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Volume 48, No.8

Electronics Australia

August 1986

THIS MONTH'S COVER

Old cars with big engines are a favourite with thieves. Our new car burglar alarm is so incredibly loud that it would frighten a bulldog out of a butcher's shop. See page 26.

Features

Entertainment Electronics

Projects and Technical

News and Comment

Departments

Dynamic noise reduction system

Give the sound from your mono VCR a lift with this dynamic noise reduction system. It dramatically reduces hiss and, as a bonus, adds simulated stereo. We show you how to build it on page 32.

What's coming

Next month, we intend to describe an engine cool-down timer for turbo-powered cars and a low-cost, high-quality 2-way loudspeaker system to go with the Playmaster 60-60 stereo amplifier. We'll also be presenting a comprehensive feature article on batteries.

Build this digital photo timer

Here's a digital photo timer that's very easy to assemble. It uses cheap and readily available components and can precisely time darkroom exposures from one second to 9 minutes 59 seconds. Details page 54.

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Letters to the editor

Downward pointing loudspeaker systems

May Forum mentioned smallish downward pointing multiple speakers, and their seeming abundance in churches, halls, etc. Voila! The Holy Family Church in Central Avenue, Indooroopilly has fourteen of these (AWA 5-inch speakers in 250mm spheres) which were installed, as far as I can remember, about eight years ago. They are custom suspended respectively from 14 luminaires, each being 320 watt. The luminaires are in turn suspended by chains from the 40ft ceiling.

This sound system replaced an up-front-speaker system that was quite unintelligible in the large concrete building. The result is a very clean uniformly dispersed sound nicely damped by the parishioners underneath and is reasonably aesthetic, being part of the illumination system.

Whilst in the writing mood, might I comment on the 'Utopiatronics' comments. It seems to me that the cost relationship between the weekly wage and the "Little General" radios of 40-odd years ago is not greatly different to that between current wages and for example, the Stereo AM/FM Tuner of EA genesis a few months ago. There is little comparison in the relative output qualities, so the edge might still be with modern technology.

Incidentally, might I add that there is nothing to stop the keen constructor even now. Veroboard is fairly cheap; various matrix boards ditto; even old and new technologies can be mixed. In the last six months I have constructed from scratch two radios, both valve and both with an AM stereo decoder, with total success.

Stricly one was a tuner and one a complete radio. The former was briefly described in "Letters to the Editor" a few months ago. There's plenty of electronics fun still to be had.

B.M. Byrne,
Indooroopilly, Qld.

Correct switching of mains appliances

As a regular reader and electrical contractor I am compelled to write to express my thoughts about a circuit on page 52 of the April issue.

The circuit is the automatic shut-off for soldering irons and in my opinion is potentially dangerous on the 240 volt mains supply. This can lead to the appliance that is plugged into the outlet

Video tape & humidity problems

Regarding the tape problems discussed in Forum of the April issue, may I suggest that a likely cause of clogging of tape heads and guides is storage of certain types of tape in a high humidity environment before playing.

This is a fairly common problem in the tropics where the relative humidity may remain continuously above 85% at temperatures above 25°C for periods of three weeks or more during the summer months. Under these conditions, tropical fungi also grow in great profusion, and some types of magnetic tapes seem to be better hosts than others.

I have been using video tape for only about two years, and so far I have not had any problems with good quality Japanese tapes in a top-of-the-line National recorder. However, I have had many years experience of audio recording, and I have found tapes which absorbed so much moisture from storage in a high humidity environment that any attempt to play them without first cleaning resulted in clogging of the heads and guides to the extent of actually stopping the tape.

My method of cleaning reel-to-reel tape is to fast wind directly between spools through a pad of Kleenex tissue held between thumb and forefinger, stopping the tape every few metres to bring an unsoiled part of the tissue into contact with the tape. This process is repeated, winding the tape backwards and forwards until no more brown residue comes off on the tissue. Some tapes will not even respond to this treatment and can only be played in drier weather

remaining on after the timing circuit has turned off if the neutral side of the load goes to earth.

Also AS 3000 Standard rule 2.19.1 states: Switches in neutral conductors — No switch or circuit breakers shall operate in a neutral conductor, other than

(a) A multiple switch which includes a contact intended for connection in the neutral;
(b) A switch employed in a control circuit; or
(c) A switch linked with corresponding switches so that the neutral contact cannot remain open when the active contacts are closed.

The switching of the neutral of this circuit would not meet part (c) of this rule.

Rule 4.1.4 states: Sequence of operation — a multiple switch or circuit breaker which includes a switch in a neutral conductor shall not

(a) Connect any active conductor before the neutral conductor is connected; or
(b) Open the neutral conductor before all active conductors have been opened.

As the active is not switched, it cannot meet the above rule. To make the circuit safer the active supply needs to be switched; not the neutral. As this circuit would be made to plug into 240 volt outlets, both active and neutral may need to be switched, as the conductors at the 3-pin plug may be transposed. This can be done using a double-pole relay.

J. Parry,
The Oaks, NSW.

after they have had ample time to dry out.

A few years ago, I had severe humidity problems with CrO_2 audio cassettes, and gave up using this type of tape. They played satisfactorily in dry weather, but very soon clogged up the recorder heads and guides in wet weather.

For the past year, most of my recording has been for an FM radio station, and I have been using, exclusively, Ampex 456 professional reel-to-reel tape. I have not had any humidity problems with it.

My past experience with various brands of reel-to-reel tape is that BASF and Agfa do not stand up well to high humidity and tropical fungi.

H.L. Harvey,
Edge Hill, Qld.

Editorial Viewpoint

Forget the bad news, here is the good news!

Lately the media has been so full of bad news about the economic scene that it would seem there is no good news to be had. That really is not the case though, is it? After all, economists are rarely right, are they? At EA we have decided to completely ignore the economic news and get on with reporting the good news. There are plenty of developments on the electronic front which make good interesting reading.

For example, just when you thought that compact disc players were all just a bit ho-hum, along comes the latest Philips machines with 16-bit digital-to-analog conversion and four times over-sampling to overhaul our performance expectations. Here is a generation of new machines which indicates that there is a lot of development still to come with compact disc. And that is without mentioning the CD-ROM (covered in our May issue) or CD-graphics which will combine still pictures with high quality sound. The review of the new Philips CD player starts on page 38. We reckon the Japanese will read it with interest.

And how about the new simple burglar alarm idea which we present on page 26? This is a diabolical idea really, and one which is sure to appeal to any car-owner who is worried about having his vehicle stolen by some irresponsible wretch. It's nice to think about striking back.

How about getting better sound from your VCR by hooking it up to your stereo amplifier? With this idea in mind we present the Dynamic Noise Reduction unit on page 32 which reduces hiss from VCR mono sound as well as giving synthesised stereo.

On a more serious note (there is always a more serious note), the article on training for electronics technicians on page 110 highlights a good opportunity for people who have at least some electronics knowledge. There is a crying need for service technicians across the board, whether to repair expensive industrial and computer equipment or just ordinary domestic appliances such as refrigerators and washing machines. These days there are a vast number of domestic appliances thrown out but still eminently repairable if only there were enough technicians available to do it economically.

With that in mind, our current series entitled "A practical approach to electronics" is most useful. This month it covers the topic of record players and turntables which seem simple enough in concept until you come to repair them.

And talking of opportunities, the articles that are submitted to our magazine tend to reflect the content which is already present. If you are interested in submitting an article on a subject not covered by EA, please do so. We'd love to see it and the money is good.

Leo Simpson

News Highlights

USSR fears the ideologically unsound video

Even the Russians have been unable to escape the long arm of Rambo, according to recent studies carried out in Britain at the Birmingham Centre for Russian and East European Studies. It seems that the Kremlin is fighting a losing battle against the influx of black market video recorders and tapes.

Two methods have been adopted by the Russians to try to stop this influx: first, by manufacturing their own clone VHS recorder; and second, using the SECAM-East television standard to combat the use of the ideologically unsound tapes from the rest of Europe, America and Japan.

However, both of these plans of attack suffer from severe failings. The Elektronika VM-12 recorder is notoriously unreliable. It has been reported that half the micro chips and every fourth video head are found to be unreliable before leaving the factory.

There is also a very poor after sales service with just four repair workshops in the whole of the USSR.

In the tape game, Soviet pirates dub Western tapes to the Russian format and add a Russian soundtrack. Actors and interpreters do the work for the chance to see the film. The videos are then screened in private clubs.

Established three years ago in the Brisbane suburb of Woodridge by local enthusiast David Hall, David Hall Electronics is now a thriving business. The store carries a wide range of electronics components and is a local agent for Jaycar and Altronics. The address is: Shop 5, Woodridge Centrepoint, Woodridge, Qld 4114. Telephone 808 2777.

Circuit board testing in the West

Circuit Technology Holdings Limited has announced the establishment of a new centre for testing electronic circuit boards at Willetton, Perth.

Special facilities to house the new centre have made up a large part of the investment. These include a dust free and temperature and humidity controlled environment, and a conditioned electricity supply.

The equipment — a Technos WPV 68 machine — is from Olivetti Australia and can test boards up to a 200V threshold. It can check unloaded boards for open and short circuits and pinpoint where the fault occurs.

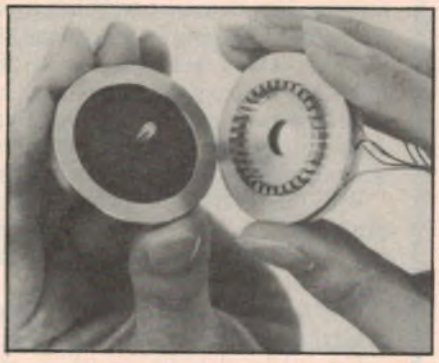
Circuit Technology is planning to increase the test centre's capabilities by installing equipment to handle loaded boards, that is, boards with fitted or bonded surface mount devices.

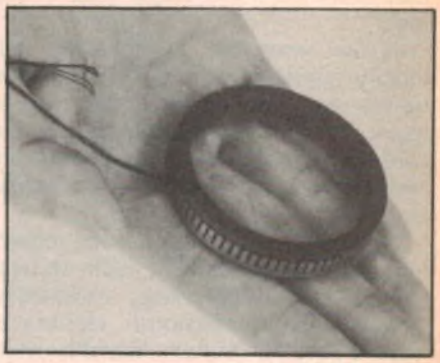
Ultrasonic motors from Matsushita use new friction drive principle

Matsushita has developed new motors which use ultrasonic vibration to produce rotation. This is in marked contrast to conventional electric motors which depend on the interaction of magnetic fields to produce rotation.

The principle of the ultrasonic motor appears to involve a "stator" of vibrating piezoelectric fingers which are in direct contact with the rotor disc. As the fingers vibrate backwards and forwards they push the rotor around.

The new motors are available in two types: (1) the disc-type ultrasonic motor, and (2) the ring-type ultrasonic motor, both of which can offer a practical level of 45% energy conversion efficiency.





At left is the Ultrasonic disc-type motor and at right is the ring-type.

The ultrasonic motors have many advantages over conventional electric motors, including simple structure, stable low-speed operation, good controllability, and high torque at low-speeds. Possible applications include auto-zoom lenses for video cameras, industrial robots and automotive equipment.

Pinpointing vehicles

In the UK, British Telecom has launched a new automatic vehicle location system. Called Pinpoint, it uses navigational, radio and computer technologies in an application which is the first of its kind in the world.

The system accurately tracks and monitors the movement of vehicles, relaying their location to a base unit where the information is displayed on an electronic screen map.

A typical user of the service would be security companies, taxi operators, the police and businesses involved in the movement of goods and people by road.

A network of radio beacons placed on street lamp posts provide the coded location signals. Each vehicle has a compact, computerised navigation unit — called a dead reckoner — which constantly calculates the direction and distance travelled, and a beacon signal receiver. The information is fed to a control unit and then relayed back to the base by radio.

Should an emergency occur the driver can press a button and an alarm will register on the screen. The base controller can then inform the police and give a precise location.

Vehicle tracking systems are not new, but Pinpoint is the first to use a network of single frequency, low powered UHF radiolocation beacons and dead reckoning.

Australia to supply UK with Barra Sonobuoy

A $40 million contract to supply 7000 Australian-designed Barra Sonobuoys to the Royal Air Force has been awarded to Plessey Marine by the UK Ministry of Defence. Under the terms of the contract, Plessey Australia will produce the underwater acoustic arrays for the Sonobuoys, with Plessey Marine responsible for final production at its Gwent factory in South Wales.

Barra is a passive sonobuoy system designed for use by long-range maritime patrol aircraft for detecting and tracking submarines. The system was developed in Australia during the late 1970s as part of a research program involving Plessey Australia, AWA and the Australian Government.

Barra is currently in service with both the RAAF and the RAF. The latest contract represents the fifth order for Barra to be issued by the UK Ministry of Defence.

Taronga Park's Purchasing Officer Mark Langley with the Webster Spectrum Minicomputer.

Taronga Park gets new inmate

If Noah had had the benefits of a computer system, his task of looking after the animals would certainly have been a lot easier.

Taronga Park Zoo in Sydney has gone one up on Noah with the installation of a new 13-terminal network from Webster Computer Corporation of Bayswater, Victoria. The $108,000 system links all the zoo's departments together as well as providing an extra terminal to incorporate Dubbo's Western Plains Zoo into the system.

The Webster Spectrum Mark 2 will be used for general accounting, inventory, payroll, animal records and veterinary histories. Such well-known identities as Hamish the Antarctic fur seal, Twiga the baby giraffe, and Ady the young pygmy hippo will be among some 4000 Taronga Zoo and 753 Western Plains residents to have their personal details such as birthdays, parentage and general health recorded.

The computer will also keep track of such items as new arrivals and sickness incidents, such as the recent bout of influenza suffered by the 24 residents of Chimpanzee Park. Then there is the necessary daily monitoring of the glucose level of Susie the diabetic chimp, regular weight checks on mothers-to-be, mating habits, and deaths and births.

The computer even keeps track of when the lions are due for their next feline enteritis vaccinations.

The system is also expected to facilitate management of both Zoos' complex housekeeping budgets. Taronga alone spends $500,000 annually on food which includes hundreds of different items such as 18 tonnes of meat, 50 tonnes of fish, 156 tonnes of fruit and vegetables, 23,000 loaves of bread, 100 tonnes of cubed food and 6000 bales of hay.

News Highlights

Quit horsing around, check the heart

If you want to check the heart rate of your steed (horse), don't get saddled with just any ECG device. This one, developed in Hong Kong by the Respironics company, is similar to ECG units used with humans but has been specially designed for use with horses.

The device has sensors which are placed on the belly and back and can be inserted between the saddle and horse. The signals are relayed to the monitor and after calculation are represented in beats per minute.

The data available can determine if the horse is being overworked or underworked according to the training schedule.

For further information, contact Respironics (HK) Ltd, 4th Floor, Microtron Bldg, 38 Hung Rd, Kwun Tong, Kowloon, Hong Kong.

US and Japan may go it alone on high definition TV

Following the recent failure of the International Radio Consultative Committee (CCIR) to reach agreement on a high definition TV standard, the US and Japan may decide to go it alone.

According to recent reports, both countries are unwilling to hold off production of HDTV until the next meeting of the CCIR in May 1990, and will probably go ahead with an 1125 line system based on 60 pictures a second.

Hackers turn to satellites

High-tech bootleggers in the US are now turning their attention to satellites and hitching free 'rides' for their signals alongside legitimate users. While most of the satellite pirates take pains not to be noticed, there was one case recently where a Home Box Office transponder was commandeered as a protest against the scrambling of pay-TV movies.

In most cases though, the bootleggers tag along by modulating low-power signals at the edges of the 36MHz transponder bandwidth, which only slightly affects the legitimate user's signal. There are even reports that spurious signals have been detected on defence satellites, although the Defense Communication Agency refuses to confirm or deny this.

In a bid to forestall the problem, the FCC recently published a general notice emphasising the penalties for interfering with satellite TV signals. These penalties can include a $10,000 fine and a one-year prison sentence.

UK's pioneering shuttle a lost opportunity

In the 1960s, British Aerospace engineers designed a space shuttle that was, many believe, more versatile than the American version and which, given funding by the British government, may have lifted off long before Columbia did in 1981.

The British concept did not involve settling for a complex amalgam of solid rocket boosters, a disposable tank, and an orbiter; instead, they wanted to build a craft consisting of three almost identical winged vehicles. These were to be strapped together at take off and, at an altitude of about 50km, the two outer vehicles were to separate and fly back to earth, while the middle headed off into space.

The British proposal was known as MUSTARD which stood for Multi-Unit Space Transport and Recovery Device. It could not deliver as great a payload as its American counterpart, but the parts were reusable. Each component would have required little more than a re-fuelling, whereas the shuttle's solid fuel rockets have to be completely refurbished.

Fast train proposal to get a fair go

In October 1985, EA ran an article and editorial on the CSIRO's Sydney-to-Melbourne Very Fast Train proposal. At this time, it looked as though the proposal had been sunk by a combination of government inertia and conservatism.

Now, however, a joint venture involving Elders IXL, Kumagai and TNT is to undertake a $600,000 study into the feasibility of the project. If the proposal does get the go-ahead, it would cost about $3 billion and would be ready by 1995.

The Very Fast Train proposal, first advanced by the former chairman of the CSIRO, Dr Paul Wild, in 1984 would give Australia the fastest train in the world with speeds of up to 350km/h. It is proposed that the train would travel between Sydney and Canberra in one hour and then on to Melbourne in two hours.

The railway would be electrically powered using power derived from coal and hydroelectricity from the Snowy Mountains scheme. According to initial studies, construction would take about six years and employ about 2500 people.

Business Brief

West Australian communications company Kensor Pty Ltd, has opened an office in Victoria so that it can better service the eastern states of Australia. Kensor is well-known for a range of radio-communications equipment which is manufactured in Perth.

The Kensor range of products includes VHF and UHF directional antennas, diplexers, multicouplers and transmitter combiners. In addition, the company is the local agent for Antenna Engineering Asia of Singapore, Sinclair Radio Laboratories of Canada and Larson Electronics in the United States.

The company's Victorian address is 13/417 High St, Preston, Vic 3072.

Smart suspension for cars

British Lotus in the UK has developed a computer-controlled suspension system which can dramatically improve the ride and handling of motor vehicles.

The vehicle can also be made to do some rather unconventional things. The computer will make it lean into a corner as a motorcyclist does, and the suspension will pitch forward rather than backwards when accelerating if the driver so desires.

The system uses an oil pump, driven by the car's engine, and a hydraulic cylinder at each wheel. These take the place of conventional springs, stabilisers and shock absorbers. Three computers take information from sensors scattered throughout the car and control the oil pressure reaching each of the hydraulic cylinders.

A car so equipped can be programmed to run smoothly over bumps, then moments later take a turn with stiff "springs".

At this stage, the technology is relatively new and is not yet ready for production vehicles. However, cars with active suspension could be on the market some time in the 1990s.

Consumers warned about stereo receivers

Confused and misleading labelling of radio receivers has led several State Consumer Affairs Departments to issue warnings to consumers and refer the matter to the Trade Practices Commission.

Only 65 radio receivers can currently claim (in labelling and advertising) to be truly 'AM/FM Stereo' or 'Stereo AM/FM', since only those 65 receivers have stereo capability on both AM and FM bands, according to Stereo AM Australia, a national body of AM radio operators.

However, many receivers in shops are labelled and promoted as 'AM/FM stereo' when in fact they only have FM stereo and AM mono capacity.

According to Chris Brammal, Chairman of Stereo AM Australia, many retailers and manufacturers are probably unwittingly giving the public misleading and deceptive information on radio receivers. And, says Mr Brammal, "there have been numerous complaints from consumers on this issue."

The advice to the consumer is this: if you want stereo on both bands, check the product out very carefully.

Lord Howe Island plugs into the satellite

One of Australia's most isolated communities, Lord Howe Island, recently entered the satellite age with the help of AWA Earth Link equipment.

Live broadcasts can now be beamed to the Island and received by satellite equipment assembled and supplied by Mitsubishi Electric AWA.

Although Lord Howe was settled almost 150 years ago, communication with the rest of the world has never been easy. For the most part, the islanders have relied on peddle radios and the postman.

With the advent of Earth Link, the islanders can receive direct television broadcasts to keep up-to-date with world affairs. It is expected that a commercial radio network will also be available by the end of this year.

Plastic PC boards the technology of the future

Moulded plastic circuit boards have, until recently, been the dark horse of printed circuit technology. Now, US industry observers are predicting a possible $2 billion market within a decade thanks to recent advances in thermoplastic materials and improved high temperature resins.

Moulded PCBs offer a host of practical advantages over conventional PCB technology. They can be moulded into three-dimensional housings of almost any shape, including connector housings, and can thus greatly reduce the number of mechanical components in a system.

For surface mount technology this process makes a lot of sense. The boards can be moulded in recesses to accommodate and protect the devices.

While hopes for the new 3-D circuit board technology are high, many experts view it as complementary to existing printed circuit board techniques.

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Our code-to-speech chip set consists of two chips - the SPO256A-AL2 an allophone-based speech synthesiser and the CTS256A-AL2 an 8-bit microcomputer programmed with a letter-to-sound based algorithm. The chip set translates English characters into speech.

Two projects use these chips - the AEM4505 Speech Synthesiser (Feb 86) which includes Microbee software plus an article on Speech Synthesis in general. The other project is in June's AEM and converts ASCII text files into speech - ideal for talking word processors. This one is for the IBM PC and works just like a printer.

Buy the chip set for **$28.00** or the synthesiser SPO256A-AL2 only for just **$15.95.** Yes the price is right!!

CONVERT YOUR MULTIMETER INTO A THERMOMETER

See ETI June 83 which features a project using the AD590JH (ETI-153). The AD590JH produces an output current proportional to absolute temperature. It's ideal for remote sensing as long cable runs have negligible effect on accuracy over a hundred metres or more! The simplest circuit requires one resistor and one pot and a battery, but better to build the proper circuit and get an accurate 10mV/degree centigrade output to put into your DMM. The AD590JH is only **$5.95.**

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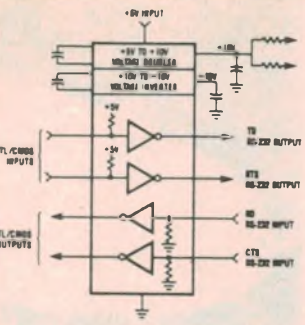

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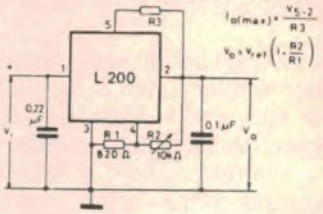

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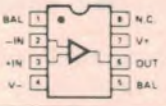

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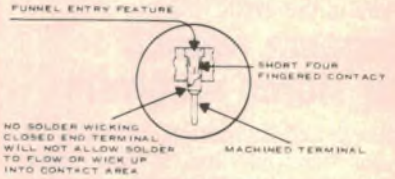

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A new approach to Electrostatic Loudspeakers

Working from his bushland retreat near Launceston, Tasmanian Alan Moss has designed an electrostatic loudspeaker system that outperforms anything on offer elsewhere in the world.

by JIM LAWLER

Most technological breakthroughs come from large research laboratories staffed by highly qualified engineers and funded by big multi-national companies. It comes as something of a surprise then to find a major breakthrough coming from the rural workshop of an untrained but dedicated amateur researcher.

Just such a breakthrough has been made by Alan Moss, a long-time hifi enthusiast. Alan has solved all the important problems normally inherent in electrostatic loudspeakers and has built pre-production models that offer staggering performance.

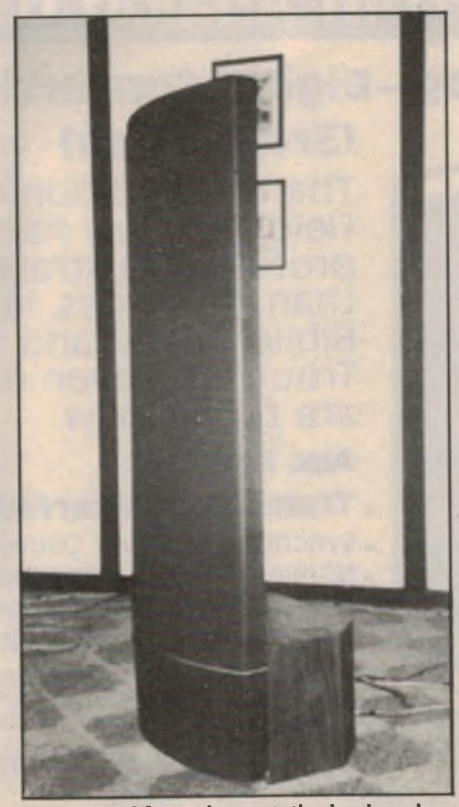
Alan Moss has had a lifetime interest in high fidelity sound reproduction and for 40 years has hoped to acquire the ultimate system. Quite early on he found that amplifiers were not the real problem — it was always the speakers that limited the fidelity of the music.

Many years ago Alan decided that electrostatic speakers offered the most likely approach for the ultimate design, but he was never satisfied with any of the commercially available units. So he set about learning all he could on the subject and dreaming of the time when he might be able to build his own perfect electrostatic loudspeaker.

However, Alan was a professional pest control contractor and he had no spare time to devote to research in a totally alien field. It was not until he went into semi-retirement six years ago that his dream of the ultimate electrostatic loudspeaker moved into the realm of the possible.

What were the problems?

His first problem was to codify and measure what he felt to be deficiencies in commercial units. These problems included low sensitivity, restricted low frequency response and a tendency to radiate high frequency energy in "searchlight" beams at right angles to the loudspeaker panel.



The new Moss electrostatic loudspeakers stand about 1.5-metres tall.

The low sensitivity and poor low frequency response were interrelated. The construction had to allow adequate movement of the diaphragm at low frequencies. But the sensitivity of electrostatic loudspeakers is inversely proportional to the spacing between diaphragm and the front and back electrodes. So improving one parameter damaged the other.

The "searchlight" effect is well known from other loudspeaker designs. Cone tweeters are only partially effective and need vanes or some kind of horn to spread the sound, or multiple units angled out into the listening area. Dome tweeters overcome this problem and radiate over a much wider angle but still give the impression of sound emanating from a point source.

This point source characteristic of many conventional loudspeakers troubled Alan. There was the tendency for the music to sound like it came through a hole in the wall and he felt that true high fidelity music should originate from an appreciable area on each side of the sonic stage. He thinks of ordinary loudspeakers as presenting two groups of musicians, crowded into tiny spaces on either side of the stage.

Alan decided that his loudspeakers would have closely spaced elements for sensitivity; a diaphragm with a large area rather than a large movement to improve the bass response and, incidentally, to improve the hole-in-the-wall effect; and a curved surface to effectively radiate the highs.

These requirements add up to a formidable list of technical problems that might tax the abilities of a professional research lab. But in the six years since his retirement, Alan Moss has solved the problems and has produced an electrostatic loudspeaker that leaves little to be desired.

Electrostatic basics

To really appreciate Alan's achievement it is necessary to consider the structure of an electrostatic loudspeaker. Basically, it is an air-dielectric capacitor with one plate free to vibrate. In fact, the electrostatic loudspeaker principle was first noticed in the early days of radio transmission, when the tuning capacitors in high powered transmitters began to "sing" under the influence of the modulating voltages.

Early attempts at building an electrostatic loudspeaker were largely unsuccessful until the Quad speakers appeared in the 1950s. Since then, several brands of electrostatic loudspeakers have appeared on the market and these have met with varying success.

Essentially, an electrostatic loudspeaker consists of a thin, partially conductive plastic film held between, but insulated from, two perforated metal plates. The film is stretched tightly between the edges of the assembly and all elements are glued firmly into position.

In operation, the plastic film is polarised with a 2kV polarising voltage. The signal, stepped up to several hundred volts in a special output transformer, is applied in push-pull to the metal plates. The electrostatic attraction and repulsion of the plastic film is the driving force of the loudspeaker.

Recent research

Electrostatic loudspeaker research has been directed to improving the bass response and spreading the highs. This has led in some interesting directions, as in one design which attempts an artificial spread of high frequency energy. Areas of the diaphragm are driven sequentially with signals derived from a series of delay lines. The result was a flat plate that acted as a spherical radiator, but only at certain frequencies. Other designs use many small cells arranged on the surface of a sphere.

No matter what the design philosophy, until now all electrostatic loudspeakers have had their limitations. The best of them have been up with the leaders of conventional loudspeaker design but none can claim to be perfect.

Alan's contribution to electrostatic loudspeaker design is to devise a way in which a stretched plastic film can be curved, without losing the stretch. Think about it! Stretch a piece of paper between both hands. Now bend the paper while keeping it tight. And remember, it's no use stretching the paper over a former — the diaphragm has to be free to move in both directions.

When I innocently asked "How on earth do you do it?", the answer was only a quizzical raising of an eyebrow. From that response I would imagine that many people want to know the answer to that one. Then I asked if I could learn the secret by taking a loudspeaker apart. The answer was an emphatic "No." The secret lies in the jigs used to assemble the panels and I did not see Alan's workshop.

Most of the materials used in Alan's loudspeakers are freely available. The perforated steel comes in eight by four foot sheets which easily provides two four foot by 21-inch panels. The plastic film is standard 12 micrometre mylar. The insulating materials are conventional and readily available. Only two items have presented supply problems.

One of these involved the method of deriving the polarising voltage. Some manufacturers use a voltage multiplier connected directly across the mains. While multi-megohm series resistors provide some measure of protection, Alan was not prepared to allow even that remote risk in his loudspeakers. So he tried to buy a small, low cost 1:1 mains transformer.

There is no such thing. The smallest is a $60, 1A unit for TV servicing. Alan's solution is to use two 240/12V transformers, back to back. Cost — about $8 and a double strength isolation as a bonus.

His other problem was the audio driver transformer. This has to be large enough to handle the powers involved and have a step up ratio of 50 to 1. This kind of transformer is not a standard item and they have to be specially wound. There have been a number of glitches in this supply line — like the computer designed transformer that wouldn't work. It had only a 12:1 ratio.

When all of these problems were resolved, Alan had a series of loudspeaker panels capable of exquisite reproduction of all frequencies from 100Hz to over 20kHz. To solve the 20 to 100Hz problem, he chose to use a 200mm dynamic sub-woofer in the sealed enclosure that forms the base for the main panel.

He also tried various combinations of active and passive crossovers, the final design consisting of an active crossover and network driving a separate sub-woofer amplifier. For convenience, the crossover and amplifier are built into the 30 litre sub-woofer enclosure. Again, the early sub-woofers were forward facing but experimentation produced better results from downward facing units. So this will be the style for production models.

Above: Alan Moss with one of his prototype electrostatic loudspeakers.

One major advantage of these electrostatic loudspeakers is their sensitivity. Most electrostatic loudspeakers require 200 watt plus amplifiers to fully drive them. This is due to the trade off between bass response and panel size. Alan's loudspeakers produce "town hall" sound with only 60 watt per channel amplifiers.

The Moss electrostatic loudspeaker panels are only about 6mm thick and, as a result, have exceptional sensitivity. Even so, they are able to make use of powers up to 300 watts per channel if one can tolerate the occasional sparks resulting from the very high signal voltages.

So how does the Moss electrostatic loudspeaker rate? Unfortunately, I am not a hifi fanatic and once sound quality reaches "very good", I cannot detect the subtle improvements that drive the Golden Ears to ecstasy. But this I can say: Alan Moss's new electrostatic loudspeakers are equal to any that I have ever heard, including the magnificent Bose studio monitors used by the ABC.

Footnote: Alan intends to go into production with his speakers, making initially two or three pairs a week in his home workshop. However, he would be interested in talking to any manufacturer with a realistic proposition. His address is New Ecclestone Rd, Riverside, Launceston, Tasmania 7250.

ALTRONICS PRESENTS

For full details see Electronics Australia Magazine May, June, July '86

Distortion at normal listening levels is typically .005%

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Jack O'Donnell
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Features of the Sixty-Sixty

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Frequency Response — *Phono Inputs* - RIAA/IEC equalisation within + - 0.5db from 40Hz to 20kHz *Line level Inputs* — -0.5db at 20Hz and -1db at 20kHz
Input Sensitivity — ★ Phono inputs at 1kHz - 4.3mV (overload capacity at 1kHz - 140mV), ★ Line level inputs — 270mV
Hum & Noise — ★ Phono (with respect to 10mV at 1kHz) - 89db unweighted, with typical moving magnet cartridge. ★ High level inputs (with respect to 270mV) - 103db unweighted with 20Hz to 20kHz bandwidth.
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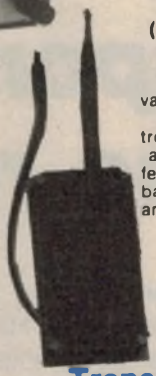

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(ETI July'83)

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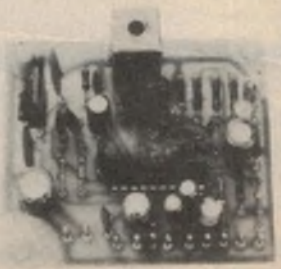


An introduction to hifi Pt.7

Cassette tape decks

Response, tapes, noise reduction, &c. Pt.2

In this further chapter, we move on from mechanical details, magnetic heads and HF bias to consider frequency response and compensation, noise reduction systems, &c. We also examine the signal paths through typical modern cassette decks with the aid of a schematic block diagram.

If the need for HF bias tends to confuse magnetic recording theory, so also do the measures necessary to achieve a reasonably flat overall frequency response. However, it is possible to explain what is involved, without getting too bogged down in technicalities.

If a tape recording head was simply fed with signal from an ordinary low impedance (constant voltage) amplifier stage, the current through the head winding — and therefore the ultimate magnetising force — would progressively diminish as the winding impedance increased with frequency.

As a result, in terms of remanent flux, the signal level on the tape would also diminish with rising frequency at a rate of approximately 6dB/octave, resulting in an impossibly small recorded signal at the upper end of the audio spectrum.

To avoid this difficulty, recording heads are commonly fed from a "constant current" source or one that exhibits a reasonably flat frequency/current characteristic.

Constant current feed can be approximated by using an amplifier stage with an intrinsically high output impedance, or by feeding the head from a generously designed voltage amplifier through a suitably large series resistance.

Recording characteristic

However, the matter does not end there. In a tape system, particularly one with narrow tracks and a low traverse speed, it is desirable to record the signal at as high a level as possible, right across the spectrum, to obtain the best signal/noise ratio.

This, in turn, calls for deliberate shaping of the recording characteristic to match the magnetic storage capability of the tape at low, middle and high frequencies — in short, to match its MOL or maximum output level, referred to in the previous article.

The solid line in Fig.1 shows the relationship between frequency and the ultimate signal level on the tape (remanent flux) which has been adopted as a standard appropriate to the compact cassette system, for normal ferric oxide coated tape.

It requires that, for a given level of input signal, the remanent flux should be flat over the range 50-1325Hz, where the MOL (maximum output level) is relatively high, with special provision for a 6dB/octave boost below 50Hz.

Above 1325Hz, where the MOL begins to taper off, the remanent flux is to be progressively reduced by 6dB/octave, on the assumption that the cut will be compensated by an equivalent degree of boost during playback.

In practice, incidental high frequency losses in the recording chain, including head and tape losses and those caused by the HF bias, may reduce the amount of treble cut that needs to be imposed. As a result, the actual recording amplifier(s) may end up with a response anywhere in the shaded area, depending on other factors.

One other point: "turnover" regions in response curves — where they change direction — normally involve the use of filters. Rather than talk in terms of the "corner" frequency in a rounded curve, engineers who design filters prefer to specify their mathematically based "time constant".

A time constant of 318μs is equivalent to a "corner" frequency of 50Hz; one of 120μs, to a frequency of 1325Hz. Keep the latter figures in mind; we'll be referring to them again later.

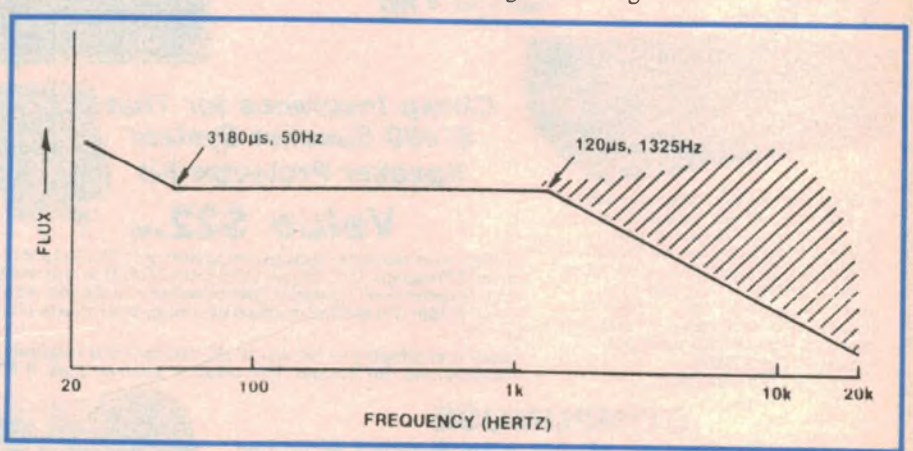
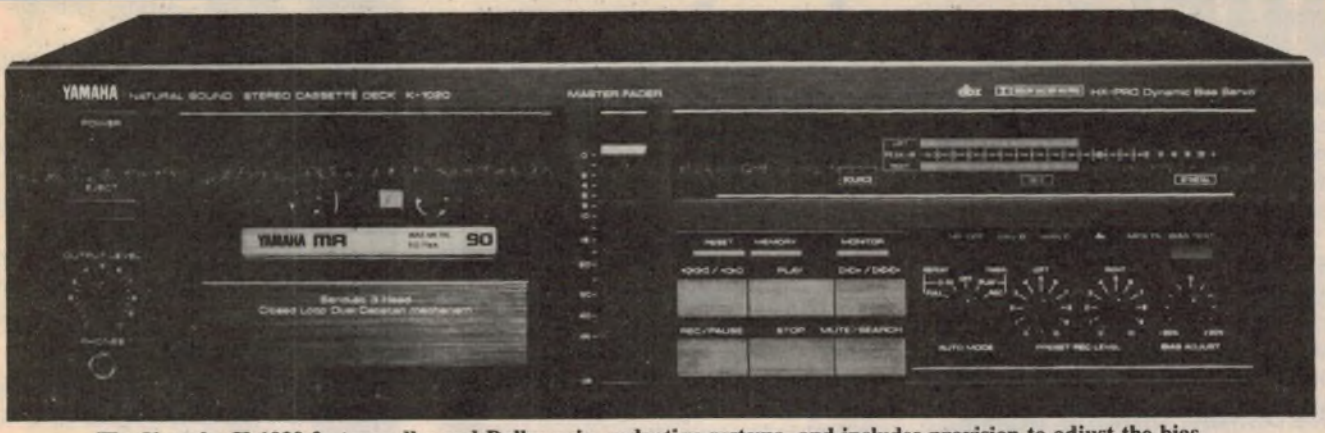


Fig.1: To match the remanent flux more accurately to the MOL of normal ferric tape, the recording amplifier includes bass boost and treble cut to produce the (idealised) flux curve indicated by the solid line.



The Yamaha K-1020 features dbx and Dolby noise reduction systems, and includes provision to adjust the bias.

Playback response

As with a magnetic phono cartridge, a tape head exhibits a constant velocity characteristic, delivering an output signal voltage which, for a given level of flux, rises with frequency at a nominal rate of 6dB/octave.

When playing back a tape, recorded as per Fig.1, it would obviously encounter a diminishing level of flux between 20 and 50Hz. Over this range, the rising response of the head would compensate for the diminishing flux, resulting in a flat signal output.

Over the range 50-1325Hz, where the remanent flux is constant, the head would deliver a signal rising by 6dB/octave.

Above 1325Hz, the flux again diminishes to 6dB/octave, which the head would reproduce as flat.

Re-plot these three segments, normalised to 1kHz-0dB, and you have the (idealised) signal voltage output from a compact cassette tape playback head as shown in Fig.2, drawn dot-dash and marked "From Head".

To modify this to a level signal to feed to a hifi system, the tape playback preamplifier would need to be compensated to provide a complementary response (again idealised) as per the dashed curve in Fig.2, marked "Amplifier Response".

A practical playback curve — minus the corners — for ferric oxide cassette tape, is shown in Fig.3, marked 120μs.

Compact cassette tape

After launching the compact cassette system in 1962, Philips made every effort to ensure that all equipment, cassettes and recordings would be essentially compatible, irrespective of their source.

Along with mechanical and physical specifications they supplied (or endorsed) ferric oxide calibration and reference cassettes to help equipment manufacturers observe common standards, particularly in respect to frequency compensation and bias level.

In the '70s, however, Japanese manufacturers, who by then dominated the compact cassette industry, began to release cassette tapes with a coercivity considerably above the European-based standard, along with decks providing a proportionately higher level of bias.

Why they did so is open to argument but it put European tapes at a disadvantage because, in Japanese decks, European tapes tended to be overbiased and to sound dull because of the adverse effect on treble response. By contrast, Japanese tapes were underbiased in European decks, sounding brighter as a result; that the distortion may have been higher, seemed to pass unnoticed!

This induced BASF to release what they described as a "Japanese compatible" tape in 1977, the "Ferro Super LH1" with an optimum bias setting some 2dB above the European standard.

Since then, negotiations through the IEC (International Electrotechnical Commission) have secured greater cooperation between the various hardware and tape manufacturers, culminating in internationally recognised standards for tape equipment generally. Ferric cassette tapes which conform to the relevant standard are now normally endorsed "IEC Category I".

The IEC initiative should ensure more uniformity in the way tape performance is measured and rated, and greater compatibility between current model decks and current production cassettes in terms of the critical bias and erase levels.

Inevitably, however, some uncertainty will remain in regard to older equipment and with cassettes which are simply branded "normal bias" and "120μs", rather than "IEC I".

In practice, anyone with older equipment, aspiring to optimum, as distinct from purely routine, recording and play-

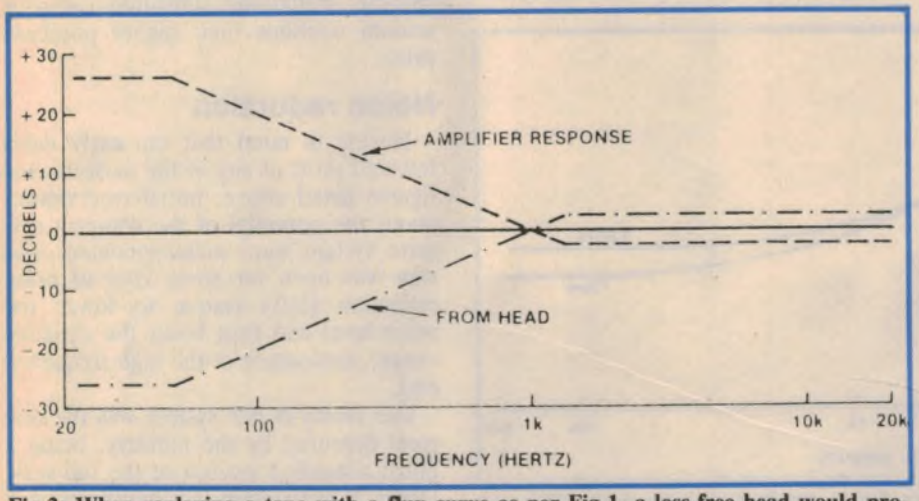


Fig.2: When replaying a tape with a flux curve as per Fig.1, a loss-free head would produce an output as drawn dash-dotted. For a flat overall response the ideal playback preamplifier compensation would be as shown dashed.

HIFI tape decks

back must be prepared to exercise some judgment as to which cassettes seem best to suit their particular deck. They may or may not be the optimum choice for someone else!

Some up-market decks include facilities, manual or automatic, for optimising the bias level — and with it the HF response — for individual cassette tapes but, for many, such decks may be either too expensive or too "technical".

Chromium dioxide tapes

While ferric oxide coatings have been greatly improved over the years, other options have become available, the most notable being a chromium oxide formulation, introduced by BASF (under licence to Dupont) in 1971. It offered a higher MOL, particularly at high frequencies, greater dynamic range and a better signal/noise ratio.

Its coercivity was higher, however, calling for a substantial increase in both bias and erase levels. And, because its HF MOL was better, it was agreed that the frequency compensation could be modified to advantage by changing the record and playback time constant to 70μs instead of 120μs. The effect on the playback characteristic is shown in Fig.3.

The arrival on the scene of CrO_2 (chromium dioxide) cassettes caused considerable consternation and argument but, in due course, "normal/CrO_2" switching became a standard inclusion in most domestic cassette decks.

In fact, CrO_2 cassettes now carry identification slots at the back, adjacent to the breakout tabs. These are sensed by fingers in the cassette compartment of some decks to effect automatic tape select switching.

For a variety of reasons, many manufacturers did not take up a Dupont licence but, instead, sought to develop competitive "chromium substitute" formulations using specially processed ferric oxide "doped", for example, with cobalt. They use the "Chromium" switch setting for both recording and playback and are said to offer equivalent results — again a matter for individual judgment.

Chromium dioxide and chromium substitute cassette tapes are now the subject of IEC "Category II" standards (Table 1).

GROUP	TAPE TYPE	BIAS	EQ.
IEC-I	Normal	Low	120μs
IEC-II	CrO_2	High	70μs
IEC-III	Fe-Cr	Medium	70μs
IEC-IV	Metal	150% higher than CrO_2	70μs

Table 1: Cassettes branded as above conform to IEC standards in respect to bias, erase, etc. Some may still be better than others, however, in terms of response, noise, distortion and MOL.

Some manufacturers, notably Sony and BASF, produced cassette tapes with a dual coating — a base layer of ferric oxide to accommodate low and middle frequencies and a thin surface layer of chromium dioxide for high frequencies.

Unfortunately, these so-called "Ferrochrome" cassettes do not fit either category I or II standards and are therefore strictly not compatible with either the "normal" or the "CrO_2" settings on current model decks.

They are subject to their own "IEC III" standards and, according to Technics, operate best with 70μs (CrO_2) equalisation, and a bias level somewhere between CrO_2 and ferric oxide. This precise combination is not available on many decks although, by chance, the ferrichrome formulation often appears to work well at one of the other settings.

Metal alloy coatings

Over the last couple of years, cassette tapes have been developed with a magnetic alloy coating based on pure iron (Fe) rather than iron oxide (Fe_2O_3). The new "metal" tapes exhibit much higher coercivity than even CrO_2, and offer a further increase in MOL and dynamic range at high frequencies.

By way of comparison, a modern high quality ferric oxide IEC-I cassette offers dynamic range figures of 58dB at 315Hz, 43dB at 10kHz and 38dB at 14kHz. For a high quality chromium dioxide IEC-II cassette, the equivalent figures are 63dB, 49dB and 44dB.

For an iron alloy coating, categorised IEC-IV, the figures read: 61dB at 315Hz; 53dB at 10kHz; 49dB at 14kHz.

However, metal tapes call for considerably higher recording, bias and erase currents, necessitating more generously designed heads and drive circuitry.

Older decks can play back an existing metal-tape recording on the CrO_2 position but are unlikely to be able to erase the tape properly or to supply adequate bias for an optimum new recording.

While most modern decks make adequate provision for metal coated cassettes, many claim that their reputed advantage over high performance chrome or chrome substitute cassettes seldom warrants their higher purchase price.

Noise reduction

Having in mind that the early tapes fell well short of any of the performance figures listed above, initial reservations about the potential of the compact cassette system were understandable. The way was open for some kind of noise reduction (NR) system to lower the noise level and thus boost the dynamic range, particularly at the high frequency end.

The Dolby-B NR system was the one most favoured by the industry, being a much simplified version of the full-scale Dolby-A NR system that had been used in professional recording and broadcasting situations since the '60s.

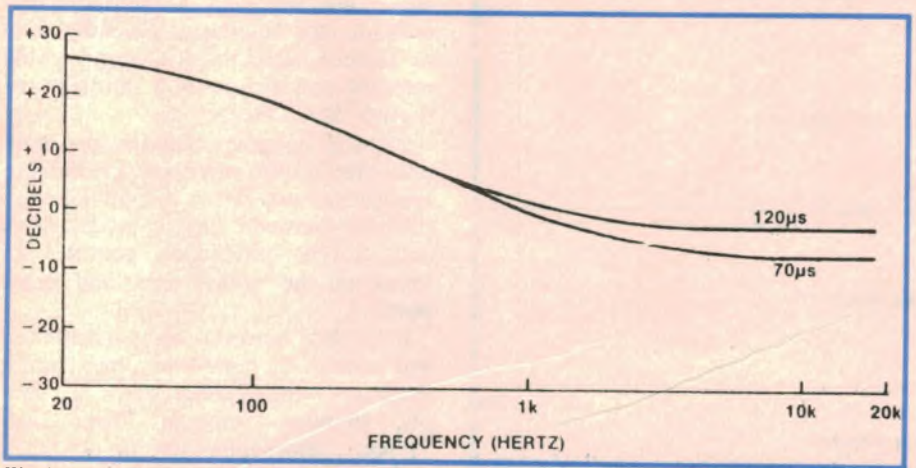


Fig.3: Practical preamplifier playback curves for a compact cassette deck. The one marked "120μs" is similar to the response curve in Fig.2 — minus the corners! The 70μs curve is as used for chromium and metal cassettes.

The Dolby-B NR system operates mainly above 1kHz, as indicated by the lower curve in Fig.4. This is the region where the tape MOL is lowest but, by reducing the high frequency noise level — apparent as tape "hiss" — by up to 10dB, the subjective dynamic range can be increased by an almost equal amount.

Fig.5 illustrates how Dolby-B operates. A typical audio signal, as fed to a tape recorder, contains high level passages (A) which pose no real problem, because they are loud enough to override or "mask" the tape noise. It is the low-level segments or passages (B) which are at risk.

From the input preamplifier, the input signal passes to a Dolby-B processor which, these days, is normally concentrated in a single dedicated IC. Without modifying the higher level segments, it senses and progressively boosts the treble component of weaker segments by up to 10dB — from (say) B to B'. In so doing, it effectively compresses the HF dynamic range by that amount.

The processed or "Dolbyised" signal is then passed to the cassette record/replay section, which typically introduces a noise component about 45-50dB below the nominal maximum recording level. Hopefully, the noise (shaded in Fig.5) will be below the weaker but now artificially boosted treble component of the signal.

During playback, signal from the head circuitry again passes to a Dolby NR stage, often the same one as used for recording but now switched to playback mode.

As before, it senses the weaker segments but, this time, restores them to their orignal level (from B' to B) effectively returning the dynamic range to what it was originally.

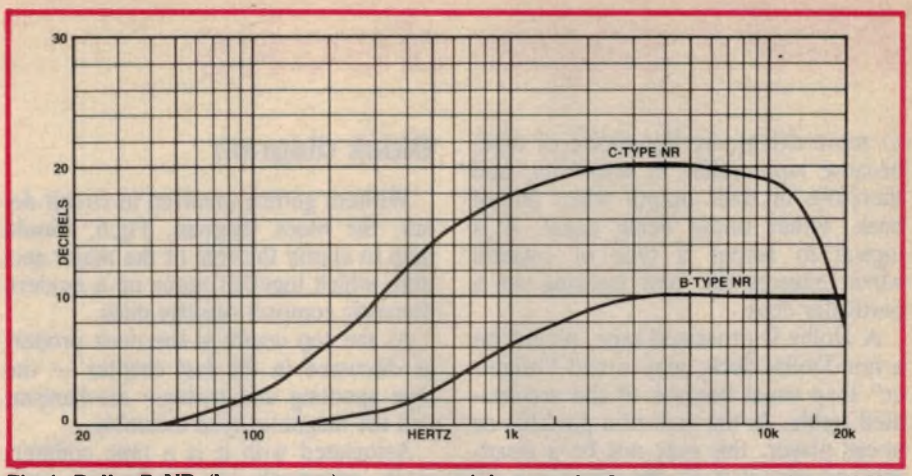


Fig.4: Dolby-B NR (lower curve) operates mainly over the frequency range above 1kHz. Dolby-C (upper curve) is one of a number of more ambitious NR systems which are now being included in some up-market compact cassette decks.

In so "de-emphasising" the lower level segments, the system also attenuates the tape noise (C to C') so that, as implied by the diagram, the recovered audio signal has a considerably reduced noise content and a subjective dynamic range up to 10dB better than indicated earlier for cassette tapes without noise reduction.

Rated overall S/N ratio figures for a typical modern compact cassette deck using CrO_2 tape and maximum input level (A weighted) read: Dolby NR out — 57dB; Dolby NR in — 67dB (above 5kHz).

For Dolby-B NR to be fully effective, it is important that the recording and playback levels "track". In other words, that the level of signal passing through the Dolby processor during playback should be the same as that when recording.

In most decks, this can be checked by first carefully monitoring the level during a test recording and noting the deck's meter or bargraph readings for high level passages. During playback, the readings should be identical or at least very similar.

Some cassette decks include special provision for adjusting the Dolby level — a procedure normally set out in the user manual. In most decks, however, the playback and signal meter levels are preset at the factory but they should be re-checked after head replacement or other major service which could affect the gain through the relevant signal paths.

