The Meeting: Improvisations on 2 pianos; Someday my Prince will Come; Put your little foot out; Poem No 3; Wiegenlied (Brahms): Chick Corea; Friedrich Guida, pianos.
Philips (DDD) 410 397-2
The New Superstars: Yo-Yo Ma, cello: Wynton Marsalis, trumpet; Cho-Liang Lin, violin.
CBS CD 39310
The Romantic Cello — works by Schumann, Bruch, Saint-Saens; Faure, Popper: Shauna Rolston, cello.
Sevel SE-CD 5036
The Yirtuoso Trumpet: works by Arban, Francaix, Tisne, Honegger, Maxwell Davies, etc: Hakan Hardenberger, trumpet; Roland Pontinen, piano.
BIS BIS CD-287
This is 'Denon CD': Symphony No 7 finale (Bruckner); Clarinet Quintet (Mozart); Feux d'Artifice (Debussy) etc: various artists.
Denon C37-7060
Time Warp — Space Spectacular: Cincinatti Symphony Orch, Erich Kunzel cond.
Telarc 80106
Toccata and Fugue; Organ works: J. S. Bach, Albinoni; Mendelssohn; Widor, etc: Peter Hurford, organ.
Decca 411 929-2
Toccata: music for two guitars: Arbiton, Schollmann, guitars.
Schwann SCH 15101
Travels with My Cello: romantic pieces for cello and orchestra: Julian Lloyd Webber, cello, English Chamber Orchestra; Nicholas Cleobury.
Philips (DDD) 412-231-2
Troubadors and Trouveres: Thomas Binkley.
Teldec 8.35 519 (2 CDs).
Trumpet concerto (L. Mozart); Toy Symphony (M. Haydn-L. Mozart); etc: Guy Touvron, trumpet; J-F Paillard Chamber Orchestra, J-F Paillard cond.
Erato ECD-88 021
Trumpet concertos by Hummel, Haydn, L. Mozart: Wynton Marsalis, trumpet; Philadelphia Orch, Raymond Leppard cond.
CBS CD 37846
Trumpet concertos by Hummel, Schwarzkopff, Querfurth: Ludwig Guttler, trumpet.
Capriccio 10.009
Trumpet concertos by Hummel, Telemann, Neruda; etc: M and L Andre and Guy Touvron, trumpets; Ensemble Orch Paris, Jean-Pierre Wallez cond.
Erato ECD-88 007
Trumpet concertos by Mozart, Haydn, Molter: Ludwig Guttler, trumpet.
Capriccio 10.010
Trumpet concertos by Stolzel, Telemann, Vivaldi, etc.
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Trumpet Concertos of the Baroque by Telemann, Baldassare, etc: Ludwig Guttler, trumpet.
Capriccio 10.055
Trumpet recital: Ludwig Guttler.
Capriccio 10.015
Turned On Broadway: Broadway Symphony Orch.
RCA RCD 14327
Under the Silver Moon — popular Chinese classics, Vol 2: Hong Kong Phil Orch, Jean cond.
Hong Kong HK 8.240279
Vienna 1850 — dances by Strauss, Diabelli: Bella Musica Ensemble Vienna.
Harmonia Mundi.
HM 90.1013
Violin concerto in D, Op 6 (Paganini-Wilhemi); Fantasy in C, Op 131 (Schumann-Kreisler): Gidon Kremer, violin; Vienna Symphony Orch, Wallberg cond.
Ariola-Eurodisc 610 120-231
Virtuoso Music for Cello: Grave (W.F. Bach); Le Cygne (Saint-Saens); Arioso (J.S. Bach); etc: Janos Starker, cello.
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Virtuoso Trombone: works by Rimsky-Korsakov, Sulek, Martin, Monti; etc: C. Lindberg, trombone; R. Poentinen, piano.
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Violin concerto in E flat (Vivaldi) Ciacona (Purcell); Concerto Grosso Op 6 No 1: Arrival of the Queen of Sheba (Handel); etc: Layton James, harpsichord; St Paul Chamber orchestra; Pinchas Zukerman, violin and director.
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Water Music of the Impressionists — works by Ravel, Liszt, Debussy, Griffes: Carol Rosenberger, piano (Bosendorfer Imperial Concert Grand).
Delos 3006
Gothic Symphony for organ (Widor); Largo (Handel); Trumpet Voluntary (Clarke); etc: John Longhurst; Mormon Tabernacle Organ.
Philips (DDD) 412 217-2
Works by Bach, Reger, Franck, Dupre: Edgar Krapp, organ of Passau Cathedral.
Ariola-Eurodisc 610 110-231
Works by Bach, Scarlatti, Brahms: Gloria Saarinen, piano.
Sefel SE-CD 5016
Works by Brahms and Webern: Bartholdy Quartet.
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Works by Dvorak, Janacek and Enesco: Enesco Quartet.
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Works by Milhaud, Poulenc, Sauguet: Orch Concerts Lamoureaux, Sauguet, Baudo.
Chant du Monde LDC 278.300
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Ernani: Riccardo Muti.
EMI 747083
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DG (DDD) 410 503-2 (2CDs)
Falstaff: Guiseppe Taddei; Rolando Panerai; Francisco Araiza Raina Kabaivanska; Janet Perry; Christa Ludvig; Vienna State Opera Chorus; Herbert Von Karajan, cond.
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Four sacred pieces: Riccardo Muti.
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Rigoletto — complete: Sutherland; Pavarotti; Milnes; Talvela, London Symphony Orch, Richard Bonynge cond.
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Rigoletto: Renato; Edita Gruberova; Neil Shicoff; Briggete Fassbaender; Robert Lloyd; Coro e Orchestra dell'Accademia Nazionale di Santa Cecilia; Guiseppe Sinopoli cond.
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Four Seasons; la Tempesto di Mare; Il Piacere: Concentus Musicus Vienna, Nikolaus Harnoncourt cond.
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Erato EC-88 042
Oboe concertos, RV 447, 453, 457, 461, 463: I Solisti Veneti, Claudio Scimone cond.
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Oboe sonatas, Op 13: Schellenberger, Geringas, Krapp, Stoll.
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BH Sings Spirituals: Barbara Hendricks, soprano.
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Cantatas and arias by Scarlatti and Melani: Judith Nelson, soprano; Dennis Ferry, trumpet.
Harmonia Mundi HM 90.5137
Come To The Fair: Kiri Te Kanawa, soprano.
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Folksongs For Children; Vienna Boys' Choir
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Four Last Songs (R. Strauss); lieder (Tchaikovsky): Terisa Zylis-Gara; Hanover Symphony Orch, Decker cond.
Rodolphe RPC 32392
French and Italian opera: Edith Gruberova, soprano.
EMI 747047
French songs by Enesco, Roussel, Debussy: Sarah Walker; Roger Vignoles.
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Gregorian chants: Paris Gregorian Choir.
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Gregorian chants; Mass of the Virgin Mary; Rorate cacle Jubilate Deo; Deo Profundis Beati mundo corde; Christus factus est; Improperium; Dicit Dominus; Jubilate Deo; Schola of the Hofburgkapelle Vienna; Father Hubert Dopf.
Philips (DDD) 411 140-2
Hallelujah from the Messiah (Handel); Panis Angelicus (Franch); Pieta, Signore (Stradella); German mass (Schubert); Ave Maria (Gounod); etc: Jose Carreras, tenor; Vienna Boys' Choir; Vienna Symphony Orchestra; Uwe Christian Harrer, cond.
Philips (DDD) 411 138-2
Japanese Favourite Songs: Konomichi; Shikarete; Soushon-fu; etc: Yumiko Samejima, soprano; Helmut Deutsch, piano.