Dolby tracking can also be affected,

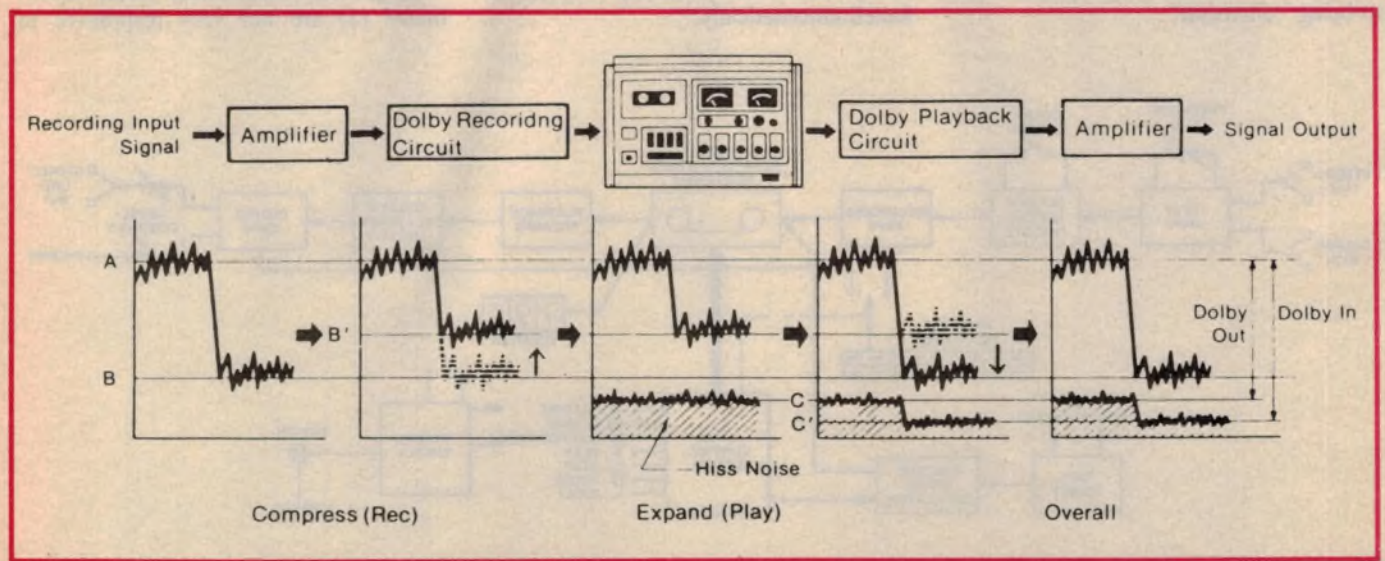


Fig.5: Reproduced by courtesy of National Panasonic Australia, this diagram illustrates the operation of the Dolby-B noise reduction system, as currently included in the majority of domestic cassette decks.

HIFI tape decks

to some extent, by the choice of tape, because tapes differ in sensitivity, and therefore in their output when played back. Other things being equal, it is logical to favour a type of cassette which ensures the best tracking on a particular deck.

A Dolby-B processed tape, played on a non-Dolby deck, may sound "brighter" than usual because of the accentuated treble. In the case of a portable or in-car player, this may not be a disadvantage but, if it is, the effect can be made less obvious by turning down the treble control, as necessary.

Playing a non-Dolby tape with the Dolby switch on may reduce the hiss but at the expense of normal treble response. Don't do it unless you happen to like it that way!

In addition to Dolby-B, some up-market decks include more elaborate NR systems, such as Dolby-C, ADRES, and dbx. Of these, dbx is of particular interest because it compresses the overall dynamic range on recording by 2:1, expanding it by the same amount on playback. Manufacturers claim that a dbx-equipped cassette deck can directly accommodate the 90+dB dynamic range of compact discs.

However, because of the more extensive signal processing employed by these more ambitious NR systems, recordings using them can only be heard to advantage on the same or a similarly equipped deck.

As yet, Dolby-B is the only cassette NR system which can lay any real claim to being "universal".

Block diagram

Without getting involved in circuit detail, the block diagram, Fig.6, should help to clarify the role of the major sections which together make up a modern domestic compact cassette deck.

At the top centre is the deck proper, as discussed in the last chapter — the tape spooling and traverse mechanism, and the magnetic head assembly.

Associated with it is a tape counter, most commonly a mechanical unit (Fig.7) belt driven from one or other of the spool tables. Such devices are not true "footage" counters, since the reading varies with the diameter of the tape roll, but they are useful, nevertheless, in keeping track of items on the tape.

Below the deck mechanism are the touch button panel controls and the now almost routine electronic "logic" control circuitry, which relays user instructions to the tape mechanism while, at the same time, blocking obviously impossible commands — like simultaneous REW and FF!

As well as activating the tape mechanism, the control system simultaneously sets up the electronic signal circuitry as required for the various modes: Record, Play, Pause, Stop, Rewind and Fast Forward plus, in some models, Cue and Review.

Separate switches are normally provided for supplementary functions such as: Mains off/on; Dolby off/on; Peak Limiter off/on; Cassette Eject; Tape Select (Normal, CrO_2, Metal) — if not effected automatically.

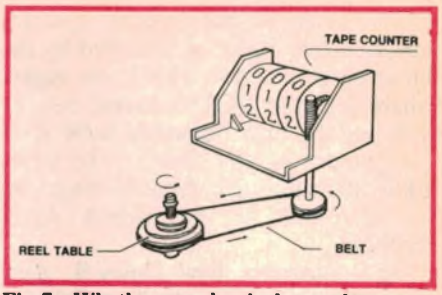


Fig.7: Whether mechanical, as shown, or electronic, normal tape counters driven by a reel table are not "footage" counters. They count revolutions!

Signal paths

Domestic cassette recorders normally provide input facilities (without mixing) for medium impedance dynamic or electret stereo microphones, and for flat response, medium output ("Line") sources, commonly accessed via the "Tape Out" sockets on the associated hifi amplifier.

With the deck in RECORD mode, the L&R (Left & Right) input signals are fed through input preamplifiers to the twin Dolby-B processors which may, in turn, be switched in or out of circuit, as desired.

The signals then pass to suitably compensated recording amplifiers, at which point a feed to the Level indicators allows the signal amplitude to be observed and suitably adjusted by means of the Record or Input Level controls.

Fig.8, by the way, reproduced from Technics literature, emphasises the need to keep the peak signal amplitude within limits, as normally discussed in the user manual accompanying each deck.

In general, mechanical meter movements (a) are not very responsive to

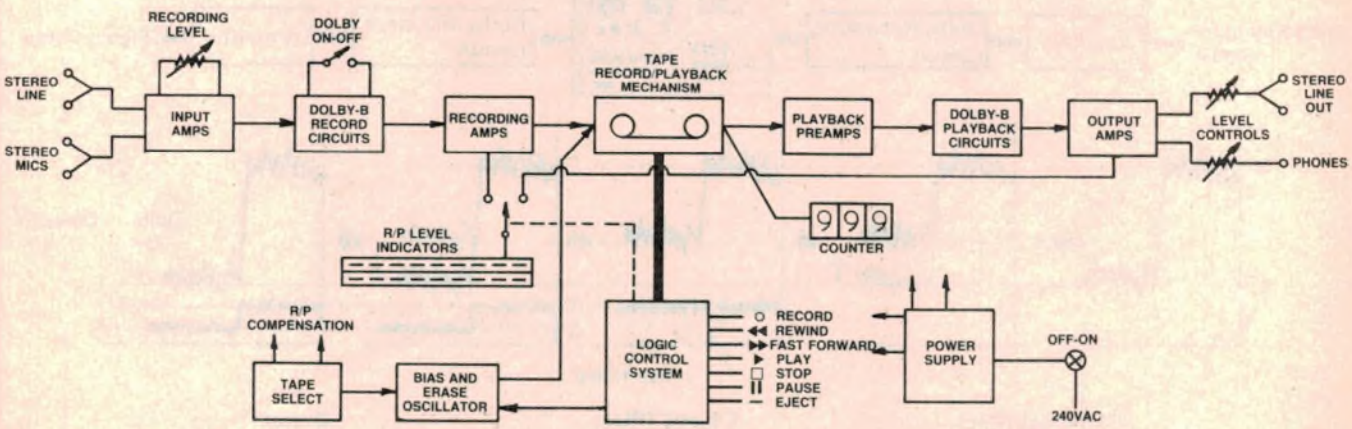


Fig.6: A modern, conventional cassette deck, depicted in block schematic form. Separate Record and Playback amplifiers are shown but the same amplifier components are often used and simply switched, as necessary, to fill both roles.

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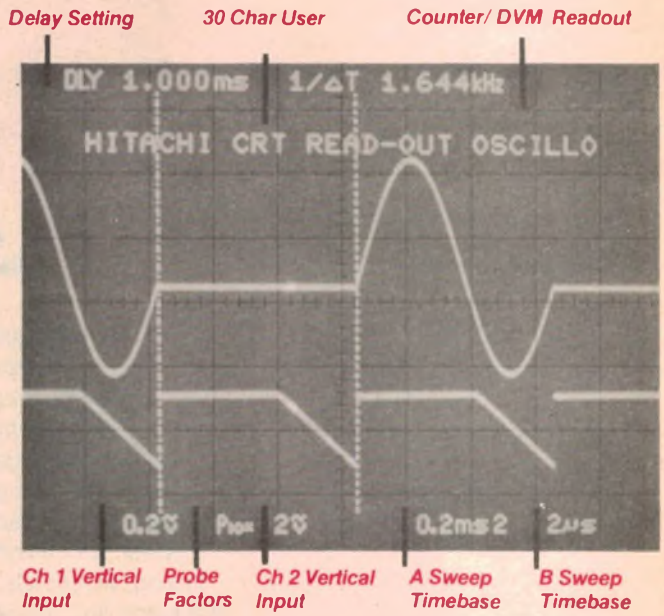

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HIFI tape decks

transient peaks and it is wise to limit visible excursions of the pointer to the 0dB mark. Fluorescent bargraphs (b) display transients much more effectively, such that they can be allowed to reach (say) +5dB.

Reverting to Fig.6, the signals are duly fed to the respective L&R windings of the Record or R/P head, along with HF bias from the erase oscillator, at predetermined levels governed by the setting of the "Tape Select" switch: Normal, CrO_2 or Metal.

(In most cases, the Tape Select switching also changes the Record and Playback compensation from 120 to 70μs or vice versa.)

In the Playback mode, signals from the Replay or R/P head pass first to compensated preamplifiers and then on to the Dolby-B processors which, again, can be switched in or out of circuit, as appropriate.

The signals are then fed to an output amplifier stage, at which point their amplitude can again be observed on the Signal level indicators. As mentioned earlier, it should match the recording level, indicating that the signals through the respective Dolby processors are tracking correctly.

The output amplifier also supplies signal to the phones and to L&R Line output connectors, either directly or via level controls, normally operating after the point at which the signal level is measured.

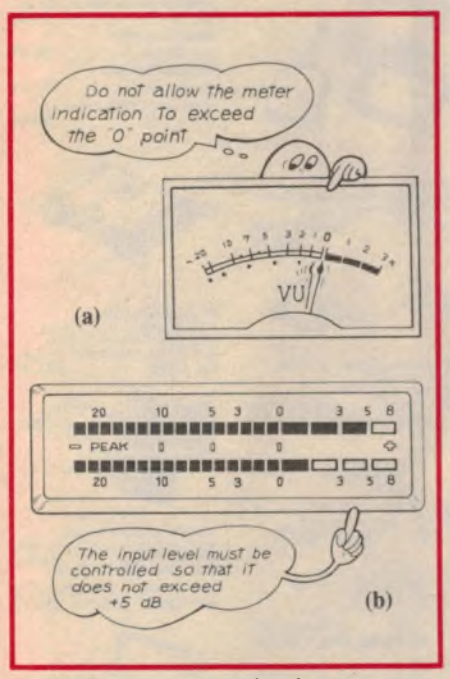

Fig.8: Because conventional meter movements do not display transient peaks very well, their readings have to be interpreted more cautiously than those of the electronic bargraph level indicators.

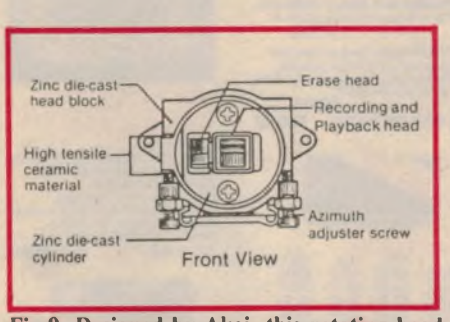

Fig.9: Designed by Akai, this rotating head assembly can flip over automatically at the end of a tape to provide bi-directional continuous play. The alternative is to use extra fixed heads with switching.

For the sake of clarity, completely separate amplifier chains have been shown for the Record and Playback modes. This would, in fact, be normal for decks fitted with separate Record and Playback heads, so as to allow the recording to be monitored directly off-tape a split second after imposition.

This obviously is not possible in decks using a combined R/P head, monitoring being confined to the input signal. In such a case, sections of the amplifier chain may well be switched from one role to the other. However, with ICs being cheap, the designers may prefer to provide separate amplifier chains in order to minimise the need for complex mode switching.

But, these days, cassette decks come in all shapes and sizes, from exotic — and expensive — high performance audiophile models to diminutive personal players.

Somewhere in between are models featuring auto reverse and continuous play, and still others with twin deck mechanisms, to facilitate cassette dubbing, at either normal or accelerated traverse speeds. In the latter case, the individual functions are similar to those depicted in Fig.6, except that there are more of them, possibly "tailored" to cope with signal frequencies artificially boosted by the higher traverse speeds.

To cover all these variants would involve far more space than is available but what has been said should clarify the basic principles and lead to a better understanding of what cassette decks are all about.

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"Buy your High Density disks at below recommended retail prices from Rod Irving Electronics and SAVE"!!
R.R.P. $113 **Our Price $99.95**

NEW INTRA HIGH RESOLUTION RGB COLOUR MONITOR!

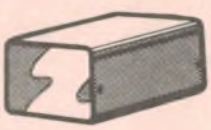
Size: 14 inch
Sync. Horiz. Scan Freq: 15.75 KHz
Sync. Vert. Scan Freq: 50 Hz
Band width: 18 MHz
Resolution: 640 x 400 dots
Display Format: 80 x 25 Characters
Display Colours: 16 colours
Input Connector: 9 pin D type
Cat. X14520 **only $695**

RITRON 2 MONITORS

Stylish, swivel base monitor, available in amber or green.
Green Cat. X14506 **Normally $215**
Amber Cat. X14508 **Normally $219**
SPECIAL, ONLY $199

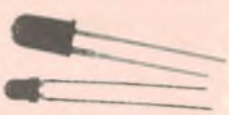
RITRON 19" RACK CASE

Tremendous Value! Dimensions 480(W) x 134(H) x 250(D)mm
Cat. H10415 **Normally $47.95**
SPECIAL, ONLY $42.95



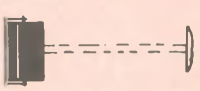
HORWOOD ALUMINIUM CASES

H10382 3 x 4 x 2 inches	$ 5.50
H10383 3 x 4 x 3 inches	$ 6.50
H10384 3 x 4 x 4 inches	$ 7.50
H10385 3 x 4 x 5 inches	$ 7.95
H10386 3 x 4 x 6 inches	$ 8.50
H10387 3 x 4 x 7 inches	$ 9.50
H10388 3 x 4 x 8 inches	$10.50
H10389 3 x 4 x 9 inches	$10.95
H10390 3 x 4 x 10 inches	$11.95



QUALITY LEDS

Cat. No.	Description	Price
Z10140	3mm Red	$0.20
Z10141	3mm Green	$0.30
Z10143	3mm Yellow	$0.30
Z10145	3mm Orange	$0.30
Z10150	5mm Red	$0.15
Z10151	5mm Green	$0.30
Z10152	5mm Yellow	$0.30



ARLEC SECURITY BEAM

This compact security system transmits an invisible, modulated beam of infrared light which can be directed across a doorway, path or any other to be monitored. Anyone walking through the beam immediately causes an audible warning to sound. Suitable for shops, homes, factories etc.
FEATURES:
- Small compact design
- Infrared modulated beam
- Prismatic reflector allows up to 10% misalignment
- Effective range is 2 - 8 metres
- Low voltage (9V) operation via S.E.C. approved adaptor
- Negligible power consumption
- Simplified wiring
- Solid state electronic circuitry
- Produces audible warning
- Easy installation
- 12 months guarantee

Cat. A15060 **$89.95**

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips). High UV intensity at chip surface ensures EPROMS are thoroughly erased. (Dimensions 217 x 80 x 68mm)
Without timer Cat. X14950
only $99.95
With built in timer Cat. X14955
only $129

U.V. TUBES

Fits into standard 15W fluoro holder. Suitable for Scotchcal, Eprom erasing etc. As used in E11 Eprom Erasing Kit
WARNING: Do not look directly into UV Tubes
Cat. H28600 **$24.95**
*If ordering by mail please include an extra $2 for "special" packing.

RS232 & 'D' TYPE SPECIALS

Part Description	Cat.No.	Price
DE9S 9 pin Female	P10881	$1.75
DE9P 9 pin Male	P10880	$2.25
DE9C 9 pin cover	P10882	$1.95
DA15P 15 pin Male	P10890	$2.10
DA15S 15 Female	P10891	$2.25
DA15C 15 pin cover	P10892	$1.15
DB25P 25 pin Male	P10900	$1.95
DB25S 25 Female	P10901	$2.95
DB25C 25 pin cover	P10902	$1.20

INDUCTORS

As used in the Series 4000 speaker kits!

L12040 0.8mm	$8.95
L12048 3.0mm	$14.50
L12056 12.6mm	$29.50
Base plate	$14.50
Circuit Board ETI 496	$12.50

TELECOMMUNICATIONS AUSTRALIAN STYLE ADAPTOR CABLE

- Australian socket to plug/socket
- Length 10 metres

Cat. Y16015 ~~Normally $15.95~~
$12.75

TELEPHONE ADAPTOR

- Australian plug to U.S. socket
- Length 10cm
- Cream colour cable

Cat. Y16026 ~~Normally $6.95~~
SPECIAL, ONLY $5.55

TELEPHONE CURL CORD

- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres
- Colours: cream, dark brown

Cat. Y16022 ~~Normally $7.95~~
SPECIAL, ONLY $6.35

TELECOMMUNICATION PLUG TO 2 SOCKETS

Ideal for modem connections
Cat. Y16014 ~~Normally $12.95~~
SPECIAL, ONLY $10.35

DPM-200 PANEL METER

- **Ultra Low Power**
- **Separately Addressable Annunciator**
- **15mm Digits**
- **Bandgap Reference**

A low profile LCD DPM with a range of useful symbols as shown. The DPM-200 features 15mm 3½ digit display, and ultra low current consumption and a bandgap reference for high stability. It also features Auto-zero, Auto-polarity, 200mV fsd. It may be used in single-ended, differential or ratiometric modes. The fsd can be easily changed by the user to indicate any other units. The decimal points and symbols can all be driven from an internal source. Wide supply and symbols can all be driven from an internal source. Wide supply rail (5-15V DC) with a variable threshold low battery warning indicator. Supplied with mounting clips and comprehensive data sheet.
SPECIFICATIONS:
Accuracy: 0.1% + - 1 digit
Linearity: + - 1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50-C
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: + - 20V
Cat. Q15510 **$99.95**

AEROSOLVE SPRAYPACKS

PCB Coating '201' Cat. N11040	$6.95
Freezing Spray '202' Cat. N11042	$6.95
Insulating Varnish '203' Cat. N11043	$7.95
Electric Motor Cleaner '204' Cat. N11044	$6.95
Electronic Super Clean (Freon) '205' Cat. N11047	$7.50
Flux Remover '206' Cat. N11049	$6.95
Elec Contact Cleaner & Lube '207' Cat. N11051	$5.95
Silver Cote '208' Cat. N11054	$6.95
Formula "66" '535' Cat. N11057	$5.95
Clear Coat Plastic Spray '540' Cat. N11059	$6.95

CENTRONICS GENDER CHANGER

- Female to Female.
- Saves modifying or replacing non-mating Centronics cables.
- All 36 pins wired straight through.

Cat. X15662 **$33.95**

RS232 MINI PATCH BOX

- Interface RS232 devices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat. X15654 ~~Normally $25.95~~
SPECIAL, ONLY $20.75

RS232 GENDER CHANGERS

Saves modifying or replacing non-mating RS232 cables by changing from male to female to male. All 25 pins wired straight through.
Male adaptor to join 2 female ends
Cat. X15650 **$19.95**
Female adaptor to join 2 male ends
X15652 **$19.95**

HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving

105x30mm Cat. H10520 **$ 3.50**
105x75mm Cat. H10525 **$ 3.50**
105x100mm Cat. H10529 **$ 4.90**
105x140mm Cat. H10534 **$ 6.50**
105x150mm Cat. H10535 **$ 6.75**
105x170mm Cat. H10538 **$ 7.95**
105x195mm Cat. H10542 **$ 9.90**
105x200mm Cat. H10543 **$ 9.90**
105x225mm Cat. H10546 **$10.50**
105x300mm Cat. H10549 **$12.00**
105x600mm Cat. H10560 **$24.95**

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 type). Comes complete with detailed instructions.

Cat. M23533 **$27.95**

NICADS!

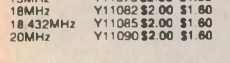
Size	Desc		1-9	10+
AA	1.2	A.H.	$1.95	$1.75
C	1.2	A.H.	$7.95	$6.50
D	1.2	A.H.	$7.95	$6.50

CRAZY SPECIAL!

CRYSTALS SPECIALS

We simply have too many of these prime spec. crystals in stock!

Description	Cat No.	1-9	10+
1MHz	Y11000	$6.00	$5.20
1.8432MHz	Y11003	$6.00	$5.20
4MHz	Y11020	$2.00	$1.60
4.194304MHz	Y11022	$2.00	$1.60
4.433618MHz	Y11023	$2.00	$1.60
4.75MHz	Y11025	$2.00	$1.60
4.915200MHz	Y11026	$2.00	$1.60
5MHz	Y11030	$2.00	$1.60
6MHz	Y11040	$2.00	$1.60
6.144MHz	Y11042	$2.00	$1.60
6.670MHz	Y11045	$2.00	$1.60
8MHz	Y11050	$2.00	$1.60
8.867238MHz	Y11055	$2.00	$1.60
10MHz	Y11060	$2.00	$1.60
12MHz	Y11070	$2.00	$1.60
14.31818MHz	Y11072	$2.00	$1.60
15MHz	Y11075	$2.00	$1.60
18MHz	Y11082	$2.00	$1.60
18.432MHz	Y11085	$2.00	$1.60
20MHz	Y11090	$2.00	$1.60



DIODES SPECIALS

1-9	10+	100+	1000+
IN4148 Cat. Z10135			
3¢	2½¢	2¢	1½¢
IN4002 Cat. Z10150			
4¢	3¢	2½¢	3¢
IN4004 Cat. Z10107			
5¢	4¢	3¢	2½¢

BRAND NEW FANS

Not noisy pullouts! Stacks of uses in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air.

240V 4⅝" Cat. T12461 **$12.95**
115V 4⅝" Cat. T12463 **$12.95**
240V 3½" Cat. T12465 **$12.95**
115V 3½" Cat. T12467 **$12.95**

10+ fans (mixed) only $10 each!

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**

SOLDER ROLLS

Absolutely top quality, unlike our opposition's!
60/40 Resin cored.

Cat.No.	Description	Price
T31000	.71mm 250gm	$8.95
T31002	.71mm 500gm	$15.95
T31010	.91mm 250gm	$7.95
T31012	.91mm 500gm	$14.95
T31020	1.6mm 250gm	$7.50
T31022	1.6mm 500gm	$13.95
T31030	.71mm 1 metre	$1.50
T31032	.91mm 1 metre	$1.25
T31034	1.6mm 1 metre	$1.00

PC BOARD HOLDER

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

Cat. T12442 **$7.95**

"SNAP TOGETHER" PLASTIC CABINET

Top and bottom simply snap together (no screws required) removable front and back panels.
Dimensions: 186(W) x 125(D) x 50(H)mm

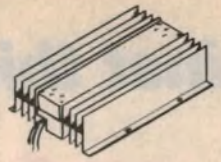
Cat. H10116 **$6.95**

TEXTOOL SOCKETS

P17016 16 pin	$14.50
P17024 24 pin	$14.50
P17028 28 pin	$19.50
P17040 40 pin	$22.50

UNIVERSAL SOLDERING IRON STAND

Cat. T11302
Normally $5.95 slashed to **$3.95**



REGULATED DC-DC CONVERTER

Built on to a heavy duty aluminium heatsink with 7 amps. Ideal for trucks and boats.
- Input 24V DC
- Output 12V DC at 7 amps
- Fully regulated with short circuit protection
- Size: 180(L) x 94(W) x 33(H)mm

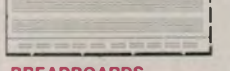
Cat. A15056 **$33.95**

VALUE! BARGAINS! RANGE! NEW! SAVE!

MINI UTILITY CASE

Features a clear plastic lid for instant inspection of contents. Up to five adjustable lower compartments plus a self elevating upper tray for smaller items.
Dimensions: 110 x 210 x 43mm

Cat. H10087 **$7.95.**



BREADBOARDS

Cat. No.	Description	Price
P11000	100 Holes	$ 2.75
P11005	640 Holes	$10.75
P11007	640 + 100 Holes	$13.00
P11009	640 + 200 Holes	$17.50
P11010	1280 + 100 Holes	$19.95
P11011	1280 + 300 Holes	$32.50
P11012	1280 + 400 Holes	$36.75
P11015	1920 + 500 Holes	$57.50
P11018	2560 + 700 Holes	$64.95

RELAY AND BASE

Can carry 10A at 28V DC or 5A at 240V AC. Supplies with Chassis Mounting Socket with screw terminals. Great for school projects and demonstrations, switching DC power supplies, central circuits and with contacts parallel up to 20A can be switched.

Cat. S14074 Normally $8.95
SPECIAL $6.95

PROGRAMMABLE 24 HOUR TIME SWITCH

- 48 switching possibilities per day
- 240V AC, 2400 watt, 10 amp
- Suitable for turning on...
  Heaters/Coolers
  pool filter
  electric blankets
  cooking appliances
  waking you, even making the coffee!
  lights etc for security while you're away from home!
- Bargain Price!

Cat. M22002 **only $19.95**

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 534
¼" shaft.

Equiv (Bourns 3540S, Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		

1-9	10+
$13.50	$12.50

SPECTROL 43P

Equiv (Bourns 3006)
Essential for precision work.

R14200 10R	R14290 10K
R14210 20R	R14300 20K
R14220 50R	R14310 50K
R14230 100R	R14320 100K
R14240 200R	R14330 200K
R14250 500R	R14340 500K
R14260 1K	R14350 1M
R14270 2K	R14360 2M
R14280 5K	

1-9	10+
$1.95	$1.75

MAGNETIC BULK ERASER

The best and by far the quickest way to erase tapes, cassettes and computer disks! Reduces noise levels below recorders own erase head level. On/Off switch located in handle 240V AC operation.

Cat. C14950 **Normally $34.95**
SPECIAL, ONLY $29.95

ARGUS 726 ADJUSTABLE MAGNIFIER WITH LAMP

Absolutely perfect for close up work! Intricate PCB's, projects, etc., will be a breeze under this superb, adjustable magnifying lamp.
- Magnifies 1.75 times
- 40 watt incandescent lamp
- 2 spring-balanced arms extendable to 95cm
- Adjustable head for optimum viewing angle.
- Comes with desk clamp. (interchangeable with base)
- Fantastic Value!!

Cat. **Our price $89**

CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
- Easy replacement of solder tip
- Protective stand which also functions as charging unit
- Sponge pad attach to stand
- Plug pack power adaptor
- Includes Nicad battery
- Instruction manual
- 12 months warranty

Cat. T12480 **$59.95**

ARLEC SUPER TORCH

A sophisticated rechargeable torch ideal for use in and around the home, the car, the boat, etc.
FEATURES:
- Powerful built-in Nicad batteries
- Reflector head swivel through 90 degrees
- 3 position switch gives on/off/ and dim
- Indicator lamp when recharging.
- Charges from mains, electricity or from a car battery.
- Supplied complete with
  (A) SEC approved battery charger
  (B) Plug and cord for car lighter socket
  (C) Handy charging bracket with fixing screws
- 12 months guarantee

Cat. A15055 **Normally only $44.95**
SPECIAL, ONLY $39.95

PANEL METERS GALORE!

We have a great range of panel meters at great prices!

Cat No.	Description	Price
Q10500	MU45 0-1mA	12.50
Q10502	MU45 50-0/50uA	12.50
Q10504	MU45 0-100uA	12.50
Q10510	MU45 0-5A	12.50
Q10518	MU45 0-1A	12.50
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

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 **Normally $69.50**
SPECIAL, ONLY $55.60

SPECTROL MULTIDIALS

Model 16-1-11 (.9")
Cat R14400 ..... **$16.95**
Model 18-1-11 (1" x 1.75" Rect.)
Cat R14405 ..... **$38.50**
Model 21-1-11 (1.82")
Cat R14410 ..... **$37.50**

CANON TYPE CONNECTORS

Cat. No.	Description	Price
P10960	3 pin line male. Was $3.90	NOW $2.70
P10962	3 pin chasis male Was $3.00	NOW $2.10
P10964	3 pin line f male Was $4.20	NOW $2.95
P10966	3 pin chas. f male Was $4.50	NOW $3.15

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

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Protect your car against thieves with

The Screecher Car Burglar Alarm

Here is a low cost car alarm designed with a new deterrent strategy. Instead of using the alarm to try to draw the attention of passers-by to the felony in progress, this alarm sounds inside the car, to deafen the thief and make it too uncomfortable to proceed with pinching the vehicle.

by COLIN DAWSON & LEO SIMPSON

"Not another car alarm!" we can almost hear you saying. After all, there are dozens of alarms available commercially at keen prices. And for the home constructor, *Electronics Australia* has already published a fine circuit which met eight out of ten NRMA recommendations for car alarms, and which is still available in kit form from several retailers (see EA, May 1984).

We also presented the "Claytons' alarm" which has only the dashboard lamp flasher but no alarm circuitry, in February 1986. This was a neat but dishonest (?) idea which tricked would-be thieves into thinking an alarm was fitted to the car.

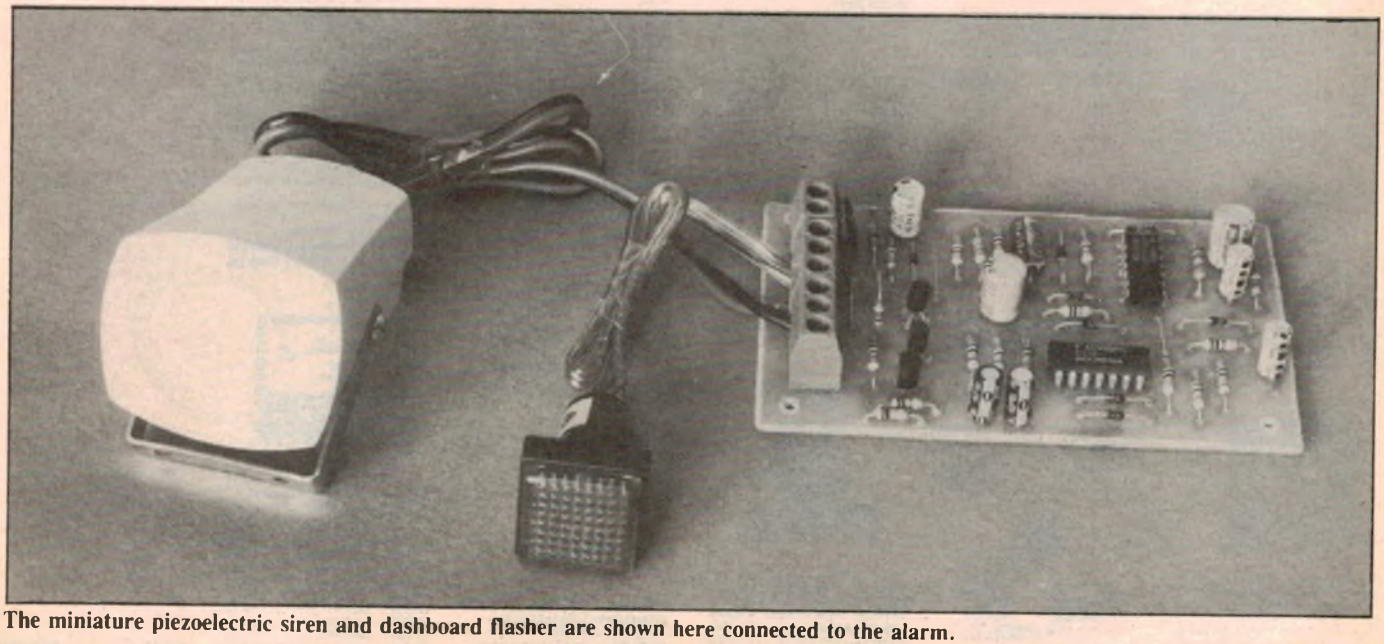
For this new circuit we have come up with a novel and at the same time practical approach. We wanted a more unpleasant and more effective thief deterrent but we also wanted to minimise the problem of false alarms. How many people actually trip their own car alarms when entering the vehicle? We think we have an effective answer to that problem.

The solution

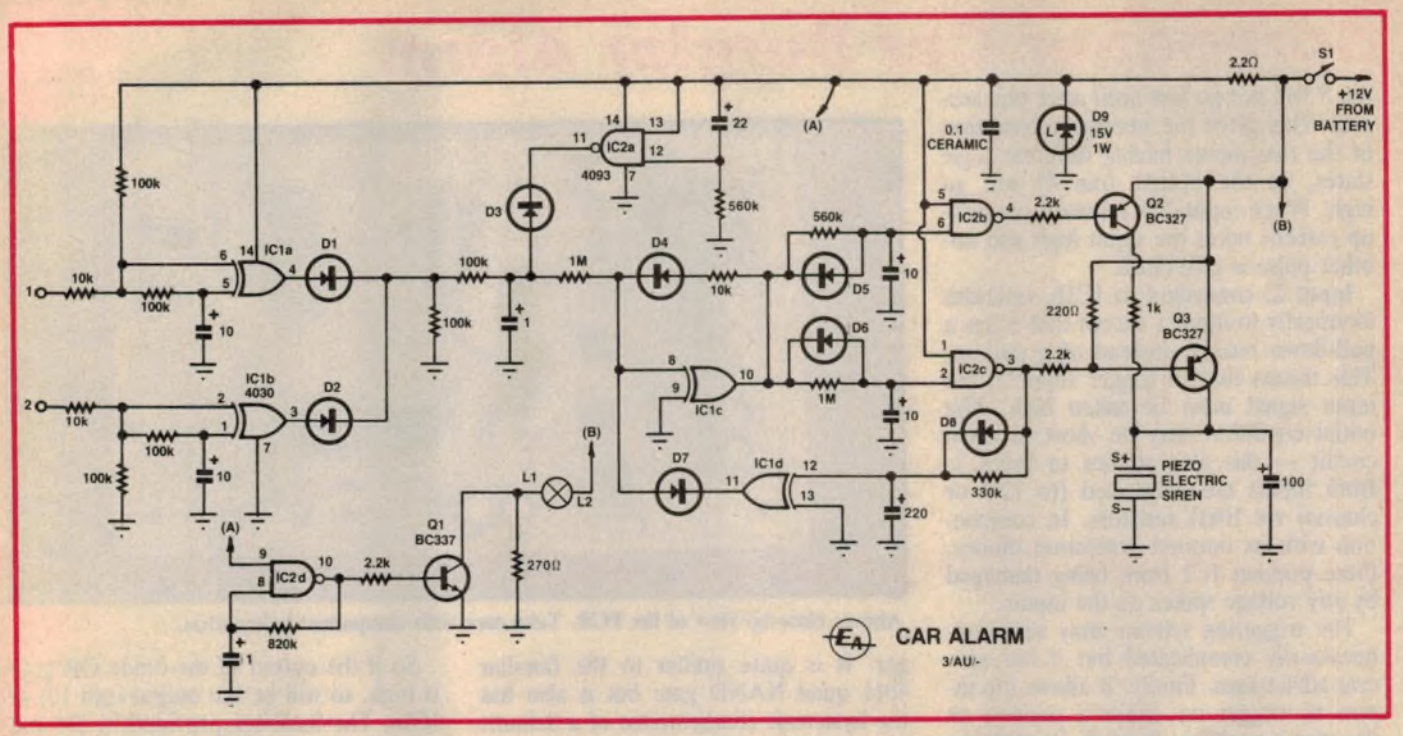
We have called it the "Screecher". Once fitted to your car, this alarm will harass unauthorised drivers with an exceptionally loud siren. It differs from normal alarms in that the siren is actually located in the passenger compartment of the car. It is intended to provide maximum discomfort for the illegal occupant and minimum irritation to nearby residents.

With the car door open, the very effective siren will be quite loud enough to attract anyone in the vicinity but that is not its main purpose. Instead, the aim is to make things unpleasant for the thief — he will want to get out as quickly as possible.

This approach has been made practical by a particularly effective miniature piezoelectric alarm which has recently become available. It is distributed by Arista Electronics Pty Ltd and is avail-



The miniature piezoelectric siren and dashboard flasher are shown here connected to the alarm.



able from kitset suppliers such as Jaycar Electronics.

It is very small, measuring only 39 x 43 x 59mm, and so is able to fit under the dash of even the smallest car. With 12V input, it consumes 150mA and produces a modulated tone at no less than 110dB at one metre. It sounds like a demented monster canary. Any person in our office who has heard it for even a short burst has been staggered — they break into a sweat.

In the confines of a car it would be utterly unbearable, unless you were stone, motherless deaf.

The concept of this alarm is so diabolical that we almost have pity on any car thief who comes up against it. We can imagine complaints to Government health departments along the lines of "I was just trying to rip this car off when it deafened me. It's unfair!" So be it. We are indebted to Arista Electronics Pty Ltd for the idea. They also supplied the sample alarm.

To back up the new siren, we have designed a control circuit which is both cheap and easy to install. More importantly, it provides the features you need most in an alarm. It has a lamp flasher, exit and entry delays, a three-second soft alarm to remind you to turn it off, and of course, automatic resetting.

The three-second soft alarm is an unusual feature for a car alarm, but one that will probably catch on sooner or later. As noted above, it seems to us that the majority of false alarms are caused by the driver forgetting to turn the alarm off. The customary entry delay time of seven seconds is still there — it's just that the alarm starts softly after this period, instead of launching straight into the maximum irritation mode. The soft alarm will give you three seconds warning before things get under way in earnest. The first time it happens, you will be grateful for this feature.

Two inputs are provided. Both respond to a change in state, whether from high to low or vice versa. The sense only becomes important when the input goes open circuit after the triggering action (this does not include door switches).

To keep installation really simple, the circuit just uses a basic on/off switch. More sophisticated circuits use the car's ignition switch to deactivate the alarm. This gives added security, but it complicates installation.

A hidden on/off switch gives reasonable security and is easy to install. When you hear the siren, you'll appreciate that it's an effective deterrent to anyone poking around under the dashboard looking for a switch.

Circuit description

Operation of the circuit is more complicated than its small component count would suggest. With only two ICs and a handful of other parts it provides entry delay, exit delay, alarm timer, lamp flasher and the three-second soft alarm feature.

Each of these circuit functions rely on a simple RC timer, but the interdependence of the sections make the sum much more interesting. Overall, the sequence of operation is as follows: one of the input gates detects a change of state, (ie, low to high or high to low). This produces a trigger pulse which must be longer than 0.1s to activate the circuit (this protects against spurious noise triggering). The input circuit limits all input pulses to a maximum of one second. The input pulse can only activate the following circuitry if the exit delay period has expired.

When an input pulse is latched, it starts two RC timers simultaneously. One of these eventually turns on the soft alarm and the other turns on the full alarm. After about one minute of the full alarm, the circuit will be reset. It can be retriggered immediately.

IC1a and IC1b are the input detectors. IC1 is a 4030 quad two input exclusive-OR gate (XOR). That's rather a mouthful, but you only need to know that each gate's output is high when either of its inputs (but not both) are high. Any other condition gives a low output. So long as the inputs of a XOR gate are different, the output will be high.

Take IC1a. This is ostensibly the negative transition detector (ie, it detects an input change from high to low), because its inputs (pins 5 and 6) are in the high state to begin with. If input 1 is pulled low, pin 6 will go immediately low. Because of the delay imposed by the 100kΩ resistor and 10μF capacitor,

Screecher Car Burglar Alarm

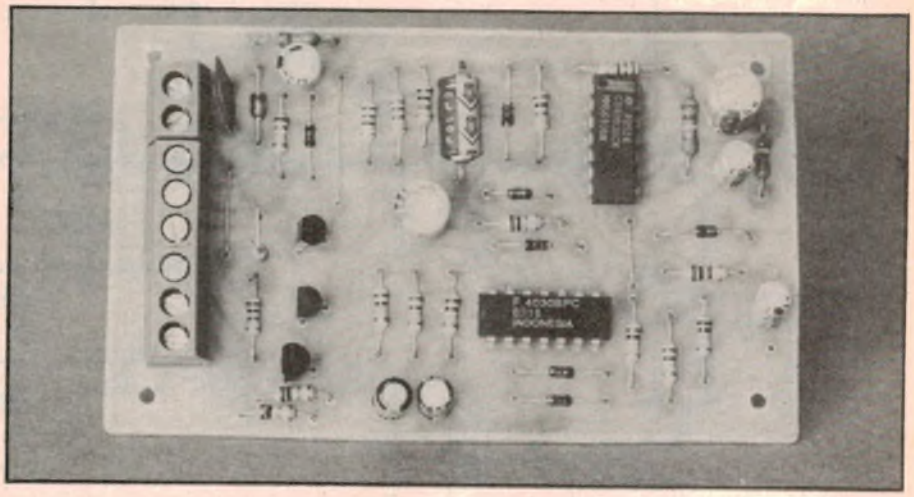
pin 5 will not go low until after one second. This gives the necessary condition of the two inputs having different logic states, so the output (pin 4) will go high. When input 1 is released, its pull-up resistor takes the input high and another pulse is generated.

Input 2, connected to IC1b, operates identically to input 1 except that it has a pull-down resistor instead of a pull-up. This means that to trigger Input 2, the input signal must be taken high. The initial condition may be short or open circuit — this also applies to Input 1. Both inputs are connected (to 12V or chassis) via 10kΩ resistors. In conjunction with its internal protection diodes, these prevent IC1 from being damaged by any voltage spikes on the inputs.

The triggering scheme may seem unnecessarily complicated but it has several advantages. Firstly, it allows the inputs to trigger on either a positive or negative transition. Second, it produces only one pulse with each transistion. This means that the circuit will trigger once when, say, a door is opened — but it will not remain permanently in the triggered state if the door is left open.

The outputs of IC1a and 1b (pins 4 and 3) feed into an OR gate consisting of diodes D1 and D2 and a 100kΩ resistor. The 0.1s protection against spurious signals is provided by the 1μF capacitor and series 100kΩ resistor connected to the output of the diode OR gate. Notice that diode D3 also feeds into this junction. D3 enables the exit delay to be effected.

At this point, the other IC used in this circuit needs to be described. IC2 is a quad two input NAND Schmitt trigger. It is quite similar to the familiar 4011 quad NAND gate but it also has the hysteresis characteristic of a Schmitt trigger device.



Above: close-up view of the PCB. Take care with component orientation.

The exit delay signal is provided by IC2a and its associated components. When power is first applied to the circuit, the 22μF capacitor connected to pin 12 of IC2a immediately begins to charge via the 560kΩ resistor. The voltage developed across the 560kΩ resistor, due to the charging current, holds pin 12 high. While the capacitor charges, the output of IC2a will be low. This provides the exit delay function.

After about 12 seconds, this voltage at pin 12 falls below the lower threshold value and so the output of IC2a goes high. D3 will now be reverse biased, which allows the output of the D1/D2 OR gate to be fed to the input of IC1a via a 1MΩ resistor.

So if the output of the diode OR gate is high, so will be the output (pin 10) of IC1a. The feedback provided by D4 and the 10kΩ resistor will enable IC1c to latch input pulses; ie, its output will then remain high even after the OR gate high signal is removed. In fact, another diode (D7) also feeds into pin 8 of IC1c but this is part of the turn off circuitry and will be discussed later.

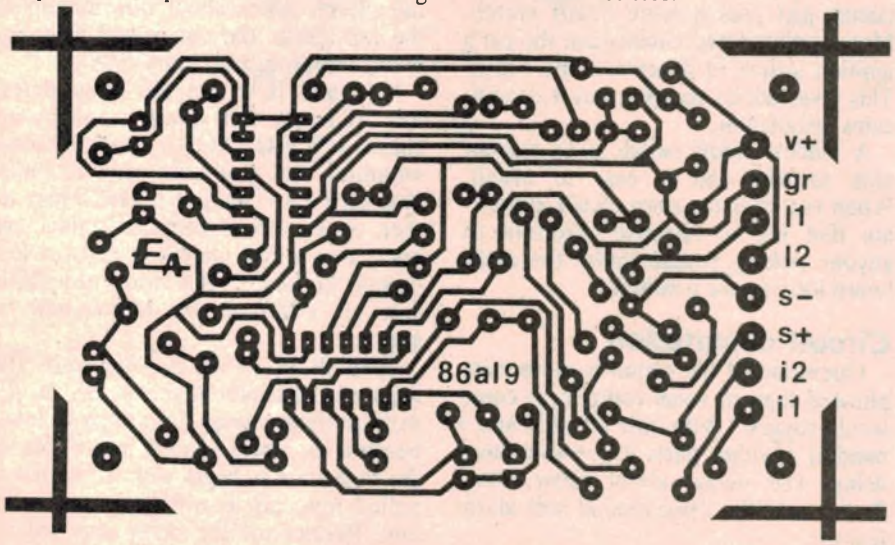
Having latched high, the output of IC1c enables operation of the two entry delay timers. The first of these consists of a 560kΩ resistor and 10μF capacitor connected to the input (pin 6) of IC2b. This is the seven-second timer.

Initially, the output of IC2b (pin 4) will be high because the input is low (due to zero charge on the 10μF capacitor). When the 10μF capacitor has charged sufficiently, the output of IC2b will go low and Q2 will be turned on, to drive the alarm siren via a 1kΩ resistor. This provides the soft alarm feature.

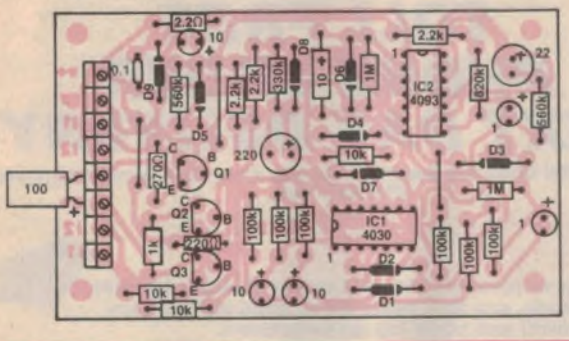
Some three seconds later, the 10μF capacitor connected to pin 2 of IC2c will have charged sufficiently to cause pin 3 to go low and turn Q3 on. This drives the siren alarm directly, which gives maximum loudness (and pain).

Notice that the output of IC2a (pin 3) is also connected to a 330kΩ resistor. This is part of the alarm timer IC1d. The 220μF capacitor begins to charge via the 330kΩ resistor and when it has reached a sufficient voltage, IC1d changes state with its output going low. D7 is now forward biased and pulls pin 8 of IC1c low. This releases the latched condition of IC1c.

So that the circuit will reset instantly, diodes D5 and D6 bypass each of the exit delay timer charge resistors. Diode



Here is an actual size reproduction of the PC artwork.



Follow this layout diagram carefully when installing the parts on the PCB.

PARTS LIST

1 PCB, 110 x 61mm, code 86a19
1 piezoelectric siren, (Jaycar Cat. No. LA-5255 or equivalent)
1 dashboard warning lamp to suit
1 single pole single throw (SPST) switch
1 8-way PCB mounting terminal block

Semiconductors

1 4030 quad 2-input XOR gate
1 4093 quad 2-input NAND Schmitt trigger
2 BC327 PNP transistors
1 BC337 NPN transistor
8 1N4148 diodes
1 15V, 1W zener diode

Capacitors

1 220μF 16VW electrolytic
1 100μF 16VW electrolytic
1 22μF 16VW electrolytic
4 10μF 16VW electrolytic
2 1μF 16VW electrolytic
1 0.1μF disc ceramic

Resistors (0.25W, 5%)

2 x 1MΩ, 1 x 820kΩ, 2 x 560kΩ, 1 x 330kΩ, 6 x 100kΩ, 3 x 10kΩ, 3 x 2.2kΩ, 1 x 1kΩ, 1 x 270Ω, 1 x 220Ω, 1 x 2.2Ω

D8 does the same for the main alarm timer IC1d. This ensures repeatable characteristics, even if the alarm is re-triggered immediately.

If you prefer, second and subsequent triggering may operate with reduced entry delay by eliminating diodes D5 and D6. D8 is essential though, as it ensures constant alarm time operation for subsequent triggering.

The other major part of the circuit is the lamp flasher. This is an inverter oscillator, based on IC2d and oscillating at around 1Hz. It drives a BC337 NPN transistor (Q1), which drives the lamp. The lamp should be of the miniature type with a rating of no more than 150mA. The 270Ω resistor in parallel with Q1 keeps the lamp filament pre-heated in the "off" periods and so reduces transistor dissipation. This part of the circuit operates continuously whenever power is applied.

Power input to the circuit is via the on/off switch and then via a 2.2Ω resistor. Immediately after this resistor is a 15V 1W zener diode which protects the circuitry against any voltage spikes on the car's DC supply line. Such spikes could come from the ignition system or from solenoids or motors.

Construction

The only components not mounted on the PCB are the siren and the lamp. Both are connected to the circuit through an 8-way terminal block. The other terminals are for power and the sense inputs.

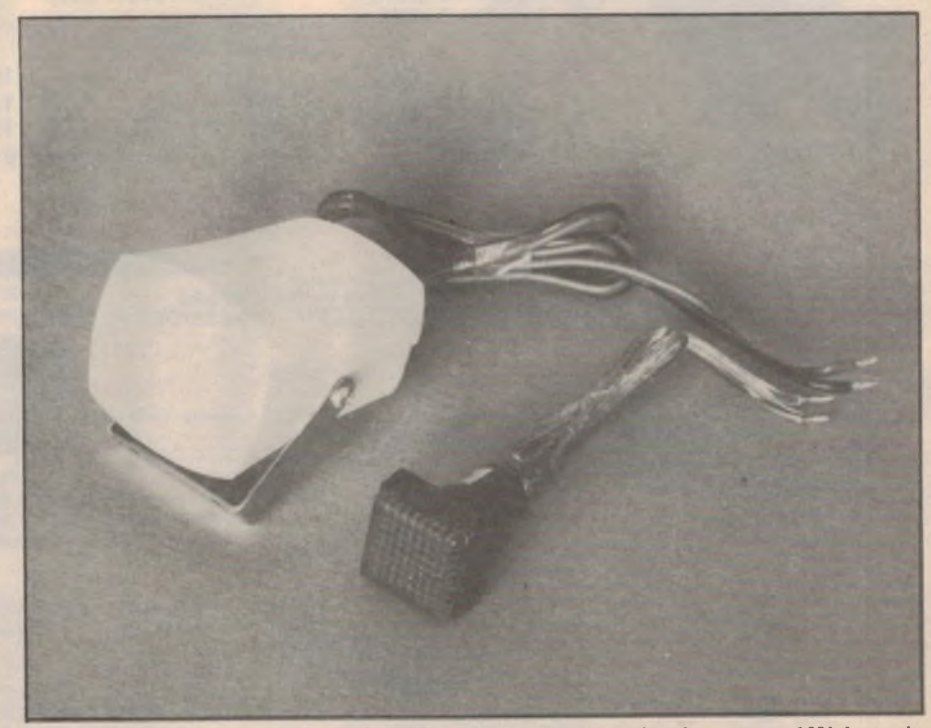
The PCB measures 110 x 61mm and the code number is 86al9. There is no special order for soldering the components in place. Many of the components are polarity-sensitive which means that they will not work unless you put them in the right way around. Follow the overlay diagram exactly. Note that a 100μF capacitor must be connected across the s- and s+ terminals.

The circuit can be housed in a plastic box if you deem it necessary. This would protect it from being short-circuited by metalwork under the dashboard but is strictly optional.

Before installing the alarm, it would be quite easy to test it on the bench. All you need is a battery or power supply of 6V to 12V. By connecting either Input 1 to ground or Input 2 to V+, it can be triggered. Check that the various times are about right (don't forget the exit delay which begins as soon as you connect power).

Prior to testing connect the alarm positive wire to its appropriate terminal through a 1kΩ resistor. This is a temporary measure to mute the alarm. Both of the siren modes will still be apparent, but not so offensive.

Installation can be very simple if you so choose. The only essential connections to the car are ground, +12V and at least one sensor input. For a really quick installation job, Input 1 can be connected to a courtesy light switch (actually, the switch side of the lamp), assuming a negative-chassis vehicle.



The piezoelectric siren is available from kitset suppliers while the square 12V lamp is available from Hi Com Unitronics, 7 President Lane, Caringbah, NSW 2229.