Denon C37-7391
Kiri Te Kanawa — Ave Maria and other well-loved church music, including Let The Bright Seraphim; Panis Angelicus; Jesu, Joy of Man's Desiring; On Wings of Song: Kiri Te Kanawa; soprano; Choir of St Paul's Cathedral; English Chamber Orchestra; Barry Rose, cond.
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La Marsellaise; Kalinka; Volga Boatmen; Soldiers from Faust and other favourite choral works: Soviet Army Choir.
Chant du Monde LDC 274.768
Lecuona Songs: Placido Domingo, tenor.
CBS CD 38828

Leontyne Price and Marilyn Horne in Concert at the Met: works by Mozart, Handel, Rinaldo, Verdi: Leontyne Price; Marilyn Horne; Metropolitan Opera Company, James Levine cond.
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Lieder by Brahms, Wolf, Schubert: Harald Stamm, bass.
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Lieder of Debussy, Ravel, Duparc, Rodrigo: Margaret Price.
Orfeo ORF C038
Lieder by de Falla, etc: Alicia Nafe
Bellaphon 690.01.010
Love is — Because You're Mine; As Time Goes By; Love Is a Many Splendoured Thing; etc: Jose Carreras, tenor; Robert Farnon and his Orchestra.
Philips (DDD) 412 270-2
Mamma; 16 popular Italian songs; Luciano Pavarotti, Henry Mancini.
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Missa Criolla: Los Fronterizos; Cantoria de la Basilica del Socorro; Ariel Ramierez, cond.
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Monserrat Caballe sings Wagner; Monserrat Caballe, soprano.
CBS CD 37294
My Life For a Song: Placido Domingo, tenor.
CBS CD 37799

Neopolitan Songs, including Funiculi, funicula; Core'ngrato Torna a Surriento, Capua: O Sole mio: Jose Carreras; English Chamber Music Orchestra; Eduardo Muller, cond.
Philips (DDD) 400 015-2
O Holy Night; popular sacred songs: Luciano Pavarotti, National Philharmonic Orch, Kurt Herbert Adler cond.

Decca 414 044-2
O Sole Mio; Neapolitan songs: Luciano Pavarotti.
Decca 410 015-2
Opera arias by Monteverdi and Cavalli: Frederica von Stade, mezzo; Scottish Chamber Orch, Raymond Leppard cond.
Erato ECD-88 100
Opera arias: Hermann Prey, baritone.
Capriccio 10.054
Operatic arias: Terisa Zylis-Gara; Polish National Phil Orch, Kord cond.
Rodolphe RPC 32402
Operatic Duets; La Traviata; Otello, etc: Joan Sutherland, Luciano Pavarotti, National Philharmonic Orch, Richard Bonynge cond.
Decca 400 058-2
Operetta Concert — 60 mins.
Delta 11.010
Operetta Favourites by Strauss, Lehar, Kalman, Stolz: Bernd Weikl, baritone; Austrian Symphony Orch; Eichorn cond.
Operetta Melodies — 60 mins: Budapest Phil Orch.
Delta 11.009
Perhaps Love: Placido Domingo, tenor.
CBS CD 73592
Placido Domingo — Be My Love: Granada; Core 'ngrato; Dein Ist Mein Ganzes Herz; Mattinata; Because; etc: Placido Domingo, tenor; London Symphony Orch, Karl-Heinz Loges, Marcel Peeters cond.
DG (ADD) 413 451-2
Placido Domingo — Grand Gala Concert: L'Elisor d'Amore; Lucia di Lammermoor; Ernani; Il Trovatore; Carmen; Aida; etc: Placido Domingo; Los Angeles Philharmonic Orch, Carlo Maria Giulini cond.
DG (DDD) 400 030-2
Placido Domingo Sings Tangos: Caminito; Nostagias Volver Vida Mia; Mi Buenos Aires Querido; etc: arranged and conducted by Roberto Pansera.
DG (ADD) 415 120-2
Placido Domingo Sings Verdi and Puccini — Aida; Nabucco; Il Trovatore; Don Carlos (Verdi); Manon Lescaut; Turandot (Puccini): Placido Domingo with Katia Ricciarelli, Leo Nucci, Ruggero Raimondo, Elena Obratztsova; etc; orchestras of La Scala, Milan; German Opera Berlin; Vienna Philharmonic.
DG (DDD) 413 785-2
Ravel: Sheherazade; Debussy: La Damoiselle Elue; Duparc: Chanson triste; L'invitation au voyage; Elly Ameling, Jacie Taylor; San Francisco Symphony Chorus and Orchestra; Edo de Waart, cond.
Philips (DDD) 41 043-2
Recital: Julia Migenes, mezzo-soprano.
WEA 240295-2
Russian Liturgical Chant: Choir of the monastery of Trinity-St Serge.
Chant du Monde LDC 278.691
Sacred Songs; Gounod: Sanctus; O Divine Redeemer; Franck: Panis Angelicus; Schubert: Ave Maria; Mcgimsey; Sweet Little Jesus Boy; Adams: The Holy City; etc: Jessye Norman; Ambrosian Singers; Royal Philharmonic Orchestra; Sir Alexander Gibson, cond.
Philips (DDD) 400 019-2
Selected songs by Brahms, Dvorak, Richard Strauss: Edita Gruberova.
Orfeo ORF C066