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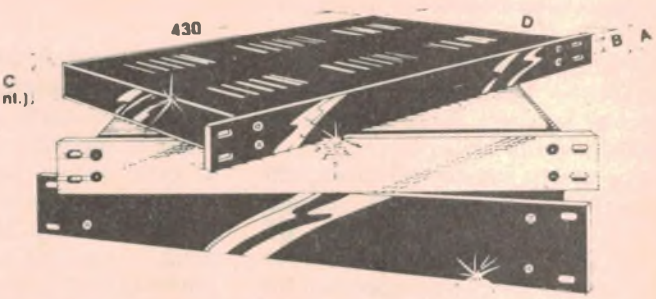

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- Alarm: Red LEDs will light up in sequence as signal strength increases. When all Red LEDs are lit and signal strength continues to increase, all Red LEDs will flash simultaneously.

Accessories Included:

- Visor bracket
- Velcro
- Cigarette lighter plug

Specifications:

Size: 3/4" H x 3-1/8" W x 4-1/2" l.

Operating Frequencies: X Band: 10:525 GHz
K Band: 24150 GHz
+110 MHz

Antenna Type: Microwave Horn, single ridge waveguide.

Power Requirements: 12V DC nominal, 10-14V limits.

Current: **190 mA**

Temperature Range: -12 deg. C to +70 deg.C (+10 deg.F to +158 deg.F)

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Improve the sound from your VCR with this

Dynamic Noise Reduction System

Give the sound from your mono VCR a lift with this Dynamic Noise Reduction (DNR) System which reduces hiss and adds simulated stereo. The circuit uses the standard DNR chip from National Semiconductor.

by GREG SWAIN

Anyone who owns a mono VCR knows that the sound quality, as it finally emerges from the TV set, is pretty lousy. In fact, it's worse than from a mono cassette recorder without Dolby noise reduction.

But it needn't be so. Most VCRs include an audio output socket which allows the sound to be routed to a stereo amplifier. That's the first step to improving sound quality.

The second step is to build and interpose this Dynamic Noise Reduction System into the signal line between the VCR and the amplifier. Depending upon the circumstances, it is capable of providing a very worthwhile 18dB (maximum) improvement in the signal-to-noise ratio.

While this figure might not mean too much to many readers, your ears will certainly appreciate the difference. Less hiss adds up to much greater enjoyment of the audio sound track. As a bonus, the circuit processes the mono soundtrack to give a realistic stereo effect and provides notch filtering of the TV line frequency (15.625kHz).

Although mainly designed for use with VCRs, the Dynamic Noise Reduction System could also be used with other audio sources where noise is a problem. For this reason, the circuit is capable of accepting both mono and stereo line level inputs. No provision has been made for line frequency extraction from stereo sources, however.

So, if you want to get the best possible sound from your VCR, this project is a must. It's easy to assemble and the setting up procedure is a snack.

Noise reduction systems

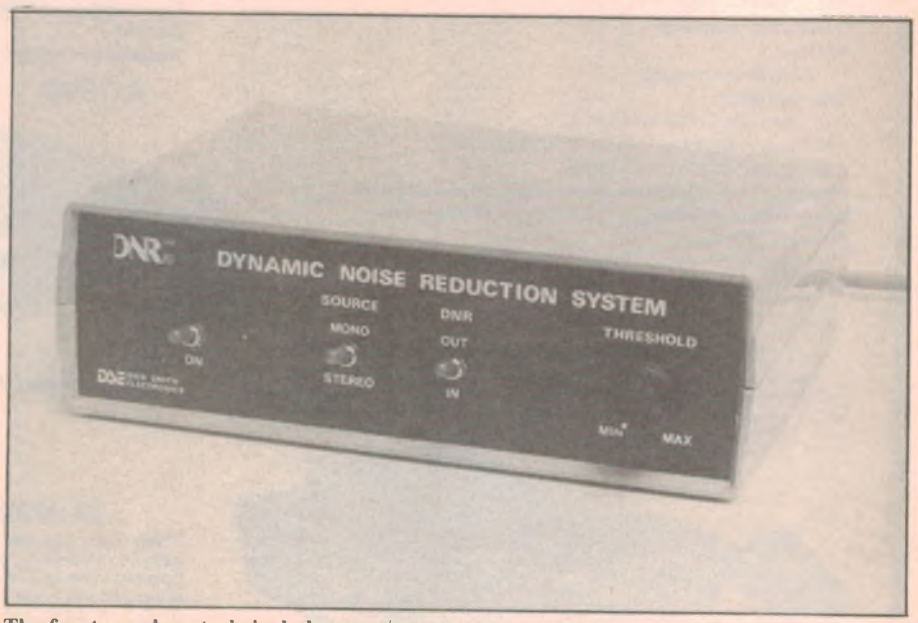
Audio noise reduction systems fall into two broad categories: complementary and non-complementary. In a complementary system, such as the Dolby and dbx systems, the signal is compressed during recording and then expanded in complementary fashion during playback. This effectively reduces the noise in the playback signal — hopefully to a level below the threshold of hearing.

In a non-complementary system, on the other hand, noise reduction takes place in the playback mode only. This is the technique used in the DNR System described here. It's main advantage is that it can be used with almost any audio source since no signal processing is required during recording.

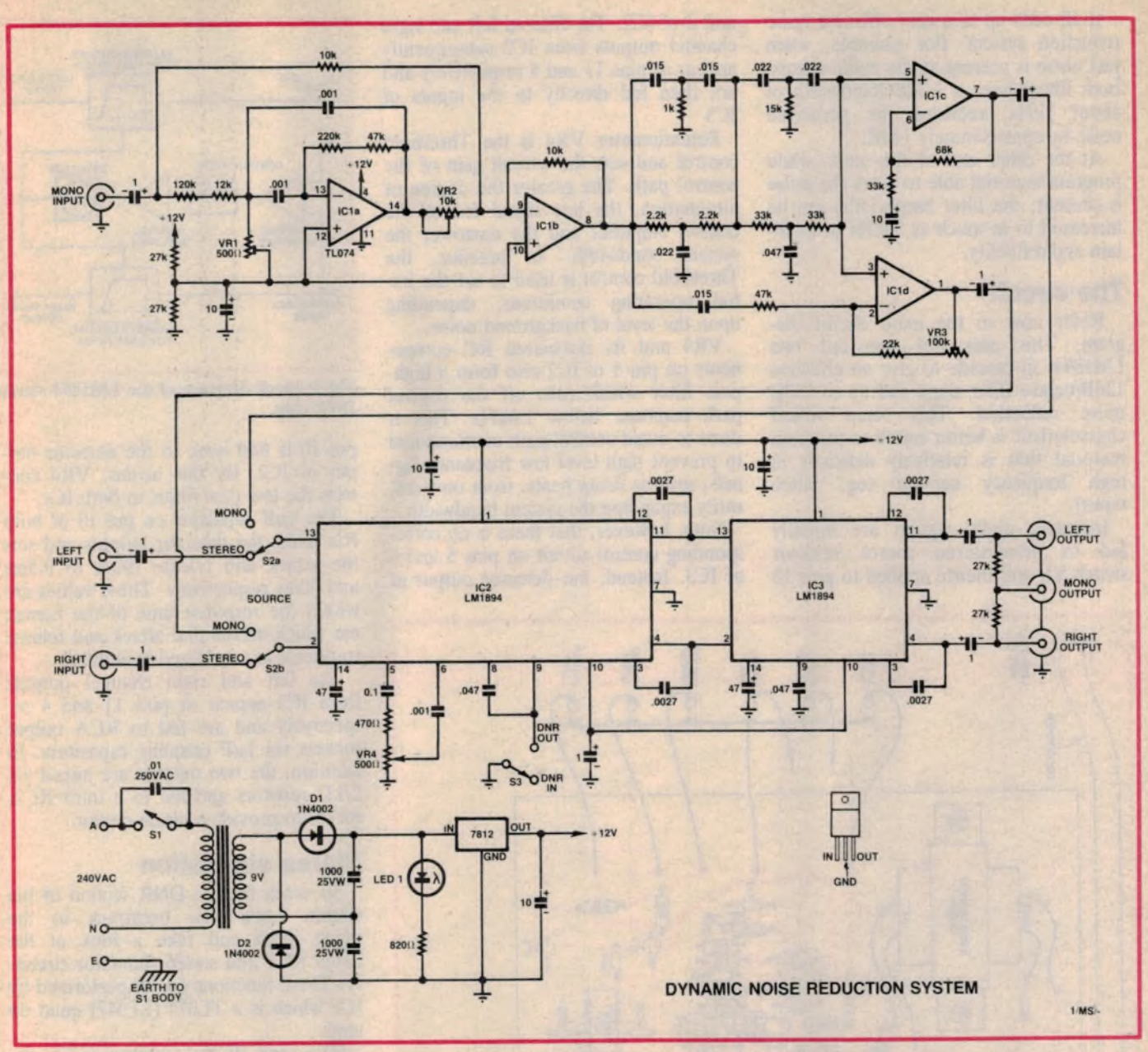
How it works

At the heart of the circuit is the LM1894 stereo DNR chip from National Semiconductor. The operation of this chip depends on two principles: (1) in any playback system, the audible noise is proportional to the bandwidth; and (2) desired signals above a certain level are capable of masking the background noise.

As an aside, most background noise (hiss) occurs at frequencies above 1kHz. This means that the noise can be considerably reduced by filtering out these high frequencies (ie, by reducing the bandwidth). The DNR system does this in such a way as to leave the program



The front panel controls include mono/stereo source switching, DNR IN/OUT, and threshold.



content largely unaffected.

In essence, the LM1894 monitors the incoming audio signal and continuously adjusts the system bandwidth in response to the signal amplitude and frequency content. This means that, when low-level or low-frequency signals are present, the bandwidth is deliberately restricted to filter out the unwanted high-frequency noise.

Conversely, when high-level or high-frequency signals are present, the noise is masked and the bandwidth is correspondingly expanded to pass the wanted program content.

Fig.1 is a block diagram of the LM1894 chip. In each channel is a variable cut-off low pass filter. These filters have a flat frequency response below the cut-off frequency, and a smoothly decreasing (−6dB/octave) response above the cut-off frequency.

The cut-off frequency is continuously adjusted by means of a control voltage derived from a weighted filter-cum-detector network. This so-called 'control path' provides summing of the audio input, while the weighted filter prevents high level low frequency signals from activating the detector.

Specifications

Gain	0dB; stereo input (note 1)
Frequency response	10Hz-20kHz; stereo input (note 1)
Crosstalk	−54dB; Vin = 775mV
Maximum input level	3.2V stereo; 2.2V mono @ 1kHz
Signal-to-noise ratio	75dB; stereo, unweighted, ref. 775mV
S/N ratio improvement	18dB maximum (note 2)

Note 1: Due to the effects of the stereo simulator circuitry, it is difficult to specify gain and frequency response figures for mono operation. Mono gain is approximately −6dB.

Note 2: the signal-to-noise ratio improvement is dependent upon noise content and spectral distribution of the source material.

It all adds up to a very effective noise reduction system. For example, when just noise is present at the audio inputs, both filters have a −3dB bandwidth of about 1kHz, reducing the perceived noise by approximately 14dB.

At the other end of the scale, when program material able to mask the noise is present, the filter bandwidths can be increased to as much as 30kHz to maintain audio fidelity.

The circuit

Refer now to the main circuit diagram. This uses not one but two LM1894s in cascade to give an effective 12dB/octave filter slope and up to 18dB noise reduction. This steep rolloff characteristic is better suited to program material that is relatively deficient in high frequency content (eg, video tapes).

Incoming audio signals are initially fed to mono/stereo source selector switch S2, and thence applied to pins 13 and 2 of IC2. The filtered left and right channel outputs from IC2 subsequently appear at pins 11 and 4 respectively and are then fed directly to the inputs of IC3.

Potentiometer VR4 is the Threshold control and sets the overall gain of the control path. The greater the degree of attenuation, the less signal fed to the control amplifier and the narrower the system bandwidth. In practice, the Threshold control is used to set the initial operating conditions, depending upon the level of background noise.

VR4 and its associated RC components on pin 5 of IC2 also form a high-pass filter which rolls off the control path response below 1.6kHz. This is done to avoid control path overload and to prevent high level low frequency signals, such as drum beats, from unnecessarily expanding the system bandwidth.

Note, however, that there is no corresponding control circuit on pins 5 and 6 of IC3. Instead, the detector output at pin 10 is tied back to the detector output of IC2. By this means, VR4 controls the low pass filters in both ICs.

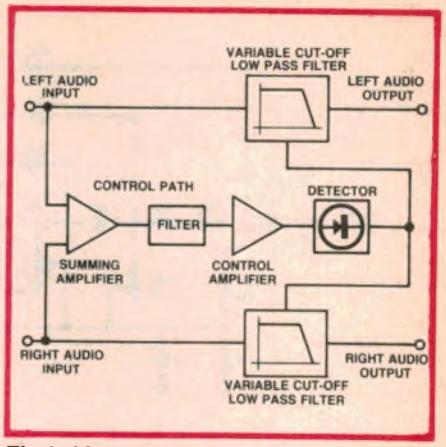


Fig.1: block diagram of the LM1894 stereo DNR chip.

The 1μF capacitor on pin 10 of both ICs filters the detector outputs and sets the attack and release times to 0.5ms and 60ms respectively. These values are within the response time of the human ear which means that attack and release transients are rendered inaudible.

The left and right channel outputs from IC3 appear at pins 11 and 4 respectively and are fed to RCA output sockets via 1μF coupling capacitors. In addition, the two outputs are mixed via 27kΩ resistors and fed to a third RCA socket to provide a mono output.

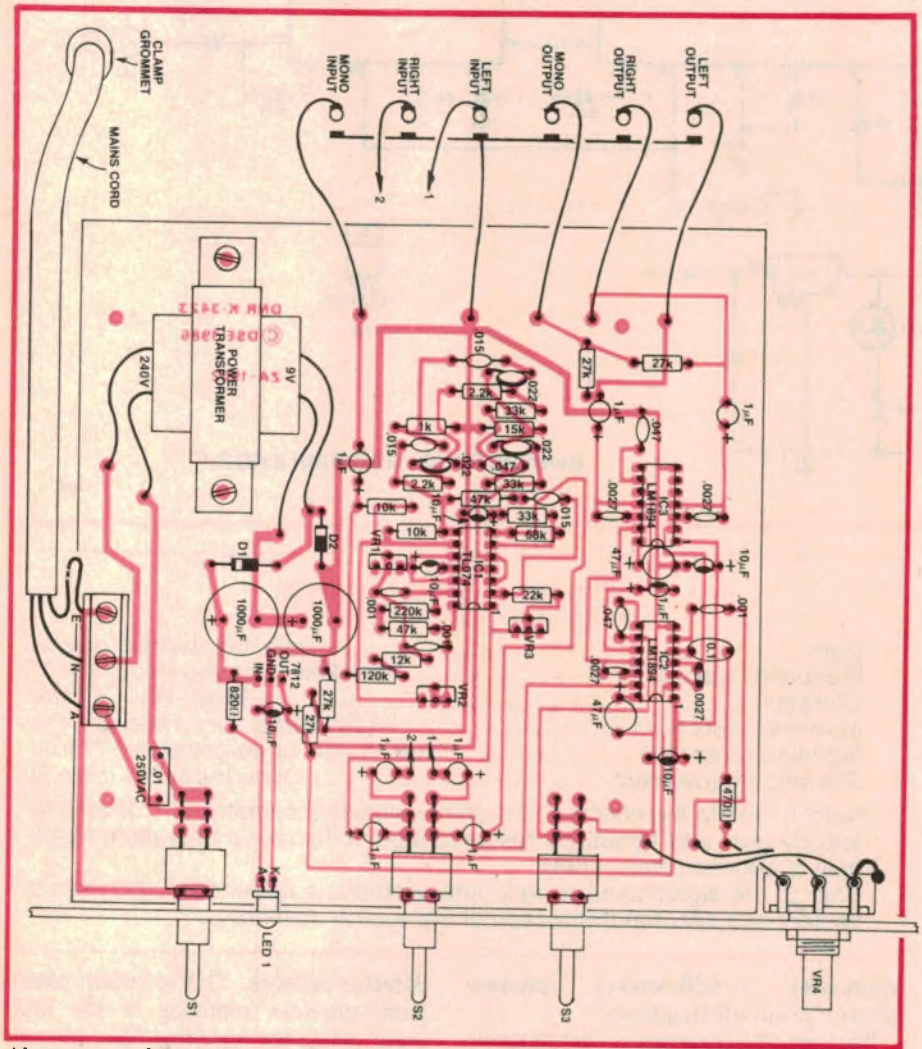
Stereo simulation

So much for the DNR section of the circuit. Let's now backtrack to the mono input and take a look at the notch filter and stereo simulator circuitry. These functions are all performed by IC1 which is a TL074 (LF347) quad op amp.

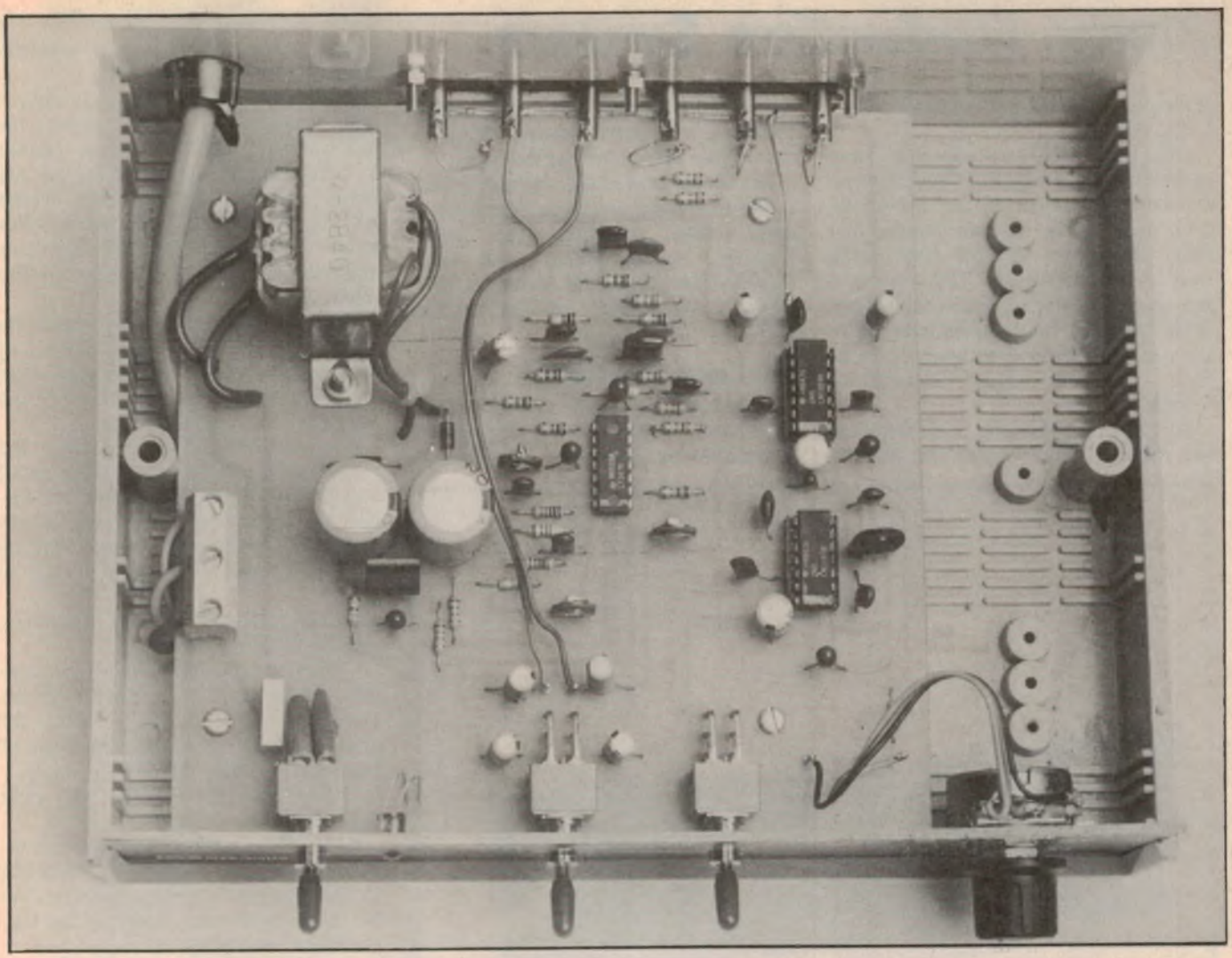
IC1a and IC1b together form the 15.625kHz notch filter circuit. Note that the bias for the non-inverting inputs of the two op amps is derived from a voltage divider consisting of two 27kΩ resistors strung across the supply rail. Trimpot VR1 sets the notch centre frequency while VR2 sets the null.

The notch filter output appears at pin 8 of IC1b and is applied to the stereo simulator circuit. This circuit is based on one that appeared in *Electronics Australia* in April 1983. It consists of op amps IC1c, IC1d and two twin-T filter networks.

Twin-T filters are so named because they consist of two T sections. One section uses an R, 2C network and the other an R/2, C network. When the exact values are chosen, the filter gives a narrow notch with almost total cancel-



Above: parts layout diagram for the Dynamic Noise Reduction System. Note that mains voltages are present on the PCB.



Virtually all the parts are mounted on a single PCB. Take care with mains wiring.

lation at its centre frequency.

In this circuit, however, the components used are deliberately off value and this has resulted in broad notches of about 20dB at 200Hz and 5kHz. These broad notches ensure effective stereo simulation.

The filtered signal from the twin-T networks is applied to the non-inverting inputs of IC1c and IC1d. IC1c applies a gain of about two to this signal, as set by the ratio of the 68kΩ and 33kΩ feedback resistors.

Unlike IC1c, IC1d is wired as a differential amplifier. Note that the output of the twin T filter network is applied to the non-inverting input, while the signal on the inverting input is derived from the output of IC1b via a 0.015μF capacitor and 47kΩ resistor. The output from IC1d represents the difference between these two input signals.

Thus, when the signals on pins 2 and 3 are common (ie, they have the same phase and amplitude), they are cancelled and IC1d has no output. When the signals are no longer common (as at the twin-T notch frequencies), only partial or nil cancellation occurs, depending upon the relative phase and amplitude differences between them.

Trimpot VR3 allows the gain of IC1d to be adjusted so that its output level matches that of IC1c. The outputs of IC1c and IC1d become the left and right channels respectively and are AC-coupled to S2 via 1μF capacitors.

Power for the circuit is derived from a 9V power transformer which drives a voltage doubler circuit consisting of D1 and D2 and the two 1000μF capacitors. The output from the voltage doubler is then applied to a 3-terminal regulator which provides a +12V rail. A red LED wired in series with an 820Ω resistor across the regulator input provides power on/off indication.

Construction

The Dynamic Noise Reduction System is available as a complete kit of parts from Dick Smith Electronics. Construction mainly involves assembly of a single PCB which is coded ZA-1502. This is housed in a plastic instrument case measuring 200 x 160 x 65mm (W x D x H).

No special procedure need be followed when wiring up the PCB although we suggest that the smaller components be installed first. The main thing to watch here is the orientation of polarised components. These include the electrolytic capacitors, the 3-terminal regulator and the ICs.

The three toggle switches are all PC-mounting types and are soldered directly to the PCB. Push them down onto the board as far as they will go before soldering. Note that S1 switches the mains — its terminals should be sleeved with plastic tubing to prevent accidental contact while the unit is being worked on.

PC stakes are used to terminate external connections to VR4 and the RCA sockets. Twelve PC stakes are required in all. The transformer leads should be

Noise Reduction System

trimmed to length and soldered direct to the PCB.

Once the PCB assembly has been completed, the 6-way RCA socket panel can be mounted on the outside of the rear panel using machine screws and nuts. This done, slip the front panel over the switch shafts. The front and rear panels, with the PCB sandwiched between them, can then be installed in the case and the PCB secured to the integral standoffs using self-tapping screws.

All that remains now is to complete the wiring. Take care with the orientation of the LED and note that the metal backshell of potentiometer VR4 is earthed via one of the pot terminals.

The mains cord enters through a hole in the rear panel and is secured using a cord clamp grommet. The active (brown), neutral (blue) and earth (green/yellow) leads are connected to a mains terminal block installed on the PCB.

Test and adjustment

To test the unit, connect it into your hifi system, switch on and check that all controls operate correctly. All you have to do is connect the unit between the output of your VCR and the auxiliary inputs to your stereo amplifier.

Alternatively, if you intend using it with a non-Dolby cassette player, the unit can be installed in the tape monitor loop between the outputs of the cassette player and the amplifier. The system can also be installed in the tape monitor loop if it is to be used with a graphic equaliser, or used with more than one signal source.

Note that the DNR system should be installed in the signal path in front of the graphic equaliser (or any other tone control system), since adjustment of the equaliser alters the noise floor.

Both the 15.625kHz notch filter and the stereo simulator require some initial adjustment. These adjustments are carried out under actual listening conditions and involve tweaking trimpots VR1, VR2 and VR3. Here's what to do:

(1) Set VR1 and VR2 to mid-range, and the DNR switch to out.

(2) Switch on, wind up the treble control of your amplifier, and listen for the 15.625kHz whistle. Adjust VR1 for minimum level, then VR2 (rejection of better than −40dB should be possible).

(3) Adjust VR3 for left and right stereo balance.

Note: VR1 and VR2 in the notch filter can also be adjusted by injecting 15.625kHz from a signal generator into the mono input and observing the output on an oscilloscope.

Using the DNR System

Careful adjustment of the Threshold control is required if you are to get the best possible sound when using DNR. The procedure is really very easy: apply tape noise to the input (ie, no program material) and adjust the Threshold control to a point slightly below where the noise comes up. This will ensure that the filters achieve optimum bandwidth when program material is present.

Note that the Threshold setting will have to be altered for different sources, depending upon the noise level. You can compare the subjective improvement by switching the DNR unit between IN and OUT. The DNR action should be most apparent between tracks and during soft passages, when it should remove nearly all of the hiss.

Finally, do not wind the Threshold control back too far. The high frequency response of program material will be noticeably restricted if you do. With just a little practice, you'll soon learn to accurately set the Threshold control by ear.

The rear panel carries the 6-way RCA socket panel.

Where to buy the kit

This project was developed in the Research and Development Department at Dick Smith Electronics Pty Ltd. It is available as a kit of parts only, and can be purchased by mail order or from your nearest Dick Smith Electronics store.

The kit comes complete and includes a pre-drilled fibreglass PCB, a plastic case, pre-punched panels with screened lettering, and a construction manual. The cost is $99.00 plus postage and packing charges where applicable.

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

Note 1: PCB artwork copyright Dick Smith Electronics Pty Ltd.

Note 2: The word "DNR" and the symbol used on the front panel of this project are registered trade marks of National Semiconductor Corporation, USA. Under the terms of the licencing agreement with National Semiconductor, the LM1894 cannot be purchased separately, either from Dick Smith Electronics or from any other source (except as a replacement item).

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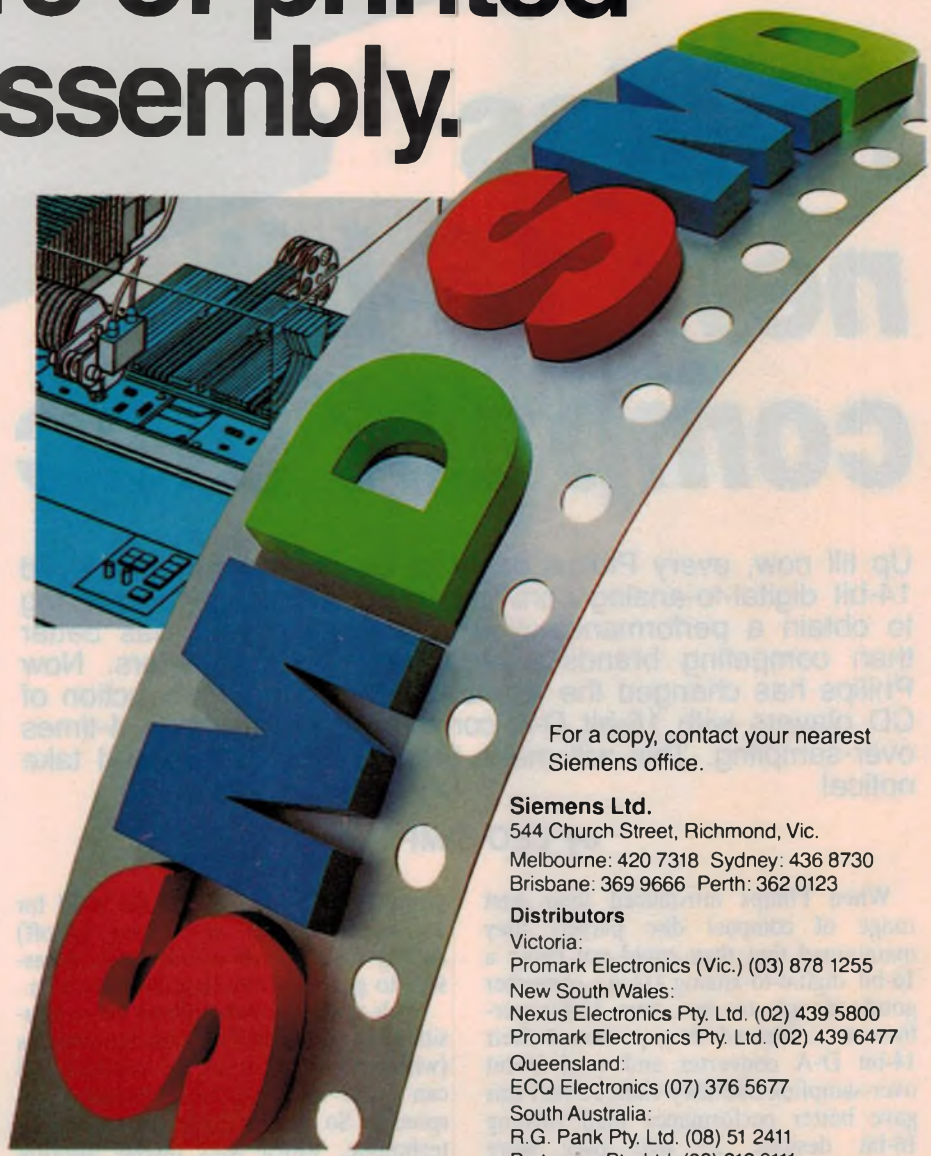

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Philips new 16-bit compact disc player

Up till now, every Philips compact disc player has employed 14-bit digital-to-analog converters and 4-times over-sampling to obtain a performance which, in many cases, was better than competing brands using 16-bit D-A converters. Now Philips has changed the whole game with the introduction of CD players with 16-bit D-A conversion and still with 4-times over-sampling. This will make the Japanese sit up and take notice!

by LEO SIMPSON

When Philips introduced their first range of compact disc players they maintained that they could not make a 16-bit digital-to-analog (D-A) converter good enough to give true 16-bit performance. Instead they produced their 14-bit D-A converter and used 14-bit over-sampling and they claimed that this gave better performance than existing 16-bit designs. In that they were correct.

The 14-bit plus 4-times over-sampling combination certainly gives the same resolution as a true 16-bit converter and also gives the same signal-to-noise ratio. At the same time, the use of the over-sampling technique avoids the need for a "brick-wall" (ie, very steep cut-off) analog filter which is otherwise necessary to get rid of the sampling artefacts.

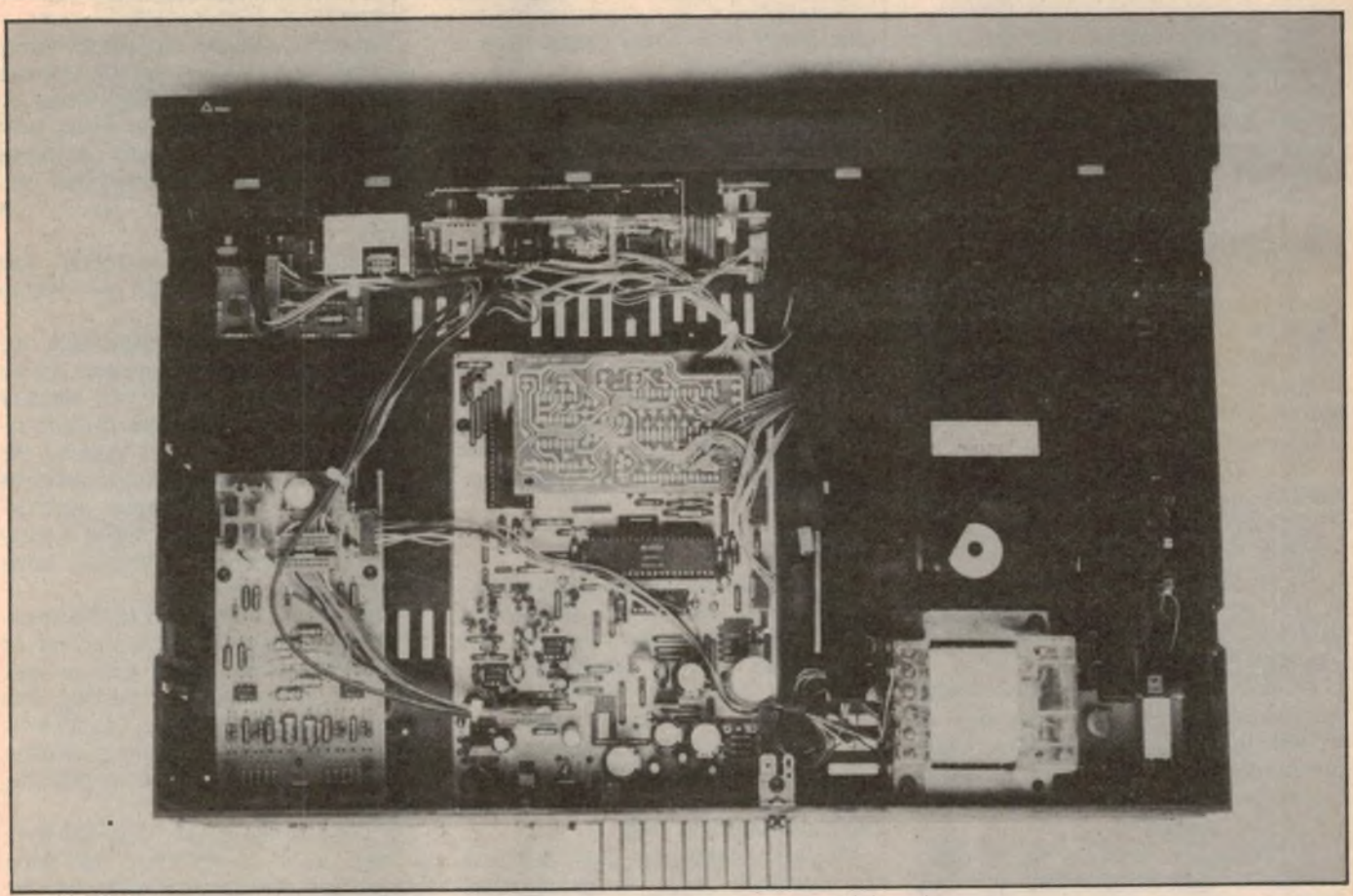
Such complex analog filters cause considerable phase shift at high frequencies (which may or may not be audible) and can cause less than ideal transient response. So the Philips over-sampling technique, which uses digital filtering plus a simple analog filter to remove any residual 176.4kHz signals, gave considerable advantages.

On a number of occasions we have been able to declare that Philips or Philips-derived compact disc players (ie, Meridian, Mission and some Marantz models) have better than average linearity and signal-to-noise ratio, which is a testimony to the efficacy of the 14-bit plus over-sampling method.

Philips has also been one of the few manufacturers to use two D-A converters rather than one. This gives a slight improvement in separation between channels and no delay in one channel due to the switching of the output from one channel to the other from a single D-A converter. Philips was able to do this, of course, because 14-bit converters were cheaper to make than 16-bit models.

Now Philips have changed the game with the release of their CD450 and CD650 models. These employ dual 16-bit D-A converters with four times over-sampling. In theory that means the new machines should be capable of giving 18-bit resolution which means better linearity, better separation and lower noise than existing 16-bit CD players.

If that was the extent of the change in the new models it would be notable enough but they bring with them much



This is the chassis of the new Philips CD650 player. There is a substantial finned heatsink at the rear.

higher performance in error correction and tracking and have some pretty useful user features as well.

Features

We reviewed the more elaborate of the new Philips players, the model CD650. This is a large and imposing machine for a CD player, and is actually larger than some current model VCRs. At first sight it may not look particularly special as far as CD players go but it certainly is quite different in presentation from previous Philips models, such as the most recent CD104, 204 and 304 series machines. In addition, the new Philips CD650 includes features not included in any other player currently on the market.

The CD650 is a front drawer loading machine but the drawer arrangement is more complicated than most. The drawer itself is quite thin and it pushes the compartment door open as it slides out. This means that the disc is very easily lifted off the loading platform and there is no possibility of interference or scratching of the disc by the front portion of the drawer, as is the case with some other machines.

Favourite track selection

Once the disc is withdrawn into the machine all the disc parameters are loaded into the memory. Play can then start or the disc can be programmed. And here is where the first of the CD650's special features become apparent — the favourite track selection.

As anybody who listens to records knows, you always have favourite tracks. Even classical music lovers will tend to have favourite movements in symphonies and concertos and so on. The CD650 lets you program the machine for those preferences, so many tracks or passages in any order, and then store them in the machine so that you can have the same program played back every time you load in that particular disc.

The machine has sufficient non-erasable memory to store 785 track selections. With that capacity, the CD650 could store up to 157 discs with an average of five tracks per disc. The machine identifies the disc as soon as it is loaded in and can play the favourite track selection immediately. Not bad, eh?

You can also do normal programming as on other CD players using either track or index numbers and this can be done via the click-out numerical keyboard. The handset controls most of the deck's features and is a luxury which will appeal to most people. Nice as it is though, we still would like to see it control volume too.

There are four separate play modes selected by a slide switch: Single play, normal play, copy pause and auto pause.

Copy pause automatically inserts four-second pauses between tracks when recording so that automatic cassette decks can find individual selections.

All the play modes are clearly indicated on the large and legible fluorescent display and every time the infrared remote control is operated, a LED flashes on the front panel to let you know the machine has received the message.

Some of the other play functions in-

clude audible music scan for rapid searching of discs and skip up and skip down. You can also have repeat play of single track, whole disc, segment or program repeat. Track access times are very fast, by the way, and average about one second.

Output facilities

The output facilities of this machine set it apart from all others. Naturally there is a standard headphone output with adjacent level control, which also controls the output level from the rear phono sockets. But there are two pairs of phono sockets.

The first pair gives a straight CD quality output with a frequency response flat from 20Hz to 20kHz within ±0.1dB (ie, exceptionally flat even for a CD player), while the second pair gives a tailored frequency response which is still very flat but slightly tapered off at the high frequency end.

In addition, there is a digital output socket for coming applications such as CD graphics, CD-ROM or digital sound processing. And there is a recording synchronisation DIN socket for precise playback comparisons.

Removing the cover of the machine reveals a big change from previous Philips machines, such as the CD304, which had a heavy diecast chassis. This new machine has an all plastic chassis with a steel lid. It is half the weight of the CD304, at only 4kg.

As you might expect with a plastic chassis, the CD650 is truly double-insulated and it uses a removeable two-core power cord. Power consumption is quoted as 30 watts.

Other big changes include a completely new and smaller CDM2 laser scanning assembly which employs a single-spot rather than a three-spot beam with integrated electronics for very precise control of focus and tracking.

And as well as the new dual 16-bit D-A converter IC and associated better filtering circuitry, the CD650 employs vastly better error correction circuitry.

The analog filtered audio output employs a separate printed circuit board accommodating dual low noise op amps to provide high order filtering with minimum phaseshift in the audio passband.

On test

Actually we had problems familiarising ourselves with all the facilities of this machine as it was so new and was not supplied with the normal user's instructions. Even so, with the usual "don't refer to the manual unless as a last resort" approach we were able to use most facilities without any problems. In these basic user tests the machine performs very well.

We were particularly impressed with the machine's ability to ignore shock and vibrations which would cause other machines to severely mistrack. You could rap the lid of the unit quite hard without fazing it at all. Similarly, sideways knocks and bumps to the player seldom caused it to jump a track. Do that to most other machines and the laser is completely thrown out.

Naturally, it played through the entire contents of the Philips No 4A test disc without a hitch (as all Philips decks do anyway) and also turned in a very good performance on our badly scratched horror disc which many machines cannot even load let alone play a few tracks.

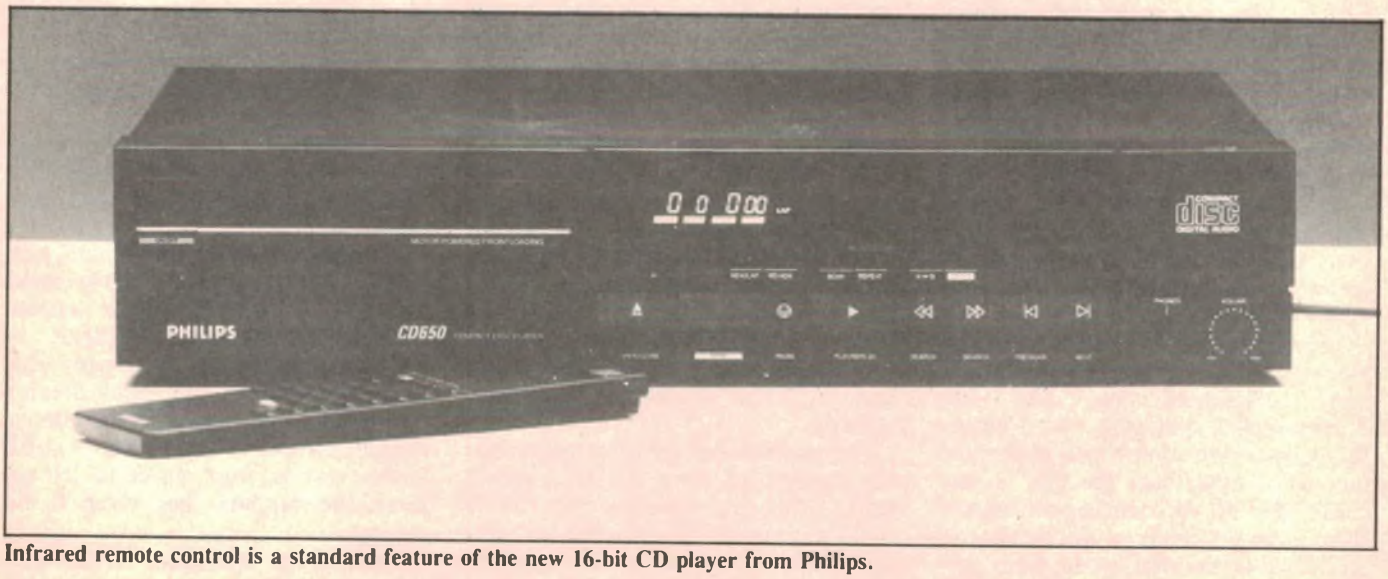
Clearly, the error-correction and tracking capability of this new Philips player is the best yet.

We did find one problem with the CD650's drawer-loading system. As we do with all machines, we test whether they can be jammed or otherwise interfered with by deliberately pushing the open drawer shut. In most households this more or less deliberate mistreatment could easily happen during a party or be perpetrated by a child or uninformed casual user.

Some machines respond to this treatment by pulling the drawer in out of harm's way while others may or may not have high resistance to pushing. The literature supplied with the CD650 indicates that it has anti-jamming protection so we felt doubly justified in pursuing this test.

In the test, the drawer does not have a high level of resistance to being pushed and goes in farily easily but the net result was that some of the transport gears jumped a cog or three and the machine would no longer work. Nor could the disc be extracted from the machine.

Since our review machine was an early production sample, we would hesitate to criticise the design on this result



Infrared remote control is a standard feature of the new 16-bit CD player from Philips.

but we would also recommend that the drawer not be pushed in by hand.

Where the CD650 really shines is in the performance tests. Frequency response from the "digital quality" outputs was as flat as anything we have measured — amplifier, CD player or whatever. We were unable to measure any deviation at all over the range from 20Hz to 20kHz, so it really is within ±0.1dB as claimed. When you think about it, that is dramatic. And the more heavily filtered analog output is still flat by the standards of many CD players, being only 2dB down at 20kHz.

Unweighted signal-to-noise ratio measured a whopping 108db. That is so far ahead of any other CD player that it is virtually academic.

Similarly, separation between channels is much better than other machines: 105dB at 100Hz; −103dB at 1kHz, −95dB at 10kHz and −89dB at 20kHz.

Linearity figures were good but not better than the best Philips player we have measured to date. We measured an error of 1dB at the −80dB level and −4.5dB at 90dB.

Distortion measurements are interesting. Measured via the "digital quality" outputs they are typical of most CD players, being around .002% at low frequencies as claimed but rising with higher frequencies as the sampling artefacts become more significant. Measuring via the filtered "analog" output gives better figures but in both cases distortion products are inaudible, in reality.

Well, how does it sound? In truth, we can't say that it sounds audibly better because we have not had enough time to listen to the machine. The most apparent improvements to the user are the greatly improved tracking and error correction ability plus the fast track-to-track access times.

As far as audio performance is concerned, on paper it is well ahead of previous Philips CD players. So if purists have opted for the Philips players and their derivatives in the past (and they have, overwhelmingly), then this new machine is sure to be the new CD yardstick. We were very impressed with it.

Recommended retail price of the CD650 is $799 while the CD450, which has similar specs including remote control, is $549.00. (L.D.S.)

The Serviceman

A video recorder that didn't need a hand

Most servicemen would agree that customers are funny — in both senses; "funny peculiar" and "funny ha ha". For the most part we tend to treat this situation with good natured tolerance. If nothing else it helps break the monotony and provide the occasional story to share with colleagues. Apart from that nobody takes it very seriously.

Unfortunately, there is also the occasional case of the very objectionable type; the type who believes that all businessmen are crooks and that he is therefore entitled to make himself thoroughly objectionable whenever he has a grievance — real or imaginary. Bluster and bad language are his typical weapons and he imagines he can bully his way through any situation.

Last month I told the story of a foreign object — a 20c piece — in a video recorder, and the havoc it caused. I also promised more of the same for this month, so here is the next story. It differs from last month's in two respects; it wasn't particularly difficult technically and the owner — unlike last month's customer, a lady who could not have been more helpful — was one of the aforementioned nasty types.

He was not one of my customers, although I knew of him by repute. The unit involved was an AWA AV21 video recorder, less than 12 months old and, therefore, well within its warranty period. I imagine this was the main reason he came to me, since I was in a position to offer warranty service on AWA devices.

He contacted me by phone in the first instance, and his manner was aggressive from the start. After identifying himself and describing the recorder he went on to say that it was under warranty and, therefore, ". . . I want you to come out and fix it."

No house calls, mate!

That rubbed me up the wrong way for a start. I told him, politely but firmly, that he would have to bring the machine to my workshop, reminding him that, under the terms of his warranty, it was his responsibility to transport any faulty appliance to the distributor or agent. Or, in simple terms, I didn't get paid to make house calls under warranty.

He was somewhat disgruntled over this and expressed himself in what might best be described as "unparliamentary language". While it wasn't all that bad, I didn't take kindly to being addressed in that manner from a perfect stranger. It was then that I realised that he was fundamentally a bully.

Anyway, the machine was duly delivered and a quick check confirmed that it was completely dead. I had more important jobs to do right then, so it was put aside for a couple of days until I had more time. Since it was completely dead I suspected a blown fuse but, if so, the real question was why.

Lend me a hand

I pulled the main cover off and the answer was staring me in the face. Lying near the recording drum was a plastic hand from a child's doll, about the size of a 50c piece. Closer inspection brought to light two cotton buds and one safety match. And, as I suspected, the real cause of non-operation was a blown fuse, presumably caused by the plastic hand jamming the loading mechanism.

Having removed the rubbish and replaced the fuse, the machine came to life and performed perfectly. I gave it a routine clean-up, then called the owner. I suppose I should have known better, but I couldn't resist the temptation to have a bit of a dig.

"Which would you like first, the good news or the bad news?"

He obviously had no sense of humour; after a few muttered comments he replied, "I suppose I'd better have the good news first."

"Well, the good news is that your video recorder is working."

"And the bad news?"

"There is no way that the fault can be covered by the warranty." I went on to detail what I had found.

I'm afraid this produced more unparliamentary language, involving AWA, the machine, and the warranty set-up. But I wasn't going to be drawn into an argument; I simply told him how much was involved and that he could collect the machine whenever he liked. This he duly did, and he paid the bill with very bad grace. As he walked out the door, I expressed a silent hope that that would be the last I would see of him.

But no such luck. About a month later I received another phone call, this time from his wife. I felt rather sorry for her; she was obviously an unfortunate downtrodden woman who, unlike other people, was in no position to stand up to his abusive manner. While she was on the phone explaining the problem I could hear him in the background shouting instructions as to what she should tell me — or, more correctly, instruct me — to do. And the language had gone past the "unparliamentary" stage, and was now positively obscene.

I realised now how he had become such an accomplished bully; he practised on his wife!

Nevertheless, she finally explained what had happened. Apparently the recorder had been sitting on the floor — don't ask me why — and one of the children tripped over one of the leads coming out of the back of it and broke the fitting. And, of course, it didn't work any more. So I simply advised her to get it up to the shop when it was convenient and I would see what I could do.

When it did arrive it was immediately obvious what had been damaged. The lead involved was the RF lead to the TV set and the damaged fitting was the "RF OUT" socket. But it wasn't as sim-

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ple as that. The socket is an integral part of the modulator and splitter amp assembly and cannot be replaced separately. As far as I could see the whole modulator unit would have to be replaced. In addition there was a blown fuse, but the machine was still dead after I replaced it.

At this point I decided to bow out. For one thing, replacing the complete modulator unit was going to be fairly expensive; much more so than might seem to be justified on the basis of a simple faulty socket. On top of that there was some other fault which might or might not be covered by the warranty. Either way, there was bound to be an argument about the charges, and I simply did not want to become involved.

So having advised him that the machine needed to be returned to AWA for a proper job, and that it probably wouldn't be covered by warranty, I duly despatched it to them. Strangely enough, on this occasion, he was largely non-committal.

Not so when the machine was returned with a bill for around $50 — which I didn't regard as unreasonable in the circumstances. Mr Nasty jumped up and down and made a great song and dance about it. Leaving out the rude words the gist of his diatribe was that he would never buy another AWA recorder as long as he lived. (I doubt whether AWA's board of directors are likely to press the panic button over that.)

Even so, I felt bound to point out that AWA could hardly be held responsible for either fault; both were "self-inflicted" and in no way the fault of the machine. Nor would it have mattered what brand of machine had been involved; no manufacturer would accept responsibility for foreign objects pushed into his machine.

A parting shot

That brought forth his parting shot: "Aw, pushing a few matches or a kid's toy into it shouldn't hurt it."

At that point I gave up in disgust. But I did have the last word. It was to the effect that, if he wanted service in the future, it might be better if he dealt directly with AWA. I felt I could no longer deal with the type of problems he seemed to attract.

And that, I'm happy to say, was the last I've seen of him — and I hope it stays that way. What a galah!

In fairness I must emphasise that types like Mr Nasty are very rare. The vast majority of customers are easy to get on with, understanding, and as helpful as their limited technical appreciation permits. And, on those few occasions when there might be a minor misunderstanding, they are at least polite. As a result, we usually get things straightened out to everyone's satisfaction.

Still on the theme of the things people do to video recorders, I had a National NV300 machine in for service recently, the complaint being that the picture wasn't very good. A quick check confirmed that it was a long way from very good, and I suspected head wear, particularly as it had obviously had a pretty hard life.

Checking the signal on the CRO seemed to confirm this and I then examined the heads through a jeweller's loupe. While it is not always possible to assess head wear in this way, there was no doubt about it in this case; the heads were physically damaged.

I returned it to the distributors for a new head assembly and learned later that their examination indicated quite clearly that someone had tried to clean the heads and damaged them in the process. Unfortunately, we will never know how they attempted to clean them.

Then there was a Sharp 9300 that came in recently. It was completely non-operational and when I opened it I found that something had obviously been spilt on it — almost certainly a glass of beer — and that this had spread over the entire top board. This was as far as I went. Cleaning that board alone would have been a formidable task, with no guarantee that the board would function afterwards anyway.

And even if it did, I hated to think what other damage might have been caused further into the machine, both electrical and mechanical. In fact, the machine could well be a write-off. Naturally, I had no intention of becoming involved. I promptly despatched it to the distributors. Its fate is unknown at the time of writing.

But, come to think of it, it must have been some party!

Marantz turntable

To change the subject, here is a follow-up on the story about the Marantz turntable which I presented in the April issue. Perhaps the term "follow-up" is something of a euphemism because, in more direct terms, the thing bounced. It goes without saying that we don't like things that bounce; we'd like to pretend it doesn't happen. But it does happen, and when it does we have to do our best to put things right and hope that the customer hasn't been too seriously inconvenienced.

As I mentioned in the April notes, the customer had left the machine with me while he was absent for several months, and it was several weeks after I finished the job until he picked it up. That fact, plus the need to accommodate other copy, is the reason I can only now tell the rest of the story.

When the customer collected the turntable I was quite convinced that it was performing perfectly. I had checked it on a number of occasions while waiting for him to collect it, and it had come up spot on the correct speed every time. So it came as something of a shock when, a couple of days after picking it up, the owner rang me to say that it was still not right; it was still running fast.