Sentimental Me; I Get a Kick Out of You; All the Things You Are: Night and Day; Caravan; Sophisticated Lady; Begin the Beguine; What is this Thing Called Love? Elly Ameling, soprano; Louis van Dijk, piano; John Clayton, double-bass.
Philips (DDD) 412-433-2
Serenata; songs by Tosti; Dowland; Satie; Hahn; Bizet; Gounod; Chabrier, etc: Elly Ameling, soprano; Rudolf Jansen, piano.
Philips (DDD) 412-216-2
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LOVE LIVE, Polygram, 818329-2.

BERLIN PHILHARMONIC ORCHESTRA
THE BEATLES IN CLASSIC, Carinia, 8.25579.

BERRY, CHUCK
BEST OF CHUCK BERRY, Another, 600033.

BIANCO, MATT
WHOSE SIDE ARE YOU ON? WEA, 240472-2.

BIG COUNTRY
STEELTOWN, Polygram, 822831-2; BIG COUNTRY, THE CROSSING, Polygram, 812870-2.

BLACK DYKE MILLS BAND
BLITZ, Chandos, CHAN-8370.

BLACK, STANLEY
DIGITAL MUSIC, Polygram, 800089-2. ETERNAL SCREEN MUSIC, Polygram, 3122-13. RUSSIA, Polygram, 820183-2.

BLAKEY, ART
ART BLAKEY & THE JAZZ MESSENGERS, Vogue, 6000 30.

BLANCHARD, TERRENCE
NEW YORK SECOND TIME, Festival, CD 39993.

BLANCMANGE
MANGE TOUT, Polygram, 810235-2.

BLEY, CARLA
LIVE, ECM, 815 730-2.

BLONDIE
BEST OF BLONDIE, Festival, CD-52003; PARALLEL LINES, Festival, CD 36694.

BLUE NILE
WALK ACROSS THE ROOFTOPS, EMI, LKHCD 1.

BOETTCHER, MARTIN ORCHESTRA
WINNETOU MELODIES, Teldec, 8.24.965.ZP

BON JOVI
7800 FAHRENHEIT, Polygram, 824509-2.

BOOMTOWN RATS
V DEEP, Polygram, 800041-2.

BORELLY, JEAN-CLAUDE
LES 20 MERVEILLES DU MONDE, WEA, 822649-2.

BOSKOVSKY, WILLI
BLUE DANUBE, Polygram, 411932-2; NEW YEAR'S CONCERT 1979, Polygram, 410256-2.

BOSTON POPS
AMERICA, THE DREAM GOES ON, Polygram, 412627-2.

BOWIE, DAVID
ALLADIN SANE, RCA, PCD14852; CHANGES ONE BOWIE, RCA, PCD11732; FAME AND FASHION, RCA, PCD14919; GOLDEN YEARS, RCA, PCD14792; HEROES, RCA, PCD12522; HUNKY DORY, RCA, PCD14623; LET'S DANCE, EMI, 746002; LODGER, RCA, PCD13254; LOW, RCA, PCD12030; PETER AND THE WOLF, RCA RCD12743; PIN UPS, RCA, PCD10291; SCARY MONSTERS, RCA, PCD13647; SPACE ODDITY, RCA, PCD14813; STATION TO STATION, RCA, PCD11327; RISE AND FALL OF ZIGGY STARDUST, RCA PCD14702; TONIGHT, EMI, 746047; YOUNG AMERICANS, RCA, PCD10998.

BOWIE, LESTER
I ONLY HAVE EYES FOR YOU, ECM, 825 902-2.

BRAND DOLLAR
ANTHEM FOR THE NEW NATIONS, Denon, C38-7261.

BRANIGAN, LAURA
BRANIGAN 2, Atlantic, 80052-2; BRANIGAN, Atlantic, 19289-2; SELF CONTROL, Atlantic, 80147-2

BRONSKI BEAT
THE AGE OF CONSENT, Polygram, 820171-2.

BROONZY, BIG BILL
BIG BILL BLUES, Vogue, 6000 41.