Anxious to know whether it was the original fault or something new, I quizzed the owner as to how much faster. He assured me that it was nothing like it had been before, but was still not right. As he put it, "Speech sounds kinda like Donald Duck." Well, at least it wasn't the original fault. I told him to bring it round right away and I would look at it immediately. (It might help readers to follow the story if they look out the April notes.)

Immediately it turned up I slipped a strobe card on it and observed the pattern. It was difficult to nominate the speed exactly but, on the 33⅓ position, it was definitely running fast, though obviously less than 45rpm. Similarly, the 45 position seemed to be running fast in about the same proportion.

I advised the owner to leave it with me and promised to contact him immediately it was fixed. Having pulled the covers off it, the first thing I did was to connect the frequency counter to pin 13 of IC3. As readers may remember, the frequency here, derived from the crystal, is supposed to be 44.44Hz, and is the reference against which the turntable speed is compared.

In fact, the counter said 44.43Hz; not a serious error and certainly nothing like the fault I was seeking, but I took the opportunity to tweak the crystal trimmer (VC1) and bring the figure up to 44.44. Next, I stoked up the CRO and checked the waveforms around IC3; pins 13, 8, and 5, as well as the waveform at the test point and at pin 7 of IC1.

In all cases, the amplitude and waveforms were exactly as they should be. That much established, the next step was to compare the 44.44Hz crystal reference frequency with the frequency at the test point, which is derived from, and is an exact indication of, the motor speed. This was done by feeding pin 13 to one trace of the CRO and the test point waveform to the other trace; in effect superimposing one on the other.

Up until now I had done nothing more than go over the ground I had covered the first time round, and had found nothing new. But with the two waveforms superimposed it was immediately evident that the one from the motor was not locked to the reference, but was drifting slowly at a rate which was undoubtedly the difference between the turntable's actual speed, and what it should have been.

At this stage I had no idea what had happened to cause this, but decided, as a first step, to go through the setting-up procedure, as set down in the manual, to bring the two waveforms into lock. If this didn't work it might at least provide a clue as to the fault.

The procedure is simple enough. It involves two variable resistors (VR4 and VR5) — just to the right of IC3 on the circuit — VR4 being adjusted for the 33⅓ condition and VR5 for 45rpm. In fact, that was all that was needed, a small adjustment of each resistor bringing the appropriate waveforms into lock and producing correct turntable speed as indicated by the strobe.

So what had gone wrong? Why had the circuit suddenly misbehaved after all the previous tests had shown it to be functioning correctly? Frankly, I can only guess. And my best guess is that the original adjustment, made in the factory, had been a bit sloppy and was a borderline setting. Subsequently, subtle minor changes caused by temperature, vibration, or even the replacement of the faulty 12V regulator, eventually added up to a situation where the system could no longer lock.

With hindsight, of course, I should have made this routine check the first time around but, quite frankly, I couldn't envisage any need for it at that time. It seemed to me that, once the obviously faulty component had been replaced, the system should revert to the condition it was in when it left the factory.

I'll know better next time.

TV distribution systems

Next, a letter from one of my readers, Mr R.C. of Benalla, Victoria, and which was prompted by the story in the June and July 1985 notes entitled "First aid for a Motel TV System". I have condensed some of his comments, in the interest of space, but without, I hope, detracting from their value. He writes as follows:

Your recent writings about TV distribution systems in small motels and the like stirred me to relate some problems that I often come up against. In the course of my work I act as advisor to many people who have television problems. I would like to itemise those I have seen in the hope that they may be of use to your readers.

(1) A lot of poor quality coax cable is being used. It has very sparse braid, is oval (squashed on the reel?), and the inner conductor is off centre. It has unknown impedance characteristics and high RF leakage. If a high gain amplifier has its input and output close together, due to these cables sharing a common conduit, the amplifier often oscillates.

(2) Indoor baluns, which are neither waterproof or ultra-violet proof, used outside. Similarly for splitters.

(3) Coax cable and 300Ω ribbon laid across iron roofs. With ribbon there can be severe unbalance, ghosting, snowy pictures, etc. Standoff insulators would have solved the problem. Additionally, the ultra-violet rays attack the twin lead of coax and their life in this hot environment is relatively short. It is desirable to strap coax to the southern side of a mast to minimise ultra-violet damage from the sun. Ribbon is often run down wall cavaties up against sisal insulation, creating similar heat problems.

(4) Masthead amplifiers are often incorrectly mounted. Some manufacturers' mounting instructions are in error in that ingress of moisture is inevitable. The moss, dirt, and spider webs found in some is surprising. Where amplifiers are housed in plastic cases they should be mounted out of the capture area of the antenna, otherwise leakage of amplified signal at the output will get back into the input. It is also amazing the number of cases where amplifier input and output cables are run together, particularly involving 300Ω ribbon.

(5) In vertical polarisation areas it is the norm, not the exception, to find that the mast intrudes into the antenna geometry. This can cause detuning, ghosting, susceptibility to interference, lack of gain, and splitting of lobes. The longest commercial offsetting bars are 450mm, barely enough for some antennae, but better than no offsetting. If 300Ω ribbon is used it should come away at right angles for at least the offset distance, a requirement often neglected. Smaller antennae, designed to be supported behind the reflector, do not require offsetting.

(6) Many masthead amplifier systems have built-in problems. Amplifiers with only one stage of amplification are rare. Most have up to three stages and 40dB gain. Usually, all three transistors are identical, which means the third transistor is being hit with 26dB more signal than the first one, and is thus that much closer to overload — which is common.

I have yet to see a domestic installation where more than 15dB is needed to overcome cable losses, to allow splitting two ways, and to make up for losses in the average TV receiver input. Where high gain is needed, a single stage amplifier at the top of the mast plus additional amplifiers in the power pack is a far better approach. Filters, if needed to guard against nearby transmitters, can usually be accommodated in the power pack.

Ideally such a masthead amplifier should have a high-pass filter at its input, low noise, and wide dynamic range. A manufacturer would need to market only one such model, but a variety of distribution amplifiers to suit all needs. A lower gain masthead amplifier would be less critical in regard to location and possible instability problems. (Item 4.)

(7) Some TV sets are likely to need a

masthead amplifier for UHF, due to poor sensitivity. One of my own sets has only one transistor — the oscillator — in the UHF tuner. There is no RF stage and the mixer is a diode.

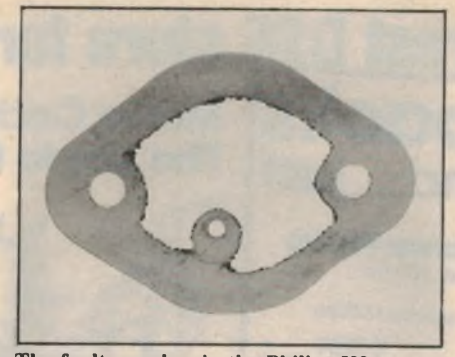
(8) Where 300Ω ribbon is used the slotted variety has the advantage that the insulator insert pimple fits in the slots and holds the cable securely. Avoid mounting insulators upside down so water can collect in them.

(9) Even professional installations sometimes use clear 300Ω ribbon outside. The sun will reduce it to shreds in about 12 months, with severe losses before this.

(10) When mounting an antenna on a chimney, mount it on the side facing the prevailing winter winds. That way smoke from winter fires will be blown away from the antenna and cable, significantly prolonging their life.

These are about all the problems I normally encounter. I trust this will be of some interest to your readers.

Thank you, R.C. I am quite sure that your comments will prove both interesting and useful to all our readers. Unfortunately, they also serve to highlight the sentiments I expressed in the original article; that many professional installations leave much to be desired.



The faulty washer in the Philips K9.

And from another reader, Mr W.N., of Penguin, Tasmania, comes a short but interesting description of a frustrating fault in a TV set. He writes:

For 12 months or more one of my customers complained that his Philips K9A would at odd times hiccup, then run normally for hours. Service calls, months apart, failed to reveal any clue, the set always operating happily when I called.

Recently, while inspecting the set, and about to advise the customer that no fault could be found, I observed a hiccup. At the same time I noticed a spark near the chopper transistor.

At last — a clue! This (see photo) is what I found. You can guess the rest. The set obviously ran OK even though most of the spacer had been burnt away, the gap providing enough insulation (but not very good thermal conduction).

Thank you, W.N., for relating a most valuable experience. Professional servicemen among our readers would be well advised to make a note of the fault in the appropriate manual. EA

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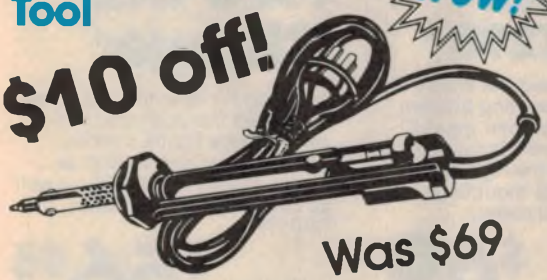

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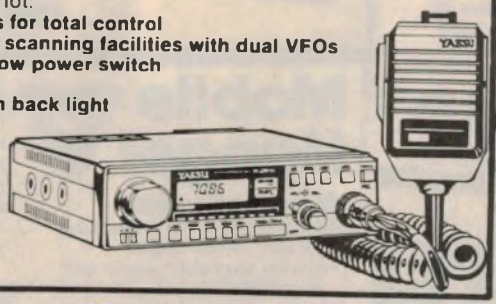

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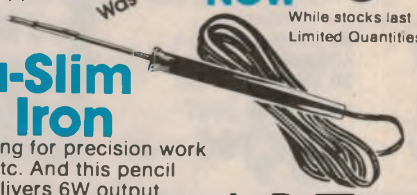


Just the thing for precision work on PCBs, etc. And this pencil like iron delivers 6W output quickly. Optional car cigarette lighter plug available for auto repairs. Cat T-1920

$15.95

Sale from August 1-31 or while stocks last!

Hurry before the Boss returns.

DICK SMITH ELECTRONICS

The Boss is away so we'v

FREE WIA CALLBOOK B-2323 WITH ANY PURCHASE OF AMATEUR RADIO EQUIPMENT (VALUE $8.50)

45 Watt Hi Performance 2mtr Mobile

This feature packed compact is designed with two microprocessors for complete control. 10 memories give you the channels you want at the touch of a button. Advanced search scanning facilities let you tour through the band with ease. And dual VFO's let you handle odd repeater splits.

Features: • LCD display — with backlight • Unique die-cast, duct-low heatsink • Compact — just 140x162x40mm • High/low power output:

Cat D-3516

$659 ~~$859~~

Shinwa Low Pass Filter

Stubborn case of TVI and BCI? Try the 'Big Gun'. Shinwa filter has helped thousands of customers. Handles up to 500 watts. Cut off is around 30MHz, insertion loss is less than 1dB and maximum attenuation is around 50dB! Ideal for amateurs and CB'ers.

Cat D-7080 **$45.50**

Yaesu Scan Mic

Excellent value! And so convenient too. Hand held mic suits all Yaesu transceivers with scanning facilities. Just plug in (standard 8 pin plug) and you're on the way to easy scanning operation. Perfect for mobile use. 500 ohm impedance. Cat C-1116

$51.50

Mobile Bracket for FT290

Yaesu designed the sturdy MB-11 mobile mounting bracket specifically for their great FT-290 transceiver. Great security featre... take the rig with you. Complete with mounting hardware and cables.

Cat D-2911 **$69**

PA-3 Car Charger

Intended for operating 10.8 volt hand-held transceivers from a car cigarette lighter socket. Includes charging as well as power. Suits FNB-3 pack as well as other style transceivers.

Cat D-2899 **$56.95**

Fan Cooled Dummy Load

100W continuous or 500W short term: that's the WELZ CT 530 Dummy Load. DC to 450MHz with SO239 socket termination and fan-forced air cooling. A must for the serious amateur.

Cat D-7020 **$149** WAS $169

GREAT VALUE! Antenna Tuner

Match your transceiver and antenna perfectly! The FC-700 will give you the most from your 'rig'. Antenna matching can be as easy as turning a dial: so you'll have more time for better things. Gives maximum power and performance. Includes large power/SWR meter, built-in dummy load AND covers all WARC HF bands. All this, and there's less than 0.5dB insertion loss. Cat D-2917

ONLY **$335**

Maldol Duplexers

What a bargain! Maldol duplexers add versatility to communications: single transmission lines are so much more convenient!

2-6m, Cat D-3555 **Was $62.95** **$52.95** SAVE $10!

2m - 70cm Cat D-3550 **Was $56.50** **$49.50** SAVE $7!

HF Mobile Antennas

Superb range of loaded whips from Mobile One — the Australian manufacturer that knows what you want! All feature adjustable tuning (no cutting required!) with heavy duty stainless steel stub, mobile mounting base, RG58C/U coax and PL259 connector.

80 Metre. Cat D-4307
40 Metre. Cat D-4308
20 Metre. Cat D-4309

ALL FOR JUST **$59.95** EACH

Mobile Hanger

Mounting Bracket

Mount your FT-757 transceiver securely... three angle positions available; place unit in suspended or slung position. Secure either under dash or on transmission tunnel. Cat D-3501 **$25.95**

PTT Switch

Perfect match for our YH-1 headset (C-4195) for better communication — especially mobile! Two-way switch with locking tx one way, PTT other. With LED indicator, 7 pin mic socket. Cat D-3512

BARGAIN **$45.95**

DICK SMITH ELECTRONICS

PTY LTD

e slashed amateur prices!

Enjoy 2m & 70cm in one Compact Unit

Cat D-3515

- 25W continuous on both bands
- Two 4-bit CPUs for complete control
- Wide angle LCD display
- Scanning mic and mobile mounting bracket

Yaesu FT-2700RH

Amateur value that's hard to beat! Enjoy the best of both worlds (2m and 70cm) without the expense or space problems of two transceivers Yaesu's FT-2700RH combines both bands in one unit with an impressive array of features. There's programmable scanning, 10 channel memory scan and priority too! Dual independent front ends, local synthesizers, full duplex crossbanding and much more!

JUST $1095

NC15 Quick Charger

Cradle-type charger/supply powers up FNB-3 or FNB-4 NiCads in no time: just around 3-4 hours... that's all! Features auto charge sensing. Can double as a handy base supply, too. Cat D-3513 $165

Economy 2m Hand-held

Yaesu's compact and light-weight transceiver for the amateur who doesn't need all the frills: the brilliant new FT-203. Thumbwheel frequency switching makes for quick and easy channel selection — so no memories are required. But the FT-203 still packs a handy 2.5W output: more than enough for average simplex and repeater (inbuilt +/- 600kHz repeater split) usage. And for mobile use the FT-203 has a no-hands VOX system when used with the optional YH-2 headset.

- **450mAh battery included**
- **144-148MHz frequency range**
- **5W input for 2.5W output (F3)**
- **Tiny size — 65 x 34 x 153mm — and only 450g including battery!**
- **Double conversion superhet receiver, 0.25uV (12dB) sensitivity** Cat D-3500

$429

Push Button 70cm FT-709R

Yaesu's FT709R — packs a load of features and performance in a compact, hand-held unit! Full keyboard entry, scanning memories etc, etc.

- **10 Memories • 5 scanning modes: selective, priority, band, skip and busy or clear • Choice of Hi or Lo (optional) battery packs: FNB-3 (10.8V, 425mAh) or FNB-4 (12.5V, 500mAh)batteries.** Cat D-3509

$549

Economy 70cm

Yaesu FT-703R — a superb little transceiver with all the most wanted features — without the expensive frills! Covers 430-440MHz with simple thumbwheel setting. There's squelch and volume controls, repeater offset switch and high/low power control. But if that weren't enough: • **VOX (with optional YH-1 headset) • Wide operating voltages: 5.5 to 13V • 2.5W power output (10.8V FNB-3 battery included).** Cat D-3508

ONLY $489 INC BATTERY

AMATEUR KITS

VHF GaAsFET PREAMPS

Gives 2m VHF receiver/transceivers added performance with >15dB gain and device noise <2dB: covers 144-148MHz. Strip line techniques add real stability. Auto rx/tx switching suits masthead mounting (bracket included). Kit comes with high quality coax relays. Cat K-6311 $129

UHF GaAsFET preamp Cat K-6309 **$129**

Build a UHF Yagi and Save!

What a bargain for the 70cm amateur! Assembling this 13-element antenna yourself saves $$$ and time — all you need is a screw driver. Cat K-6305 $39.95

Ideal for satellite work: stack two units using our phasing harness. Cat K-6299 $9.95

VHF 2m with 10dBd gain!

This affordable 9-element Yagi kit will get your 2m gear working to the full! And there are no tuning hassles; pre-drilled for easy installation Cat K-6297 $89.95

70cm Vertical Base Antenna

Get the most from 70cm action with our latest base station antenna — from RF Aerospace, the leading manufacturers. Boasts impressive 3.2dB gain over 1/4 wave whip. Wide band: 430-440MHz at <1.5:1 SWR. Compact and easy to install, comes with a mounting clamp. Cat D-4704

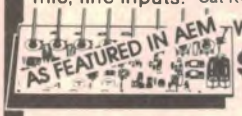
JUST $59.95

Rush in before the boss co

Kit value! Build it & save!

4 Input Mixer Preamp

Money saver for bands! Great capabilities for a $$$ saving kit! Use all 4 inputs to connect guitars or to mix: guitar mic, line inputs. Cat K-3036



WAS $59.95
$55

Ultra Fidelity Preamp

WAS $49.95
$39.95
AS FEATURED IN AEM

Up-graded to a CD player? Impove your amp's performance with this magical kit! Improves dynamic range, noise & freq. response. Cat K-3037

Stereo Simulator

Enjoy sensational stereo-like sound without buying an expensive new video. Quality sound brings movies alive! Build it yourself and save $$$. Cat K-3421

$19.50
WAS $24.50

Infrared Controller

$69.95

Luxury that's practical! Compact controller turns electrical appliances on/off up to 12m away with a matchbox sized transmitter. Ideal for TV, stereo, lights, etc. Very low battery drain. Cat K-3428

Teletext Remote Control

$39.95
WAS $49.95
WOW!
Suits Teletext Kit Cat K-6315

Are you enjoying the free information of Teletext on your TV? Then you'll appreciate the convenience of our remote controller: replaces the old cord controller. Cat K-3425

Go Anywhere Kit Amp

Brilliant battery powered amp for connecting electric guitar or organ for go-anywhere musical action. Features bass/treble/volume controls, high level and low level inputs. Cat K-3447

$79.95
SHORT FORM KIT
CASE & HARDWARE NOT INCLUDED

Plus more sensational kit bargains!!

Transistor assisted ignition. Cat K-3301	$37.50	Negative ion generator. Cat K-3333	$34.50
Fluoro Starter Kit Cat K-3082	$5.50	60W Mosfet amp module Cat K-3441	$79.95
		LCD panel meter. Cat K-3450	$34.95

Build your own HF Transceiver...

Superb money saver with the features and performance of more expensive commerical units. **Features: • CW/LSB/USB modes • covers any single 500KHz band within 2-30MHz • PTT mic.** Cat K-6330

$349
80 meter version supplied

1GHz Frequency Counter

8-Digit counter for lab or hobbyist work bench. 3 Gating times: 0.1, 1 and 10 sec. 3 Freq. ranges: 10MHz 60MHz and 1GHz. Plus many more exciting features. Cat Q-1315

$499 WAS $539

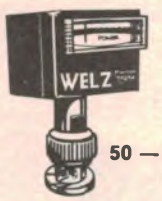
Pocket-sized Meter

Wow! A compact 3.5 digit meter, loaded with features, that's only 10mm thick! There's super fast auto ranging, auto polarity (with minus sign) and audible continuity. Can be used as an AC milli-volt meter (up to 20KHz). Cat Q-1555

$49.95

Welz 5W Power Meter

Beauty! A portable meter that measures the effectiveness of hand-held VHF/UHF transceivers. Complete with dummy load.



Cat Q-1343
$49
WAS $55
50 — 144 — 430MHz

3.5 Digit Meter with memory

Compact, thin meter boasts two selectable current ranges, 20mA or 10A. Plus rotary auto ranging, 10uV, DC resolution, 10uA D current resolution. Cat D-1515

Protective Case Cat Q-1522 $9.95

JUST $89.50

Economy Pocket-size Meter

Ultra compact meter for on-site testing. It's small but packs a load of features: **3.5 digit wide angle LCD • overload protected.**

Cat Q-1520
$59
ONLY

Hang-on... even more savings for hobbyists!

RC Audio oscillator. Cat Q-1220 WAS $99.50	$89.50	Signal injector Q-1276	$12.25
VHF power/SWR meter. Cat Q-1341	$110	LCD 3.5 Digit panel meter. Cat Q-2200	$49.95
3.5 Digit push button Multimeter. Cat Q-1444	$69.50	LCD 4.5 digit panel meter. Cat Q-2202	$99.50

Send YOUR Boss [redacted] off!

During August you could win a trip for two to Fiji for your boss, **PLUS** a trip for two for yourself
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Super value & more to come!

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DICK SMITH ELECTRONICS PTY LTD

mes back... and win a trip!

Tune into antenna savings & accessory bargains!

1. 27MHz Helical
no ground plane required

A whip antenna for glass, wood and cement boats. This helical antenna doesn't need a ground plane. Complete with mounting base cable and simulated ground plane.
Cat D-4070 **$54.50**

2. 27MHz Mini Whip

Another one from Mobile One! Top-loaded helical with fully adjustable tip stud.
Cat D-4420 **$22**

3. Scanner Antenna
Broadband 65-520MHz

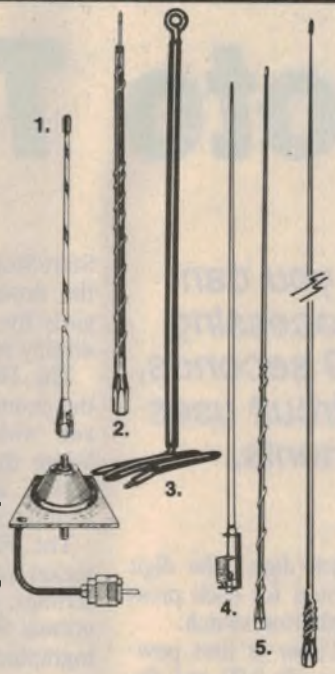
Covers all major scanner bands — 70 to 174 and 400 to 500MHz, with easy mounting via the eye hook. Overall length is 155mm, and fitted with 3.5m cable, terminated in standard car radio type co-ax plug.
Cat D-4432 **$57.50**

4. 27Mhz Base Station
½ wave vertical

Easy to erect and very easy to SWR in. Not just for CB — also ideal for surf clubs, boating clubs, etc. etc.
Cat D-4427 **$79**

5. 27MHz Whip 36"
Adjustable tip

Just 1 metre long — with really great performance. Less wind resistance, less danger of being hit by low flying aircraft.
Cat D-4072 **$17.50**



6. 27MHZ Mobile Whip

Sensational value! 1.52m whip for mobile CB action. Pre-tuned... no cutting or SWR hassles. D-4074 **$19.95**

Mobile Antenna Pack
Ideal for 4-Wheel Drive!

Wow! All you need for immediate set-up: **• 2.5m, ¾ wave 27MHz whip (Yes, it's big!) • sturdy spring assembly mount base • and coax lead with PL259.** Simple assembly requires only 12mm hole (eg. in bullbar).
Cat D-4080 **$99**

Lightweight Spring

Designed to suit standard loaded ¼ wave mobile whips, to give the type of flexibility required in today's low car parks! Cat D-4500

$8.50

Quick Disconnect

Enables you to remove your antenna from its mount with an easy press and twist. Saves your antenna being stolen. Cat D-4501

$11.50

Universal Mirror Mount

Clamps to your roof rack or mirror as a support for standard antennas. It has a 12mm hole for mounting the stud mount, D-4510, less centre plate. Made of plated steel. Cat D-4512

$7.95

Weatherproof Base
for HF/CB/VHF use

Universal base for mobile use. Neoprene and nylon washer ensure weather-proof mount. Requires 14mm hole, has standard 5/16 in 36 tpi stud.
Cat D-4056

$5.50

Swivel Base

CB'ers will love it! Mount base at any convenient angle, then properly position antenna... it's simple and quick. Cat D-4502

$14.95

Scanner Antenna

Enjoy scanning facilities in your car? Then you really appreciate this fantastic mobile whip antenna: specifically designed for scanning within the 70-525MHz range. Cat D-4434
$9.95

How's this for value...

Super heavy-duty CB antenna for years of reliable operation within the 27MHz range. Sturdy design takes a load off your mind! Cat D-4078
$99

ROYEL Soldering Iron Station

Pro quality and performance! With precise variable temperature control for quick, safe soldering of expensive circuits. **Includes: • electro-static shields • voltage switching • auxiliary tip ground connectors in power supply.**
Cat T-2050

$169

Accessory Tips

Fine Cat T-2051
Medium Cat T-2053
Large Bevel Cat T-2054
$5.95 each

MORE BOOKS IN STORE FOR YOU!

Digital ICs & LEDs WAS $26.50	Cat B-1785	$22.50
World Radio TV Handbook '85	Cat B-2085	$12.50 WAS $32.50
ARRL Antenna Handbook	Cat B-2207	$19.95 WAS $29.95
Understanding Amateur Radio	Cat B-2232	$11.95 WAS $14.95
ARRL Satellite Experimenters Handbook	Cat B-2235	$26.50
Amateur Radio & Electronics Study	Cat B-2319	$9.95 WAS $14.95
Transistor Specification Manual	Cat B-4508	$9.50 WAS $14.50
WIA Radio Amateur Callbook	Cat B-2323	NOW ONLY $4.25 WAS $8.50
CB PLL Data Book International	Cat B-2326	$16.95
Phillips General Catalogue	Cat B-4010	$9.50 WAS $12.50
National Linear Data Book	Cat B-4017	$19.50 WAS $21.50
Small Signal Trans. Data Book	Cat B-4035	$14.50 WAS $22.50
DSE Semiconductor Hand Book	Cat B-4200	$4.75 WAS $9.50

For darkroom exposures up to 9 minutes 59 seconds

Build this classy Digital Photo Timer

With this classy Digital Photo Timer you can precisely time your photographic processing from one second up to 9 minutes 59 seconds, in increments of one second. The circuit uses cheap and readily available components.

by JOHN CLARKE

Although photographic timers can be very simple with just a rotary knob used to preset time settings, the most versatile types include an LED readout. They have the advantage of a visible and "safe" display in the darkroom environment plus a vast selection of time settings.

Our latest Digital Photo Timer includes an LED readout plus several refinements. It has three digits with individual setting pushbuttons for each digit. A Start/Stop pushbutton and Hold and Focus toggle switches control the timer operation. Times from one second up to 9 minutes 59 seconds can be set which is more than adequate for photographic usage. It also displays the time remaining before the end of the timing period.

The timer is housed in a compact plastic instrument case with an attractive front panel artwork to label the function of the switch controls. At the rear of the case is the mains cord entry and a switched mains panel socket for the photographic exposure lamp.

On the 3-digit readout, the lefthand digit shows minutes, while the middle and righthand digits show tens of seconds and seconds respectively. Each digit can be separately set by using the pushbutton switches directly below each digit.

Any number from 0 to 9 can be set on the seconds and minutes digits, while any number between 0 and 5 can be set on the tens of seconds digit. The digit increments by one count for each press of the respective pushbutton switch.

When the Photo Timer is first powered up, the display reads 0.00 and the exposure time needs to be set before the Start/Stop pushbutton switch will operate. When the Start pushbutton is pressed, the Photo Timer begins counting down from the preset time and the rear-mounted mains socket is switched on to activate the lamp of the photographic enlarger.

The timer can be reset at any time during this count period by pressing the Start/Stop pushbutton again. This stops the down counting sequence, de-energises the mains socket and returns the display to the preset time.

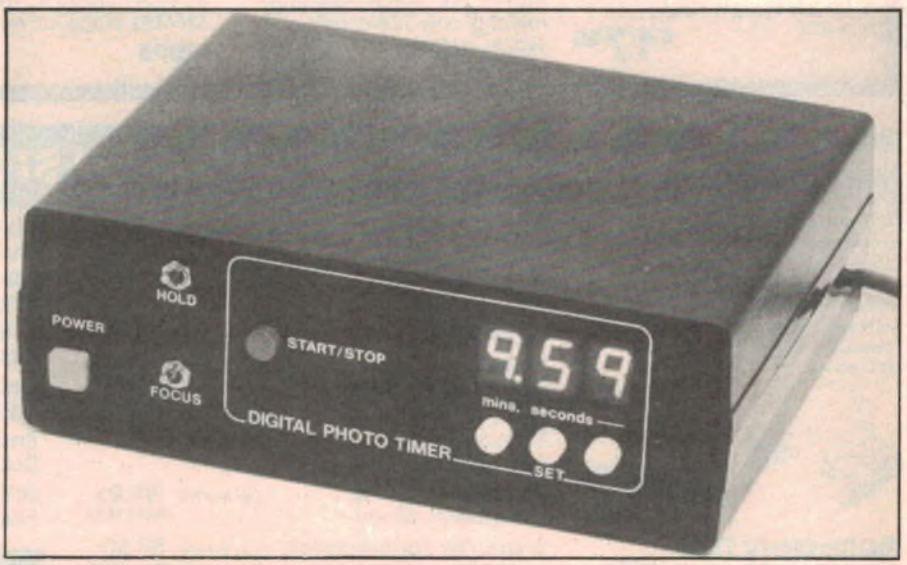
The Hold switch is used to interrupt the countdown during the timing period and switches off the mains socket. When the Hold switch is released, the socket is powered again and timing recommences.

The Focus switch powers the mains socket regardless of the timer or Hold settings. This effectively bypasses the normal timer operation so that the photographic enlarger can be focussed.

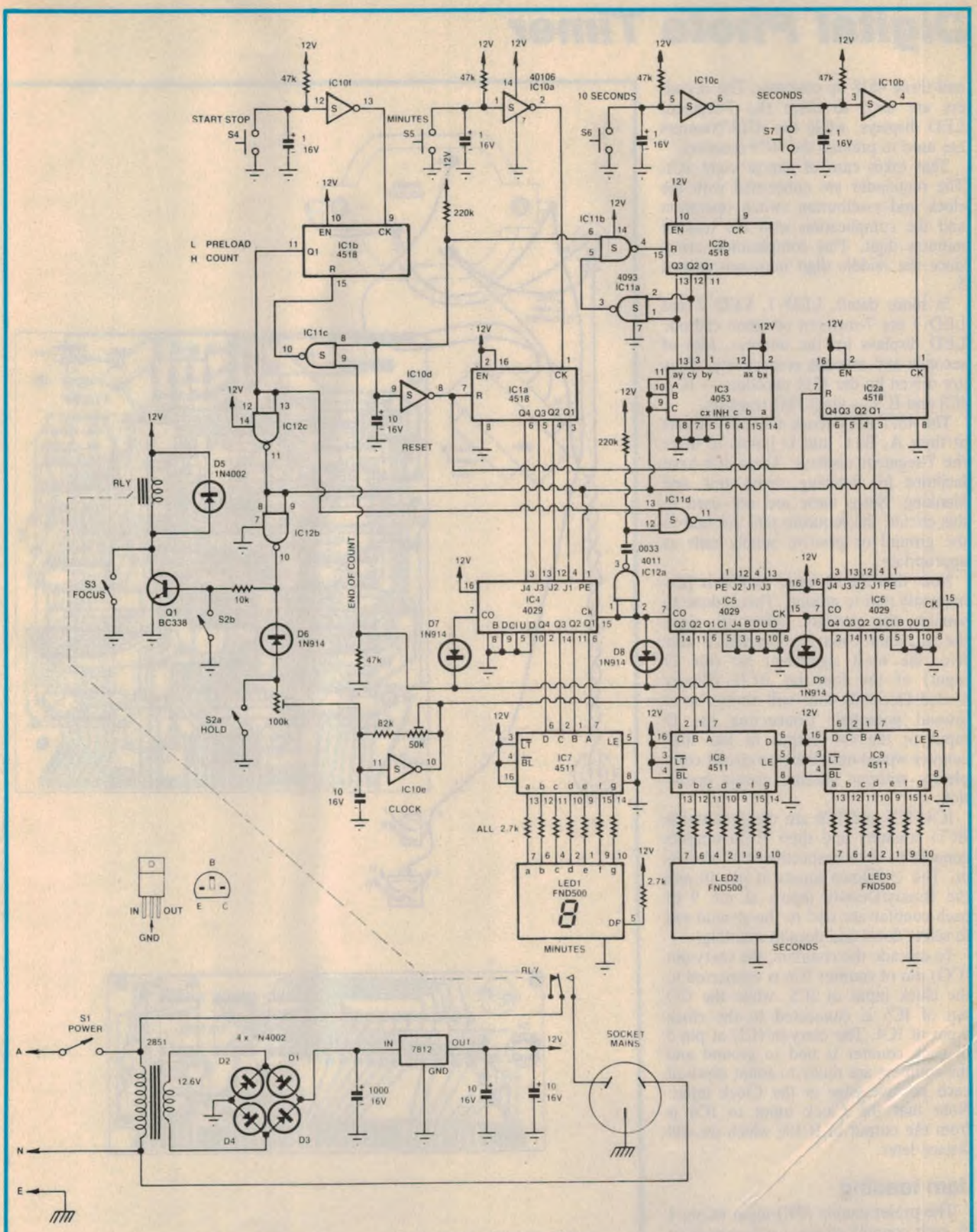
How it works

Although there are twelve CMOS ICs used in the circuit of the Digital Photo Timer, they are all cheap and readily available devices. Basically, the circuit is based around three 4029 presettable binary/decade up/down counters — one for each digit.

Supporting these counters are three 4511 BCD to 7-segment decoder ICs



The new Digital Photo Timer is housed in a standard plastic instrument case.



DIGITAL PHOTO TIMER 2 PT-

Digital Photo Timer

and three 4518 up counters. The decoders are used to drive the 7-segment LED displays, while the 4518 counters are used to preload the 4029 counters.

That takes care of almost eight ICs. The remainder are concerned with the clock and pushbutton switch operation and the complication with the tens of minutes digit. This complication arises since the middle digit must not exceed 5.

In more detail, LED 1, LED 2 and LED 3 are 7-segment common cathode LED displays for the minutes, tens of seconds and seconds respectively. They are driven by the 4511 decoders — IC7, IC8 and IC9 — via 2.7kΩ resistors.

The 4511 ICs decode the BCD inputs at their A, B, C and D inputs to drive the 7-segment displays. These ICs have facilities for latching, lamp test and blanking. Since these are not used in this circuit, the requisite pins are tied to the ground or positive supply rails as appropriate.

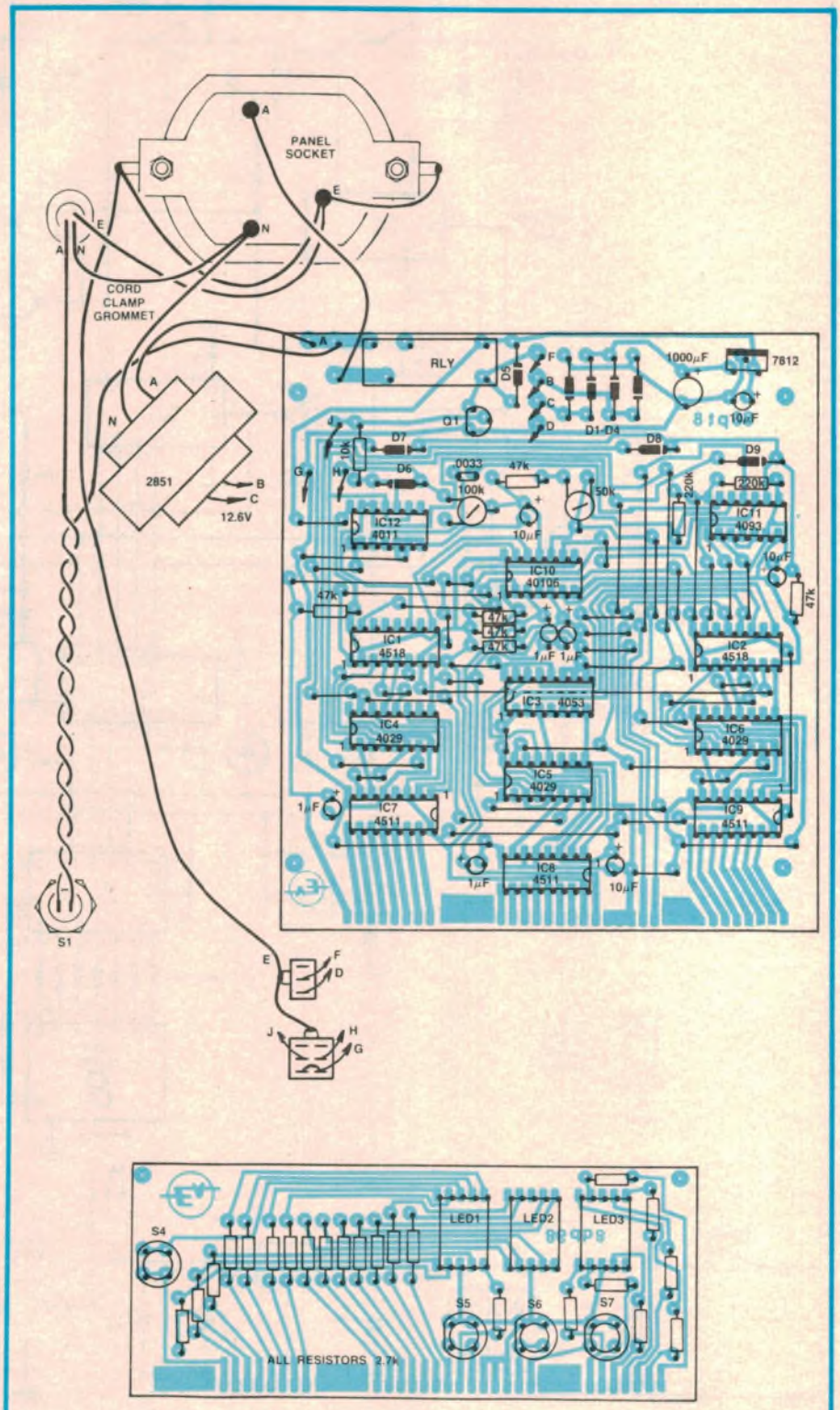
Note that the D input to IC8 is permanently tied to ground. This is done to simplify the circuitry. After all, since the maximum count for this digit is only five, the most significant bit (the D input) of the four bit BCD (Binary Coded Decimal) code will always be at ground potential. Connecting the D input to the Q4 output of the 4029 counter would only increase circuit complexity without altering circuit operation.

IC4, IC5 and IC6 are the presettable BCD counters and their BCD outputs connect to their respective 4511 decoder. The Up/Down inputs at pin 10 and the Binary/Decade inputs at pin 9 of each counter are tied to the ground rail to select down and decade counting.

To cascade the counters, the carry-out (CO) pin of counter IC6 is connected to the clock input of IC5, while the CO pin of IC5 is connected to the clock input of IC4. The carry-in (CI) at pin 5 of each counter is tied to ground and the counters are ready to count down at each positive edge at the Clock input. Note that the Clock input to IC6 is from the output of IC10e which we will discuss later.

Jam loading

The preset enable (PE) input at pin 1 of each counter allows a preset code at the jam-load inputs J4, J3, J2 and J1 to be loaded into the counter when pin 1 is high.



Above: parts layout for the display and main PCBs. The two boards are soldered together at right angles.

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	10-99	100+	1000+	10K+
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41256	$ 5.00	$ 4.50	$ 4.00	$ 3.40
6116P-3	$ 3.00	$ 2.90	$ 2.20	$ 2.00
2716	$ 6.50	$ 6.00	$ 5.50	$ 5.00
27128	$ 5.00	$ 4.50	$ 4.00	$ 3.50
2532	$ 7.50	$ 6.50	$ 6.40	$ 6.30
2732	$ 6.50	$ 6.10	$ 5.90	$ 5.50
27256	$11.00	$10.00	$ 9.00	8.00
6264	$ 5.50	$ 5.00	$ 4.50	$ 4.00
2764	$ 6.00	$ 5.00	$ 4.50	$ 4.00

Plus 20% tax where applicable

HOOK UP WIRE

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

PRICES PER 100 METRE ROLL

1-9	10+
$3.50	$3.00

Plus 20% tax where applicable

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

PRICES PER 100 METRE ROLL

1-9	10+
$9.00	$7.00

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

PRICES PER 100 METRE ROLL

1-9	10+
$11.00	$10.00

Plus 20% tax where applicable

W11280	32/.2 BROWN
W11282	32/.2 BLUE

PRICES PER 100 METRE ROLL

1-9	10+
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ADD ON DISK DRIVE FOR 6502 SYSTEM (APPLE* COMPATIBLE)

1-9	10-24	25+
$160	$150	$140

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(*Apple is a registered trademark)

MITSUBISHI DISK DRIVES

		1-9	10+	25+
4851	5¼" 500K	$195	$185	$175
4853	5¼" 1M	$265	$245	$215
4854	5¼" 1.6M	$295	$260	$235
2896	8" 1.6M	$650	$625	$600

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RITRON II

Swivel base monitor in stylish case

	1-9	10+	50+
Green Cat. X14506	$145	$135	$115
Amber Cat. X14508	$150	$140	$120

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TRANSFORMERS

Cat No.		1-99	100+	1000+
M12851	2851	2.50	2.25	1.90

240V 12-6V CT 150mA

M12155	2155	4.80	4.10	3.70

240V 6-15V 1A tapped

M12156	2156	6.35	6.15	5.95

240V 6-15V 2A tapped

M16672	6672	6.35	6.15	5.95

240V 15-30V 1A tapped

M12860	2860	3.00	2.50	2.30

240V to 15V C.T. at 250mA

Plus 20% tax where applicable

NEW TRANSFORMER!

M12840	2840	3.00	2.50	2.30

240V to 9V C.T. at 150mA

Plus 20% tax where applicable

TELEPHONE CABLE (200 METRE ROLLS)

		1-9	10+
W11302	2 Pair	24.00	23.00
W11303	3 Pair	36.00	34.00
W11310	10 Pair	120.00	115.00

Per 200m Roll

20% Sales tax where applicable

75 OHM COAX CABLE IN 100M ROLLS

Cat No.	1-4 rolls	5+ rolls	10+ rolls
W11222 3C2V	18.00	17.00	16.00
W11224 5C2V	27.00	25.00	24.00

(5C2V WHITE OR BLACK)

LINE LOSS PER 100 FEET (33M 200MHz)

W11222 3C2V 6.2dB (Approx.)

W11224 5C2V 3.9dB (Approx.)

Plus 20% tax where applicable

FREE
50 PAGE WHOLESALE PRICE LIST!
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PANEL METERS

		1-9	10+	100+
Q10500	MU45 0-1mA	6.95	6.75	6.50
Q10502	MU45 50-0-50uA	6.95	6.75	6.50
Q10504	MU45 0-100uA	6.95	6.75	6.50
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Q10530	MU52E 0-1mA	9.95	8.35	
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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
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7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75
78H12	7.00	6.00	5.90
78HGKC	7.50	6.50	6.00
79HGKC	16.50	16.00	14.00
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W12626	26 Way	2.60	34.00	32.00	29.00	26.00
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Digital Photo Timer

The jam-load inputs to counters IC4 and IC6 are connected to the Q4, Q3, Q2 and Q1 outputs of IC1a and IC2a respectively. This allows the BCD code from the 4518 counters to be directly preloaded into the 4029 counters.

As for the IC5 counter, the three jam inputs (remember the most significant bit is not necessary since we can only count to 5) are connected to IC3. This is a triple 2-channel analog multiplexer.

In operation, IC3 can be considered as a three-pole two-way switch. When we want to preload IC5, the jam inputs connect to the Q3, Q2 and Q1 outputs of the 4518 counter, IC2b. In other words the Q3, Q2 and Q1 outputs of IC2b pass via the ay, cy and by terminals to the a, c and b terminals of IC3 and thence to the jam inputs of IC5.

IC3 can also switch the jam inputs of IC5 to terminals ax, cx and bx of IC3. These connect respectively to the positive supply rail, ground and the positive supply rail, to provide a "5" in binary.

Why this switch-over is necessary becomes clear when we consider what actually happens when IC5 counts down from a preloaded number, say 4. When IC5 begins to count down, it goes to 3, 2, 1, 0 and, for the next number, IC5 must be preloaded with a 5 (remember, IC5 is the tens of seconds counter).

So, whenever, IC5 is counting down, IC3 connects the jam inputs of IC5 to a 5, and when IC5 is being loaded with the preset time, IC3 connects the jam load inputs of IC5 to IC2b.

Let us take each of these two loading sequences in turn.

To determine switching of IC3, the A, B and C inputs at pins 11, 10 and 9 of IC3 are taken either high or low. When low, the jam inputs to IC5 are connected to the "5". When high, the jam inputs are connected to the outputs from counter IC2b.

Initially, assume that the IC5 counter is counting down from a preset number. When the counter reaches zero, on the next clock pulse, the CO goes high and this is inverted by IC12a. The subsequent low is applied to the pin 12 input of Schmitt NAND gate IC11d via a .0033μF capacitor. Since pin 13 of IC11d is high during this sequence, IC11d inverts the CO signal again and a positive signal is applied to the preset enable (PE) input of IC5.

Thus, IC5 is preloaded with a 5 on the next clock pulse after a 0. The PE signal to IC5 is quite short since the .0033μF capacitor charges up to the positive supply via the 220kΩ resistor. IC5 is therefore ready to continue counting down on the next clock pulse.

Preloading a particular number from the 4518 counter IC2b is done with the A, B and C control inputs of IC3 high. Note that this also connects to the PE pins of both IC4 and IC6 which are preloaded from IC1a and IC2a. Also the output of IC11d (and consequently the PE of IC5) is high due to the low now at its pin 13 input.

Loading the jam loaders

IC10a, IC10c and IC10b are Schmitt triggers used to apply clock pulses to the IC1a, IC2b and IC2a counters. Initially, the inputs are held high with the 47kΩ resistors at the inputs. When one of the S5-S7 switches is pressed, the corresponding Schmitt trigger input goes low and its output goes high, clocking the counter.

The 1μF capacitor at each input is used to debounce the switch contacts.

Both the IC1a and IC2a 4518 counters will count from 0 to 9 and the BCD code is directly loaded into the IC4 and IC6 presettable counters.

For the IC2b counter, the Q3 and Q2 outputs are monitored with NAND gate IC11a. When the counter reaches the count of 6, both of these Q outputs go high and the output of IC11a goes low to reset the counter to zero via IC11b. Consequently, IC2b will count up from 0 to 5. When 6 is reached, the counter is immediately reset to zero.

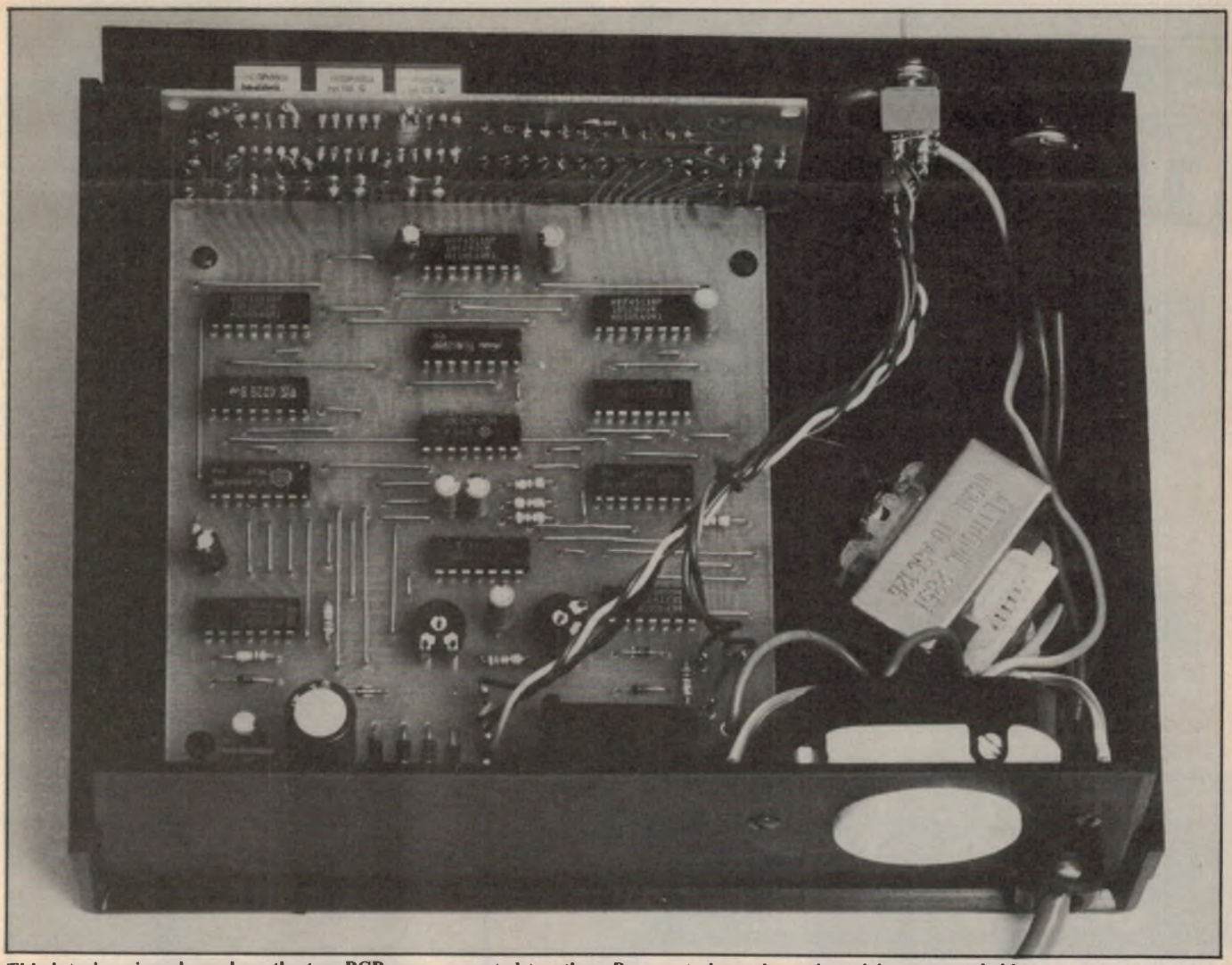
Start/Stop

IC1b determines the Start and Stop sequence of the timer circuit. It is clocked with Schmitt trigger IC10f. At each clock pulse from IC10f, the Q1 output changes state. When Q1 is low, the PE inputs to the IC4 and IC6 4029 presettable counters are held high via inverter IC12c. IC11d inverts for the IC5 PE input.

Inverter IC12b is used to stop the clock signal from IC10e so that it is poised ready to start timing.

Clock

Clock IC10e is a Schmitt trigger oscillator, set to oscillate at 1Hz. Initially, the 10μF capacitor at its input is discharged and the output is high. The capacitor charges up via the 82kΩ resistor and VR1. When the input voltage reaches the upper threshold voltage of the Schmitt, the output goes low. The



This interior view shows how the two PCBs are connected together. Be sure to keep the mains wiring neat and tidy.

capacitor now begins to discharge via these resistors and when the capacitor voltage reaches the lower threshold of the Schmitt, the output again swings high.

When IC12b's output is low, the output of IC10e is forced high and D6 and VR2 set the input to a point just below the lower threshold of the Schmitt. This ensures that the first period from IC10e will be only slightly longer than subsequent periods.

When Q1 from IC1b is high, pin 10 of IC12b is high and D6 is reverse biased. Clock IC10e is free to oscillate and counting at the clock input of IC6 begins. In addition, transistor Q1 is switched on due to the base current through the 10kΩ resistor. This switches on the relay to connect the 240V active to the mains socket.

The Hold switch (S2a) brings the input of IC10e below the lower threshold of the Schmitt, thus stopping the clock. The S2b pole of the switch also disables Q1 by shorting its base current (supplied via the 10kΩ resistor) to ground.

The Focus switch bypasses Q1 to energise the relay.

Timing period ends

The end of the timing period occurs when all the counters reach zero. At this point all the CO outputs are low and pin 9 of IC11c is pulled low by diodes D7, D8 and D9 which form an OR gate. This switches pin 10 of IC11c high which resets IC1b so that its Q1 output (pin 11) goes low.

When this happens, the output of IC12b also goes low and turns off Q1 and the relay. Diode D5 is used to quench the back-EMF from the relay when it is switched off.

Finally, the 4029 counters are loaded with the initial timing period and the clock is stopped.

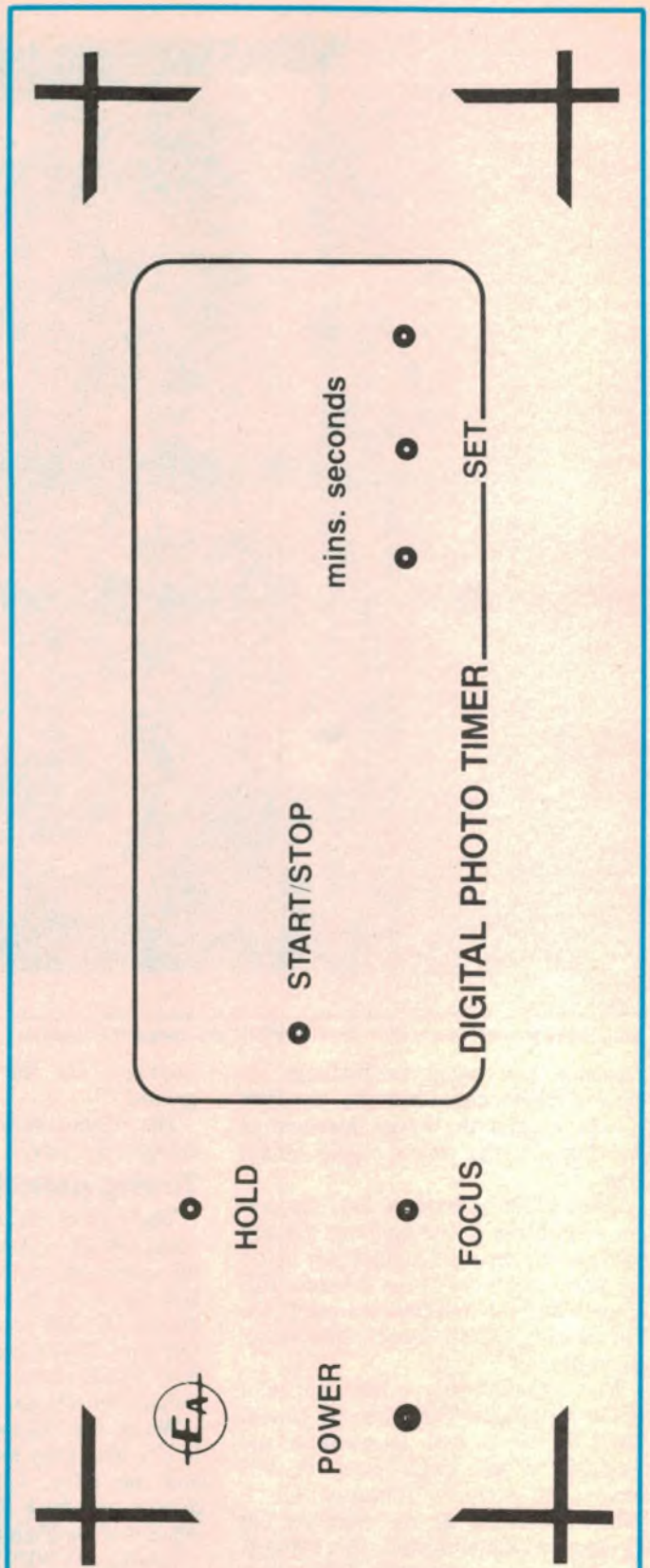
Power-on reset

The circuit includes a power-on reset to ensure that all the counters are set to zero and that the Q1 output of IC1b is low when power is first applied. This is done using Schmitt triggers IC11c, IC11b and IC10d which apply a reset signal to IC1b, IC2b and both IC1a and IC2a respectively. They each have inputs connected to an RC time delay formed by a 10μF capacitor and 220kΩ resistor.

Initially, when power is first applied, the 10μF capacitor is discharged and the outputs of IC11c, IC11b and IC10d are high. When the capacitor charges up to the positive thresholds of the Schmitts, the outputs go low and release the reset.

Power supply

Power for the Digital Photo Timer is provided from a mains transformer with 12.6V secondary winding. This is rectified with diodes D1 to D4 and filtered with a 1000μF capacitor. A 7812 3-terminal regulator then provides a 12V supply for the circuits. The two 10μF capacitors at the output of the regulator provide supply decoupling.



Shown above is an actual size reproduction of the front panel artwork.

Digital Photo Timer

Construction

Construction of the Photo Timer is relatively easy. Most of the components are mounted on one of two printed circuit boards (PCBs). The main PCB is coded 86pt8 and measures 115 x 126mm while the display PCB is coded 86db8 and measures 123 x 50mm.

The display PCB is soldered at right angles to the main PCB so that internal wiring is kept to a minimum.

Start construction by checking the PCBs for broken or shorted tracks. Note that the front of the main PCB must be trimmed so that the bus connector tracks run right to the edge. Ensure that these tracks on both PCBs are not shorted by a thin strip of copper along the front edge.

Begin work with the main PCB. Install all the wire links first, followed by the low profile components such as the diodes and resistors. Make sure that all semiconductors and electrolytic capacitors are correctly oriented.

In particular, note than IC7, IC8 and IC9 are oriented differently to the remainder of the ICs.

We used PC stakes to terminate the external wiring connections from the front-panel toggle switches. You will require seven PC stakes in all.

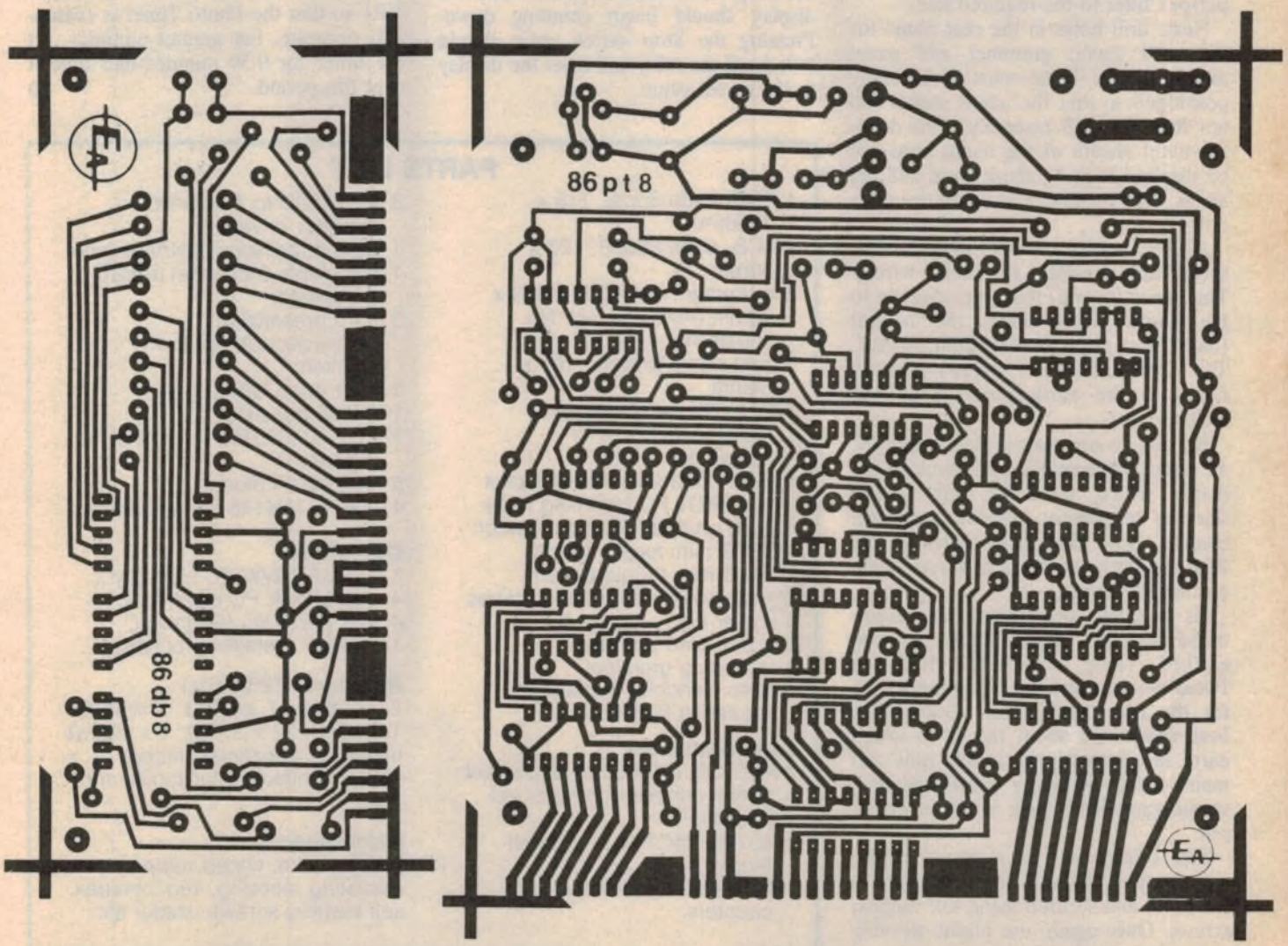
The display PCB can be assembled next. Install the resistors first and make sure that the flat side on each switch faces towards the left hand side of the PCB. We used a green switch for the Stop/Start switch and white for the three Set switches.

The exact method of mounting the displays depends upon the type used. If they have an integral red filter, they must be mounted proud of the PCB so that, when the assembly is installed in the case, they end up flush with the front panel. In this case, install the displays so that there is just sufficient pin length at the rear of the PCB for soldering.

If, as is more likely, the displays do not come with integral filters, mount them hard against the PCB surface.

The two PCBs are soldered together so that the bottom edge of the display PCB overlaps the bottom of the main PCB by about 1mm. Line up the tracks on each PCB and lightly solder tack them together at a couple of convenient points. Make any necessary adjustments so that the two boards are at right angles, then solder the remaining tracks.

The completed PCB assembly is mounted on the integral standoffs within the plastic case, but using additional 4mm standoffs. Transistor mounting bushes were used for these. This allows the PCB to sit level without the



Here are actual size artworks for the two printed circuit boards.

Digital Photo Timer

solder connections fouling the numerous other standoffs on the plastic case. Use self-tapping screws to secure the PCB in place.

The Scotchcal artwork can now be attached to the front panel and the holes drilled using the artwork as a template. Drill holes for all the switches and drill small holes around the border required for the displays. If displays with integral filters are used, then the eventual cutout should be such that the displays are a tight fit into the front panel. For displays without a filter, the border can be larger than the display area, so that a red perspex filter can be inserted in the cutout.

After drilling, break out the cutout and file the hole to the requisite shape until either the displays or the perspex filter are a close fit in the front panel. In the latter case, you will need to cut a perspex filter to the required size.

Next, drill holes in the rear panel for the cord clamp grommet and panel mount socket. These must be carefully positioned so that the mains socket will not foul the PCB assembly. This done, the outer sheath of the mains cord can be stripped back by about 16cm and the mains cord clamped securely in position.

All that remains now is to install the socket and complete the mains wiring. The active (brown) lead goes directly to the mains switch while the neutral (blue) lead goes to the output socket. The earth lead (green/yellow) goes directly to the earth terminal on the mains socket.

Be sure to use mains-rated wiring for all mains connections and insulate the mains switch terminals with plastic sleeving to prevent possible accidental contact. Note that mains wires to the PCB should be soldered in direct — do not use PC stakes.

As a safety precaution, we recommend that all exposed metal parts be earthed. These include the Hold and Focus switches and the mounting screws for the rear panel mains socket. The best way to go about this is to install earth lugs beneath the switch nuts and mains socket mounting screws and then to run earth leads back to the socket itself.

The transformer is mounted diagonally on two of the integral standoffs in the case, and secured using self tapping screws. Once again, use plastic sleeving to insulate the transformer terminals.

Testing

When the unit is complete, check your work carefully to ensure that the mains wiring is correct and safe. Also, go over the PCB components and check that they are both oriented and located correctly.

Switch on the unit and check that the output from the regulator is at 12V. All the supply pin voltages on the ICs should also be correct (ie, 12V). At this stage, the display should be lit and reading 0.00. Any unlit segments will be due to lack of continuity between the segment pin and the associated pin on one of the 4511s.

Press the set switches and check that the outside digits can be preset from 0 to 9 and that the centre digit can be set from 0 to 5.

The relay should be activated when the Stop/Start switch is pressed and the display should begin counting down. Pressing the Stop switch again should switch off the relay and reset the display to the preset value.

Check that the Focus switch operates the relay and that the Hold switch stops counting and deactivates the relay when the timer is counting.

Calibration

To set VR2, reset the timer by pressing the Stop/Start switch or by turning the mains power off and on. Turn VR2 fully clockwise and connect a jumper lead between pin 11 of IC10e (at the 82kΩ resistor) and the +12V rail. Connect a multimeter between pin 10 of IC10e and ground and measure the voltage. It will be about 0V.

Now disconnect the jumper lead and adjust VR2 until pin 10 of IC10e goes high. Advance the setting of VR2 a little further than this to ensure reliable operation of IC10e.

VR1 must be set so that IC10e oscillates at 1Hz. To do this, set the timer to give a period of 1.00 minute. Start the timer and compare the timer period against your watch. After several attempts it should be possible to adjust VR1 so that the Photo Timer is reasonably accurate. For greater accuracy, set the timer for 9.59 minutes and time it over this period. EA

PARTS LIST

1 PCB, code 86pt8, 115 x 126mm
1 PCB, code 86db8, 123 x 50mm
1 instrument case 200 x 160 x 70mm (Altronics Cat. No. H-0480/1)
1 front panel artwork, 195 x 64mm
1 12.6VAC centre-tapped transformer, 2851 or equivalent
1 panel mounting mains socket
1 12V SPDT PC mounting relay
1 push on/push off mains switch
1 DPDT mini toggle switch
1 SPDT mini toggle switch
4 snap action keyboard switches
4 solder lugs
1 mains cord and plug
1 cord plug grommet
4 4mm standoffs (transistor insulating bushes)

Semiconductors

3 FND500, FND560 or equivalent 13mm common cathode red displays
1 40106, 74C14 hex Schmitt trigger
2 4518 dual synchronous up counters
3 4511 BCD to 7-segment decoder drivers
1 4093 quad Schmitt NAND gate
1 4053 triple 2-channel analog multiplexer
3 4029 presettable binary/decade up/down counters
1 4011 quad NAND gate
1 BC338 transistor
1 7812, LM340T12 3-terminal regulator
5 1N4002 1A diodes
4 1N914, 1N4148 signal diodes

Capacitors

1 1000μF 16VW PC electrolytic
4 10μF 16VW PC electrolytic
4 1μF 16VW PC electrolytic
1 .0033μF metallised polyester

Resistors (0.25W 5%)

2 x 220kΩ, 1 x 82kΩ, 5 x 47kΩ, 1 x 10kΩ, 22 x 2.7kΩ, 1 x 100kΩ miniature horizontal trimpot, 1 x 50kΩ miniature horizontal trimpot.

Miscellaneous

Hookup wire, tinned copper wire, insulating sleeving, red perspex, self tapping screws, solder etc.

Books & Literature

More than just reading schematics

HOW TO READ SCHEMATICS: by Donald E. Herrington. Published by Howard W. Sams & Co, Indianapolis, USA. Soft covers, 217 x 136mm, 258 pages, illustrated with diagrams and photographs. ISBN 0-672-22457-7. Recommended retail price $27.50.

The first reaction to this book was "Why is it so thick?" Over 250 pages just to explain schematic diagrams? In fact, it turns out that it is something of an introduction to electronics for the complete novice. Beginning with elementary atomic theory, it covers passive and active devices and then progresses to some simple circuits.

Both analog and digital circuits are covered. By way of example, some amplifier circuits are given, along with a BCD-to-decimal decoder circuit. At each stage, the explanations appear to be very down to earth. Certainly, the stated objective of the book is met — to provide a working knowledge of schematic diagrams.

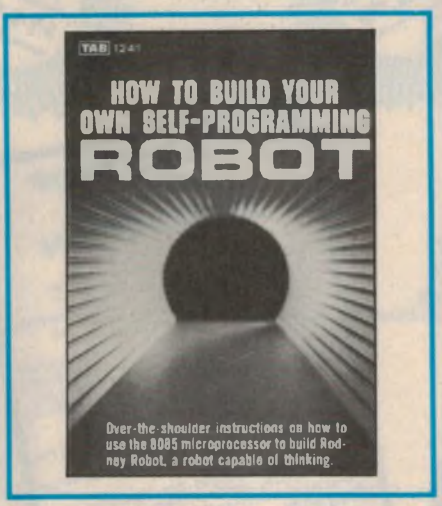
Although not stated, the book seems to imply that, having read it, you would be equipped to undertake servicing of commercial equipment. This would be rather ambitious but anyone wishing to become involved in servicing would certainly consider this as a first step. Our review copy was supplied by Jaycar. (C.R.D.)

Building a robot

HOW TO BUILD YOUR OWN SELF PROGRAMMING ROBOT by David L. Heiserman. Published 1979 by TAB Books, USA. Soft covers 210 x 130mm, 237 pages, illustrated with diagrams and photographs. ISBN 0-8306-1241-6. Recommended retail price $16.95.

Another robot book? Yep, sure is. There's been so many of them published in the last few years that most of us get glassy-eyed at the mere mention of a robot. But wait — stop yawning! This one is actually interesting.

Despite repeated attempts by the author at dissuading the potential reader, the book actually flows along quite



smoothly, at least for the first couple of chapters. "So if you are hoping to find some casual reading about robots, you would do well to look around for a different kind of book on the subject" states the author, somewhat unnecessarily.

Undoubtedly, the book is really only of practical value to anyone with a reasonable knowledge of microprocessors and electronic project assembly. Given this qualifier, however, it has some quite interesting philosophical discussion of robotics. The repeated assertion that the book is a waste of time unless you actually intend to build the robot seems a little harsh.

The big feature of the "Rodney Robot" is that it is "self programming". A basic Alpha class robot is described as having purely reflexive and random behaviour. The Beta class improves on this by remembering which responses have been successful and using them again. The most sophisticated class are the Gamma robots which not only remember specific responses, but are also able to generalize. In this respect, they are self programming. "Rodney Robot" can be built up through each of the three classes.

The project is based on the 8085 microprocessor. Control and diagnostic programs are listed, along with a description of some of the instruction set. A disappointing omission was the printed circuit board artworks. The author has obviously made the boards himself — even half size reproductions would have been worthwhile. As it is, all of the work in converting the circuit diagrams into circuit boards is left up to the constructor.

This complaint aside, David Heiserman's book is one of the better references on the subject of robots and anyone interested in the subject should certainly consider it. Our review copy was supplied by Dick Smith Electronics. (C.R.D.)

Radio and TV handbook

WORLD RADIO TV HANDBOOK, 40th ANNIVERSARY EDITION. Editor-in-Chief J.M. Frost. Published 1986 by Billboard Publications Inc. USA. Soft covers, 227 x 146mm, 607 pages. Illustrated with photographs. ISBN 0-902285-11-4. Recommended retail price $32.50.

This is the 40th anniversary issue of the book no DXer would leave home without. If you've never heard of the publication, a section from the facing page probably best describes the features:

- The world's broadcasters and their services are listed country by country.
- A special hour-by-hour guide to broadcasts in English directed to your area.
- Essential station information including frequencies, transmitter powers, operating times, languages, addresses, etc.
- Listings of stations in frequency order to help you identify them more easily.
- Maps of principal transmitter sites worldwide.
- Names and addresses of international radio listeners clubs.
- Information on reception conditions, Time Signal Stations and other specialised subjects.
- Widely acclaimed annual test reports on receivers for the international listener.

The usual temptation to thumb through a few sections of a book proved something of a shock in this instance. The reader is confronted with a veritable barrage of lists, languages, advertisements and columns. To make matters worse, the index lists the wrong page number for the user's guide. Once you sort this out, though, it has about the most information you'll ever find on the subject in one place. (C.R.D.)

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Ref: EA June 1986
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Ref: EA July 1986

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Two of these devices are available from Jaycar. Simply connect them in series with the speakers you wish to protect.

RN3410 is suitable for protection of tweeters in systems up to 100 watts. It's rated at 50 volt and ½ amp. Nominal resistance is 0.4 ohms.

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Cat. RN-3415 **$6.98 each**
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Cat. KE-4720

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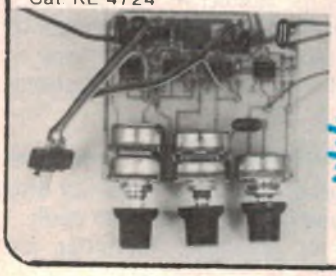
Ref: ETI August 1986
This module can be used on its own or in gangs as effects units, and also in synchronous sweep effects.
Cat. KE-4724



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NEW $14.99

IONISER KITS COMPLETE

High efficiency emitter head - fits completely inside a high quality ABS box (NOT a metal lid) - only 2 core mains flex protrudes from the box - you can pay over $80 for a built-up inferior unit!
Cat. KJ-6611

ONLY $49.50

SHORTFORM

Runs directly from 240V mains and has a low power consumption. Produces high intensity electric field with an output of around 7.5kV. Does not necessarily produce ozone in standard form. Ideal for those who wish to try an ioniser at an economical price.
Cat. KJ-6610

ONLY $27.50

ETONE 10" SUB-WOOFER

As used in the Electronics Australia sub-woofer system.

SPECIFICATIONS

SIZE	10" (250mm)
CAST FRAME	QT=0.39 VAS=631
POWER HANDLING	100 watts rms
FREE AIR RESONANCE	32Hz ±1Hz
VOICE COIL DIAMETER	2"
MAGNET	3kg (6.6 lb)

Cat. CW-2119

ONLY $119.50

SUBWOOFER AMP

Ref: EA July 1982
State-of-the-art MOSFET technology combined with a low pass filter. Around 100 watts rms drive capability. Ideal for use with the Jaycar Subwoofer speaker (Cat. CW-2119). Amp will take line level (1V) input or connection direct to speakers. The Jaycar kit includes all PCB parts, heatsinks and power supply filter capacitors.
Cat. KA-1452

ONLY $119.95

JAYCAR DEALER

EAGLE ELECTRONICS
54 UNLEY ROAD, UNLEY, S.A.
Telephone (08) 271 2885

SUPER HIGH POWER MOSFET AMP MODULE

Ref: EA October 1985
This mighty circuit designed by the EA engineering team is basically a 'beefed-up' version of the Playmaster 200. It consists of essentially the same power amp circuitry as the 200 except on a redesigned PCB which also incorporates a speaker protection and turn on relay. Considering the power available this is very prudent!
The Jaycar kit contains all PCB components including the heavy duty relay.
Cat. KA-1622

ONLY $89.50

ELECTRIC FENCE CONTROLLER

Ref: EA December 1985
BRAND NEW MODEL NEEDS NO AUTO COIL!

This new electric fence is a considerable development over the older design (which is still currently available). Because this new circuit uses a special output transformer it is far more likely to work well into false loads such as tall grass or dirty insulators. The new circuit has also less current drain but far higher overall performance.
The Jaycar kit is supplied with a slightly different box than shown in the illustration. Also included is the length of HT cable and heavy HT connecting clip.
Cat. KA-1660

ONLY $45.00

"ELECTRIC FENCE"

Ref: EA September 1982
Mains or battery powered this electric fence controller is both inexpensive and versatile. It should provide an adequate deterrent to all manner of livestock. Additionally, its operation conforms to relevant clauses of Australian Standard 3129.
(Kit does not include automotive ignition coil which is required)
Cat. KA-1109

$19.95

JAYCAR No.1 FOR WINTER BARGAINS

UNBELIEVABLE SEMICONDUCTOR BARGAINS!!!

MOTOROLA 6800 SERIES SENSATIONS!!!

6809 8/16 bit microprocessor
Cat ZZ-8055 **NORMALLY $10.00**
THIS MONTH $5.00

6821 Peripheral interface adaptor
Cat ZZ-8061 **NORMALLY $5.00**
THIS MONTH $2.00

6845 CRT Controller
Cat ZZ-8063 **NORMALLY $12.00**
THIS MONTH $5.00

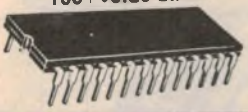
6850 Asynchronous communications interface adaptor
Cat ZZ-8065 **NORMALLY $7.00**
THIS MONTH $2.00

6818 Real time clock
Cat ZZ-8057 **NORMALLY $10.00**
THIS MONTH $3.00

MEMORY

27128 EPROM Cat ZZ-8468
1-9 $5; 10-99 $4; **100+$2.50**

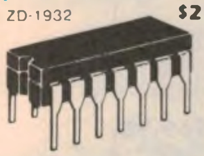
2114 RAM Cat ZZ-8414
1-9 $2; 10-24 $1.50; 25-99 $1.00; 100+$0.80 each



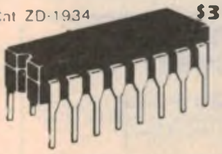
OPTO COUPLER MADNESS BARGAIN!!

We have purchased a large shipment of "SHARP" brand opto couplers. They are LED phototransistor types with a 5000 volt rating each device is a multiple unit coupler and is supplied with data.

TYPE PC837 3 x optocoupler in a 12 pin DIP package.
Cat ZD-1932 **$2.00 each**



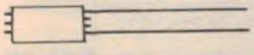
TYPE PC847 4 x OPTOCOUPLERS IN A 16 PIN DIP PACKAGE
Cat ZD-1934 **$3.00 each**



BARGAIN RF CHOKE

Heavily attenuates from 10MHz - 100MHz. Uses Philips Ferrocube bead with 3 turns of tinned wire. Will carry 2 - 3 amps so is ideal for in-line RF attenuator in power supply wiring.
Cat LF 1200

$1.00 ONLY each



VIDEO LEAD

5 pin DIN plug to 5 pin DIN plug reverse
Cat AV-6532

ONLY $5.95

If you have any surplus stock contact
Gary Johnston or Bruce Routley on (02) 747 2022

TEXAS INSTRUMENTS CALCULATOR BARGAINS!!

Jaycar is proud to announce distribution of famous Texas Instruments calculator products. To celebrate we have 3 specials for this month.

"LITTLE PROFESSOR" Famous childrens math learning aid. A fun way for your children to learn addition, subtraction, multiplication & division! AND at a NEW LOW PRICE.

NORMALLY $39.95 THIS MONTHS INTRODUCTORY SPECIAL
ONLY $34.95
SAVE $5.00

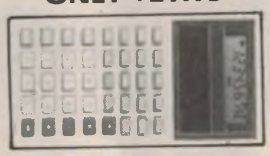
Cat QC-7160

TI-30 SLR - SOLAR POWER "SLIDE RULE" CALCULATOR

TI-30 SLR calculator will never fail you during an exam. Sunlight or electric light will keep your calculator working, indoors or out.

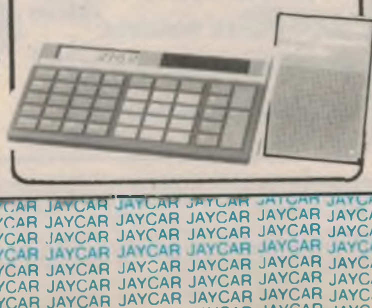
- AOS™ algebraic operating system
- 8 digit display
- Scientific notation 5 + 2
- 15 parantheses levels
- 4 max pending ops
- Constant
- Memory store/recall
- Sum to memory
- Exchange display with memory
- Sin, cos, tan and inverses
- DRG conversions

Cat QC 7164
NORMALLY $39.95 - SAVE $10
ONLY $29.95



TI-35 "GALAXY"

This 62 function scientific student calculator has an advanced design keyboard with extra large well spaced textured keys for sure fingered data entry. Helps reduce errors. It's colour-coded and slanted for comfortable and confident calculating.
New patented display indicators show pending operations to help students learn. Takes energy from any normal light source indoors or out. You'll never need batteries. The TI-35 Galaxy™ solar has the functions today's math and science students need: powers, roots, reciprocals, common and natural logarithms, trigonometric functions, degree/radian/grad conversions and much more. And AOS™ (algebraic operating system) makes it easy to use. You enter problems just as they are written, left to right.
A comprehensive student's guidebook is included to provide instructions, information, examples, and problem solving specifics.
Calculator comes with a tough, hard plastic "clam-shell" carrying case.
Cat QC 7168
NORMALLY $49.95 - SAVE $10
ONLY $39.95



VIDEO LEADS

Jaycar has purchased some distress stock of video leads.
Rather than just buying one lead you need for a recording, this system incorporates just about all connectors you will need. You should never have to purchase another video lead. This system incorporates a lead 5 ft long with a 6 pin DIN plug on each end. You also receive 6 additional leads which plug into either end of the long lead and then into your video. The range of plugs is enormous.
EACH KIT INCLUDES:

2 x BNC plugs
1 x mini plug
1 x 5 pin DIN plug
2 x PL259 plugs
3 x RCA plugs
and MORE

NORMALLY WORTH $35.00
TOTAL 7 LEADS
FOR ONLY $6.95
Cat AV-6540

HEADSHELLS

We have noticed that headshells have become very hard to get and very expensive recently. Jaycar has purchased the entire quantity of a manufacturers stock. This is your lost chance to grab one or two.
Both are high quality standard "½" mount complete with hardware.

BLACK BRUSHED FINISH
Cat AA-0200
ONLY $2.95
NORMALLY $9.50

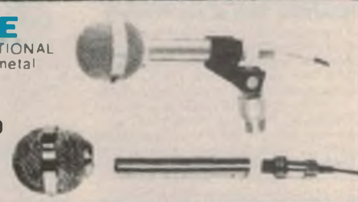
HIGH QUALITY
● Lightweight aluminium ● gold plated contacts ● one piece body for reduced latent feedback problems
Cat AA-0205
ONLY $4.00
NORMALLY $14.50

MID RANGE LEVEL CONTROL

The usual level control for mounting in speaker boxes. These are marked as MID.
NORMALLY $7.95
ONLY $2.00 each
Cat AC-1680
LIMITED QUANTITY

MICROPHONE

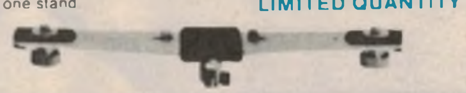
DUAL IMPEDANCE OMNI DIRECTIONAL
Dynamic Lavalier with detachable metal mesh ball windshield.
Frequency response 80 - 13kHz
Impedance 50k - 600 ohms
NORMALLY $29.00
ONLY $12.00
SAVE $17.00
Cat AM-4084



TWO MICROPHONE ATTACHMENT

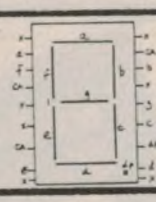
With this handy device you can use two mics (stereo) on the one stand.
Cat AM-4110

NORMALLY WORTH $16.00
ONLY $2.50
LIMITED QUANTITY



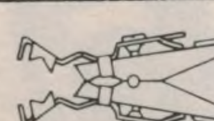
BARGAIN

1" HIGH (25.4mm)
7 SEGMENT RED LED DISPLAY
● Right hand DP ● Common anode
Only a small quantity available, some with slight imperfections.
Cat ZD-1860
ONLY $3.00 each



ALLIGATOR LINE CLIP

3 way TV clip for fastening antenna lead in to TV
Cat HM-3050
80¢ each
10 or more 70¢ each



PENLIGHT NiCads

Don't keep wasting money buying throw away batteries. Step up to rechargeable NiCads.

SUPERB "ROCKET" BRAND AA (Penlight) 450mAh

Cat. SB-2452 **$2.95**

SPECIAL 4 FOR $10

DIE CAST HEATSINKS

Jaycar is proud to announce a range of Made in Australia die cast heatsinks. They are gravity cast in Aluminium, have the area where semiconductors mount milled flat and are fully finished in powdercoat black. They are low cost for the performance offered. Size: 134 x 65mm (high) x length (see below)

BFNF SERIES

Cat. HH-8540 (50mm long) **$3.95**
10 or more $3.75 each

Cat. HH-8541 (75mm long) **$5.95**
10 or more $5.50 each

Cat. HH-8542 (100mm long) **$7.95**
10 or more $7.50 each

Cat. HH-8543 (150mm long) **$9.95**
10 or more $9.50 each

MF10 - 2F - 75

74(H) x 144(L) x 46(W)mm (bracket 34mm wide)
Cat. HH-8548 **$7.50**
10 or more $6.95 each

4½ DIGIT ACCURACY - 3½ DIGIT PRICE!! AND DIGITAL HOLD TO BOOT!!

Once again Jaycar has smashed the price barrier for a full 4½ digit multimeter. Just think a multimeter with 0.15% accuracy on most ohms ranges, 0.05% on DC volts and 0.5% MAX on DC current! STAGGERING. Plus, continuity buzzer and LED symbol, auto polarity, auto zero, vinyl case and DATA HOLD as well!!! NOT TO MENTION the transistor and diode tester!!

We are absolutely convinced that you will be delighted with this meter. So much are we convinced that we have extended our normal satisfaction guarantee by another week. That's right! Personal shoppers can try this superb instrument out in their own workshop for 14 - obligation free days. (Mail order customers 21 days!) If you are not happy with this product in any way return it in ORIGINAL condition for a full refund (less P&P for M/O).

SPECIFICATIONS:

★ 0 - 1kV DC 0.05% ★ 0 - 750V AC 0.8% (max) ★ 0 - 10A DC 0.5% (max) ★ 0 - 10A AC 1.0% (max) ★ 0 - 20M ohm 0.5% (max)

FEATURES

● All ranges fully protected ● Auto zero ● 0.5" high LCD ● Diode test (1mA fixed current) ● Audible continuity ● Data hold ● LCD display feature ● Functional annunciators ● Extremely accurate ● 20 page instruction manual included

Cat. QM-1550

NEW ONLY $159.00

ALARM STICKERS

LARGE 125mm x 75mm

Suitable for house, factories, caravans etc. Will stick on the outside i.e. sticky on the back.
Cat. LA-5102

ONLY $1.95 each
SPECIAL 5 for $7.50
SAVE $2.25

SMALL 73mm x 33mm

Specifically designed for cars. Sticky on the front so you can stick them on the inside glass. Thieves will not know whether you have an alarm or not.
Cat. LA-5100

ONLY 95¢ each
SPECIAL 5 for $3.50

"MAINS MUFFLER" - 2 OUTLET

This fully approved Electricity Authority unit is the ultimate mains suppression device. It is fitted with a circuit breaker & VDR's for extra suppression capacity. Nothing but clean 240V goes through.

Recommended for:

Computers Printers Disc Drives VDU's Videos Medical Equipment

Max load 1000 watts 4 amps 250V
Cat. MS-4040

ONLY $149.00 NEW
(4 OUTLET PICTURED)

MICRON TEMPERATURE CONTROLLED SOLDERING STATION

Select the temperature you require at the flick of a switch - no more changing tips to obtain correct working temperature.
Cat. TS-1600

ONLY $99.50

REPLACEMENT TIPS

Cat. TS-1601 Micro Chisel 1mm
Cat. TS-1602 Mini Chisel 1.5mm
Cat. TS-1603 Standard Chisel 3mm

ALL PRICED AT $3.95 EACH

GORE HILL OPEN UNTIL 4pm SATURDAY

HEAVY DUTY STRAP HANDLES

Overall length 250mm. Will lift a maximum weight of 50kgs!! Ideal for speakers, amps, etc. made in England.
Cat. HS-8020

ONLY $7.95 each

MARSHALL CABINET HANDLE

If you are having trouble lifting speaker cabinets, or PA bins, or any large box, try these handles. They are easy to fix, just drill holes and screw in.
Cat. HS-8010

ONLY $16.50 each
10 or more $16.00 each

METAL CORNER BRACKET

Keep the corners of your PA bins or party speakers undamaged. Just screw these on to your speakers, and start throwing them around.
Cat. HM-3822

$2.25 each
10 or more $2.00 each

PLASTIC LOCKING CORNER PIECE

Heavy duty plastic moulded corner fitting featuring male/female inserts. These are designed to fit together so that pieces of equipment (the same size) can be stacked up and locked together. Ideal for stacking speaker boxes.
Cat. HM-3826

$2.25 each
10 or more $2.00 each

QUALITY PRODUCTS

IDEAL FOR PA - DISCO - HOME

AUTOMATIC TELEPHONE DIVERTER

This professional quality product will automatically transfer an incoming call to another telephone number anywhere. Your business will not lose any important calls if you move as incoming calls can be diverted to your new office address. Two telephone lines are required.
Cat. YT-6505

ONLY $159.50

JAYCAR VIDEO ENHANCER

A MUST when you record from one video to another.

- Built and designed in Australia
- 625 line 50 frame PAL-D
- Features Core/Gamma control
- Will drive up to 3 VCR's at once
- Standard 75 ohm coax fittings

Cat. AV-6501

$69.95

12C AV power pack Cat. MP-3020 *$11.95*

POLYPROPYLENE CONE WOOFERS

HIGH QUALITY AT LOW COST

12" WOOFER

★ Power handling 80 watts rms system ★ Impedance 8 ohms ★ Resonant frequency 23.2Hz ★ Sensitivity 92.3dB 1 watt 1 metre ★ Effective frequency response 23Hz - 5kHz ★ Electromagnetic Q - QES 0.481 ★ Peak cone excursion 2 x/max 1.6mm
Cat. CW-2130

$79.50

10" WOOFER

★ Power handling 70 watts rms system ★ Impedance 8 ohms ★ Resonant frequency 24.3Hz ★ Sensitivity 91.9dB 1 metre 1 watt ★ Electromagnetic Q - QES 0.398 ★ Peak cone excursion 2 x/max 1.25mm
Cat. CW-2116

$69.50

8" WOOFER

★ Power handling 60 watts rms system ★ Impedance 8 ohms ★ Resonant frequency 23.2Hz ★ Sensitivity 88.2dB 1 metre 1 watt ★ Effective frequency response 23 - 5kHz ★ Electromagnetic Q - QES 0.481 ★ Peak cone excursion 2 x/max 1.6mm
Cat. CW-2114

$42.50

NOW AVAILABLE

5" MIDRANGE FERROFILLED

Cat. CM-2085 **$29.50**

LOUD PLATE TWEETER

Cat. CT-2030 **$39.50**

10" PASSIVE RADIATOR

Cat. CR-2180 **$36.50**

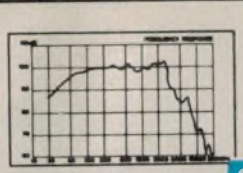
12" PASSIVE RADIATOR

Cat. CR-2190 **$47.50**

PIONEER 8"
BACK IN STOCK

Best value 8" woofer we've seen. Excellent sound and a beautiful looker. Ferrofluid 30 watts rms, frequency response 50 - 3000Hz, resonance frequency 50Hz, SPL 99dB/½ metre.
Cat. CW-2111

ONLY $19.95



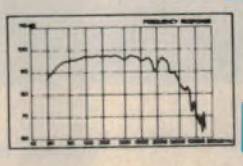
$19.95

PIONEER

PIONEER 355
10" WOOFER

10" woofer with excellent tone. Ferrofluid 50 watts rms, frequency range 25 - 2.5kHz, resonance frequency 25Hz, SPL 96dB/½ metre.
Cat. CW-2117

ONLY $34.50



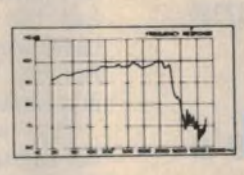
$34.50

PIONEER

PIONEER 418
12" WOOFER

White cone and chrome surround with superb specifications make this driver a winner. Only ½ the price of European equivalents. 65 watts rms, frequency response 25 - 2.5kHz, resonance frequency 25Hz, SPL 97dB/½ metre.
Cat. CW-2121

ONLY $47.50



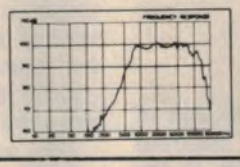
$47.50

PIONEER

PIONEER
MIDRANGE 107

Our most popular midrange. Beautiful white cone, large sealed back. Extra clear, crisp midrange. Ferrofluid. 80 watts rms system power. Frequency 320 - 6kHz, resonance frequency 320Hz, SPL 100dB/½ metre.
Cat. CM-2080

ONLY $22.50



$22.50

PIONEER

PIEZO HORNS

Jaycar has broken the price barrier for Piezo Horn speakers. We now import DIRECT a range of Piezo Horns at prices that will still stagger you. Similar units are used everywhere in P.A., Disco and Hi Fi applications. Only Jaycar, however, can bring you these products at low Jaycar prices!

PH 1005A

3½" square super horn for P.A's, Disco's. Very efficient. Around 50 watts rms equivalent capacity.
Cat. CT-1900

ONLY $15.95

PH 1038A

Hi Fi version of the PH 1005A. Slightly less sensitive but a smoother response.
Cat. CT-1902

$15.95

$15.95

JAYCAR No.1 FOR SPEAKERS

'T-REX'

Our wirestripper, nicknamed Tyranosaurus Rex is far from extinct! It's a great way to strip all sorts of cable without damaging the conductors. It's also a price breakthrough!

- ★ Automatically adjusts to insulation diameter.
- ★ One hand operation.
- ★ New low price for an automatic wirestripper.

Cat. TH-1824

ONLY $9.95

TOROIDALS
WHY A TORODIAL?

- ★ Smaller size and weight to meet modern "slimline" requirements.
- ★ Low electrically induced noise demanded by compact equipment.
- ★ High efficiency enabling conservative rating whilst maintaining size advantage.
- ★ Lower operating temperature.
- ★ Simple, quick, single bolt mounting.

The Toroidal transformer is now accepted as the standard in industry, overtaking the obsolete laminated type. Industry has been quick to recognise the advantage toroidals offer in size, weight, lower radiated field.

NEW LARGER RANGE

Cat. MT-2112	12 + 12V 160VA
Cat. MT-2113	18 + 18V 160VA
Cat. MT-2114	24 + 24V 160VA
Cat. MT-2115	30 + 30V 160VA
Cat. MT-2116	35 + 35V 160VA
Cat. MT-2117	40 + 40V 160VA
Cat. MT-2119	45 + 45V 160VA

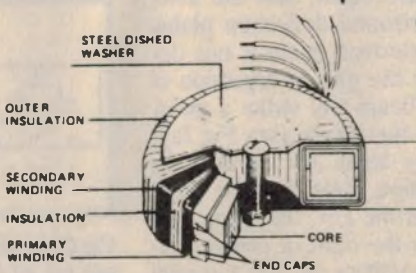
ALL $49.50 each

Cat. MT-2130	12 + 12V 300VA
Cat. MT-2132	18 + 18V 300VA
Cat. MT-2134	24 + 24V 300VA
Cat. MT-2136	30 + 30V 300VA
Cat. MT-2138	35 + 35V 300VA
Cat. MT-2140	40 + 40V 300VA
Cat. MT-2142	45 + 45V 300VA

ALL $62.50 each

Cat. MT-2150 45 + 45 + 15V 300VA

ONLY $79.50



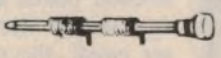
WIRE WRAP PINS

Great for those into wire wrapping. These are gold plated 0.025" square post with 3 level wire wrapping.
Cat. HM-3712 (WWT2) PKT OF 20

ONLY $3.75

Cat. HM-3714 (WWT4) PKT OF 20

ONLY $3.75



MAIL ORDERS
FOR ORDERS (008) 022 888
FOR ENQUIRIES (02) 747 1888

MICROCHARTS
WHAT ARE MICROCHARTS?

MICROCHARTS are professional, comprehensive plastic summary cards packed with key time-saving information on: microprocessors, electronics, programming, and tools for business. Colourful 100% plastic MICROCHARTS are carefully organised for fast use at work, home, and in the classroom.

- ★ Solid plastic - lasts a lifetime
- ★ Two comprehensive sides
- ★ Crystal clear printing
- ★ Instant access to data you need
- ★ Full 8½ x 11" size
- ★ 2mm plastic protection layer
- ★ All key data in one place

ALL MICROCHARTS ONE LOW PRICE

$12.95 each

7400 PINOUTS

Part-number, family-type, description and pinouts in new compact tabular form. Virtually all parts are covered. Avoids missing data sheets and not knowing about chips from other manufacturers; use for 74C, LS, HC etc. as well.
Cat. BM-8503

WORDSTAR

Much more info than keyboard overlays and can be flipped over faster. Allows large text window and avoids sub menu hopping. For beginners and advanced users. Covers full manual and more.
Cat. BM-8506

HOW TO SAMPLE

Lets you estimate how many objects or people have a characteristic by examining only a small sample. No math background needed. For manufacturing, QC, research, etc.
Cat. BM-8514

ALGORITHMS

Core of programs for searching, sorting, plotting, and some math operations. Algorithms are in BASIC and designed for easy conversion to assembly. Also a 3 by 5 dot matrix character set is included.
Cat. BM-8504

8086 & 8088

Full instruction set, ASCII, hex and decimal conversion, flags, cycle times, interrupt structure, pinout, disassembly table, key memory locations, reg map, and cautionary notes. No binary codes to translate.
Cat. BM-8508

Z80 CPU

Full instruction set, ASCII, hex and decimal conversions, flags, cycle times, interrupt structures, pinout, disassembly table, reg map, addressing, code for comparisons, powers of 2 diagrams and more.
Cat. BM-8500

6502 (65XX)

Full instruction set, ASCII, hex and decimal conversions, flags, cycle times, interrupt structure, pinout, disassembly table, memory and reg maps, code for comparisons, addressing, notes and more.
Cat. BM-8502

8080 & 8085

Full instruction set, ASCII, hex and decimal conversions, flags, cycle times, interrupt structure, pinout, disassembly table, program example, code for comparisons, reg map, diagrams and more.
Cat. BM-8501

BASIC INTRO

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INSIDE THE OSCILLOSCOPE

PT.1

No test instrument in electronics is as important or as versatile as the oscilloscope. After all, oscilloscopes do more than just measure — they also let you "see" the signals at various stages of a circuit. Here's how they work.

by ROGER M. STENBACK & CARL LARON

What do you know about oscilloscopes? Have you ever wondered how they convert the signal measured at the probes into a visible signal? Have you ever wondered if you are getting the most you possibly can out of a scope? What about scope specifications — do you know what they mean and which are most important? In this short series of articles we are going to answer those questions, and more.

With so much to cover, let's get to it.

Inside an Oscilloscope

Look at an oscilloscope, and the first thing you'll notice is the cathode-ray tube (CRT). Much as the case in a TV set, it is the job of the CRT to convert a stream of electrons that are emitted from a set of electrodes at one end into a visible, usable display. Fig.1 shows a typical CRT. Like a TV CRT, the electron gun located in the narrow end of the tube generates a beam of electrons and propels it in the direction of the wide end of the tube. At the wide end, of course, is a phosphor-coated screen. Whenever the beam strikes the phosphor the phosphor glows.

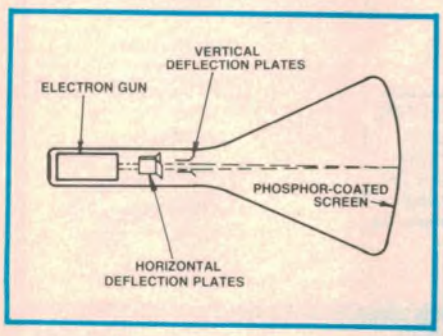


Fig.1: this diagram shows how the electron beam is projected from the electron gun to the phosphor-coated screen. The electron beam passes between vertical and horizontal plates which deflect the beam sidewise and vertically.

In addition to the electron gun, the narrow end of the tube has two pairs of deflection plates — one vertical, the other horizontal. As their name would suggest, the purpose of those plates is to deflect the beam in either the horizontal or vertical direction. To do that, voltages are applied to the plates. The deflection that occurs is based on the principle that the negatively charged electron is attracted to a deflection plate when that plate is more positive than its counterpart opposite it.

Let's see how those plates do their job. If the voltages on the vertical deflection plates are equal, and the voltages on the horizontal deflection plates are equal, the electron beam is not deflected (actually the pull or repulsion is equal) and the beam will strike a point at the centre of the screen (see Fig.2a). If, on the other hand, the voltage on the right deflection plate is more positive than that on the left, the beam will strike a point to the right of centre (assuming that the voltage on the top and bottom vertical plates is still equal); that is shown in Fig.2b. The amount of deflection is determined by the difference and polarity in voltage. If the left plate had the greater positive voltage, the beam would, of course, be deflected to the left. Vertical deflection takes place in a similar manner.

That takes care of up-and-down and left-and-right positioning. Positioning the beam in other locations on the screen is handled by combinations of vertical and horizontal deflections. If, for instance, the beam were deflected equally in the up and right directions, it would be positioned as shown in Fig.2c.

The next step is to consider what would happen if we were to replace the DC voltages on the deflection plates just discussed with changing voltages. The result would be that those changing voltages would cause the beam to constantly move, or scan across the screen. If, for instance, a sawtooth voltage were applied to the horizontal deflection plates so that the right plate would go positive, the beam would scan from left to right. On the descending edges of the waveform, the period where the sawtooth goes from its maximum voltage to its minimum, the beam would quickly snap back from the right to the left side, due to the rapid voltage change. As a sawtooth is a periodic (repeating) function, that process repeats itself over and over. The result is a visible horizontal trace, called the sweep.

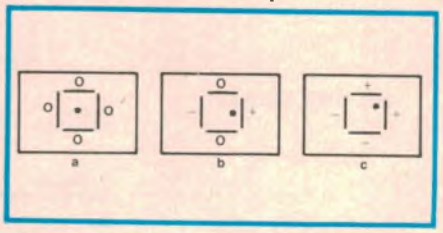
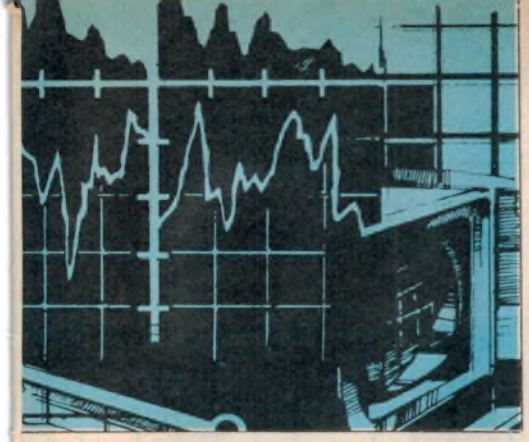


Fig.2: by looking directly at the screen, we can get an idea of how the deflection plates operate on the electron beam. The four lines that appear as an open-cornered box are the deflection plates. The solid dot inside the box is where the electron beam strikes the screen, and the O, + and − signs indicate the voltage polarity, or no voltage, applied to the plates. The text describes the action that takes place.

This article originally appeared in Hands-On Electronics, Vol.2 No.5, and appears here by arrangement.



During all that, we have assumed that there has been no voltage applied to the vertical deflection plates. If, there is a voltage on the vertical deflection plates, the result is no longer a horizontal line. Let's see what happens.

For our example, let's assume that the voltage placed on the vertical deflection plates is a sinewave. Now, a varying positive voltage is placed on the top deflection plate during the first half-cycle of the sinewave and a varying positive voltage is placed on the bottom deflection plate during the second half-cycle. As the beam is swept from left to right, during the first half-cycle it is also pulled upward in response to the voltage on the top plate. During the second half-cycle, the beam is pulled downward in response to the voltage on the bottom deflection plate. The result is that the varying voltage pattern of a sinewave is traced on the oscilloscope screen. In a similar fashion, other types of waveforms, such as square waves, triangular waves, or more complex waveforms (such as a video signal) can be displayed.

Fig.3 shows a simplified block diagram of an oscilloscope. The signal to be input is fed to a vertical amplifier. In that stage, the signal is applied first to a calibrated attenuator and then to the actual amplifier. From the amplifier the signal is applied to the vertical plates of the CRT. We'll talk more about the attenuator when we look at how a scope is used, a little later on in this article.

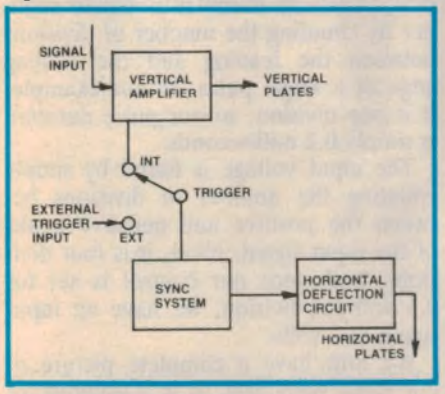


Fig.3: simplified block diagram of the deflection sections of an oscilloscope. The Trigger switch and Time/Div are front panel controls.

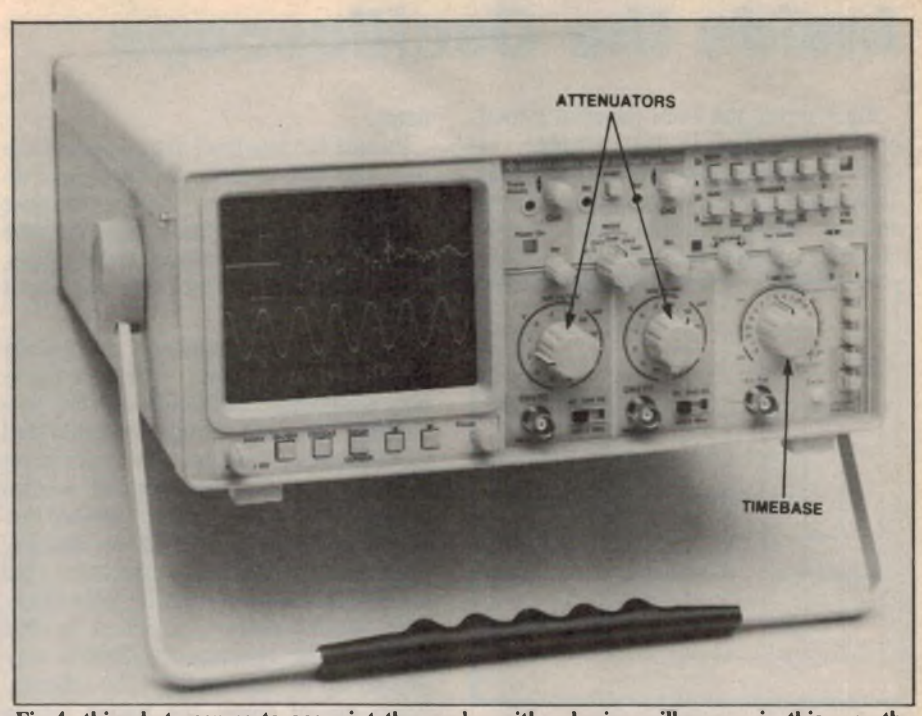


Fig.4: this photo serves to acquaint the reader with a basic oscilloscope, in this case the Gould 20MHz Type 1425 which is a dual-beam instrument.