BROWN, CLIFFORD
ALTERNATIVE TAKES, EMI, 746098; BIG BAND, Vogue, 6000 25; CLIFFORD BROWN QUARTET/SEXTET, Vogue, 6000 20.

BROWN, JAMES
CD OF JB, Polygram, 825714-2.

BROWNE, JACKSON
LAWYERS IN LOVE, Elektra/Asylum, 60268-2.

BROWNE, TOM
BROWNE SUGAR, GRP, D9517.

BRUBECK, DAVE
THE QUARTET, Denon, 7681; TIME OUT, CBS, CDCBS62068.

BRYSON, PEABO
STRAIGHT FROM THE HEART, Elektra/Asylum, 60362-2.

BUCKINGHAM, LINDSAY
GO INSANE, Polygram, 822450-2; LAW AND ORDER, Polygram, 800045-2.

BURDON, ERIC
STARPORTRAIT, Polygram, 825231-2; WINDS OF CHANGE, Polygram, 825712-2.

BURRELL, WASHINGTON
TOGETHERING, EMI, 746093.

BURTON, GARY
REAL LIFE HITS, ECM, 825 235-2; WORK SERIES, ECM, 823 267-2.

BUSH, KATE
HOUNDS OF LOVE, EMI, 746164; KICK INSIDE, EMI, 7460$12; LION HEART, EMI, 746065.

BUZON, PIERRE
LA VIE Vol 1, MRA CDA 358.

BYRD, DONALD
NEW PERSPECTIVE, EMI, 746096.

CALE, J. J.
AUGUST MOON, Polygram, 3112-28; GRASSHOPPER, Polygram, 800038-2; No 8, Polygram, 811152-2; SHADES, Polygram, 800105-2; SPECIAL EDITION, Polygram, 818633-2; Troubador, Polygram, 810001-2.

CALIFORNIA PROJECT
PAPA DOO RUN RUN — Beach Boy's Hits, Telarc, 70501.

CARA, IRENE
WHAT A FEELIN', CBS, CDEPC24730.

CARNES, KIM
CAFE RACERS, EMI, 746022.

CARPENTERS
THE SINGLES, Festival, CD 38093; VOICE OF THE HEART, Festival, CD 53113; YESTERDAY ONCE MORE, Festival, CD 60017/8.

CARRERAS, JOSÉ
LOVE IS . . . POPULAR ROMANTIC SONGS, Polygram, 412270-2.

CARS
CANDY-O, Elektra/Asylum, 507-2; HEARTBEAT CITY, Elektra/Asylum, 60296-2; SHAKE IT UP, Elektra/Asylum, 567-2; GOOD TIMES ROLL, Elektra/Asylum, 64135-2.

CARTER, RON
TELEPHONE, Festival, CD 39670.

CASH, JOHNNY
20 GREATEST HITS, Bellaphon, 290.13.001; ORIGINAL GOLDEN HITS, Bellaphon, 288.07.002; THE HIGHWAYMAN, CBS, CDCBS26147.

CHACKSFIELD, FRANK
GOLDEN GREATS, Polygram, 3122-3.

CHARLIE
CHARLIE, Polygram, 813662-2.

CHICAGO
16, Warner, 2-99235
17, Warner, 25060-2.

CHINA CRISIS
FLAUNT THE IMPERFECTION, EMI, CDV 2342; WORKING WITH FIRE, EMI, CDV 2286.

CHUCK BERRY
BEST OF CHUCK BERRY, Vogue, 6000 33.

CLAPTON, ERIC
461 OCEAN BOULEVARD, Polygram, 811697-2; BEHIND THE SUN, Warner, 25166-2; BLUES BREAKERS, Polygram, 800086-2; JUST ONE NIGHT, Polygram, 800093-2; SLOWHAND, Polygram, 823276-2; TIMEPIECES, Polygram, 800014-2; TIMEPIECES Vol 2, Polygram, 811835-2; BACKTRACKIN', Polygram, 821937-2.

CLARK, PETULA
GREATEST HITS, Vogue, 6000 58.

CLAYDERMAN,, RICHARD
COEUR FRAGILE, WEA, 822517-2.; MUSIQUES DE L'AMOUR, WEA, 822440-2; REVERIES, WEA, 818629-2.

CLAYTON, JOHN
SENTIMENTAL ME (POPULAR BALLADS), Polygram, 412433-2.

CLIFF, JIMMY
POWER AND THE GLORY, CBS, CDCBS25761.

TO BE CONTINUED

Next month we will conclude our listing of classical and popular compact discs.

Remote-Controlled Mains Switch

You don't have to get out of bed to turn the TV set off. With this infra-red remote-controlled switch, you can turn any mains appliance on or off by pressing the button on a small hand-held transmitter.

Onkyo CD Player

Next month, we have a look at the DX-200 CD player from Onkyo, a brand name that has returned to Australia after a long absence.

Next month in Electronics Australia

UHF TV Down-Converter

Interested in SBS television but stuck with a VHF-only TV set? Our new UHF down-converter is the answer. It's easy to build, can be continuously tuned from channels 21 to 63, and provides a converted output on VHF channel 1.

CD Adaptor for Cars

Held over again due to lack of space, this simple unit allows you to connect one of the new portable CD players to your car hifi system.

Note: Although these articles have been prepared for publication, circumstances may change the final content.

Books & Literature

Electronics for alternative energy

ELECTRONIC DESIGN AND CONSTRUCTION OF ALTERNATE ENERGY PROJECTS: by R. Andrew Motes. Published 1985 by Tab Books Inc. Soft covers, 282 pages, with appendices and bibliography. Illustrated with diagrams, tables and examples. ISBN 0-8306-1672-1. Retail price $19.95.

In this book, author R. Andrew Motes has addressed what, to date, has been a major problem in alternative energy literature: the lack of material on electronic control systems. Most books have previously tended to devote themselves solely to the mechanical aspects of such systems.