Part of the input signal is split off and fed to the sync system of the scope. That system is used to trigger the start of the sawtooth waveform that we spoke of earlier. The waveform itself is generated by the horizontal deflection circuit.

The Sweep Signal

The sync section (Fig.3) is important as the sawtooth waveform must be synchronized to the input signal. If the sawtooth is not synchronized to the input — that is, if their periods were different — the display would be hopelessly jumbled.

In the simple oscilloscopes, the task of synchronization is handled by using a free-running generator to create the sawtooth. Such a unit is called a recurrent sweep oscilloscope. The scope is synchronized by adjusting the sawtooth generator until its output waveform has the same frequency, or some multiple thereof, as the input signal. To achieve that aim, the vertical signal is sampled, and injected into the generator. The generator locks onto that sample, and follows the frequency and phase of the input.

While recurrent sweep is the lowest-cost type of synchronization, it has many drawbacks and is rarely if ever used in modern scopes. Among its limitations are that it is difficult, if not impossible, to change the point where triggering starts and it is difficult to determine the period of the sweep signal.

Those problems can be solved through the use of a triggered sweep scope. In that type of scope, the free-running generator is replaced with a one-shot, and the sawtooth waveform is replaced with a ramp. The one-shot is set, using a comparator circuit, to output its ramp at a specific point on the input waveform, assuming that the scope is used in its internally triggered mode. The user, using a timebase control, usually labelled as TIME/DIV, can select the exact period of the sweep signal.

Thus far, we've considered only internally triggered scopes; that is, scopes that trigger the sweep at a specific point on the input signal. Most scopes also have provision for the input of an external trigger signal. When a scope is externally triggered, the sweep generator outputs its ramp at a specific point on the *trigger* waveform. Needless to say, the trigger waveform should be time related to the input waveform. Otherwise, the display would not provide useful information as triggering would be random.

Calibration

Look at the CRT of almost any modern scope and you will notice that it features a square grid, called the *graticule*. On a typical scope, the graticule is a 10 by 10 or 10 by 8-division calibration grid with 1-centimetre by 1-centimetre spacing.

Inside the Oscilloscope

Fig.4 shows the front panel of a modern oscilloscope; in this instance, we show the Gould Type 1425 20MHz unit. Take note of two of the controls we've already briefly touched upon — the timebase control, and the vertical attenuator.

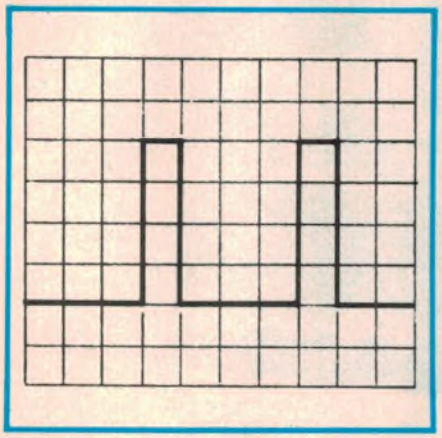


Fig.5: here is a simple bi-symmetrical square wave that is displayed to coincide with the graticule on the oscilloscope screen. The settings of the calibrated Timebase control and vertical attenuator permit the viewer to determine the frequency and peak-to-peak voltage (see text).

Except for low-level signals, input signals can not usefully be displayed directly on the screen. That is because most input signals would extend above the top and bottom of the screen. Thus, all scopes have some type of input attenuator.

The vertical attenuator is usually made up of two parts. One is a precision attenuator, calibrated in volts-per-division, although it might be calibrated in volts-per-centimetre. The other is an infinitely variable, uncalibrated control that allows for adjustment between the switch positions if needed or desired. Note that for calibrated operation, the uncalibrated control must be fully clockwise; usually there is a detent in that position. The calibrated control is usually set up in the familiar 1-2-5 scheme. For a typical scope, the lowest setting might be 0.1 volt, and the highest possibly 500 volts.

The timebase control is used to set the period of the sweep signal. It, like the attenuator control, usually consists of two parts — a calibrated rotary switch, and an infinitely variable uncalibrated control. The uncalibrated control allows for selection of a timebase between two switch positions. If calibrated operation is desired, the uncalibrated control must be turned fully clockwise until it snaps into a detent. The calibrated timebase control is usually also set up in the familiar 1-2-5 pattern.

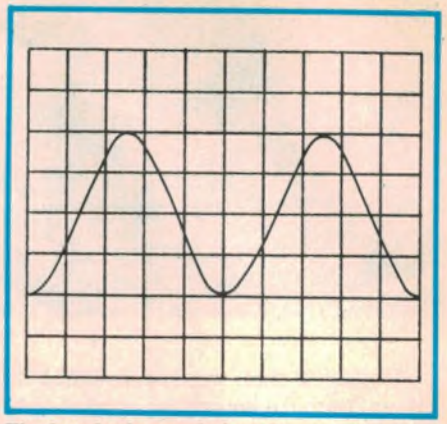


Fig.6: what's good for the square wave should work for the sinewave. As before, the frequency and peak-to-peak voltage can be accurately determined.

Analysing a Display

Let's now look at a display, and see how our two basic controls affect it. Fig.5 shows a squarewave. For our example, let's assume that the attenuator is set for 0.5-volt-per-division, and the timebase has been set for 0.2 millisecond-per-division. Both controls are set for calibrated operation.

In the figure, the distance between the leading edge of two adjacent pulses is four divisions. With that information, the period of the input waveform can be determined. It is quite simply $4 \times 0.2 = 0.8$ milliseconds. Once the period is known, it is a simple matter to convert to frequency using the formula.

$$f = 1/T = 1/0.0008 = 1250\text{Hz}.$$

If you needed to know pulse duration, it can be found in a similar manner by counting the number of divisions between the leading and the trailing edge of a single pulse. In our example, it is one division, so our pulse duration is simply 0.2 milliseconds.

The input voltage is found by simply counting the number of divisions between the positive and negative peaks of the input signal. Here, it is four divisions, and since our control is set for 0.5 volt-per-division, we have an input signal of 2 volts.

We now have a complete picture of our input waveform. It is a squarewave with a frequency of 1250Hz, a pulse duration of 0.2 millisecond, and a voltage of 2V P-P (peak-to-peak).

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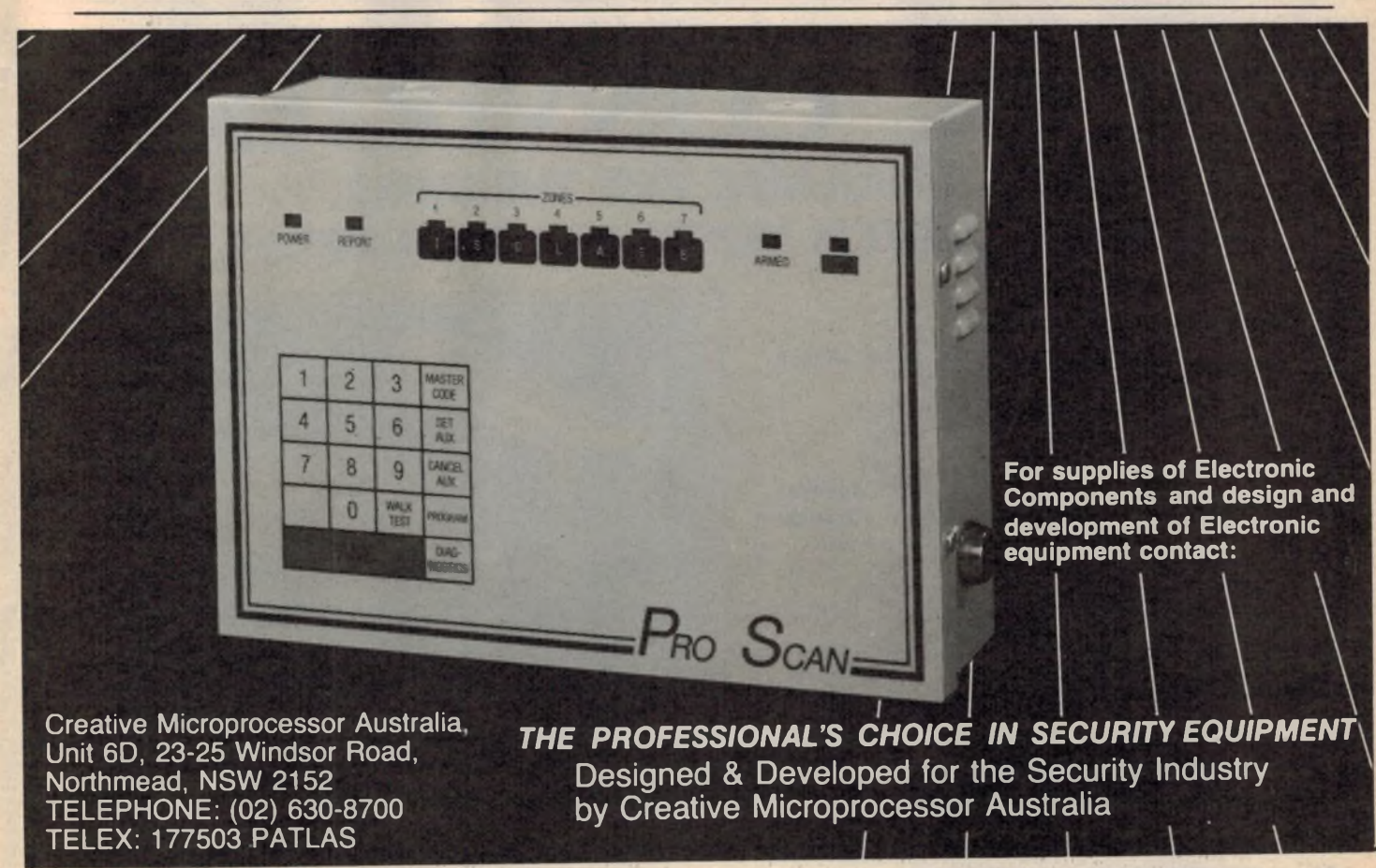

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Let's look at a second example. This time it is the sinewave shown in Fig.6. We will assume that this time the attenuator is set for 0.5-volt-per-division and the timebase for 50 microseconds.

As before, the peak-to-peak voltage can be found easily enough by counting the number of vertical divisions. In this case, it is four, so our peak-to-peak voltage is 2V ($4 \times .05 = 2$).

To find frequency, we first need to find the period of the waveform. That's done by measuring the divisions between two like points on two successive cycles. For instance, from the crest of one peak to the crest of the next. In our example, there are five divisions between one crest and the next, thus the period is $5 \times 50 = 250$ microseconds. The frequency is then found from $f = 1/T = 1/(250 \times 10^{-6}) = 4000\text{Hz} = 4\text{kHz}$.

Dual Trace Oscilloscopes

Thus far, we've talked only about single-beam scopes. In such a scope, only one input can be displayed at a time. But it is often useful, if not essential, to compare signals at different parts of a circuit — typically at the input and the output. You could, if you wish, examine the signal at the circuit input and then move the probes to the output to examine the signal there. There are some obvious drawbacks to that. The chief one is that, because neither trace remains on the screen once the input is removed, it is difficult to do useful comparisons. The way to overcome that, of course, is with a dual beam or a dual trace oscilloscope.

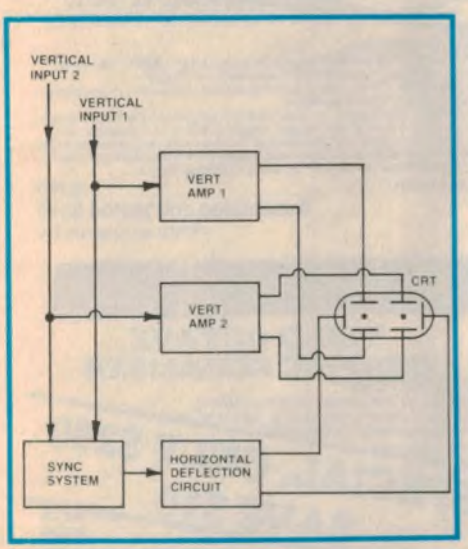

Fig.7: here is a block diagram of a dual-beam oscilloscope. Note that the box array shown in Fig.2 has been altered here because there are two electron guns generating electron beams to hit the oscilloscope screen. Both beams are synchronised in the horizontal sweep section; however, each beam can be independently vertically manipulated so that two time-related waveforms are displayed.

A simple block diagram of a dual-beam scope is shown in Fig.7. That scope uses a special CRT with two electron guns, two pairs of vertical deflection plates, and a single pair of horizontal deflection plates. Both electron beams are deflected from left to right simultaneously by the horizontal amplifier. As to vertical deflection, each beam responds only to the signal from the appropriate vertical amplifier and deflection plates. In essence, such scopes act as two independent scopes sharing a common display. Often, however, such dual-beam scopes are prohibitively expensive.

Because of that, dual-trace oscilloscopes are much more popular. Fig.8 shows a simple block diagram of a dual-trace scope. That scope is similar to our single-trace scope except that the circuit uses two vertical preamplifiers. In addition, there is an electronic "switch" that is used to connect either of the preamplifiers to the main amplifier. The switch is controlled by the sync circuits, or by an internal oscillator, and operates in one of two modes: alternate or chopped.

In the alternate mode, the switch is changed from one preamplifier to the other (and hence from one input to the other) after each horizontal sweep. Thus, on the first sweep, input 1 is displayed; on the second sweep, input 2 is displayed; on the third sweep, the first input is displayed, and so on.

The alternate mode works well for sufficiently fast sweep rates. At those speeds, the first trace will not have time to fade during the interval that the second one is being displayed.

At slower speeds, however, a flicker problem may result. In those cases, the chopped mode is used. In the chopped mode, the switch is no longer changed after successive sweeps. Instead, its operation is controlled by an internal oscillator. The oscillator operates at a frequency of from 50 to 200kHz.

In the chopping mode, both channels are alternated at a rate equal to the oscillator frequency. In operation, the input 1 signal is applied to the deflection plates for a very short interval, and then the input 2 signal. At the frequencies involved, as long as the chopping rate is greater than the frequency of the input signals, it will appear as if two continuous traces are being displayed.

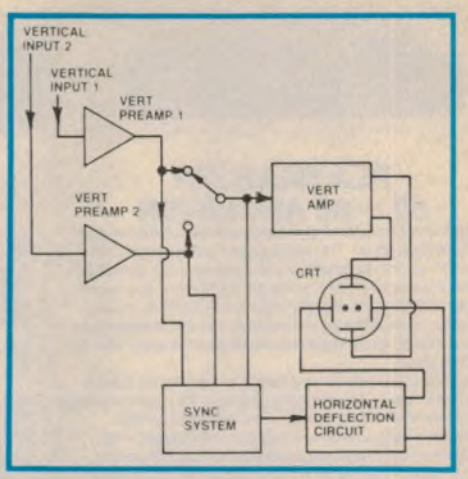

Fig.8: this block diagram of a dual-trace oscilloscope shows two trace dots inside the boxed area of a conventional CRT. What happens here is that one input is displayed first, then the other, and so on. In practice, the switch shown is an electronic type hidden inside the oscilloscope.

Next time

Take a look at any modern oscilloscope and you'll notice that there's a lot more there than the attenuator and timebase controls. What those controls are, what they do, and how they are used are just some of the topics we'll cover in part 2. EA

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Frequency Response: Phono Inputs - RIAA/IEC equalisation within + – 0.5dB from 40Hz to 20kHz and within 1dB from 20Hz to 40Hz. High Level Inputs – 0.5 dB at 20Hz and – 1dB at 20kHz.

Channel Separation: (Measured at 60W) 10kHz 66dB; 1kHz 75dB; 100Hz 79dB; (undriven inputs loaded with 1k ohm)

Input Sensitivity: Phono inputs at 1kHz - 4.3mV; Overload capacity at 1kHz - 140 mV; High level inputs - 270mV

Hum and Noise: Phono (with respect 10mV at 1 kHz) - 89dB unweighted; High level inputs (with respect to 270mV input) 103dB unweighted with 20Hz to 20kHz bandwidth.

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Stability: Unconditional

(EA May, June, July '86)

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Frequency Response: – 3dB at 5.5kHz

Harmonic Distortion: Mono; 0.4% at 30% modulation
Stereo; ·1% at 30% modulation

Audio Output: 450mV RMS into 4.7 ohm load at 100% modulation

Stereo Separation: Typically 30dB

AGC Range: 40dB for a 6dB change in audio output

Signal to Noise Ratio: 70dB with respsect to full output for signal levels of 9 and 10 on bar graph display; better than 60dB with respect to full output for signal levels greater than 6

Usable Sensitivity: 350uV at – 6dB audio level

FM TUNER.....

Tuning Range: 87.9 to 107.9 MHz

Frequency Response: – 1dB at 20Hz, – 0.5dB at 15kHz

Harmonic Distortion: Mono; 0.15% (100Hz); 0.15% (1kHz); 0.2% (6kHz)
Stereo; 0.4% (100Hz); 0.4% (1kHz); 0.4% (6kHz)

Audio Output: 450mV RMS into 4.7 ohm load at 100% modulation

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(EA Dec. '85 Jan-Feb '86 85tu12)

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2.8Hz to 65kHz +0, – dB

Hum: – 100dB below full output

Input Sensitivity: Line 300mV 90dB S/N
Moving magnet 2mV 80dB S/N
CD input 2V 94dB S/N

Distortion: 0.01% maximum typical; 0.003% 20 - 20kHz

Stability: Unconditional

(EA Jan, Feb, Mar '86)

Cat. K85 ..... **$449**

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**

AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder. (81AO10) (EA Oct '81)

Cat. K81101 **$59.50**

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INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTR... SERIES 5000 POWER...

• 1% Metal F...

SPECIAL, ONLY $319

SAVE $40

...ed and developed by ...ING ELECTRONICS and is being supplied to other kit suppliers.

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 ..... **$359**

Assembled and tested $549

packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING ... "ROD IRVING ELECTR...

SPECIAL, ONLY $289

SAVE $30

...(We believe that dollar for ... a commercial unit available that sounds as ...

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 ..... **$319**

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(= 10...

20KHz BANDWIDTH DISTORTION...

sliders at 0, gain at ...

FREQU...

SPECIAL, ONLY $209

SAVE $10

...unit **$219**

$429

packing and postage $10

Rod Irving Electronics for kits!

HI FI SPEAKERS

A comprehensive range of matched appearance speakers, all with square silver grey frames and black cones - Ideal for building up low cost speaker systems that will look and sound superb.

1½" TWEETER

SPECIFICATIONS:
Sensitivity: 90dB
Freq. Response: 1.2 - 20 kHz
Impedance: 8 ohms
Power RMS: 10 watts
Magnet Weight: 2 oz

Cat. C10200 **$4.95**

2½" TWEETER

SPECIFICATIONS:
Sensitivity: 94dB
Freq. Response: 1.1 - 17 kHz
Impedance: 8 ohms
Power RMS: 10 watts
Magnet Weight: 2 oz

Cat. C10202 **$5.95**

4" MIDRANGE WITH SEALED BACK

SPECIFICATIONS:
Sensitivity: 96dB
Freq. Response: 650 - 15 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 3.6 oz

Cat. C10204 **$9.95**

4½" MIDRANGE WITH SEALED BACK

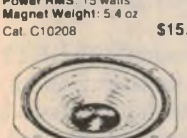
Clothed edge surrounds
SPECIFICATIONS:
Sensitivity: 97dB
Freq. Response: 600 - 8 kHz
Impedance: 8 ohms
Power RMS: 20 watts
Magnet Weight: 5.4 oz

Cat. C10206 **$12.95**

6½" WOOFER

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 96dB
Freq. Response: 55 - 7 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 5.4 oz

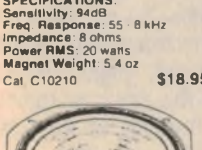
Cat. C10208 **$15.95**



8" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 94dB
Freq. Response: 55 - 8 kHz
Impedance: 8 ohms
Power RMS: 20 watts
Magnet Weight: 5.4 oz

Cat. C10210 **$18.95**



10" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 95dB
Freq. Response: 37 - 6 kHz
Impedance: 8 ohms
Power RMS: 25 watts
Magnet Weight: 10 oz

Cat. C10212 **$29.95**

12" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 92dB
Freq. Response: 32 - 4 kHz
Impedance: 8 ohms
Power RMS: 30 watts
Magnet Weight: 13.3oz

Cat. C10214 **$39.95**

12" HIGH POWER MUSICAL SPEAKER

- Aluminium die cast chassis
- Carbon fibre impregnated cone paper
- Foam edge
- Light grey cone, silver dust cap
- High temperature "NOMEX" voice coil

SPECIFICATIONS:
Sensitivity: 97dB
Frequency Response: 50-4kHZ
Impedance: 8 ohms
Power RMS: 60 watt
Magnet Weight: 30 oz

Cat. C10216 **$59.95**

PIEZO DIRECT RADIATING TWEETER

Requires no crossover, handles up to 100 watts.
Sensitivity: 98dB
Maximum Input: 24 volts
Freq. Response: 3.2 - 30kHz
Dimensions: 95mm diameter.

Cat. C12104 **$11.95**

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

PHILIPS SPEAKERS

Unfortunately we cannot always guarantee Philips speakers to be in stock due to availability problems" -Rod.

Cat. C12030 AD01610 T8 **$16.95**
Cat. C12040 AD02160 SQ8 **$34.95**
Cat. C12045 AD70620 M8 **$49.00**
Cat. C12050 AD12550 W8 **$95.00**
(or Philips equivalent supplied)

VIFA/AEM 2 WAY SPEAKER KIT!

This exciting new speaker kit, designed by David Tillbrook (a name synonymous with brilliant design and performance) uses VIFA's high performance drivers from Denmark. You will save around $800 when you hear what you get from this system when compared to something you buy off the shelf with similar characteristics. Call in personally and compare for yourself!

The system comprises:
2 x P21 Polycone 8" woofers
2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphrams
2 pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D25T SPEAKER SPECIFICATIONS
Nominal Impedance: 6 ohms
Frequency Range: 2 - 24kHz
Free Air Resonance: 1500Hz
Operating Power: 3.2 watts
Sensitivity (1W at 1m): 90dB
Nominal Power: 90 Watts
Voice Coil Diameter: 25mm
Air Gap Height: 2mm
Voice Coil Resistance: 4.7ohms
Moving Mass: 0.3 grams
Weight: 0.53kg

P21 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 26 - 4 000Hz
Free Air Resonance: 33Hz
Operating Power: 2.5 watts
Sensitivity (1W at 1m): 92dB
Nominal Power: 60 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.8ohms
Moving Mass: 20 grams
Thiele/Small Parameters: Qm: 2.4
Qe: 0.41
Qt: 0.35
Vas: 80.1

Weight: 1.65kg

Speaker Kit Cat.K90000 **$489**
Cabinet Kit Cat.K90000 **$179**
All Together Cat.K90000 **$589**
(Save 79!)

MIDRANGE HORNS

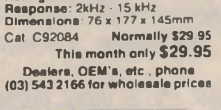
Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS, in a system they will handle over 100 watts RMS.
Two sizes to choose from:
Size: 4" x 10½"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm

Cat. C92082 **Normally $49.95**
This month only $49.95

Size: 3"x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm

Cat. C92084 **Normally $29.95**
This month only $29.95

Dealers, OEM's, etc., phone (03) 543 2166 for wholesale prices



DIGITAL ECHO CHAMBER

Features 2 microphone inputs with 1 volume control, 1 line input with 1 volume control, volume controls for delay time, repeat and echo. Outputs for footswitch, delay and mix.
- Delay time 180m seconds
- Inputs Mic 1 and 2 -46dB Line -20dB
- Output level 30MV (max).
- Frequency response 50 - 15kHz
- Signal/Noise ratio 40dB
- Power 9V battery or AC adaptor
- Power on LED
- Weight 950 grams
- Dimension 232 x 65 x 140mm

Cat. A12050 **$95**

VIFA/AEM 3 WAY SPEAKER KIT!

This superb 3 way speaker kit competes with systems that cost 2 - 3 times the cost of these units! (which may even be using VIFA drivers etc.) Never before has it been possible to get such exceptional value in kit speakers! Call in personally and compare for yourself!

The system comprises:
2 x D19 dome tweeters
2 x D75 dome midrange
2 x P25 woofers
2 x pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D19 DOME TWEETER SPEAKER SPECIFICATIONS
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20kHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts
(to 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2ohms
Moving Mass: 0.2 grams
Weight: 0.28kg

D75 DOME MIDRANGE SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 350 - 5,000Hz
Free Air Resonance: 300Hz
Sensitivity (1W at 1m): 91dB
Nominal Power: 80 Watts
(to 500Hz, 12dB/oct)
Voice Coil Diameter: 75mm
Voice Coil Resistance: 7.2ohms
Moving Mass (incl. air): 3.6 grams
Weight: 0.65kg

P25 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resonance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Music Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 44 grams
Thiele/Small Parameters: Qm: 3.15
Qe: 0.46
Qt: 0.40
Vas: 180.1

Weight: 1.95kg

Speaker Kit Cat.K90000 **$779**
Cabinet Kit Cat.K90000 **$309**
All Together Cat.K90000 **$989**
(Save a huge 110!)

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**

ELECTRONIC RHYTHM BOX

- 8 selectable rhythms, Trot, Rock Disco, Bossanova, Waltz, Slow Rock, Cha Cha, Rumba.
- Power 9V battery or AC adaptor
- Volume control
- Rhythm tempo control, 10 steps
- Power on LED
- Footswitch facilities
- Output level 150mV (max)
- Weight 750 grams
- Dimensions 190 x 52 x 132mm

Cat. A12048 **$79.95**

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

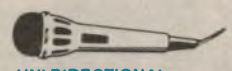
Cat. A10450 **$19.95**

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**



UNI DIRECTIONAL MICROPHONE DM323

Low impedance microphones that must be the best value for money in microphones! Features on/off switch and available in the following colours: White, Blue, Red, Yellow, black and Gold.
Impedance: 600 ohms
Frequency Response: 100 - 15kHz
Sensitivity: -76dB
Cord/Plug: 2.9 metre, 6.35mm phone plug
Dimensions: 50 x 200mm

Cat. A10133 **$13.95**

2 WAY MINI BOOKSHELF SPEAKERS

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

Cat. C10760 **$179**

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 6½" 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

Cat. C10762 **$299**

ELECTRONIC CASSETTE DEMAGNETISER

Cat. A10006 **$22.95**

TDK AUDIO TAPE BARGAINS

Description	Cat No.	1-9	10+
DC46 TDK	A11305	2.95	2.65
DC60 TDK	A11307	2.98	2.35
DC90 TDK	A11309	3.99	3.50
DC120 TDK	A11311	5.49	4.50
AD60 TDK	A11315	3.99	3.45
AD90 TDK	A11317	5.25	4.50
AD120 TDK	A11319	7.95	6.25
ADX60 TDK	A11320	4.95	4.25
ADX90 TDK	A11322	5.95	4.95
SA60 TDK	A11325	5.95	4.95
SA90 TDK	A11327	6.99	5.50
SAX60 TDK	A11329	6.69	5.77
SAX90 TDK	A11332	8.95	7.25
MAC60 TDK	A11335	8.29	7.25
MAC90 TDK	A11337	11.50	8.95
MAR60 TDK	A11340	13.50	10.95
MAR90 TDK	A11342	16.99	14.50

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**

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Electronics Australia reviews the . . .

Mitac Portable PC from Microbee

The Mitac is an imported IBM-compatible portable machine made in Taiwan. Does this mean that Microbee is shifting from a manufacturer to an importer? Have they made this shift to IBM compatability and will they no longer design machines in Australia? We asked these questions and a lot more when we sat down recently to review this fascinating machine from Microbee.

by LEO SIMPSON

As readers of this magazine will already be aware, Microbee Systems have recently been fully occupied with the release of their exciting new Gamma machine which offers very advanced features include fancy graphics. So while they have been really flat out with the Gamma, they have had few resources left over for the development of a new machine.

That's not surprising really, as few companies in the world would have the resources to develop more than one machine at a time. Accordingly, they decided to investigate the possibility of importing a machine. The result of their investigations is the Mitac portable reviewed here.

Taiwan has a number of large personal computer manufacturers of which the best known in Australia is Multitech. Less well known, but just as big, is Mitac, a company which has been specialising for a number of years in the manufacture of IBM-compatible machines. It currently has a manufacturing capacity of 10,000 computer systems a month.

In deciding to sell a portable PC with IBM-compatibility, Microbee Systems have recognised the inevitability of market forces. They still have a policy of maintaining compatibility with their previous models but they also can see where the market is heading.

And in going to Mitac as an overseas manufacturer, Microbee are recognising the excellent design and quality control practices that this company has developed over ten years of electronics manufacturing. There is also the possibility of Mitac manufacturing Microbee computers under licence, which will be an interesting development and a profitable exercise in generating overseas revenue.

The Mitac Portable PC is quite unlike any of the existing range of Microbee computers and is not really similar to any other machine on the market for that matter, portable or not. Up till now, most portables have been incorporated into a bulky box together with a monitor, such as the Osborne or Kaypro. The Mitac has no integral display and is a single compact unit with processor, keyboard and single disc drive in the one case. As well as being an unusual portable, it is also IBM PC-compatible.

There are various definitions of IBM-PC compatibility of course. At the highest level, an IBM clone is both software and hardware compatible, meaning that it not only operates with all software written for the IBM PC but also will operate with all hardware made for the PC, such as its numerous plug-in cards. The Mitac PC is claimed to be software-compatible only, as its physical configuration prevents it from accepting the standard plug-in cards. It satisfies the hardware criterion with its expansion box, discussed later.

Measurements of the unit are 337mm wide, 74mm high and 412mm deep. At 5.1kg the Mitac is not overly light but it has a sturdy handle which folds out from underneath the keyboard to make carrying comfortable, at least for short distances.

The keyboard is a standard QWERTY arrangement with ten function keys arranged in the top row but without a separate numerical keypad. Instead, pressing the NUMerical LOCK key activates a group of 14 keys (to the right of centre) as a numerical keyboard for mathematical operations. To the right of the spacebar are four cursor control keys while keys for page up, page down, home and end are in the extreme right-hand column. Total number of keys is 81.

Both the Caps Lock and Num Lock keys are located together towards the top righthand side of the keyboard and both have inbuilt indicator LEDs. So while the keyboard arrangement is certainly not identical to the IBM PC, all the wanted facilities are provided.

The keys themselves are comfortably dished and have an "over-centre" click action which, while not as positive as that on the IBM, is better than the majority of IBM clones.

On the righthand side of the case is a single half-height 5.25in disc drive made by Matsushita. This reads double-sided, double-density 360K discs to the IBM standard. The drive has a LED indicator to show when disc operations are occurring but since this is not normally visible to the user, the Mitac has an additional LED adjacent to the power indicator on top of the case, near the front. This is good thinking although it would have been better if the drive LED had been red rather than the anaemic orange one used. It's a bit hard to see.

At the back of the case is a standard IEC three-pin mains connector, the on/off switch, D connectors for RGB monitor, Centronics printer interface, two RS-232C ports and an additional disc drive. As well, there is an RCA socket for a composite video output signal and a 16-pin socket for a games or mouse port. Finally, on the side opposite the disc drive, is a clip-off cover which hides a large D connector for an expansion port.

Access inside the case is gained by removing nine small screws from underneath. This allows the top of the case to be removed. The top holds the keyboard PC board which is tethered to the main board by a ribbon cable (which can be detached if necessary). Immediately visible in the case is the disc drive and the compact switchmode mains power supply.

Below these units is the main board which occupies most of the area of the case. Our review sample was supplied with 256K of RAM (random access memory) but was socketed for an extra 256K. An extended memory version of the machine, fitted with 512K of RAM, is socketed for a further 256K of RAM although current versions of MS.DOS can only access the standard limit of 640K.

However, we understand that it may be possible to use the presently unusable 128K (678 – 640 = 120K) of RAM as a RAM disc (which can function like a very fast disc drive and thereby speed up programs which access the disc drive frequently).

Standard equipment with the Mitac is the graphics/colour adapter board which mounts in the righthand side of the case. It gives graphics performance to the IBM PC standard.

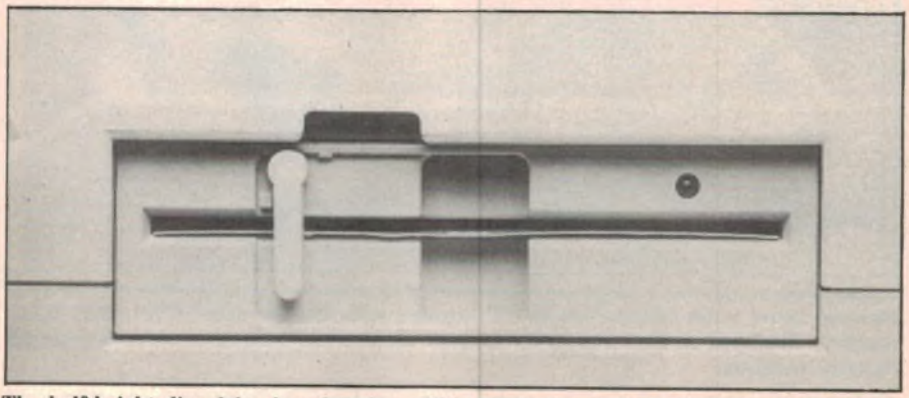
The processor used is the 80C88, the

Pictured above is the Mitac Portable PC together with the Microbee 7030H RGB colour monitor. Displayed on the screen is a Wordstar file overlaid with three windows from the Sidekick program.

MITAC PORTABLE PC SPECIFICATIONS

Processor:	80C88 running at 4.77MHz.
RAM:	256K bytes, expandable on board to 640K.
ROM:	16K bytes, expandable on board to 64K.
ROM BIOS:	Licensed BIOS from Phoenix Software Assocs.
Operating Systems:	MS-DOS Version 3.1, licensed from Microsoft Corporation.
Disk storage:	One 360K byte 5.25-inch floppy disc drive inbuilt. Second 360K drive optional, 20M hard disc drive may be added via optional external expansion box.
Keyboard:	81-keys, non detachable.
Display:	Inbuilt colour graphics adaptor (CGA) with outputs for composite (mono) and RGB colour monitors.
1/0 ports:	One Centronics-type parallel printer port Two RS-232C serial communications ports. Game port.
Power supply:	40 watts, internal.
Other facilities:	Real time clock/calendar inbuilt.
Dimensions:	412 x 337 x 74mm (L x W x H).
Gross mass:	5.1kg.
Operating Envir:	5-40°C; 5-95% relative humidity.
Expansion Options:	Second 360K floppy disc drive plugs in directly. Expansion box connects separately, provides additional power supply plus three standard expansion slots, room for two half-height disc or tape drives.

The Mitac has a total of 81 keys which include 10 function keys along the top and cursor control keys at bottom.



The half-height disc drive is quiet. An additional drive activity LED is placed on top of the case.

Microsoft MS.DOS is supplied with the Mitac.

Mitac

CMOS version of the 8088 and it runs at the standard speed of 4.77MHz. In practice this means that all software runs at the same speed as it would on the IBM PC.

Supplied with the review sample machine was the Microbee 7030H RGB colour monitor. This is quite effective in operation but its performance is not up to the standard of a high resolution green screen monitor. An interesting feature is the ability to turn the colour display into either a green or amber display. This is certainly easier on the eyes for the display of text although the amber is really closer to red than orange.

Our sample monitor also had a rather penetrating 15,750Hz whistle which is hard to tolerate if you are keen-eared. (Contrary to what some readers may think, most RGB monitors operate at the US NTSC sweep frequency of 15,750Hz rather than the Australian TV standard frequency of 15,625Hz).

The audible whistle is perhaps another reason to prefer the IBM-standard high-resolution green monitor which runs at a horizontal sweep speed of 18.4kHz which is much more subdued, for most ears. At present though, Microbee have no plans to make available a monochrome adaptor board although the expansion box will take an extended graphics card which would provide a high resolution monochrome display.

On the other hand, the Mitac does not have the IBM's noisy cooling fan and its single disc drive is also quieter than those on the IBM machine.

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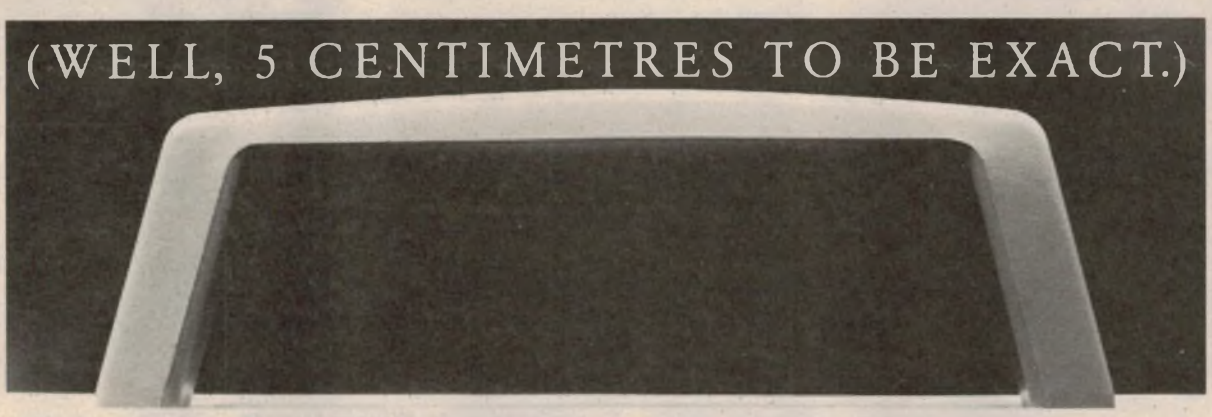

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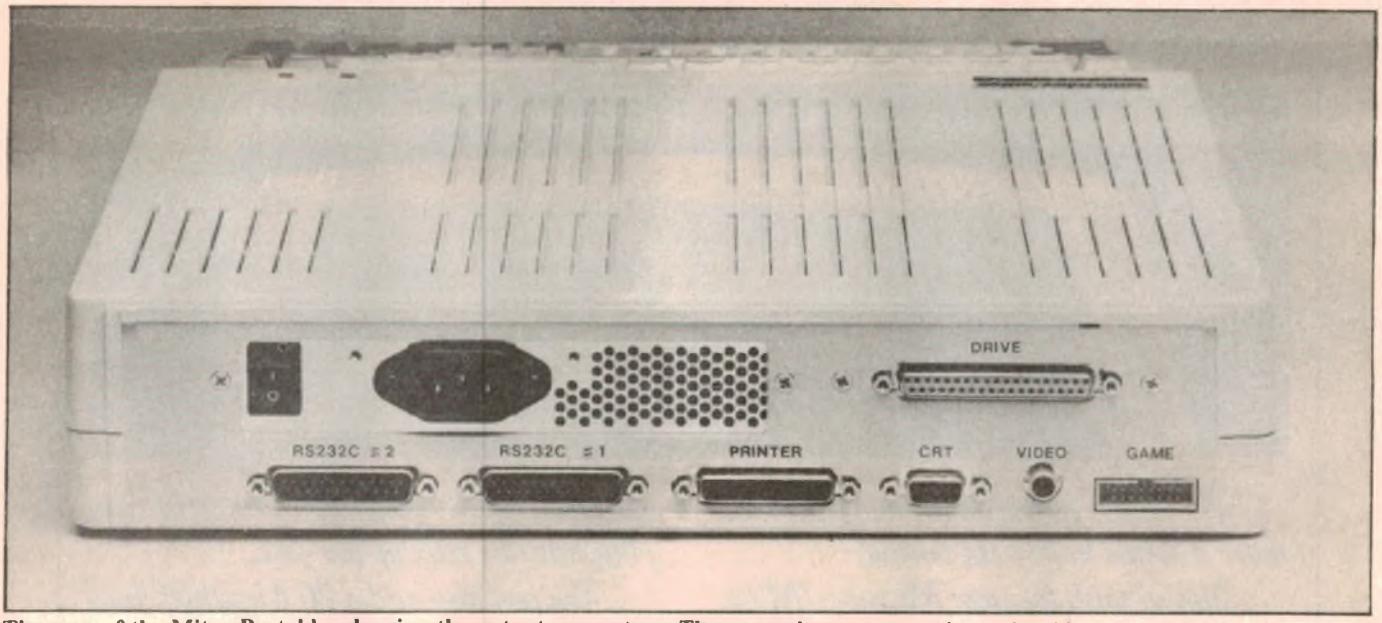
Mitac Portable PC from Microbee



The rear of the Mitac Portable, showing the output connectors. The expansion connector is on the side opposite the disc drive.

Setting up the Mitac portable presented no problems and you can get down to work very quickly. As with the IBM, Mitac goes through a memory check procedure every time you turn it on, before it boots the disc. However, it also goes through the memory check procedure when you do a "warm boot", ie, by pressing Ctrl, Alt and Del keys. This is a little disconcereting but not really a problem. It's probably a characteristic of the Phoenix BIOS firmware used by the Mitac.

I ran a variety of IBM software and found no problems which could be sheeted home to basic incompatibility of the Mitac. However, there is one problem which may arise if the Mitac is intended to be used in conjunction with an existing IBM PC or clone which is fitted with two disc drives or a hard disc. In this situation you come right up against the drawback of a single-disc machine. And the situation is worse if the IBM machine in question is fitted with the Qubie 6PakPlus board which includes real time clock, extra RAM for configuration as a RAM disc and so on.

To consider a particular example, I work with a Wordstar boot disc which includes an Autoexec.bat file to load the Qclock routine (and thereby label all my files with the date and time of creation) plus the very handy Sidekick. This boot disc also reads the file directory of my work disc which normally sits in drive B. If you put this boot disc in the Mitac, you get an error message when it tries to read drive B (which isn't there, of course).

So if you want to work in Wordstar with the Mitac, you need a boot disc which is not write-protected, so you can save your work.

And while the Mitac worked OK with Sidekick, it would not show the correct time or date and consequently the calendar was wrong. Nor were files created under PC.DOS labelled correctly with date and time. However, the time/date facility was correct when the supplied MS.DOS disc was used because it then calls up the Mitac's own real-time clock.

These problems are all surmountable if you spend some time with the MS.DOS manual and then customise your discs but they do highlight the difficulties in using discs which have been set up for a machine with two disc drives. We guess that many buyers will go for the optional external disc drive which is an easy way of getting around these problems.

So if you intend buying the Mitac as your first IBM-compatible machine, you will have few problems. It would appear to be as compatible as any clone machine can be. I ran quite a bit of software on it without any problems (although there is now quite a bit of software which requires more memory than the 256K RAM complement of our review sample).

Microbee Systems have also run it with a whole raft of programs without any real problems.

However, if you are purchasing the basic Mitac as "the machine you use when you're not using your PC", life will not be as simple as it might first appear to be. This is because of the basic incompatibilities of discs set up for machines with hard discs, or two floppies instead of one. And your Mitac will need the same RAM size as your existing PC if you're using large memory-gobbling programs.

With those quibbles aside, the Mitac Portable PC must be rated as one of the best value IBM-compatibles around. The fact that it is a portable too, is a bonus. We tip that many buyers will purchase it as their first IBM-compatible because they know it is backed by a computer company (Microbee) with a proven track record of customer service.

At $1495 for the 256K version, the Mitac is good buying. The 512K version sells for $1595 and the 640K version for $1695. The external 5.25in disc drive is $699. The expansion box with three slots for standard IBM PC board is $395 while a 20 megabyte hard disc with controller is $1350 (you also need the expansion box for this option). A mouse accessory is $149 and a fancy nylon carry bag is $59.50.

Finally, Microbee have two RGB monitors to suit the Mitac. The 7030H is $699 while there is a Thomson ESE (with somewhat less resolution) at $499.

For further information, contact Microbee Systems Ltd, Unit 2, Eden Park Estate, 31 Waterloo Rd, North Ryde, NSW 2113.

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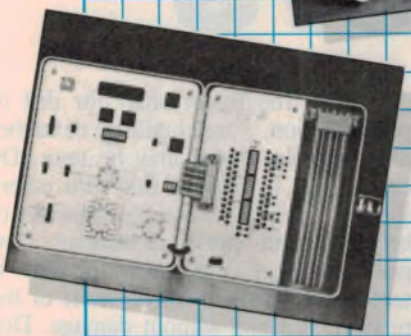

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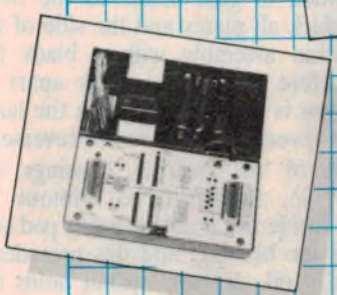

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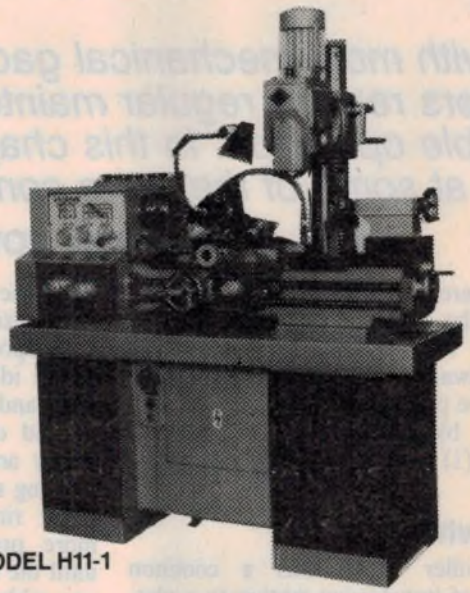

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A practical approach to Electronics PART 10

How to service record players

As with most mechanical gadgets, record players require regular maintenance to ensure reliable operation. In this chapter, we take a look at some of the more common problems.

by KINGSLEY HOWE

As there is a large variety of models in use, the most convenient approach is to start with the low cost types and work upwards to the more complex and expensive players.

Three basic types of drive are employed: (1) idler wheel; (2) belt; and (3) direct.

Idler wheel

The idler wheel was a common method of transferring motion to a platter from the motor, before belt drive became popular. It consists of a diecast hub with a rubber tyre moulded to its perimeter. The tyre is held firmly to the hub, and is not removable.

The wheel will be seen near the motor drive spindle. Most of them are mounted on a spring-loaded pivoting arm, which swings into place when the play mode is selected. Pressure is applied to the idler rim by the motor spindle, so that it wedges tightly against the drum beneath the platter.

The motor shaft is stepped with different diameters, to enable a selection of speeds to be obtained. The speed selector control lifts or lowers the idler wheel via a mechanical linkage, thus engaging the appropriate position on the shaft.

Slow speeds will be encountered when the idler wheel rim becomes glazed after years of use. The wheel may be replaced or, if it is in good condition, dressed with rough emery cloth to restore the grip. The tyre should be soft and flexible, without radial cracks or worn spots on the rim.

The idler may be removed from the deck and dressed by hand, or it can be treated on the deck. Simply start the motor and push the wheel against the rotating shaft. Apply emery cloth to the outer rim, using light pressure. Use more pressure as the grip increases, until the surface is roughened. Clean off any rubber dust and small particles with solvent or methylated spirits.

Wheels with heavily worn areas, or indentations, are not suitable for reconditioning, as these will cause vibration and rough running.

The idler wheel should spin freely on its shaft. If it is found to be stiff or tight, remove it from the shaft, and clean off the old oil residue with solvent. The inside of the bearing in the idler can be cleaned out using a cotton bud and mineral turpentine.

Lubricate the shaft, then re-assemble. Make sure that any oil on the tyre is removed with solvent, then check the wheel for end play. If the wheel is found to rock or tilt, a thin washer may be inserted to correct this. Some tilt is permissable to enable free running, however too much tilt will not allow the rim to maintain correct position on the motor shaft.

One indication of this fault is sudden changes in speed — for example, jumping from 45rpm to 33rpm.

Examine the motor shaft for dirt or contamination. Some build up of rubber from the idler wheel may be seen. Do not attempt to remove this with emery cloth, as this will reduce the diameter of the shaft and cause permanent slow speed running. The safest cleaner is steel wool. This will lift off most of the stubborn material without damage. Dirt in the corners may be cleaned out by the use of a sharp knife whilst the motor is turning.

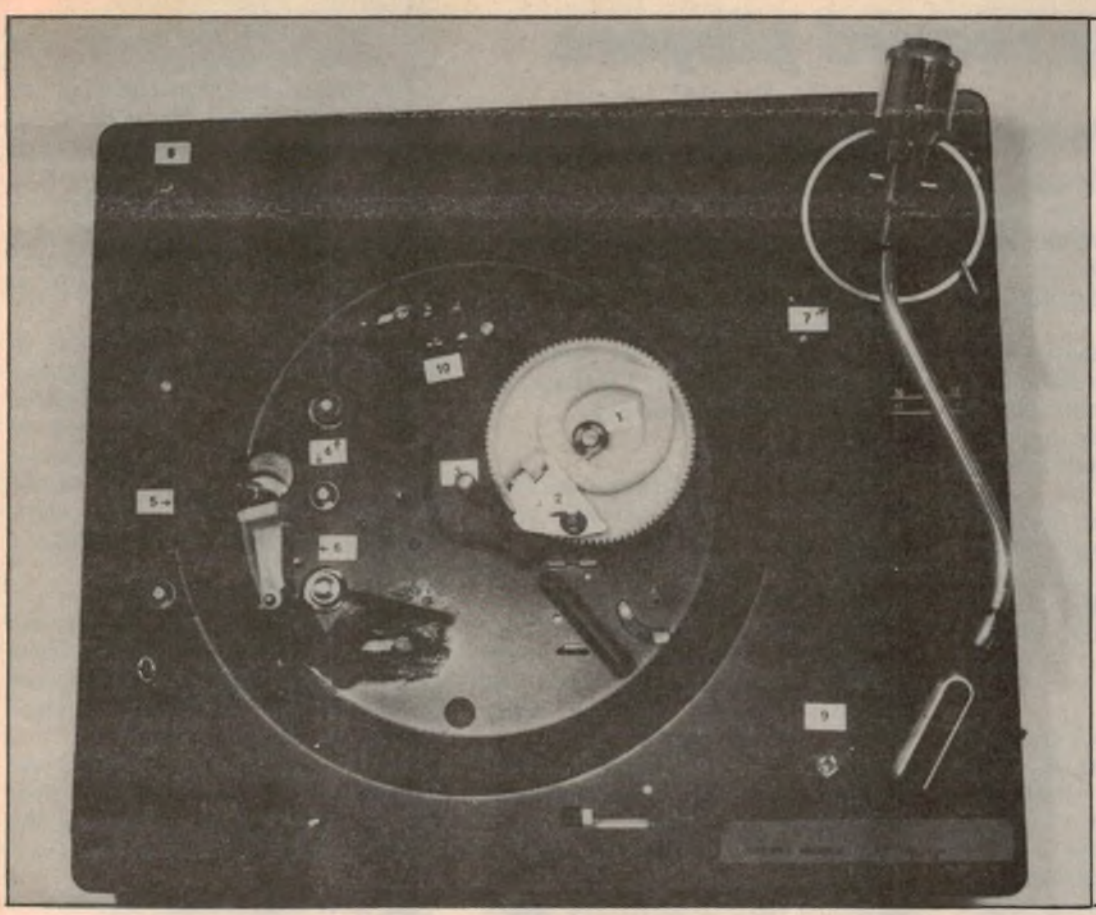
Bearings

When the motor employed is mains-powered, the bearings will require lubrication to prevent seizure. On most decks, the motor must be removed and dismantled to gain access to the bearings. Mark all plates and the side of the lamination assembly with a black felt pen, before taking the motor apart. If the motor is re-assembled with the laminations inverted, it will run in reverse.

Most of the bearing housings are closed; ie, manufactured without oil holes. Inside the housing, a felt pad surrounds the bearing, and this provides a supply of oil. A wave washer holds the bearing and felt washer in position. The felt may be oiled by filling the bearing hole after removal of the shaft.

With the upper bearing, a different approach is required. The stepped section may prevent removal of the bearing, so the only way that it can be lubricated is by running oil around the shaft and allowing it to soak in. This may have to last for some years before another service is performed, so make certain that the felt is saturated. Don't overdo it, though. Too much oil is as bad as none.

When remounting the motor in the deck, examine the rubber damping bushes. These should be in good condi-



Record player upper deck; 1 — main gear wheel (note cam outline); 2 — plates; 3 — platter spindle; 4 — motor mounts; 5 — motor pulley; 6 — belt lifter (speed change); 7 — [illegible]nged lifter; 8 — re[illegible]ransport screw; 9 — [illegible]nt transport scre[illegible]w; 10 — left and right channel output sockets.

tion. Perished or stretched bushes will cause several fault conditions. Perished bushes allow the motor to sag. The idler wheel is then unable to engage the correct position on the shaft when the platter speed is selected.

Stretched bushes exhibit an oversized or elongated hole. This allows the motor to move back too far when under load. The idler wheel will then be drawn in so far, that it causes the motor to stall. This may result in the windings overheating, or the motor burning out.

Small standard grommets may be used if the original type is not to hand. Grommets that are too large may be reduced in size to fit by cutting a V-shaped piece from one side, with sidecutters or a sharp knife.