"Alternate Energy Projects" fills an important void. But this is not just a theoretical text. Its 14 chapters are full of practical advice on the setting up of alternative energy projects, with special emphasis on wind and solar power.

In particular, the book concentrates on monitoring and control devices for wind and solar power, and presents many useful circuits. For the most part, these circuits are designed to use low-cost, readily-available components, including salvaged automotive parts.

A look at the chapter headings reveals the scope of the book: (1) Basics of Wind Energy; (2) Measuring Wind Speed; (3) A Wind-Power System Simulator for Testing Alternators; (4) Circuits for Charging Nickel-Cadmium Batteries; (5) Circuits for Charging Lead-Acid Batteries; (6) A Tip-Speed-Ratio Controller for Wind Generators; (7) Automobile Alternator Modifications for High Output Voltage; (8) DC-to-AC Converters; (9) Automatic Load-Switching Circuits; (10) Basics of Solar Energy; (11) Circuits for Automatic Control of Solar Energy Gathering Devices; (12) Converting Solar Energy to Electrical Energy; (13) Microprocessor-Based, Priority Power Distribution System; (14) Circuits for the Control, Monitoring and Support of Electric vehicles.

In addition to the above chapters, there are three appendices: Basic Electronics, 8080A Instruction Set, and Keyboard and Bootstrap Machine Language Program.

This is most certainly a book not to be missed by alternative energy enthusiasts.

Our review copy came from Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. (L.U.)

Worldwide shortwave listing

RADIO DATABASE INTERNATIONAL: Quick access guide to shortwave broadcasting schedules: edited by Lawrence Magne and Tony Jones. Published by International Broadcasting Services Ltd, Penn's Park, PA, 1985. Soft covers. International Broadcasting Edition (Part 1), 217 pages plus reviews; Tropical Bands Edition (Part 2), 57 pages plus reviews. Part 1 ISBN 0-914941-01-1; Part 2 ISBN 0-914941-02-X. Retail price $28.50 for both.

Compiled in a tabloid form, these guides give the user quick access to the world's shortwave broadcasting schedules. The stations are listed in order of increasing frequency, with accompanying graphics data providing broadcasting schedules, transmitter power, alternative frequencies, mode, and the target area.

According to the jacket notes, the list of stations has been made as accurate as possible and is updated each year. The list even includes clandestine operations, pirate stations and jamming transmissions.

The frequency list comes in two parts. Part 1 is the "International Broadcasting Edition" and covers the shortwave spectrum between 5.73MHz and 26.1 MHz. Part 2 is the "Tropical Bands Edition" and covers 2-5.73MHz.

A short section at the back of Part 1 contains reviews of a number of shortwave receivers. It should be noted, however, that these reviews apply to the US market. Not all the models reviewed are available in Australia.

For the avid shortwave listener, these books would make handy reference material. Our review copy was supplied by Technical Book & Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne, Vic 3000. (L.U.)

Principles & Practice of Digital ICs and LEDs

PRINCIPLES & PRACTICE OF DIGITAL ICs & LEDs: by Don Inbody. Published 1984 by Tab Books, Blue Ridge Summit, PA. Soft covers. 275 pages with appendices and glossary. Illustrated with circuit diagrams and projects. ISBN 0-8306-0177-5. Retail price $22.95.

As its title suggests, the aim of the book is to provide the student with a thorough grounding in the fundamentals of digital logic, including both TTL and CMOS ICs, LEDs, construction techniques and troubleshooting.

The book is both theoretical and practical in concept, and describes numerous projects for the student to build. These include a digital logic probe, an executive decision maker, digital dice, a darkroom timer, a clock and a metronome. In each case, the project is designed to illustrate theoretical concepts.

There are nine chapters in all: (1) Digital Basics; (2) Getting Started; (3) Light Emitting Diodes; (4) Building Blocks; (5) Construction Techniques; (6) Troubleshooting; (7) Projects; (8) Digital Timer Projects; (9) Fundamentals of Electricity.

Chapter 5 is particularly useful. It explains the pitfalls and joys of designing and building your own metalwork, right up to the labels. Chapter 6 is entirely devoted to troubleshooting, not only the projects described in the book but anything the reader may tackle in general.

At the back of the book are four appendices; Selected Integrated Circuits and LED Displays; References; Sources of Components; Schematic Diagram Symbols. The book concludes with a glossary of terms and an index.

From a learner's point of view, "Digital ICs & LEDs" provides an excellent introduction to the theory and practice of digital logic. Our review copy came from Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde 2113. (L.U.)

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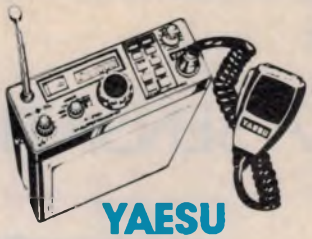

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164 Pacific Hwy	Gore Hill	439 5311
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QLD

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SA

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Main North Rd & Darlington St	Enfield 260 6088
24 Park Terrace	Salisbury 281 1593

WA

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NT

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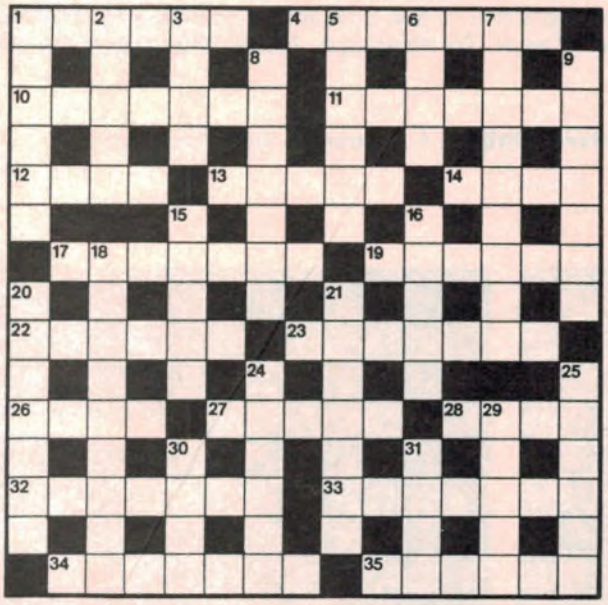
MARCH CROSSWORD

DOWN

1. Measuring device. (6)
2. Comparative unit. (5)
3. Fleming had one for his hand. (4)
5. Remove from jack. (6)
6. Cable of an appliance. (4)
7. Register of parts. (9)
8. Again inserts cassette. (7)
9. Distorted the peaks of waveform. (7)
15. Could it be 27 down, alphanumerically? (1,1,1,1,1)
16. Turntable specification. (5)
18. Aircraft landing system. (9)
20. Unit showing battery capacity. (3-4)
21. There could be a signal to a driver here! (3-4)
24. Good feature of EFTS. (6)
25. Part of speaker structure. (6).
29. Automatic teller output. (5)
30. Possible brief 'scope label. (4)
31. Said of an unrestricted field. (4)



ACROSS

1. Code type. (6)
4. Kind of component mounting. (7)
10. Brief variation in voltage, etc. (7)
11. British Viewdata system. (7)
12. Prefix indicating, for example, stability principle for satellites. (4)
13. Title of a regular Electronics Australia column. (5)
14. Spot on radarscope. (4)
17. A quartz crystal is silicon _____. (7)
19. Outermost point in satellite orbit. (6)
22. Word describing the MKS system. (6)
23. Type of dial. (1,1,6)
26. Said of high-frequency x-rays. (4)
27. Electrical contact. (5)
28. Type of connector. (4)
32. Said of certain solder. (7)
33. Discoverer of an electromagnetic relation. (7)
34. Logic device. (3,4)
35. Transducer. (6)

SOLUTION FOR FEBRUARY

I	N	T	E	R	C	O	M		F	M	W	A	V	E
N		R		A		V	S		O		D			X
D	A	I	S	Y		E	N	C	O	D	E	D		C
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G	O	L	F		B	L	A	N	K		B	E	L	T
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	V	A	R	I	C	A	P		W	A	T	S	O	N
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V	A	L	V	E	S		C	A	S	C	A	D	E	
E		I		D		S		N		H				S
R	I	G	S		S	P	A	D	E		S	Y	N	C
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Write to: **The Assistant Editor, "Electronics Australia" PO Box 227, Waterloo, NSW, 2017**

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly

March 1936

Latest Pontiac: (from an advertisement) a 1936 Pontiac Straight Eight Sedan, fitted with wireless and costing 500 pounds, will be given away shortly as a lottery prize.

This beautiful car has "all that's best of all that's new" — tall, narrow fronted radiator and aristocratic length of bonnet — high mounted streamlined headlights — no draught ventilation — dual electric windshield wipers — steel wheels — armourplate safety glass windshield — the latest, most up to date wireless.

Olympic games: the Berlin television station is to broadcast the more important events of the Olympic games direct. It will be remembered that recently there was news of a German television ban, but this will probably be the first time in the world that comprehensive television pictures of an important open air gathering will be transmitted.

Sea-borne FAX: all American ships running between Europe and the USA are to carry radio facsimile gear which will print weather maps automatically. This gear works on the Fultograph principle, an inky needle working on a piece of paper stretched around a drum like the drum of the old style phonograph.

Radio horn: Berlin experimenters are perfecting a radio car horn; every car is to be fitted with an ultra-low frequency transmitter and receiver, the advantage being that warnings will be audible to people inside cars.

RADIO, TELEVISION and HOBBIES

March 1961

Automatic depth-sounder: not only can the modern mariner switch on automatic steering for his vessel, but he can now also set a depth warning device, which will ring a bell, when shallow water or rocks are approached.

This is being made possible by a new revolutionary British all transistor instrument, "Diver 60". It can be set to give a warning at any depth up to 36 fathoms.

First U.K. satellite: plans for the launching of the first British satellite — U.K. No. 1 — early this year were announced in London recently.

The satellite, which will carry scientific instruments now being designed and made in Britain, will be launched from the east coast of the United States by the American scout rocket.

Ultra-capacitors: a completely new type of capacitor has recently made its appearance in American electronic equipment. Known as Ultra-Kaps, these patented units are made of ceramic and have the same appearance as other ceramic disc capacitors. But they are engineered on an entirely different principle.

Ultra-Kaps are low voltage capacitors used mainly in transistor circuits. They provide extremely high capacitance for their size — 50 to 100 times greater than that of standard ceramic units.

A most unusual aspect of these capacitors is their self regulating voltage characteristic. They undergo a molecular change when subject to an overvoltage. This permits the current to flow through the unit, causing it to operate as a conductor rather than a capacitor.

Largest nuclear station: the 800 megawatt nuclear power station planned by the Central Electricity Generating board for Anglesey, in North Wales, will be the largest in the world equipped with nuclear reactors. Its electrical production will be 200 megawatts above that of any station in Britain, the largest to date being now under construction in Sizewall.

Information centre

Variations in tape speed

I recently read in your magazine a review of a stereo tape deck where it was mentioned that the speed varied from that of other decks — up to a semitone, which is quite a lot to my mind.

I therefore made some tests using a pre-recorded cassette and compared it with a disc recording. On only one deck — a new Sharp — was the speed spot on. An Akai deck some five years old played fast, as did a Philips recorder and a Sanyo.