Extra washers may then be needed to raise or lower the motor to the correct height. Some idler wheels are adjustable in height setting, by means of a slotted screw. Other models may require the repositioning of an extension piece (usually brass), mounted on the motor shaft.

The extension piece is held in position by a small screw which is usually coated with paint or lacquer to prevent loosening. The screw should be heated with a soldering iron until the coating becomes soft before any attempt is made to remove it. This will avoid damage to the screw slot.

A general indicator of incorrect idler wheel height is a large amount of rubber dust on the deck directly below the idler. Most of this will be from beneath the idler, where a deep groove is worn near the rim. The unit may still function in spite of this, after a good cleanup. Uneven running on test suggests that the groove is collapsing under pressure, allowing the rim to fold in. Some of the English wheels are difficult to obtain but certain types are interchangeable with those of Japanese manufacture.

Belt drive

Most of the problems encountered with this type of drive are related to the belt itself. A stretched or slipping belt will either drop off or not allow the automatic return to operate correctly.

Sometimes the loose belt will run off when the speed is changed.

Most platters are easily removed from the spindle, by inserting a thumb and finger through the lifting holes in the platter, and giving a slight tug. However, a few tight ones are encountered and these may prove to be quite stubborn.

Removing a tight platter

Try lifting the platter in the usual way, then tap the spindle with a block of wood. A sharp rap is often enough to release the grip. Do not use a hammer or other metal tool for this purpose as the spindle may be burred or bent off vertical. In the latter case the platter will exhibit a tilt, and scrape when running. This is difficult to correct, mainly because the spindle bearing is damaged or the bearing mount may have shifted.

Several light raps are preferable to brute force. Usually, a really stubborn platter has cold-welded itself to the spindle, so before re-fitting it, coat the spindle with grease or petroleum jelly. This will make future removal easier.

Fitting a new belt

The replacement belt should be of the same width and thickness as the original, especially where a mechanical speed changer is involved. In the latter case, the motor is fitted with a stepped motor shaft extension, so correct positioning of the belt is essential. A belt of narrower width may not be lowered or lifted enough to make the correct speed change. In some cases, a narrow belt will stay on the one speed, regardless of the selector setting. In others, it will

Servicing record players

change for one or two turns, then jump back.

An overwidth belt on the other hand will tend to roll onto its side between the changeover guide fingers, and a scraping noise will be heard coming from under the deck, accompanied by slow running.

Fitting belts that are undersize places excessive pressure on the motor bearings. The deck will run normally, but the motor life will be greatly shortened.

If a new belt of the correct size keeps throwing off, remove it and clean it with solvent or belt cleaner. The motor pulley must also be cleaned and an examination of the platter drum carried out. Look for the mark left by the belt. If it is too low, try raising the motor pulley.

Lifting the pulley

In extreme cases, the belt may actually run partly off the drum. The player can run for weeks without trouble, then suddenly throw the belt for no apparent reason. The only cure for this is to raise the motor pulley. (Some plastic platter drums develop a taper near the bottom, and the belt tends to run downwards).

Where the pulley is found to be glued to the motor shaft, apply a hot iron to the top of the pulley to melt the adhesive. Use a little pressure on the iron to detect movement of the pulley when the adhesive softens. Insert a screwdriver blade beneath the pulley and lift carefully whilst hot. Support the pulley with the blade until cool. Lubricate the motor bearing before running.

Motor mounts

If a new belt of the correct size keeps throwing off, suspect defective motor mounts. These will allow the motor to tilt, and the belt then works its way to the end of the pulley and slips off.

Some motors are suspended from a rubber strap. This strap is fixed at two or three points to the deck plate, and the motor actually hangs in mid-air without further support. These are prone to toss belts continually, whether the belt is old or new or the suspension rubber has been replaced. The motor on these decks is usually mains operated, and accelerates to full speed before the platter starts to move. The sudden kick when starting tilts the motor pulley, and the belt jumps off.

The trouble has been traced to too much grip by the belt. The cure for this strangely enough is to apply a light coating of talcum powder to the belt so that it initially slips. This allows the motor to run up to full speed, then gradually increase the speed of the platter. Normal running is not affected by this treatment.

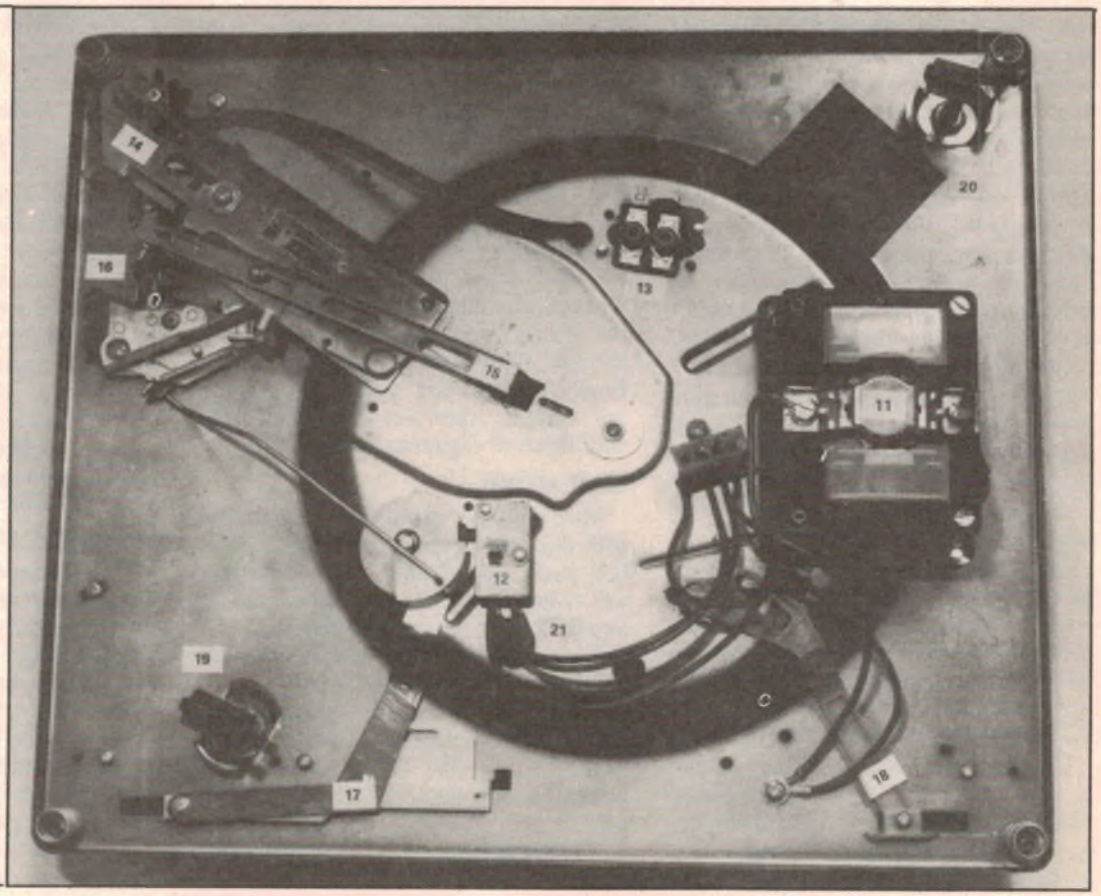
As a test, allow the deck to run, so that the belt will settle and straighten. Now stop the deck and view the motor pulley through the inspection slots in the top of the platter. A slight movement of the platter to and fro should turn the pulley firmly, and a quick movement should show some slippage.

DC motor drives (belt)

Most popular record players are driven by brushless DC motors. These may be of the same type as those used in cassette decks, or specially manufactured short motors (low profile).

Speed change on these models is accomplished by electronic means, rather than the older method of moving the belt from one pulley diameter to another.

The speed control usually consists of a



Record player lower deck: 11 — motor bearing housing; 12 — microswitch for motor; 13 — left and right channel output sockets; 14 — tonearm return linkage; 15 — tonearm trip linkage; 16 — tonearm swivel (base) plate; 17 — front transport screw and clip; 20 — rear transport screw and clip.

two position switch (33 and 45rpm). This is connected to a small circuit board which is attached to the motor by flying leads. Two trimpots are fitted to the board to allow independent adjustment of each speed. These trimpots are factory preset and do not normally require any adjustment.

Some players also feature a 'Pitch' control which consists of a small potentiometer attached to the deck. The user is thus able to accurately adjust the speed while referring to a strobe disc on the platter mat or, on some platters, to silvered strobe bars moulded to the outer rim.

Speed Problems

Slow running of the platter may be due to slippage of the belt or a fault in the motor control.

Erratic speeds may occur when the speed change switch contacts become dirty or corroded. If the belt is tight, and not slipping, isolate the fault by shorting the two leads from the speed change switch. If the platter now maintains a steady rpm, then the switch must be replaced. Otherwise, the motor or speed control board is at fault.

Some motors may be replaced with standard cassette types. Note, however, that only mechanical regulator types are suitable for this purpose. Electronic models with inbuilt regulators will run at too high a speed (2400rpm).

Replacing the switch may affect the running speeds. In this case, slight adjustments to the trimpots will be required. Some decks are even provided with access holes through the platter and deck. They are usually marked '33' and '45', with arrows indicating '+' and '–' directions.

AC motor problems

Apart from the lack of lubrication, few troubles arise with these. In small portable players, the amplifier is often powered from an overwinding on the motor. A burnt-out winding will then result in no motor movement or amplifier power.

As most of these are specially made, the only recourse is to fit a standard motor and separate transformer.

Larger mains motors sometimes jam when the end plates become loose, throwing the bearings out of alignment. This may be caused by screws or nuts shifting with vibration, or end plates not being correctly seated when re-assembling.

Another possibility is a break in the windings. The motor may otherwise appear to be in sound condition. Test the windings with a multimeter. A reading of 500Ω or thereabouts should be found.

Worn bearings may produce vibration or rattling noises. As some types are no longer manufactured, the only method of salvage is to squeeze the bearing slightly from the side, or to burr the edge slightly to remove the slack. In either case, only small tolerances are involved, so be careful. It is always a wise move to keep old motors of this type for spare parts. Often, several motors may be rebuilt from salvaged units.

Motor keeps running

On some decks, notably Japanese 240V models, motor power is supplied via a microswitch. In normal operation, the switch opens when the tone arm returns to the rest position, and closes at the start of play. After several years of use, the motor may begin to run continually. Check the microswitch with an ohmmeter, then head for the suppression capacitor. This may be found some distance from the switch, and may be hidden by a thick plastic sleeve. It may be seen mounted on a tagstrip, with a few drops of adhesive to hold the sleeve in place.

A resistance test on this component will often reveal an internal short, allowing power to be fed to the motor whether the switch is open or not. The majority of these motors draw less than ten watts, so the capacitor is unlikely to show any signs of distress such as warping or discolouration.

Any replacement capacitor should be of a higher voltage rating, as it is likely that line spikes have exceeded the insulation rating and caused punch-through. This can happen in areas where heavy load switching occurs, and line surges place extra stress on insulation.

Auto change decks

The majority of these decks are British made, eg, Garrard, and BSR (British Sound Recorders). Other European makes are also encountered, such as Dual etc.

Many millions of these decks are in use, giving good service. Provided regular maintenance is performed, a working life of twenty years or more can be expected. Operating problems are mainly confined to the mechanical section, and these will be dealt with in detail.

Lubrication

Lack of regular lubrication is a common fault and, in some cases, the whole

Servicing record players

deck may be frozen, with the mechanisms unable to be moved. Under no circumstances should the deck be forced to 'loosen it up'. Have a good look first.

If the bearings are tight and dry, and the linkages are covered with a dark brown coating, this is an indication that the lubricant has oxidised. When felt with the fingers, the greased areas will feel glassy and varnish-like.

As a first step, remove the platter and idler wheel. Turn the unit upside down, place it on several sheets of newspaper, and spray the linkages with a generous coat of CRC 5-56. Make sure that every part is covered. Now try to move some of the slide controls, such as the speed and size selectors, and the stop-start lever. Do not use excessive force!

Once these are freed up, remove as much old grease as possible. Use tissue paper and cotton buds. When the underside is cleaned, turn the unit over and work on the upper side. Use a cloth or tissue soaked in mineral turpentine to remove any old lubricant and accumulated dirt. Brush off any dirt or fluff from corners, especially around the base of the tone arm support.

When the deck is fully cleaned, remove the large gear wheel situated near the platter spindle. This gear is used to move the tone arm to and from the record.

The hub bearing of this gearwheel is normally greased. This eventually dries out, causing stalling of the platter when loading or unloading the tone arm. As the clearance is very fine, the bearing and post will have to be cleaned before lubricating with fresh grease.

Note that two small metal sliding plates are attached to this gear on a small metal pin. These should also be removed and cleaned. Make sure that these plates move freely, as failure to do so can cause some very serious problems. As a double check, tilt the gearwheel from side to side. This should make the plates move backwards and forwards. Note also that these two plates should move independently.

Before refitting the gear to the deck, apply grease to the cam groove underneath. When the gear is placed on its post, position it so that the cam groove is close to the cam follower, then push the cam follower under the gearwheel with a screwdriver blade. The gear will then sit in its proper location, and the 'C' washer can be fitted. The cam follower is fixed to a linkage which connects directly to the tone arm baseplate.

Correct operation of the linkages and associated components must be checked before the platter is fitted. To do this, rotate the gear slowly by hand in an anti-clockwise direction. If all is well, the tone arm should rise and fall, and move to and fro across the deck. The manual lift should be engaged during this procedure to prevent damage to the stylus or cartridge.

Note that the main gearwheel must settle with the small metal plates near the platter post. A gap in the teeth of the main gear at this point allows the platter gear to rotate without the two gears engaging.

There are two linkages attached to the tone arm. One moves the tone arm in or out; the second is used to push the small plates. Move the tone arm towards the centre of the deck. If the pusher linkage is working correctly, then the small plates will move.

Relubricate the linkages under the deck. All of these should move freely, provided they have not been damaged or bent through use of excessive force, or the main gearwheel has not been turned backwards.

Now replace the platter in its usual position. Before fitting the retaining washer, rotate the platter manually to check that the deck is working properly. Assuming everything is OK, replace the deck in the cabinet and give it a final wipe down with a clean cloth.

Try moving the record size and speed selector controls. These should slide fairly easily, and lock into position at the appropriate places. Load a record onto the platter to test the player and then make any final adjustments as needed.

Adjusting the tone arm

With automatic loading, the tone arm should be adjusted so that the stylus lands approximately 3mm in from the edge of the record. A small screw is located at the front of the tone arm post about half way between the tone arm and the deck plate. This will move the arm in or out to give the correct position.

When any alteration is made to the landing position, check that the arm will still trip the automatic return, when the run-off groove on the record is reached. These two adjustments are set independently, but some interaction does take place.

No automatic return

The type of mechanism involved here is common to both idler wheel-driven automatic and belt-driven single players.

To carry out the adjustment, firstly remove the platter. Look on top of the large gear near the centre spindle. There you will see two small plates. One of these has a tab bent at right angles, near the gap in the gear teeth. The other (lower) plate also carries a tab, which passes through a hole in the gear. The lower tab is pushed by the tone arm linkage, whilst the upper tab engages the lug on the platter gear.

These operate as follows: When the stylus travels into the runout groove, the linkage pushes the tab forward until the top tab contacts the platter gear lug. The lug then moves the tab forward as it turns, just enough to allow both sets of gear teeth to mesh. Once this happens, the main gear continues to turn, lifting the tone arm, and returning it across the deck.

When the main gear has completed one revolution, the gap arrives at its original position and the gears become disengaged.

If the above conditions are not met, then the trip will not function. To correct this, bend the upper tab outwards by several millimetres. If, however, the tab is bent too far, the trip will operate constantly.

Constant tripping

Many of the newer models have plastic deck gears, rather than metal types. The manufacturing tolerances for plastic components are not as fine as those for metal, and this gives rise to relatively large clearances, especially so with regard to holes. These are normally fairly sloppy.

This allows free movement of parts, but brings its own share of problems.

The main fault is confined to the plates on the large gear. Once the trip is operated and the gear executes a full turn, the two small plates should be returned to a 'park' position, where they are well clear of the gap. When these plates are loose, vibration from the deck can cause them to slide to the engage position.

Vaseline can be applied to the plates to prevent this movement. Indeed, some manufacturers use this method. However, the grease is either pushed aside after a short period or dries out.

Too much grease will cause a new set of problems, as the tone arm linkage is then unable to move the plates due to drag. The deck will then not shut off.

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Modify a Princess & live happily ever after

Convert your TV to a computer monitor

Colour monitors are expensive. This article shows how to convert a low-cost Princess colour TV receiver to accept both direct composite video and RGB inputs. The set can still function as an ordinary TV receiver after conversion.

by J. C. HOLLIDAY

One problem which confronts the purchaser of a personal computer is whether to buy a colour monitor or not. The answer to this dilemma is complicated and depends on many factors such as financial, personal preferences, and the use to which the computer will be put. I have faced this decision twice over the last couple of years, firstly when I bought an Apple computer and secondly when I upgraded and replaced the Apple with an IBM PC.

On both occasions, since the major use for my machine would be mathematical and word processing applications, I could not justify the purchase of a colour monitor. Yet there were times when I often wished I had colour capability, especially when a piece of recreational software came my way, or when I wished to evaluate some educational software designed for children and which used colour as a motivational device.

This article describes how I overcame the colour problem very economically by converting a well known colour TV receiver so that it could be used as a colour monitor both for sets which have a composite video output colour signal (such as the Apple), and those which have separate Red, Blue and Green outputs (such as the IBM) and hence require an RGB monitor. Of course another design requirement was that the set still had to function as an ordinary TV receiver.

The colour set I chose to modify was a Princess model 14CT6 which at the time of purchase cost about $345. The main criteria for choosing this set were:

(a) It uses a transformer in the power supply which isolates the chassis from the 240VAC supply and therefore makes the set safe to modify. It would seem that the manufacturers of this particular set have made it so that it is suitable for both the American NTSC system and our own PAL system. Evidence of this can be seen when looking closely at the functions of IC501 (see Fig.1).

At the right end of IC501 there is a PAL/NTSC switch and a PAL/NTSC matrix. The set is therefore designed to operate directly from a 120VAC supply and all that is necessary to adapt the set for Australian conditions is to change a few components and add that vital 240/120V transformer. When selecting a set to modify you MUST check that it uses a mains isolating transformer in its power supply.

(b) There is a suitable point in the video chain to insert a composite video signal. With sets now using complex ICs which carry out a multitude of functions internally, the video signal often remains forever buried within such an IC and never surfaces at a convenient point to suit our modification purposes. From this point of view, the point marked TP11 is ideal, coming as it does between the video detector (IC101) and the video amplifier (IC501).

A further stroke of good fortune is that the level of the signal at this point is 2.7V p-p which is about the level of output from the composite colour signal of a computer, and the polarity of the signal (negative sync pulses) is just right.

Composite video

I will describe first the addition of a composite signal input as it is the simplest task to tackle and some people may only be interested in this aspect. This composite colour input is also necessary for the RGB conversion which will be described later.

The colour video signal from the computer cannot merely be coupled to TP11

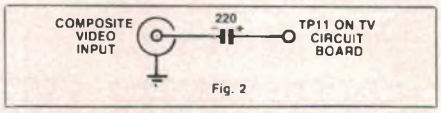


Fig. 2

by an isolating capacitor as shown in Fig.2. If this is done you will get a colour image on the screen but the horizontal stability will be affected by noise from the front end of the set which is now operating at full gain as there is no received TV signal to supply any AGC voltage. Nor can you just use a simple switch to switch off the front end noise because this upsets the vital DC levels which are necessary at the input of IC501.

To solve this dilemma a simple filter, introduced when the set is being used as a monitor, was used. This was done by removing R202 (330Ω) and attaching two leads from the resulting circuit board holes to a 2-way switch mounted on the right side of the receiver. This switch now selects between the repositioned R202 and the filter as shown in Fig.3. The filter components and R202 were fitted on a small section of veroboard mounted inside the receiver next to the switch.

You will also need to install an RCA socket for the video input, connecting it to TP11 as shown in Fig.2. (One thing about this TV set is that there is plenty

of space inside for these added components. Also as a practical suggestion, don't mount anything on the inside of the back cover as this then ties the back and front pieces together and makes further work on the set difficult.)

With the modifications made as

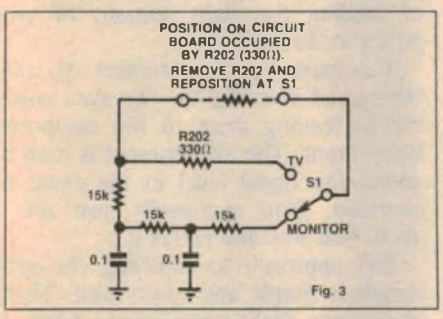


Fig. 3

shown in both Figs.2 and 3, your set will now work as both a TV receiver and a colour monitor using a composite video signal. The performance with output taken from an Apple computer was excellent. Graphics and 40-column mode text left nothing to be desired.

However, text in 80-column mode was not legible. This is really no problem with an Apple since if you are in 80-column mode you have no colour capability anyway so why use a colour monitor? Just switch back to your high resolution black and white monitor.

It was precisely this point which caused such a pleasant surprise when I subsequently further modified the set to accept the RGB output from an IBM computer. I was fully prepared to accept an illegible 80 column text output. But to my amazement there was the 80-column output on the screen, perfectly legible, although not as sharp as you get from an RGB colour monitor. But then, such devices can cost an extra $300.

The reason for the marked improvement in resolution lies in the fact that, in the RGB mode, the video signals are fed directly into the bases of the output transistors, whilst in composite mode the signals have to be processed by IC501 first, where they apparently are degraded sufficiently to make 80-column resolution impossible.

RGB modification

Fig.4 shows the additional circuitry necessary to add the RGB modification. There are 7 outputs from the 9 pin D connector on the IBM. These signals are:

Pins 1 and 2 ..... Ground
Pin 3 ..... Red output
Pin 4 ..... Green output
Pin 5 ..... Blue output
Pin 6 ..... Intensity signal
Pin 8 ..... Horizontal sync

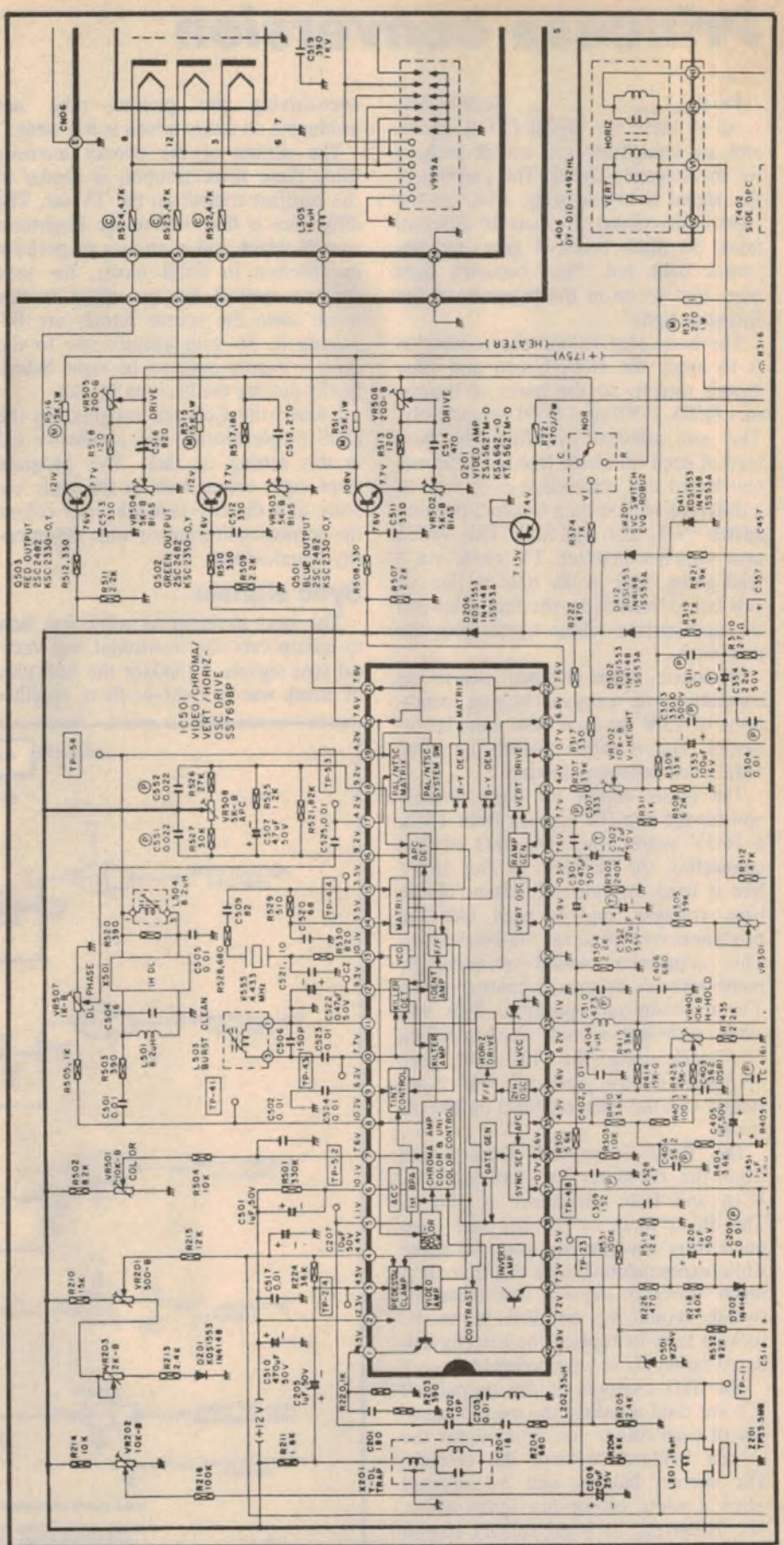


Fig.1: Video output and R, G, B driver stages for the Princess 14CT6 colour TV receiver.

Princess conversion

Pin 9 ..... Vertical sync

All of these are digital (TTL) signals and are straightforward except perhaps for the Intensity signal. The purpose of this signal is to add some white to the eight basic colours to create 16 different hues. So black becomes grey, red becomes light red, blue becomes light blue, and so on in the presence of the Intensity signal.

The basic idea behind the conversion is to apply the Red, Green and Blue signals directly to the bases of transistors Q503, Q502 and Q501 respectively. This was affected by lifting the base lead of each transistor free from the circuit board and connecting each base to a different section on a 6-pole 2-position switch (S2e, S2d and S2c). This switch now switches between TV mode via a lead going back to the hole in the circuit board vacated by the base lead and the appropriate colour signal from the computer.

Of course, when switched over to the computer, the original biasing conditions of 7.6V on each base must be restored. This is achieved with the three 1kΩ/2.2kΩ potential dividers.

The power supply for these dividers and for the two ICs is taken from TP16, a 16.5V supply line. The 1kΩ trimpot connecting the dividers to the 16.5V line is used for fine adjustment of the base voltages, and is used like the brightness control to set the black level. This adjustment would normally be made with the brightness control on the TV at about mid position. This will allow sufficient latitude in controlling brightness using the TV set's own brightness control once this unit is installed and the back replaced on the receiver.

The Red, Green and Blue signals from the computer are fed to IC1a, IC1b and IC1c which act as buffers. This IC is there to protect your computer from any mistakes you may make while experimenting with this unit. It is much easier to replace this cheap IC (which should be installed in an IC socket) than to replace the directly soldered buffer IC in your computer.

The 5kΩ trimpots at the outputs of IC1 are used to adjust the overall intensity of each colour and to allow for the correct balance between the colours. The correct balance will be attained when a white colour bar looks white. The balancing between colours should be carried out at a level which is not over-driving the picture tube nor producing an image which is too weak.

The setting of the overall intensity using these three trimpots is similar to the contrast control on the TV set. The difference is that, unlike the brightness control which still continues to perform its function in RGB mode, the set's contrast control has no effect in this mode since the colour signals are bypassing it. So your adjustments to the three trimpots have to be right before finally putting the back on the set.

I found the Colorbar program on the DOS supplementary disk a valuable aid in this setting up task. This program gives eight colour bars in the basic colours and directly beneath each colour the corresponding colour with the intensity signal added.

Sync signals

The next problem to solve was how to incorporate the horizontal and vertical sync signals. I thought the best plan of attack was to combine them together to form a "blank" composite signal — that is, a signal with no video information consisting only of the horizontal and vertical sync pulses — and feed this empty signal back to the composite input which was completed previously. This made the set do all the hard work of feeding the right amount of sync pulses at the right place.

IC2a performs the function of combining and inverting the two sync pulses before feeding them to the composite video input. The 5kΩ trimpot is used to adjust the signal level in the event of overload. You can really just set it about half way and forget it.

This approach to injecting the sync signals is simple and works well. There is just one slight complication which is easily overcome. The problem is this. The video information is fed directly to the output transistors, whilst the sync pulses have to be processed first by IC501. This causes the sync pulses to be delayed relative to the video information with the effect that the characters appear one or two positions too early on the screen. This may mean that the first character in each line cannot be

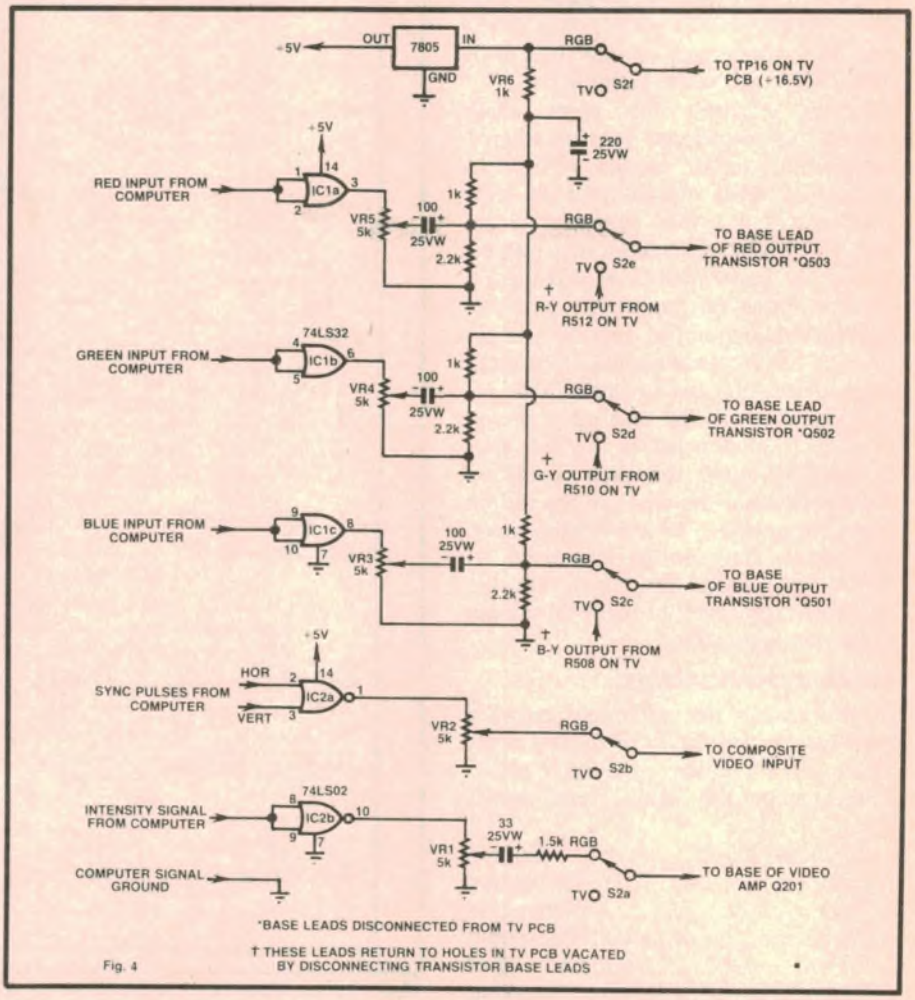


Fig. 4

seen.

The problem is easily overcome by using the MODE 80, R, T DOS command which will allow you to shift the display the required number of characters to the right.

That leaves just the Intensity signal to deal with. The problem is to combine the Intensity signal with the Red, Green and Blue signals. You can't merely use an OR gate to combine say the Red with Intensity because a basic Red signal ORed with an Intensity signal gives the same output whether the intensity signal is there or not. The manner in which I finally chose to combine the Intensity signal with the three colour signals is rather interesting.

When you examine closely the colour output stages, you see that the bases of the three output transistors Q503, Q502 and Q501 aren't really supplied with Red, Green and Blue signals from IC501. Rather, they receive only the partially decoded R-Y, G-Y and B-Y signals. A -Y signal is also decoded by IC501 and appears at pin 23. It is then mixed with horizontal and vertical blanking signals at the base of Q201. The composite signal containing the -Y information appears at the emitter of Q201 where it is then applied to the emitters of the three colour output transistors.

Taking into account the phase reversal at the collector of a signal applied to the base of a transistor and the non phase reversal of a signal applied to the emitter, the net effect is that -R, -G and -B signals appear at the collectors of the corresponding output transistors. These colour signals are then applied to the cathodes of their respective colour guns.

The Intensity signal (I) that we wish to mix with our RGB signals is analogous to the Y signal generated in the TV receiver. All we have to do is apply -I to the base of Q201 and, through the chain of events outlined in the last paragraph, -(R+I) will appear at the collector of Q503, -(G+I) at the collector of Q502 and -(B+1) at the collector of Q501, which is exactly the desired result.

IC2b performs the function of inverting the Intensity signal from the computer and the 5kΩ trimpot allows for adjustment of the level which is applied to the base of Q201. The adjustment of this trimpot is best performed with the Colorbar program running. Adjustment is left to the subjective judgment of the constructor. Apply as much Intensity signal as you desire to obtain contrast between a colour and its lighter version without visible overload occurring on the screen.

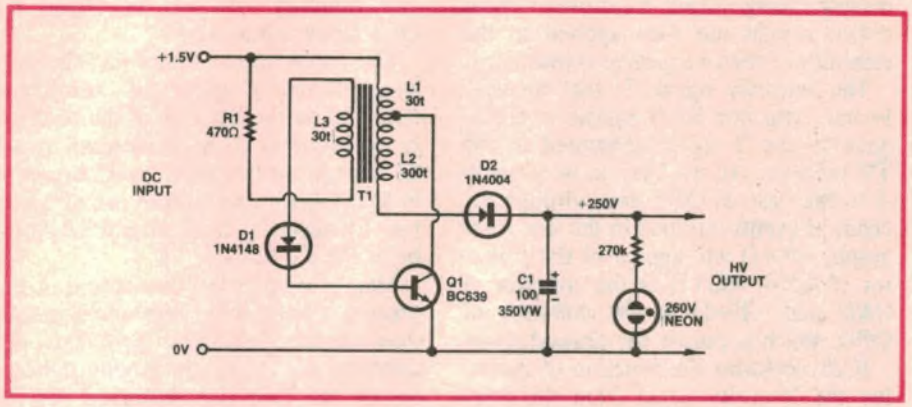
Note that the adjustment must be carried out in conjunction with adjusting the three trimpots controlling the Red, Green and Blue signals as described earlier. It may take judicious adjustment of Brightness, Red, Green, Blue and Intensity trimpots to obtain the Dark Grey colour bar.

The circuit just outlined was also constructed on a piece of veroboard, mounted on the left side of the receiver. In operation as an RGB monitor, switch S2 must be in the RGB position and S1 in MONITOR mode, and to use as a normal TV receiver, both S1 and S2 should be in the TV mode.

That completes the description of this project. I hope that some of the discussion of the principles, problems and solutions will help you modify either a set of the type just described, or another variety, but please make sure the set is safe to work on by checking that it is isolated from mains potential by employing an isolating transformer in the power supply. Do not attempt to modify a TV receiver which warns you on the back that the chassis is live. If in doubt seek professional advice before going any further. EA

Circuit & Design Ideas

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



High-efficiency 1.5V photoflash inverter

This simple circuit is ideal for use in battery-powered equipment. Although suggested for use as an electronic flash inverter, it could form the heart of a low-cost electric fence, or could easily be adapted to suit the EA High-Voltage Insulation Tester (June, 1985).

It has two main advantages over other designs. First, it will work efficiently with battery voltage as low as 0.8V. Second, the current drain and power output are virtually constant, regardless of output voltage. This makes it ideal for charging large capacitors, even from a fairly "dead" AA-size penlight cell.

Fig. 1 shows the inverter output and efficiency for an input of 1V DC. The entire circuit can be viewed as a variable-ratio DC-DC transformer, adapting its output current and voltage to suit the applied load.

This "constant power" characteristic is preferable to the usual "constant voltage" type of inverter because the latter will be working at very poor efficiency until the flash capacitor is almost fully charged.

Operation begins with Q1 forward biased by the 1.5V supply via R1, L3 and D1. As soon as Q1 starts to turn on, its base current rapidly increases, since the voltage across L3 follows the rise in voltage across L1. When Q1 is fully on, the voltage across L1 and L3 is 1.5V and the base current, which is limited by R1, is about 4mA.

The current through L1 now starts to rise linearly at a rate equal to the applied voltage divided by the inductance. When the current reaches a value too high to be sustained by Q1 (ie, when the current is greater than beta x 4mA or the transformer core saturates, whichever comes first), the voltage across L1 (and L3) drops and Q1 begins to turn off.

The voltage across L1 (and L3) now reverses as the collapsing magnetic field tries to keep the current going. The only path for the current now is through rectifier diode D2 and into flash reservoir capacitor C1.

At this stage, the collector of Q1 is at say, +25V, the feedback winding (L3) is developing −25V, and the 10:1 overwind (L2) is delivering a voltage of +275V to D2. D1 prevents reverse breakdown of Q1's emitter-base junction during this phase.

With −25V now across L1, the current decreases linearly at a fairly rapid rate and quickly reaches zero. At this point, the voltage across all windings also drops back to zero, the large negative voltage across the feedback winding disappears, and Q1 begins to turn on again.

Note that Q1 should have a voltage rating of more than 30V and a current rating of 1A (eg, BC639). Ideally, D2 should be a fast-recovery high-voltage rectifier diode, but these can be difficult to obtain. A 1N4004 can be substituted with virtually no loss of performance.

As it stands, the circuit will have an operating frequency of about 1kHz. This can be scaled up by reducing the number of turns on all windings.

S. Payor,
Kogarah Bay, NSW. **$25**

Connecting a VCR to two TV sets

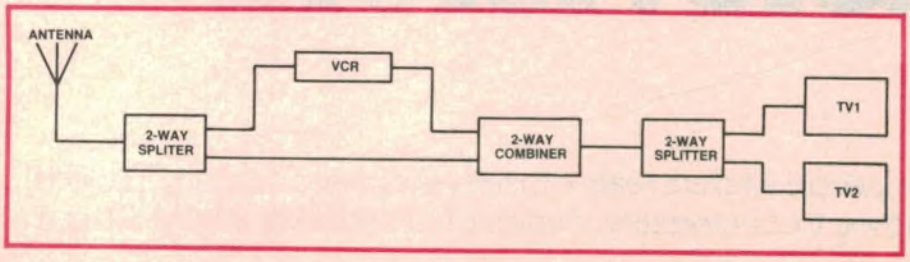
A method for connecting a VCR to two TV sets was shown in EA for April, 1986, page 124. This method gave reasonable results when used with an Akai VS3 VCR, but would not work when the VCR was subsequently upgraded to an Akai VS606.

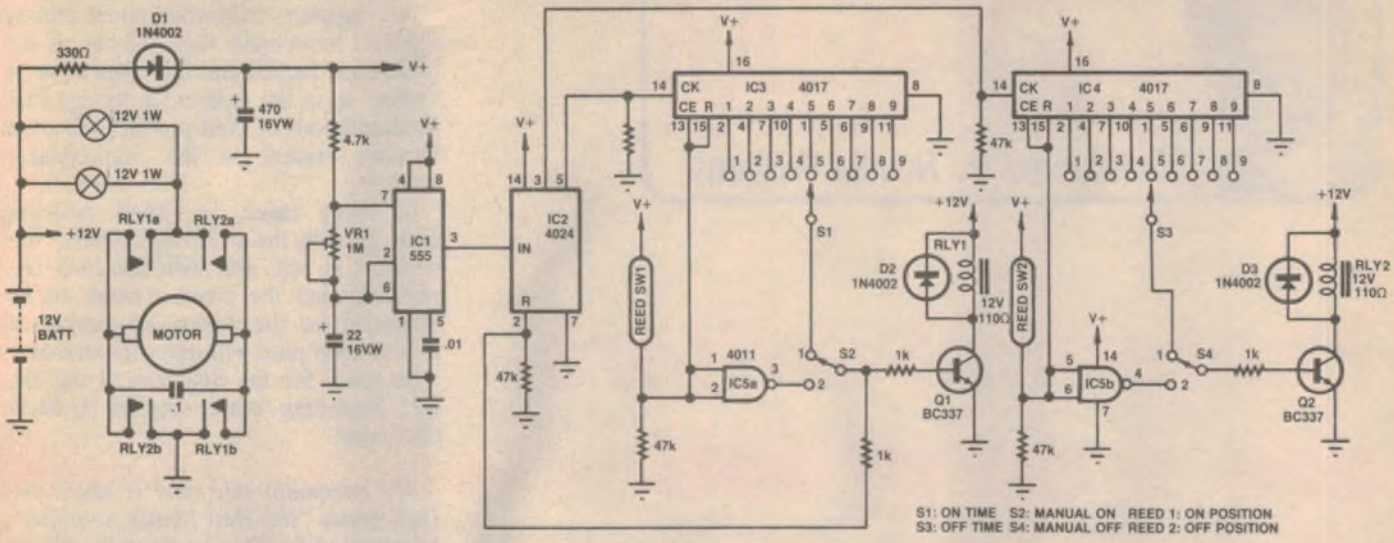
With the VCR switched on, all was fine, but as soon as the VCR was switched off, all VHF signals from the antenna disappeared. These signals could be restored by disconnecting either the input or the output of the VCR.

After much experimenting, the accompanying circuit was devised. It works like this: incoming signals from the antenna are first fed to a 2-way splitter and thence to the VCR. The VCR output and the remaining output from the splitter are then fed to a 2-way combiner, followed by a second 2-way splitter for distribution to the two TV sets.

As it stands, the circuit provides good results in areas of high signal strength.

D. Hogg,
Warrandyte North, Vic. **$12**





Electronic sprinkler timer

This circuit was designed to turn a sprinkler system on and off to water a vegetable garden. As mains power was not available, low power consumption was necessary. A disused car battery powers the circuit for one month between recharges.

The "tap" is a ball valve with an extended operating arm. A bar magnet on the operating arm, together with two reed switches, detects whether the valve is in the 'on' or 'off' position. An old tape recorder motor and clock mechanism provide the 'push' and 'pull' to turn the valve on and off. Fishing line in a continuous loop was used between the valve operating arm and the clockwork mechanism.

Five ICs are used in the circuit. 555 timer IC1 produces a square wave, the output of which is divided by binary counter IC2. Pin 5 of IC2 goes high after 16 clock cycles while pin 3 goes high after 64 clock cycles.

The pin 5 output of IC2 is further divided by decade counter IC3, the outputs of which are selected by S1. When the selected output goes high, Q1 turns on and operates RLY 1. This supplies power to the motor which in turn moves the extended arm and magnet to the valve 'off' position.

At this point, reed switch 1 operates and resets and inhibits IC3. IC4, which was previously held reset by reed switch 2, now counts the 'off' time, as selected by S3. When the selected count is reached, RLY 2 operates and turns the valve on.

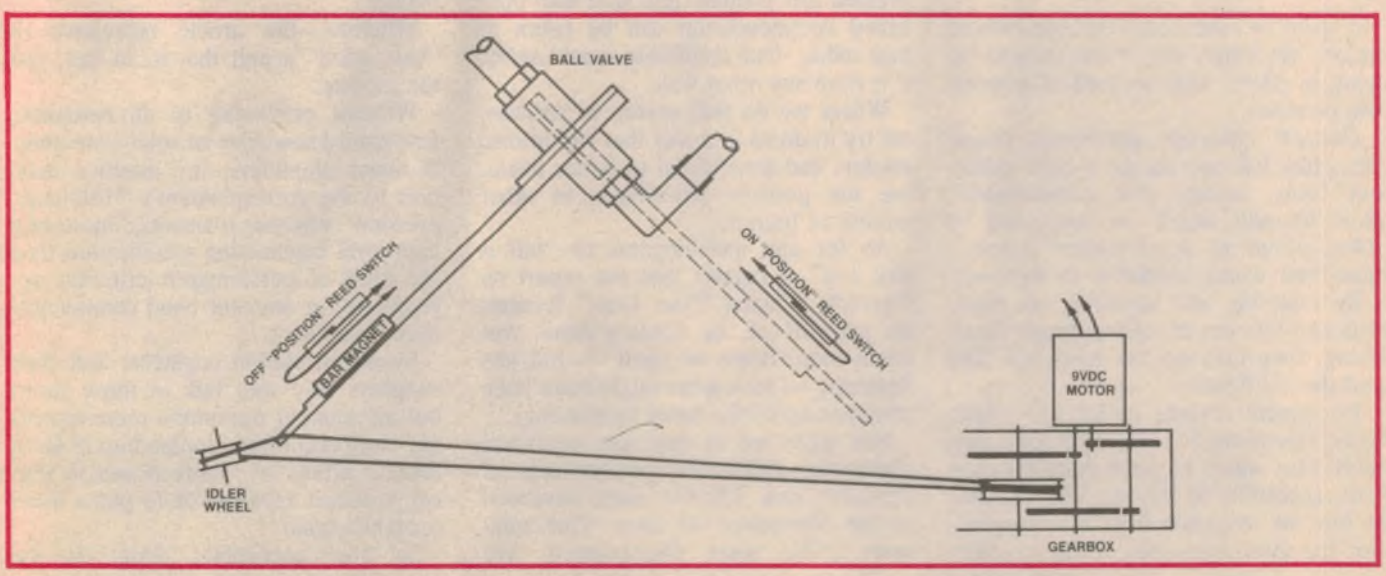
S2 and S4 allow the valve to be manually turned on and off by selecting the outputs of IC5a and IC5b. For example, when reed switch 1 is open (ie, the ball valve is in the on position), the output of IC5a is high. If this output is selected by S2, Q1 will turn on, and the arm will move to the 'off' position.

As soon as the 'off' position is reached, the output of IC5a goes low and Q1 turns off, thus stopping the motor. S4 and IC5b operate in similar fashion to turn the ball valve on.

The 470μF capacitor, together with D1 and the 330Ω resistor, provides supply rail decoupling, while the two incandescent lamps act as a resistor in series with the motor and prevent damage if both relays operate at switch on.

With IC1 set to a period of approximately 14 seconds, 'on' times ranging from 4 minutes to 64 minutes in 7.5 minute steps are obtained. The 'off' times range from 16 minutes to 4 hours 16 minutes in 21 minute steps. These times can easily be altered by adjusting VR1.

D. Harvey,
Stanthorpe, Qld. **$25**



FORUM

Conducted by Neville Williams

Technical writers are a sorry lot!

Faced with the task of reporting on a new piece of equipment, technical magazine writers are forbidden to "tell it like it is" by an editor who, in turn, is being stood over by advertisers. At least, that's the way things are, as seen through the eyes of a reader from Berowra Heights, NSW.

In case you think that I'm exaggerating, let me quote verbatim the opening pars from a letter over the signature of G.McD:

Dear Sir,

One of the things which annoy me about equipment reviews in electronics magazines is that, almost invariably, the equipment reviewed is very good.

It seems that the electronic equipment buyer is never offered anything which doesn't measure up to the advertised specifications; or is it that the particular magazine editor is afraid of losing advertising dollars if he really tells it like it is???

I seem to have heard this somewhere before but it may not be too soon to repeat, in effect, what we said on a previous occasion.

General coverage electronics magazines like EA operate on a quite different basis, legally and commercially, from journals which are supported by subscriptions to a consumers' association, and which specialise in methodically sampling and reporting on products and services of various types. In so doing, they turn up the good, the bad and the indifferent.

Equipment reviews in EA are essentially "occasional" and represent one facet of a much broader editorial content, accessible to anyone who chooses to buy the magazine from a newsagent. For the most part, they relate to interesting new releases, which manufacturers or distributors agree to make available, unconditionally, for examination and report.

Because we specialise in electronics, and are not easily beguiled by empty words, we are rarely invited to comment on equipment which might, in reality, fall short of what it's supposed to be. It is not surprising, therefore, that most of the items submitted to us do indeed measure up to the advertised specifications.

Having personally written or checked countless such reviews over the years, I can assure G.McD, and any who may share his views, that the opinions expressed are genuine and that any published commendation can be taken at face value. Our credibility would suffer if it were any other way.

Where we do find reason to criticise, we try to do so in a way that will inform readers and assist them to better evaluate the possible advantages of other models or brands.

As for any unwillingness to "tell it like it is", I suggest that our report on Carver's "Digital Time Lens" feature, on page 27 of the January issue, was much more down to earth — and less flattering — than what might have been conjured up by the fancy terminology.

Nor were we in any way equivocal about the AM-stereo performance of Pioneer's new TX-960 tuner, reviewed in the November '85 issue. Our summary: "We were disappointed. We think prospective buyers will be, too."

Are suppliers concerned about critical reports? Sometimes they are but, if the criticism is factual and fair, they have to "wear" it, in the certain knowledge that the limitations of their product will soon become evident in the marketplace, anyway.

In many cases, published criticism ends up with the overseas supplier, underlined in red, and with the clear implication that the product needs to be upgraded for the Australian market, if it is to keep pace with the competition.

So much for the first part of the letter. Becoming more specific, G.McD continues:

My complaint this time is about the Dick Smith "100 Watt Linear Amplifier" kit reviewed by Greg Swain in the March '86 issue of EA.

One way of specifying the power output of a linear amplifier is to quote the power output at 1dB compression. Examination of the figures quoted in the article on the amplifier indicates that this is likely to occur at something closer to 50 watts, rather than 100! (see diagram)

In fact, no matter which way you look at it, it isn't a 100 watt "linear" amplifier.

So why don't you be honest with your readers and say so?

Yours faithfully, etc.

Perhaps one could quibble by pointing out that the article referred to is not a product review but a full constructional feature, which we chose to run because of its potential interest to amateurs. More to the point, however, is whether the article offends in a way that substantiates G.McD's general complaint:

Whether, the article represents as "very good" a unit that is, in fact, just the reverse.

Without professing to an extensive, first-hand knowledge of solid-state class-B linear amplifiers, my intuitive reaction to the correspondent's "1dB compression" was that it smacked more of a high level engineering specification than the kind of performance criterion appropriate for amateur band communications equipment.

Broadcast station engineers and their suppliers may well talk in those terms but an amateur operator's requirements are more accurately summed up in Greg Swain's article as: "more power to trigger a distant repeater or to put a more readable signal".

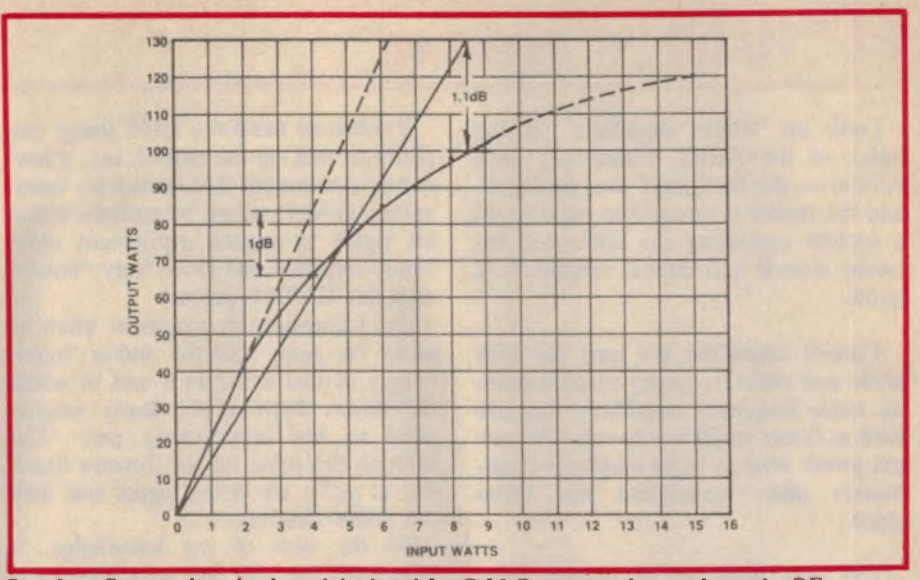
So how applicable, really, is the

graphical exercise depicted in the appended diagram? How would it look if, instead of envisaging a line "tangential" to the origin of the curve, one were to draw a "best fit" line? A cursory check seemed to suggest that, relative to such a line, the stage could be driven to the rated 100 watts output with a discrepancy of plus or minus a decibel or two!

A graphical exercise it may be but when the stage is being used for FM transmission — a very popular mode on the 2-metre band — it literally doesn't matter two hoots, anyway, because the output power level is constant. For sure, the amplifier in question has to be driven harder to obtain the rated power, but this is clearly indicated in Table 1 of Greg Swain's article.

It also occurred to me that the shape of the original curve could have been affected by power supply regulation. In that case, an SSB speech signal might fare somewhat better than a continuous carrier by reason of the reservoir effect of the filter capacitors.