The latter two were bought in Australia. However, no two decks were exactly the same. I also tried the tape on two car cassette players and these, strangely, were closer to the correct speed.

The point is, how are the speeds set in the first place? Specifications show 1⅞ inches per second (ips), but this is only a nominal figure. Can they be varied?

I agree that for most uses the difference isn't all that important, but if specifications are worth anything why not try to standardise them? (M.M., Auckland, NZ.)

• It is true that many tape decks are not exactly on speed, but as you suggest this is not ultimately important as far as the music is concerned.

Strictly speaking cassette speed is supposed to be exactly 1.875 inches per second. Those decks with electronic speed control generally do come pretty close to this figure.

Field-strength meter for TV

Thank you for your informative, educational and entertaining Serviceman column in EA, the best in the magazine in my opinion.

Where I live in Wollongong, we have signal strength problems with FM radio and TV, especially with channels 7, 9 and 10.

I would be prepared to experiment with antenna systems but have no way of knowing field strength. However, on page 46 of EA, January 1986, your colleague mentions "a check with the field strength meter".

I have looked everywhere for such a meter but only get offered gadgets for transmitters. Where can I buy, hire or build a VHF/UHF (or at least a VHF) field strength meter? (E.B., Wollongong, NSW.)

• As far as we know there are only two signal strength meters available in this country. One costs $400 and the other around $800. Both can be obtained from companies such as Hills Telefix (10 Wiggs Rd, Riverwood, NSW 2210.)

Clearly this price is beyond most of us and we are looking at the possibility of presenting a do-it-yourself design.

Playmaster Series 200 Amplifier

I am considering building the Playmaster Series 200 amplifier in kit form. However, there seems to be no provision for accessing the preamp outputs and power amplifier inputs. This would provide the option of using the power amplifiers only, as found on many commercial amplifiers.

It would seem fairly easy to provide phono jacks at the rear of the case using shielded cable. Do you see any problems with doing this?

Also, I have just built your "Pest Off" kit and have not noticed much success yet. The kit was supplied by Jaycar and the output checked OK using an oscilloscope. The tweeter supplied is only rated up to 30kHz. This would seem unsuitable, considering the 22-63kHz output range of the circuit.

What modifications to the circuit would you suggest to increase the output power still further? Would this affect TV reception? I mention this point because I have just read of such problems in the USA in *Video Age* magazine.

I am a regular reader of EA and find it both interesting and informative. Keep up the good work. (G.P., East Brunswick, Vic.)

• Although we haven't tried it, we can see no reason why the Playmaster Series 200 amplifier cannot be modified in the

Black bodies do radiate

A comment made in the October issue of *Electronics Australia,* in the home security supplement, has left me wondering.

On page 6 of the supplement it is stated: "One of these rules paraphrased states that the darker the body, the less infrared radiation it emits; eg a matt black toaster radiates less heat than a chrome plated one."

If this comment is correct, and I am not sufficiently familiar with the laws of emission to disagree, then it would appear that all is not well in the State of Denmark, so to speak.

Practically all objects that I can think of at the moment, such as motor car radiators, heatsinks, IC bodies and so on, seem to be black or matt black in colour. Page 34 of the same edition shows a good picture of the high power mosfet amplifier with a large black heatsink and states not to use a smaller one.

So, if the comment on emission is correct, why aren't heatsinks bright aluminium, motor car radiators chrome plated and IC bodies moulded in white in order to perform the function for which they are intended.

All very confusing. Maybe Neville Williams could discuss the issue in Forum, a segment which I find stimulates my mental cells more than most. Carry on the good work I have been following for the last 40 years. (A.M., Mullumbimby, NSW.)

• The statement on page 6 of the supplement concerning black bodies is ridiculous. A perfect black body is the most efficient type of radiator. Thank you for pointing the error out to us.

manner you suggest. Note that the outputs from the preamplifier stages should be taken from the wipers of the balance control pot and fed back into the power amplifiers via the 1μF capacitors.

Note also that the cable shields should be earthed to the central earth point on the amplifier PC board, and to nowhere else.

Regarding the Pest Off, while the tweeter may only have a nominal range to 30kHz, it is fairly normal for these piezoelectric devices to have a peaky output above this frequency. This means that the device can be expected to work as designed.

We have also had a number of reports that ultrasonic pest repellers of this type take a number of months to have a noticeable effect. The power output may be increased by increasing the supply voltage, but don't go above 15V.

It is unlikely that the Pest Off (or any other ultrasonic pest repeller) will cause TV interference, although it could interfere with AM radio reception.

Remote TV headphones

I recently came across a reply to a reader's letter in the April 1984 issue of *Electronics Australia*. The reader's query centred on the possible usage of the Remote TV Headphone circuit (EA, November 1977). In response, you suggested the usage of the headphone amplifier circuit (EA, March 1984). Its benefits were lower power consumption and better drive capability.

Although I have the amplifier, I cannot make the connection between the two. Would you please elucidate on this. Is the remote circuit infrared, ultrasonic or other?

What is the 216 type 9V battery, and what is the significance of pre- and post-transformerless TVs on the circuit? I would greatly appreciate your assistance.

Also, did EA ever publish a laser project. If so could you please supply details. (G.P., East Brunswick, Vic.)

• The Remote TV Headphone circuit is used as an inductive pick-up. The transmitter for this circuit was a loop of wire around the perimeter of the room to be used. The inductive pick up coil could be used to provide the input for the Headphone Amplifier, instead of to the original LM380 amplifier.

The common 9V "transistor" battery was the Eveready type number 216. Unfortunately, there is no standardization for type numbers among manufacturers and the Eveready number is probably the most widely used. We do not recommend the project for transformerless TV sets.

We have published designs for several laser projects in the past, the latest a 1mW helium-neon laser in October 1977. There may now be some difficulty in obtaining the parts for these projects. We suggest that you make enquiries to Laser Electronics, PO Box 359, Southport, Qld.

Problem with AM stereo decoder

I have constructed the Stereo AM Decoder from a kit which came with tantalum capacitors for the five capacitors around pins 11 to 14 of the MC13020 IC.

I can not get any signs of stereo and the LED cathode remains at about 7V. From the information enclosed I would be grateful if you could make any suggestion as to the likely fault. (M.H., Beaumaris, Vic.)

• From your detailed voltage table it appears that the IF input signal is too high and although the pin 19 voltage indicates that the oscillator is in lock, this is not verified by the lock voltage on pin 10.

We suggest that you reduce the IF signal input until the voltage on pin 4 is between 2V and 3V. You can do this by increasing the series resistor connected between the tuner and the input of the decoder.

This modification should cure the lack of stereo reception and also remove the distortion. The voltage at pin 10 should now be close to 4.3V.

Notes & Errata

HOME BURGLAR ALARM (January and February 1985, 3/MS/112, 113): to prevent false triggering, a 330kΩ/.047μF RC delay circuit should be connected to pin 11 of IC7b. Connect the 330kΩ resistor between pin 11 of IC7b and pin 3 of IC8e, and connect the .047μF capacitor between pin 3 of IC8e and ground. At the same time, the .01μF capacitor on pin 13 of IC5f should be changed to .047μF to extend the length of the test pulse.

HOME & CAR SECURITY (supplement to *Electronics Australia*, October 1985): the statement on page 6 that "the darker the body, the less infrared radiation it emits" is incorrect. A black body is in fact a very efficient radiator of infrared energy.

EA marketplace EA marketplace

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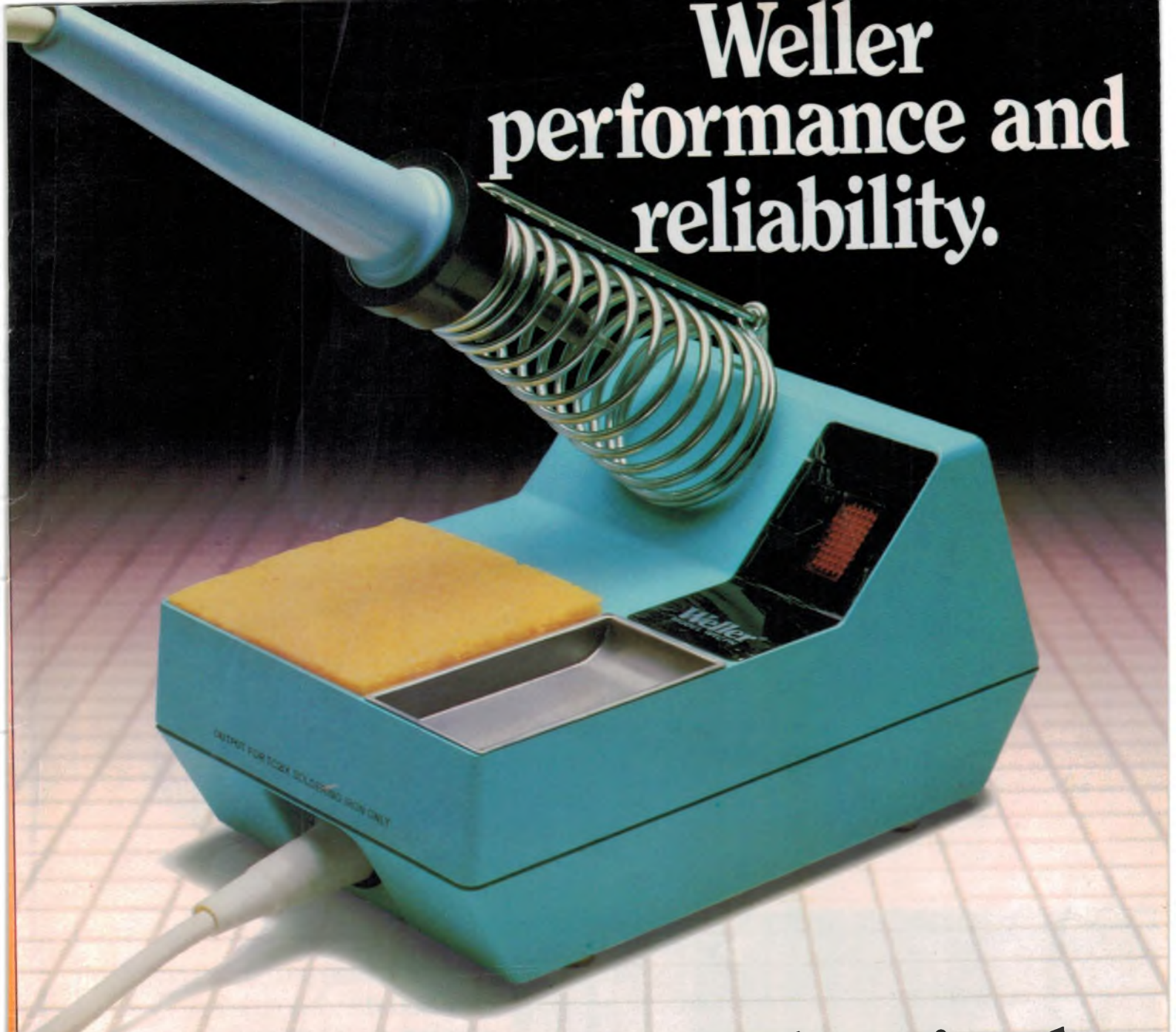

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