But, either way, I was far from convinced that the unit presented any real problem, having in mind the specified figures for harmonic and intermodulation suppression?



Based on figures given in the original article, G.McD reasons that, at best, the RF amplifier in the March issue is "linear" to only 65W. A "best fit" line looks more accommodating but, in any case, the unit satisfies amateur band criteria based on figures for intermodulation suppression.

Second opinion

At this juncture, I talked to Winston Muscio who, prior to retirement from STC, was heavily involved with commercial transmitting equipment. Having read the article, he observed that, while it was in a quite different league from what he had been accustomed to, he found nothing in the article to get upset about, from the viewpoint of an amateur station operator.

In commercial broadcasting and communications, the design specifications for linear amplifiers do need to be quite tight, he said, especially where there might be two or three such stages in tandem. But, having in mind the nature and purpose of the unit in question, the person responsible appeared to have done a good job.

The designer's concern to minimise insertion loss was commendable, as also were the figures for harmonic and intermodulation suppression. On the assumption that the on-air signal proved to be clean, he saw no reason to criticise the project.

A semantics problem?

However, reading G.McD's letter again, I noted the quote marks around the word "linear" in the penultimate paragraph. Could it be that his quarrel was not with the design at all but purely and simply with our description of the unit as a "linear" amplifier?

If so, a single word seemed a rather tenuous basis on which to build a whole argument, especially as it would need to set aside fifty years of usage in this precise context. Amateurs have been talking about linear amplifiers for at least that period of time, associating them mainly with class-B operating conditions, as distinct from class-C.

Sound amplification in reverberant spaces

While, nowadays, most people need voice amplification to address an audience of 500 people, it is claimed that in the classical Greek "theatrum", actors addressed 15,000 people helped only by a mask that acted as a sort of megaphone.

It is well to remember that the theatrum was in the open air, with no reverberation and a background noise level of about 15dBA. In these conditions, good speaking voices need be only 7dB above background to be intelligible. Even at 80 metres from the speaker, with reasonably declamatory speech, these conditions would hold. Industrially induced deafness was unknown.

The art of public speaking is now almost dead; people have bizarre ideas about the achievements possible with electronic equipment. Unintelligible mumble is expected to be amplified as clear speech; mousy whispers converted into leonine roars. Some expect their poor grammar to be magically corrected by the marvel of the microphone!

Speech intelligibility in an enclosed space suffers from the fact that the speech reaches the listener both directly and with varying time delays after reflections from the surrounding surfaces.

Add to that the ubiquitous high background noise level, as well as the noise of the audience itself, and it is easy to understand the problem of providing speech able to be understood without effort by the listener — especially if that listener has a hearing loss induced by noisy working conditions or simply by the passage of time.

FORUM – *continued*

Look up "linear amplifiers" in the index of the ARRL Handbook, 1936 edition — the first one I ever owned — and the reader is directed to page 58, to a section explaining the difference between class-B and class-C amplifiers. I quote:

Class-B amplifiers are used for both audio and radio frequency amplification. As radio frequency amplifiers they are used as linear amplifiers to raise the output power level in radio telephone transmitters after modulation has taken place.

The text goes on to suggest that, while class-B linear amplifiers should ideally be linear, a considerable degree of non-linearity can be tolerated in practice.

This is quantified in later amateur literature, not in absolute terms but as evidenced by non-linear distortion and the emission of spurious signal components.

The 1976 RSGB Handbook on my shelf talks about the two-tone test and the desirability of reducing intermodulation products to −35dB or less. Significantly, from the published specifications, the unit described in the March issue would appear to satisfy that criterion.

Whether or not it would meet the specifications likely to be set by a commercial broadcaster or a Government department is beside the point. It doesn't pretend to. It is presented as an "afterburner" for use with amateur band transmitters and transceivers — a "linear" amplifier conforming to what amateurs would expect and understand by the term.

Designer's reaction

Last but not least, I talked to the person actually responsible for the design, Andrew Keir, of Dick Smith Electronics. Having already seen a copy of the letter, forwarded to him from the EA office, he shared most of my own reactions.

He was able to confirm that, using the linear on air, he had received a number of comments on the clean, robust signal, as received — free from obvious distortion and free from spurious radiation. He claimed that it compared more than favourably with ready-built commercial gear — something that a person in the business should know.

If someone needed a 100W linear amplifier to tack on the end of, say, a low-power community AM broadcast transmitter, G.McD would be entirely within his rights to suggest equipment more highly specified and more truly "linear" than this EA/DSE project.

But I question his judgment when he seeks to apply criteria and/or terminology of that order to a unit of which the raison d'etre is so clearly emphasised in the introductory par: "Cut through the noise on the 2-metre band. Put a really whopping signal out with this 100W afterburner . . ."

To the best of my knowledge, it would perform the task very effectively and live up to any expectations generated by the article.

Mumble in, mumble out!

To change the subject from amateur operators to amateur orators, I've received quite a deal of feedback following the article in the October '85 issue entitled: "A Guide to Correct Microphone Use".

It was addressed primarily to people involved in churches and small social groups who have occasion to use microphones and amplifiers, often with indifferent success.

The point was made that, when members of an audience complain that they cannot hear what is going on, the amplifier system is frequently blamed, on the grounds that it is not sufficiently "sensitive".

The message in the article is summed up by a paragraph on page 18 of the aforesaid issue:

"Basically, it isn't an amplifier problem at all. What you really need to do is to insist beforehand that everyone taking part in proceedings speaks deliberately, distinctly and loudly enough to be heard. If they can't or won't, they are simply not going to be able to communicate. If particip mble into the microphone, et 'mumble' from the loudspea

"I DECLARE THIS ... WHOOPS!... ... MUMBLE, MUMBLE OPEN!"

Having read the article, quite a few appear to have thought it through and come to appreciate the point that was being made. One person pointed out that, when dealing with children, or with adults known to be microphone-shy, the best time to anticipate the problem is when they are being introduced to the audience. Said he:

"Adjust the microphone to their height, gently move them a little closer if they are too far back and urge them to speak up for the sake of those at the back. They get the message on the spot — and so does everyone else for future occasions!"

In a letter headed "Parallel Thought", another reader, R.C. of Emery Bay, NSW, encloses a quote from some class notes which he makes available to students attending his course on electro-acoustics, given at the University of NSW. They are set out in the accompanying panel and you may care to read them at this stage.

Thank you R.C. for your interesting contribution. It caused me to think back to my own boyhood, spent in the "bush" and surrounded, for the most part, only by the noises of nature. There were no aircraft to speak of, few cars and an occasional steam train in the distance.

What I do remember was the tell-tale hum of swarming bees, the sound of carpenters' hammers working on some distant building, and the pulsating echoes as a hard-tyred 1920-model Thornycroft lorry toiled up a mountain road three or four miles away!

Today, everything is so much closer, so much louder: traffic in the street, motor lawnmowers all around, aircraft overhead and, above them all, ear-splitting audio — literally.

On page 17 of the February issue, I quoted the average noise level in even a "quiet" suburban listening room as 40dB — a widely accepted figure. For an open-air Greek theatrum, presumably with a hushed audience, R.C. quotes 15dB, with the audience able to resolve speech 15dB above that.

It's interesting to recall the level of sound unleashed at a modern open-air rock concert, to an already partially deafened audience. We've certainly come a long way since we invented amplifiers!

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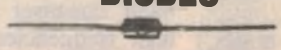

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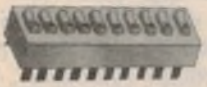

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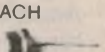

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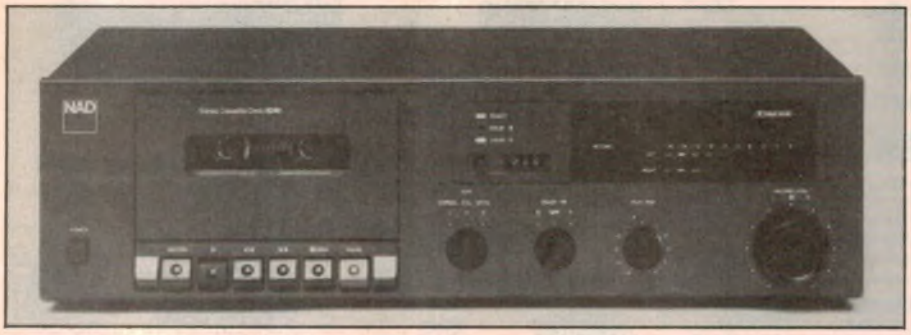


Cassette deck from NAD

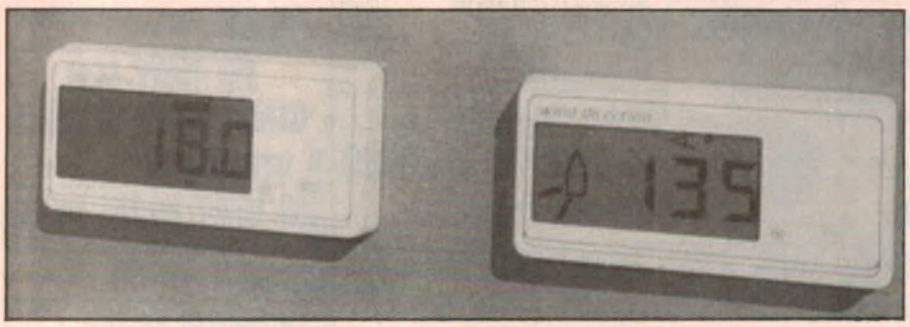
New from NAD, the model 6240 is a mid-priced cassette deck with two performance-optimising features not normally found within its price range: "Dyneq" and "Play Trim".

Dyneq (Dynamic Equalisation) is designed to prevent high frequency saturation. All cassette recorders employ a steep high-frequency boost during recording, to overcome treble losses associated with the slow 1⅞ ips tape speed. At high recording levels, this pre-emphasis causes tape saturation whenever the music includes strong high-frequency sounds.

The Dyneq circuit functions as a high-frequency limiter to prevent tape saturation; ie. treble pre-emphasis losses during playback.

The Play Trim circuit is a narrow-band equaliser that operates only at high frequencies, providing an adjustable boost or cut of up to ±3dB at 10kHz and ±6dB at 20kHz. It is located in the playback path ahead of the Dolby NR decoder, so that it can restore treble response before Dolby decoding takes place.

For further information contact The Falk Electrosound Group, 28 King Street (PO Box 234), Rockdale, NSW 2216. Telephone (02) 597 1111.



Navigation system for small craft

VDO Instruments Australia have released the new VDO microcomputer-controlled Navpac, a modular navigation instrument package.

Navpac is designed for yacht and motor cruisers as a compact, accurate, and easily-calibrated integrated navigation system.

It can provide course, log speed, wind direction, wind speed and echo sounding display. The electronic compass frees skippers from the need to adjust compass bearings to neutralise interference from a vessel's ironwork.

Racing enthusiasts will find the Log Speed's trim function (speed increase/decrease) particularly useful for optimising boat speed.

The Navpac system is compatible with all modern position finding equipment and autopilots.

For further information contact VDO Australia, 115 Northern Road, Heidelberg West, NSW 3081. Telephone (03) 450 3209.

Soldering stations from Scope

Scope Laboratories has announced two new soldering station models. They allow the operator to select any temperature from 200° to 470°C without the need to change soldering tips. A LED display shows the selected tip temperature as well as the actual tip temperature.

A feature of the new soldering stations is zero voltage switching of the iron heater. This eliminates switching spikes which could destroy MOS type devices when they are being soldered.

In addition, the ETC60L-FE provides a means of disconnecting the conventional earth. A short length of flex with an alligator clip then connects the iron tip to the PCB earth rail. This ensures that the soldering tool, the component and, if desired, the operator, will all be at a common potential, free of any noise or voltage from the mains earth.

For further information contact Scope Laboratories, 3 Walton Street, Airport West, Vic 3042. Telephone (03) 338 1566.

Portable, printing, energy analyser

A new portable Energy Analyser, model Microvip MK1, has been released by the Italian company Elcontrol.

It measures and prints out: Volts (true RMS), Amps (true RMS), Cos (inst. power factor), kW (active power), kWh (active energy consumed), kVArh (reactive energy consumed), kVAr (reactive power required), LmA (current leakage), Hz (line frequency) and clock (time/date).

Single-phase and three-phase electrical systems can be monitored continuously and four different measured quantities are displayed on a large labelled LCD.

Alarm presetting is possible on: minimum and maximum voltage, minimum and maximum current, minimum and maximum active power, averaged over 1 minute.

The range of power/energy analysis possibilities that the unit offers should improve electrical energy usage in small or large electrical systems.

For further information contact Emona Instruments Pty Ltd, PO Box K720, Haymarket, NSW 2000. Telephone (02) 212 4599.

High-resolution colour monitor

Sony has released a new high-resolution colour monitor. Designated the model KX14CPI, it utilises Sony's "Super Trinitron Fine-Pitch Tube" and is both Sony and IBM PC compatible.

In addition to use as a computer monitor, the KX14CPI can also be used with VCRs, videodisc players, TV tuners or 8mm video players. It is equipped with "Automatic Colour Selection" for PAL, SECAM and NTSC transmission standards and automatically selects for either 110V or 240V mains systems.

For further information contact Sony Australia Pty Ltd, 33-39 Talavera Road, North Ryde, NSW 2113. Telephone (02) 887 6666.

Power supply from Boschert

Amtex Electronics has just introduced the highest-rating Boschert switchmode power supply onto the Australian market. Called the HL1000, this unit delivers 1000W from a single 5V output. The industry standard 5 x 8 x 11-inch enclosed box incorporates a blower.

Incorporated into the unit is Boschert's unique single wire paralleling system which provides reliable current sharing for multiple power supply applications.

Other standard features include: user selectable input voltage, overvoltage protection and overvoltage shutdown signal, undervoltage protection and output undervoltage signal, adjustable maximum and short circuit current, power fail detect signal, remote inhibit and overtemperature protection with advance warning signal.

For further information contact Amtex Electronics, 36 Lisbon Street, Fairfield 2165. Telephone (02) 728 2121.

New sealed stationary battery

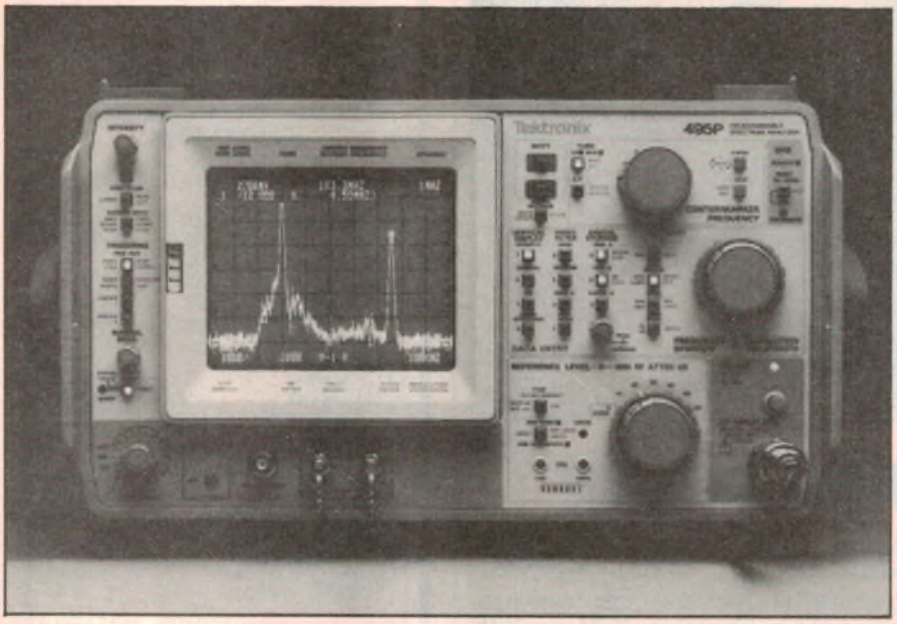
A new sealed lead-acid stationary battery, the Yuasa UXL Type, has just been introduced by Amtex Electronics.

Conventional vented-type batteries require water replenishment due to water decomposition during charge. The new Yuasa UXL type, on the other hand, is completely maintenance-free, eliminating such troublesome chores as electrolyte level check and water topping-up.

Other features include: compact size; can be used in any orientation; no liquid leakage or acid vapour; and long life (10 years typical). The new batteries are available in 2, 6 or 12V configurations with capacities ranging from 30 to 500A.h. They are suitable for communications power supplies, emergency power supplies, uninterruptible power supplies, alarm and security systems.

For further information contact Amtex Electronics, 36 Lisbon Street, Fairfield, NSW 2165. Telephone (02) 728 2121.

Spectrum analysers with downloadable programming

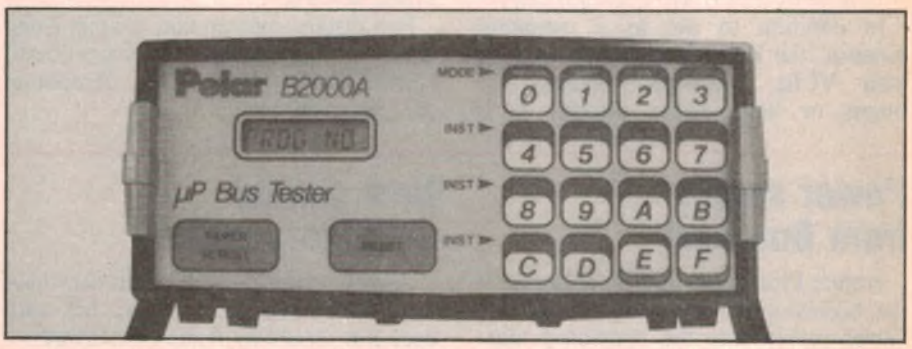


Tektronix has released a pair of spectrum analysers which cover the frequency range from 100Hz to 1.8GHz, with −130dBm sensitivity.

The 495 and 495P have optional "macro programming capability", a facility which allows the user to download frequently used measurement programs into the non-volatile memory. This option also provides internal centre and dot marker frequency accuracy to one part in 10 and provides a built-in signal counter capacity.

Other features include intelligent signal processing for sorting continuous wave (CW), pulsed RF and other signals; an occupied bandwidth function which marks and measures the occupied bandwidth at a user-determined level below the displayed peak of a desired (marked) signal; a help mode; and a **MATE/CIIL** language option with direct memory access for extension to the standard GPIB codes and formats.

For more information contact Tektronix, 80 Waterloo Road, North Ryde, NSW 2113. Telephone (02) 888 7066.



Microprocessor system tester

The Polar B2000A is a test instrument designed for fault finding and the testing of microprocessor-based boards. The B2000A does not test the microprocessor but is capable of testing the numerous other ICs connected to the processor bus. These devices will typically include memory ICs, the decoding circuitry and input/output ports.

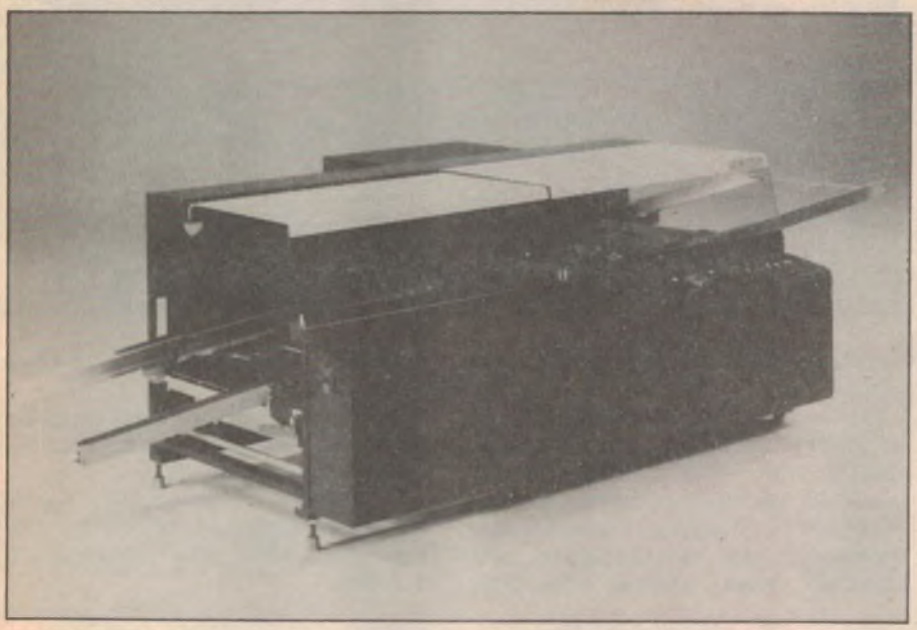
To carry out the job the processor in the unit under test is removed and the B2000A is plugged into the vacant socket via a pod configured for the microprocessor which it has replaced. The B2000A is now capable of controlling the various devices on the bus.

For example, the user may wish to test the RAM. The B2000A will do this by writing to all the memory locations and then trying to read the data back. Faulty areas will be printed out on the integral printer. To test the ROM, the B2000A calculates the CHECKSUM which can then be compared with that of a known good memory.

A special looping program causes the instrument to continuously repeat a programmed instructing sequence. This allows the user to trace repetitive signals around the circuit with a logic probe or oscilloscope.

The processors supported are: Z80, 6800, 6502, 6802, 1802 and 8080.

For further information contact Emona Instruments, PO Box K720 Haymarket, NSW 2000. Telephone (02) 212 4599.



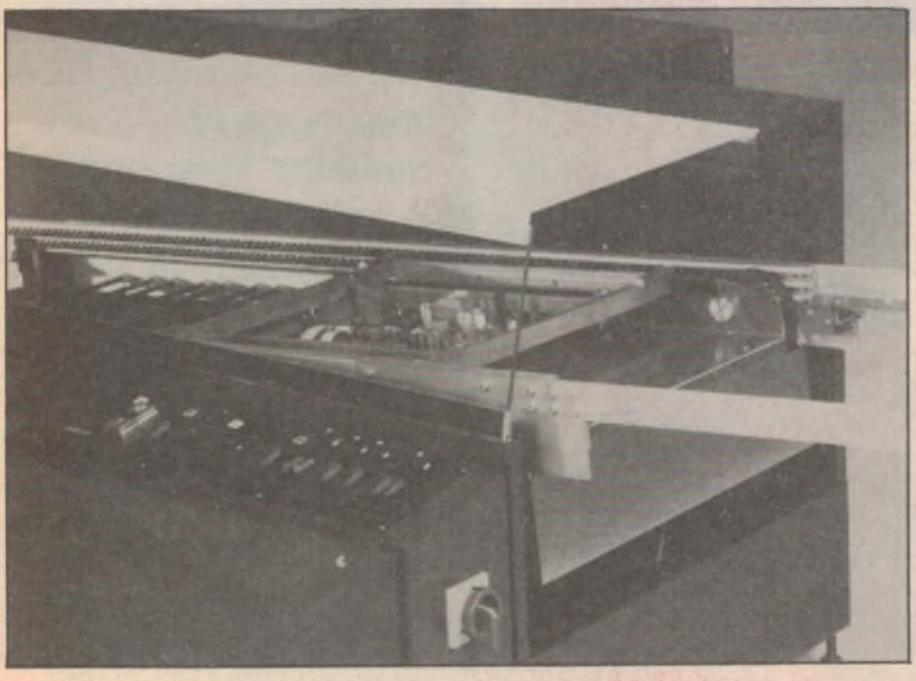
Wave soldering machines

With the trend to surface mount components, wave soldering machines are becoming increasingly important. One such machine is the Zevatron MPS-200 which employs a 'chip wave' method for soldering densely packed SMDs. A 'chip wave' is a turbulent wave that is precisely modulated and controlled.

The MPS-200 can also be used as an ordinary machine and is available with the standard working widths of 300 or 360mm. The solder pump is made from high-tensile titanium alloy and special steel is used for the nozzles and solder channels.

A number of other features allow this soldering machine to form the basis of a fully automated production line. These include automatic replenishment of solder and flux, component insertion stations, conveyer and return conveyer belts, ascent and descent units and transverse and angular transfer units.

For further information contact Alfatron Pty Ltd, 1761 Ferntree Gully Road, Ferntree Gully, Vic 3156. Telephone (03) 758 9000.



New Products...

Programmable synthesiser & function generator

This new 20MHz programmable generator, the Kikusui FGE-3520, features accurate, highly stable frequency programming in the synthesiser mode and a frequency sweep/modulation capability in the function generator mode.

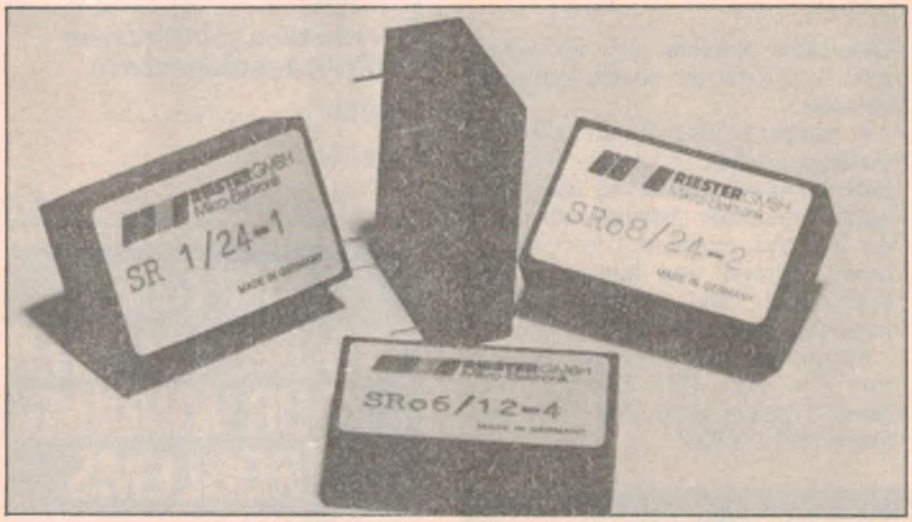
In both modes of operation, the basic output waveforms are sine, triangular, square, with adjustable DC offset and voltage controlled amplitude.

In the synthesiser mode, the frequency can be set from 10Hz to 20MHz with 5-digit resolution and a .002% accuracy using either an internal reference oscillator or an external 10MHz reference.

In the function generator mode, the frequency can be set from 0.001Hz to 20MHz with 3-digit resolution. In this mode of operation, a number of functions can be programmed including triggering, gate and burst oscillations, with accurate phase control, frequency modulation and sweeping to a preset upper limit.

The device can be remotely controlled by way of a GP-IB interface or used as a stand-alone instrument.

For further information contact Emona Instruments, PO Box K720 Haymarket, NSW 2000. Telephone (02) 212 4599.

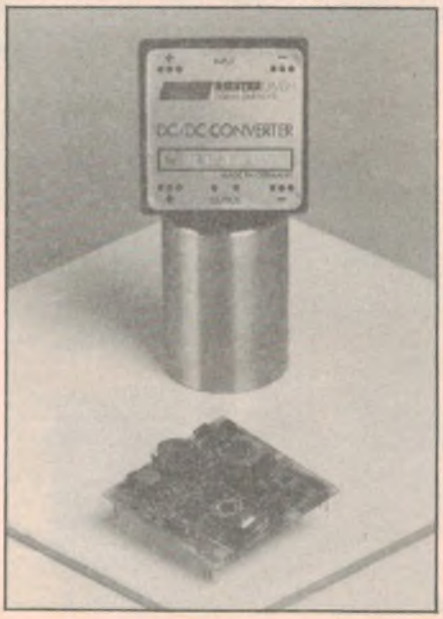


24-pin DC/DC converters

New from Brandner is a series of encapsulated 24-pin dual-in-line DC/DC converters manufactured by Riester of West Germany. These are available with either single (5, 12 or 15V) or dual (+5, +12 or +15V) outputs rated at 1.5, 2 or 3W. Input supply voltage options are 5, 12, 15, 24, or 48V.

Also available from Brandner is the Riester Series SI compact converters with output ratings of 10W. These are available with single outputs of 5, 12, 15 or 24V and operate from 12, 24, 48 or 60V DC sources.

For further information, contact Brandner Australia Pty Ltd, 20 Shasta Avenue, Brighton, Vic 3186. Telephone (03) 592 4298.



New range of speakers from Tannoy

A selected range of speakers from the British company Tannoy is now available in Australia. The six models released range from the $399 Titan up to $1199 for the Venus Mk II and the newly introduced DC-200. Other models ranging up to $11,000 can be ordered upon request.

Two models making their debut are the DC-100 and DC-200 dual concentric speakers. This type of speaker has both drive units mounted on the same axis, one cone behind the centre of the other.

For further information contact Regent Audio, 16 Suakin Street, Pymble, NSW 2073. Telephone (02) 449 5666.

Check our test equipment range!

605 3½ DIGIT MULTIMETER

New replacement for YF1100. See specification tables below for details.

Cat. Q11035 ..... **$79.95**

705A 3½ DIGIT MULTI/CAPACITANCE METER

See specification table below for details.

Cat. Q11040 ..... **$119**

605 & 705A SPECIFICATIONS

Capacitance

Range	Resolution	605 Accuracy	705A Accuracy	Test Signal	Max Input
2nF	1pF	NC	3% +4	400mV rms	3V DC/peak AC on all ranges
20nF	10pF			512 Hz 40mV rms	
200nF	100pF				
2000nF	1nF				
20μF	10nF				

AC Current

Range	Resolution	605 Accuracy	705A Accuracy	Burden Voltage	Overload Protection
200μA	100nA	NC	1% +4	0.3V max	705A: 0.7A fuse up to 250V. 605: 2A fuse up to 250V. 10A range not fused
2mA	1μA	1% +4			
20mA	10μA				
200mA	100μA				
2000mA	1mA	2% +4	NC		
10A	10mA	15% +4	3% +4	0.7V max	

Resistance

Range	Resolution	605 Accuracy	705A Accuracy	Open Voltage	Overload Protection
200Ω	100mΩ	1% +2	1% +2	4V +/- 3.5V Lo V - 0.25V	250V DC/rms on all ranges
2kΩ	1Ω	1% +2	0.8% +2		
20kΩ	10Ω				
200kΩ	100Ω				
2000kΩ	1kΩ				
20MΩ	10kΩ	2% +4	3% +4		

DC Voltage

Range	Resolution	605 Accuracy	705A Accuracy	Input Impedance	Overload Protection
200mV	100μV	0.5% +1	0.5% +1	10MΩ on all ranges	1000V DC peak AC on all ranges
2V	1mV				
20V	10mV				
200V	100mV				
1000V	1V	0.8% +1	0.8% +1		

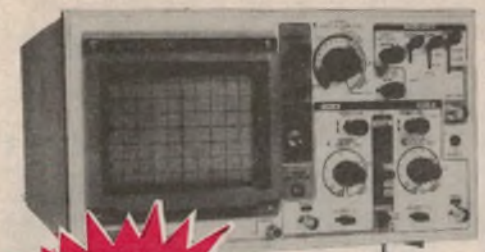
AC Voltage

Range	Resolution	605 Accuracy	705A Accuracy	Input Impedance	Overload Protection
200mV	100μV	1% +4	1% +4	10MΩ on all ranges Capacitance < 1000pF	750V rms on all ranges except 200mV AC ranges. 15 seconds max above 250V rms AC
2V	1mV				
20V	10mV				
200V	100mV				
750V	1V	2% +4	2% +4		

DC Current

Range	Resolution	605 Accuracy	705A Accuracy	Burden Voltage	Overload Protection
200μA	100nA	NC	1% +1	0.3V max	705A: 0.2A fuse up to 250V. 605: 2A fuse up to 250V. 10A range not fused
2mA	1μA	1% +1			
20mA	10μA				
200mA	100μA				
2000mA	1mA	1.5% +1	NC		
10A	10mA	3% +1	1% +1	0.3V max	

NC = Not Connected



Includes two free probes!

12 months warranty!

HUNG CHANG (RITRON) 20 MHz DUAL TRACE OSCILLOSCOPE

- **Wide bandwidth and high sensitivity**
- **Internal graticule rectangular bright CRT**
- **Built in component tester**
- **Front panel trace rotater**
- **TV video sync filter**
- **Z axis (intensity modulation)**
- **High sensitivity X-Y mode**
- **Very low power consumption**
- **Regulated power supply circuit**

COMPONENT TESTER is the special circuit with which a single component or components in circuit can be easily tested. The display shows faults of components, size of a component value, and characteristics of components. This feature is ideal to troubleshoot solid state circuits and components with no circuit power. Testing signal (AC Max 2 mA) is supplied from the COMPONENT TEST IN terminal and the result of the test is fed back to the scope through the same test lead wire at the same time.

CRT

CRT: *6" (150mm) Flat-faced high brightness CRT with Internal Graticule*
Effective display area: *8 x 10 div (1 div = 10 mm)*
Acceleration potential: *2KV*

VERTICAL

Operating Modes: *CH-A, CH-B, DUAL, ADD (CH-B can be inverted) Dual modes: After, 0.2uf/s - 0.5ms/div. Chop; 1ms - 0.5s/div. CHOP frequency 200KHz approximately.*
Deflection factor: *5mV/div 20V/div +/- 3%, 12 ranges in 1-2-5 step with fine control*
Bandwidth: *DC; DC - 20MHz (- 3dB). AC; 10Hz - 20MHz (-3dB).*
Rise Time: *Less than 17ns*
Overshoot: *Less than 3%*
Input Impedance: *1M ohm +/- 5%, 20pF +/- 3pF*
Maximum Input Voltage: *600Vp-p or 300V (DC + AC Peak)*
Channel Isolation: *Better than 60 dB at 1KHz.*

HORIZONTAL

Sweep Modes: *NORMAL, and AUTO*
Time Base: *0.2uf/s - 0.5s/div +/- 3%. 20 ranges in 1-2-5 step with fine control*
Sweep Magnifier: *5 times (5X MAG)*
Linearity: *3%*

TRIGGERING

Sensitivity: *INTERNAL: 1 div or better for 20Hz - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to more than 30MHz).*
Source: *INT, CH-A, CH-B, LINE and EXT.*
Slope: *Positive and Negative, continuosly variable with level control. PULL AUTO for free-run.*
Coupling: *AC, HF-REJ and TV. TV SYNC Vertical and Horizontal Sync. Separator Circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing. TV-H (Line) and TV-V (Frame) are switched automatically by SWEEP TIME/DIV switch. TV-V: 0.5s/div to 0.1ms/div. TV-H: 50uf/s/div to 0.2uf/s/div.*

X-Y OPERATIONS

X-Y Operations: *CH-A: Y axis. CH-B: X axis. Highest Sensitivity: 5mV/div*

COMPONENT TESTER

Component Tester: *Max AC 9V at the terminal with no load. Max current 2mA when the terminal is shorted. (Internal resistance is 4.7K ohm)*

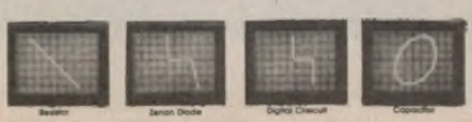
OTHER SPECIFICATIONS

Intensity Modulation: *TTL LEVEL (3Vp-p). Positive ..... brighter. BANDWIDTH: DC - 1MHz. MAXIMUM INPUT VOLTAGE: 50V (DC + AC Peak)*
Calibration Voltage: *0.5Vp-p +/- 5%, 1KHz +/- 5% Square wave.*
Trace Rotation: *Electrically adjustable on the front panel*
Power Requirements: *AC: 100, 120, 220, 240V 20W*
Weight: *7kg approximately*
Size: *162(H) x 294(W) x 352(D)mm*

Cat. Q12105 ..... only $695

(tax exempt only $595)

Bulk orders, schools, please phone (03) 543 2166 for special low pricing



METEX MULTIMETERS

These instruments are compact, rugged, battery operated, hand held 3½ digit multimeters. Dual-slope A-D converters use C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided.

METEX 3800 MULTIMETER

Features
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- 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 3½ 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)

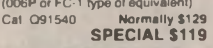
Cat. Q91530 ..... Normally $99.95
SPECIAL $89.95

METEX 3530 MULTIMETER

Features
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- 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.
- Capacitance measurements to 1pF.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3½ 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)

Cat. Q91540 ..... Normally $129
SPECIAL $119



STANDARD DESOLDING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 195mm.

Cat. T11241 **$16.95, Now $14.95**

MINI DESOLDERING PUMP

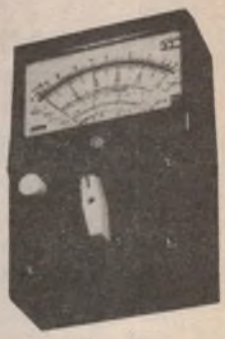
Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 165mm.

Cat. T11251 **$15.95, Now $13.95**

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, Now $19.95**



ANALOGUE WORKHORSE KT370

FEATURES:
- Fuse and diode protection.
- hFE measurements 0 - 1000 (by x 10 range).
- Mirror scale for more accurate reading.

SPECIFICATIONS...
RANGES:
DC Voltage: 0 - 0.1, 0.5, 2.5, 10, 50, 250, 1000V (20k ohm/V)
AC Voltage: 0 - 10, 50, 250, 500V, 1000V (8k ohm/V)
DC Current: 0 - 0.05, (50uA), 2.5, 25, 250mA
Resistance: 0 - 2K, 20K, 2M, 20M ohm
Load Current: 0 - 150uA, 15mA, 150mA
Load Voltage: 0 - 3V
Volume Level: - 10 - + 22dB + 62dB
DC Current Amplification Factor (hFE) 0 - 1000

ACCURACY
DC Voltage & Current: + -3% f.s.
AC Voltage: Within +/- 4% f.s.
Resistance: Within +/- 3% of arc.
Battery: 1.5V (um-3) 2pcs. 9V (6o6p) 1pc.
Fuse: 0.5A, 5ø x 20mm
Diode: 4148 x 2
C.C. .04uff x 50V
Size: 147 x 99x 57mm

"The same type as I have carried in my toolbox since I started in electronics 15 years ago." - Rod

Cat. Q11030 ..... **only $34.95**

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$500 plus	$12.50

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56 Renver Rd, Clayton.
Ph (03) 543 2168 (3 lines)

Errors and omissions excepted.

*Apple and IBM are registered trade names.

MasterCard VISA

New Products...

Audo dial, auto answer modem

Microbee Systems Ltd has released a new low-cost software controlled direct-connect data modem. Providing full duplex operation at both 300/300 and 1200/75 bps, the new Microbee Automodem is designed to operate with any computer having a suitable RS-232C serial communications port and compatible terminal software.

The Microbee Automodem is designed and manufactured in Australia and features auto-answering of incoming calls, either using its own internal hardware or under the control of suitable terminal software.

Selection of baud rates and answer/originate operating mode is achieved either manually, via front panel switches, or under host control via RS-232C control lines.

The Automodem plugs directly into a standard Telecom socket and comes complete with a push-button telephone for optional voice communication and/or manual dialup of data calls. An optional customer upgrade allows it to operate on Bell system standards as used in the USA as well as CCITT.

The quoted retail price of the new Automodem is $249.00. For further information contact Microbee Systems Limited, PO Box 105, North Ryde, NSW 2113. Telephone (02) 887-3723.

New catalog from Arista

The 1986-87 edition of the Arista catalog is now available. It is close to 100 pages long and features a big range of products including: all types of plugs, jacks and sockets; hand tools; power packs; car accessories; audio accessories; video accessories; speakers; public address equipment; security equipment; telephone accessories; audio mixers and amplifiers; and microphones.

For further information contact Arista Electronics Pty Ltd, 57 Vore St, Silverwater, NSW 2141. Telephone (02) 648 3488.

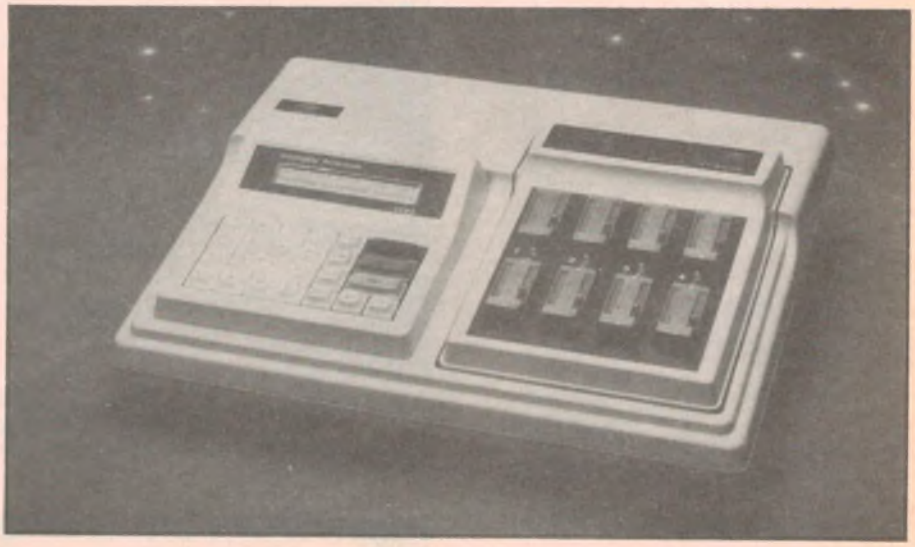
Intelligent EPROM Programmer

A new universal programmer for EPROMs, PLAs and single chip microprocessors has been released by Alfatron.

A 64K memory is standard and new high speed algorithms are available. A 2-line by 24-character alphanumeric display and keyboard are provided for stand-alone operation. A "Help" function may be called at any part of the operating procedure, with the display then providing further information on how to use the particular command.

The XP-80 also has serial/parallel ports for communication with host systems and may be fully remotely controlled via the serial link. Diagnostics include voltage margin check, logic level check, mis-insertion/mis-orientation and bus short checks.

For further information contact Alfatron, 1761 Ferntree Gully Road, Ferntree Gully, Vic 3156. Telephone (03) 758 9000.



Solar powered warning lights

Wattmaster Alco has added a "Solar Powered Blinker Light" to its range of audio-visual warning products.

The Blinker Light was primarily developed for roadside warning applications but can also be used in marine, industrial, and commercial applications and on building sites. They may be used in both temporary and permanent installations, and are particularly suitable in applications where no external power supply is available.

Because they are solar powered, no electrical wiring work is required. This makes for quick and simple installation, and the lights can be easily relocated if necessary.

The life expectancy of the solar cell module is 10 years, while the solar rechargeable battery has an expected life of six to eight years. The lights can be used 13 'night hours' a day for 15 no-sunshine days and there is an ambient light sensor circuit which automatically turns the unit on and off.

For further information contact Wattmaster Alco Pty Ltd, 11 Rachael Close, Silverwater, NSW 2141. Telephone (02) 648 3755.

Computing multimeter

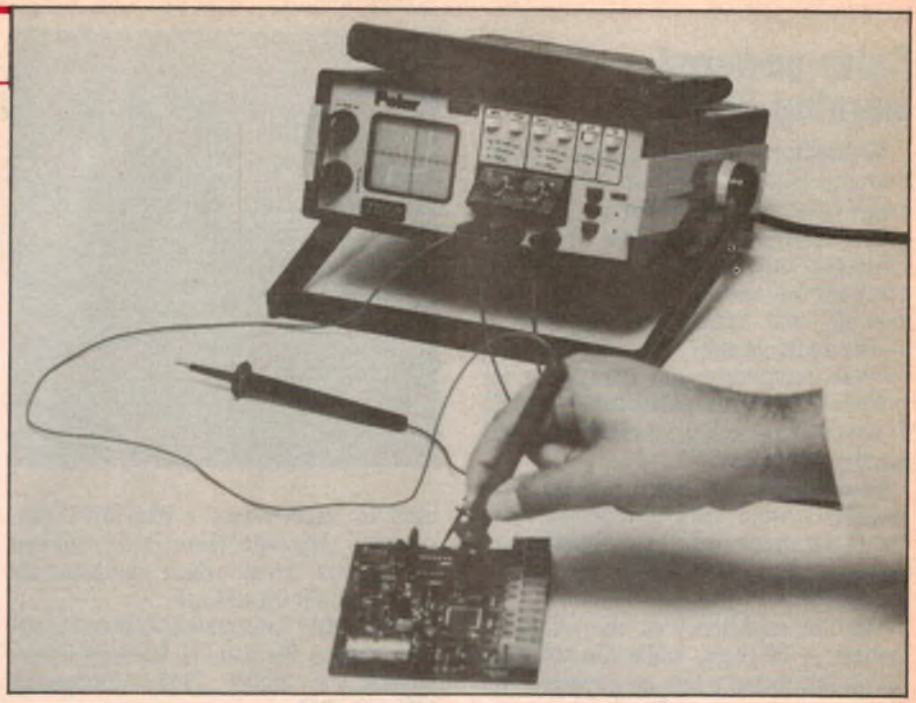
The Solartron 7151 Computer Multimeter provides all the functions of a normal multimeter and comes with a comprehensive suite of processing programs. Some of these include scaling, offset, percentage deviation, ratios, limits, max-min, peak-to-peak, mean, variance, standard deviation and RMS. It also has the ability to measure temperature from a resistance thermometer.

Other features include 3½ to 6½ digit true averaging with pushbutton null and electronic calibration. By using the analog output, a live graphic display can be obtained on a chart recorder or oscilloscope. IEEE488 and RS232C interfaces are built in as standard, and the system has a power-fail recovery option.

For further information contact Tech-Sales Pty Ltd, PO Box 621, Ringwood, Vic 3134. Telephone (03) 879 2733.

New Products...

In-circuit fault locator



Two new in-circuit fault locators, the model T1200 and the model T1000, are now available from Emona Instruments. Both units offer the same facilities, but the T1200 has its own internal CRT whereas the T1000 must be connected to a CRO with XY facilities.

By using these units, faults can be located on unpowered boards and quickly isolated to a particular component. In fact, troubleshooting can often be carried out without a detailed knowledge of how the faulty circuit works. In addition, simple transistor curve tracing facilities are incorporated, allowing individual devices to be checked for gain etc and matched where necessary.

General fault finding on a large variety of unpowered boards is achieved using the Lo or Hi ranges. When selected, these ranges produce a current limited AC test voltage across a pair of probes plugged into the front panel.

The probes are connected between two points on the faulty board and the display shows the impedance signature seen by the probes. The display can be used to locate faults in two ways: (1) by recognition of a suspect display; and (2) by comparison with results from a known good board.

Two channels, A and B, are provided so that the unit can be switched between two boards for easy signature comparison.

For further information contact Emona Instruments, PO Box K720, Haymarket, NSW 2000. Telephone (02) 212 4599.

New range of colour monitors

A new range of medium, high and very high resolution colour monitors is now available from Alfatron Pty Ltd. No less than 21 models are included in the line-up and these come in 12-inch, 14-inch and 20-inch screen sizes with three scan rates up to 31kHz in each model size.

The monitors were developed for cool running, are available cased or uncased, and include a number of interfaces (TTL, RGB, 1V 75-ohm and IBM compatible for graphics cards).

For further information contact Alfatron Pty Ltd, 1761 Ferntree Gully Road, Ferntree Gully, Vic 3156. Telephone (03) 758-9000.

Isolating platform for turntables

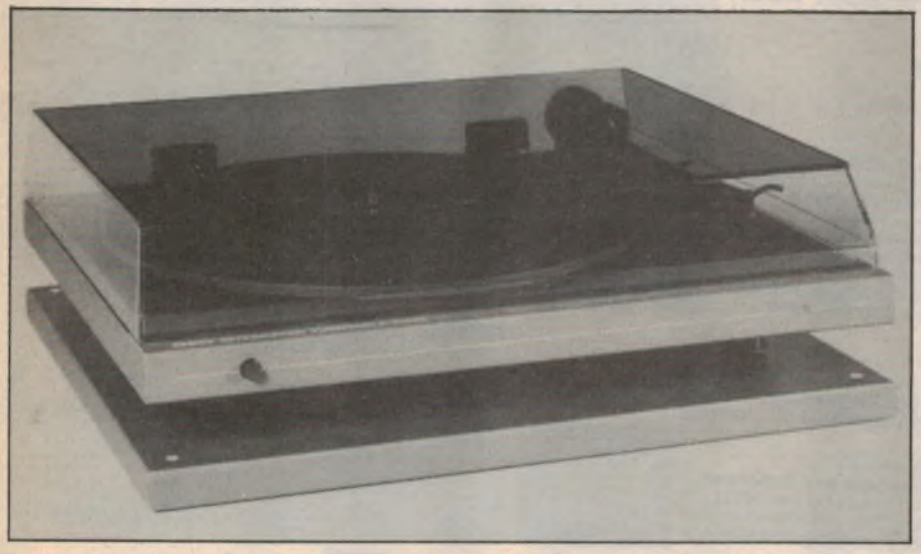
During use, turntables both generate and receive unwanted vibrations. These vibrations interact with the wanted audio sound fidelity.

One way of damping out these vibrations is to mount the turntable on an isolating platform. Turntables generally work best when mounted on light rigid surfaces which are isolated from the adverse effects of heavy tables or cabinets.

The Torlyte range of such platforms from QED have been especially designed for use with audio turntables. They are made from a light rigid material, feature four adjustable point supports which provide levelling and act as low frequency filters, and come in three sizes: TP1, 400 x 340 x 20mm; TP2, 445 x 350 x 20mm; and TP3, 480 x 370 x 20mm.

In addition, model CD-T measuring 340 x 240 x 20mm is available for use with compact disc players.

For further information contact Leisure Sound, 102 Glover Street, Cremorne, NSW 2090. Telephone (02) 908 3611.



Bubble-etcher for PC protos

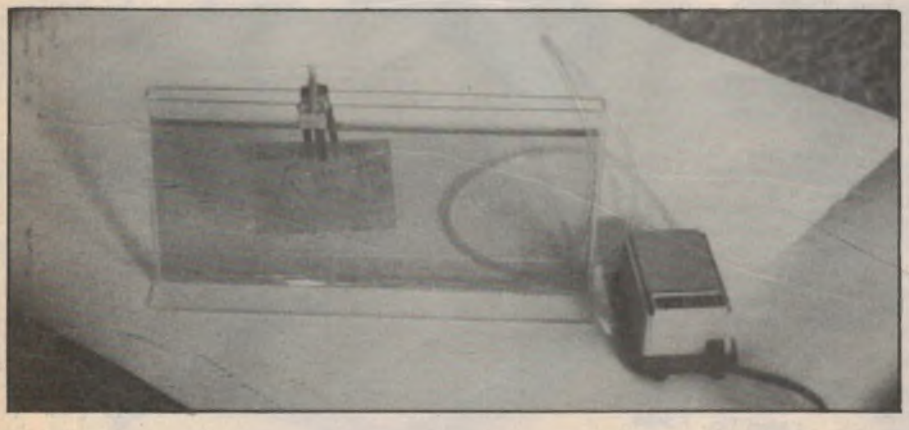
Designed to etch prototype PC boards with minimum usage of etching material, the Bubble-Etcher is a clear acrylic tank which holds 500ml of etchant, in a half-inch wide slot, into which bubbles are driven by a small air pump.

The PC board is suspended in the etchant and the movement of the fluid washes away the dissolved copper, leaving the board etched clean.

The Bubble-Etcher can be used with all etchants but is best used with ammonium persulphate, as this clear solution allows you to see the etching take place.

The kit includes the air pump, hose, clamps, silicon glue, and precut tank parts to suit boards up to 230 x 115mm.

For further information contact Sesame Electronics, PO Box 452, Prahran, Vic 3181. Telephone (03) 527 8807.



Special report:

Technical training for electronics servicemen

Australia is now facing a serious shortage of trained electronics service technicians. This report was originally prepared by the author for the Tasmanian Department of Technical and Further Education. It backgrounds the problems and recommends a solution.

by JIM LAWLER (MTETIA)*

* *Secretary, Tasmanian Division, TETIA.*

At the present time, 1986, there is a serious shortage of electronic technicians in all fields of electronics service but most acutely in the domestic and small commercial areas.

Most existing technicians have more work than they can handle but the economics of the industry are such that there is neither the time nor the money to train apprentices. No new trainees are being taken into the domestic service industry. Most newcomers to the scene are those who have dropped out of the high pressure but sometimes boring commercial and industrial areas.

The reason

The economic difficulties arise because of the relatively low initial price of domestic electronic appliances. Many owners relate the cost of repairs to the original cost and feel cheated when the former is high relative to the latter. This leads to low profits and a hand-to-mouth existence for most self-employed servicemen.

The public — the ultimate employers of these technicians — will not pay for their services at a rate that will permit the employment of trainees, even allowing that there is now enough work to justify their employment.

As a result of these pressures, at least here in Tasmania, only a handful of apprentices have been trained in the past ten years, and none at all in the past four years.

This should not be taken to imply that electronic servicemen in the domestic field are economically disadvantaged. The fact is simply that most self-employed servicemen earn a moderate living for themselves, but not enough to cover the wages of relatively unproductive trainees.

Background

The origin of this shortage of technicians can be traced back to the introduction of colour television to Australia in March 1975, and to a lesser degree to the introduction of solid state technology into consumer electronics.

The colour TV revolution had two effects on employment and training in the domestic and small commercial areas.

Firstly, the new technology "frightened off" many older technicians who were approaching retirement age. Many of these were ex-servicemen who had learned their trade in the wartime services and so felt that they had done enough.

> ***"Many owners relate the cost of repairs to the original cost and feel cheated when the former is high relative to the latter".***

Secondly, the advent of so many new colour TV sets dramatically reduced the need for servicemen. The new sets were also far more reliable and this had the same effect on employment.

As a result of these factors, at least half and possibly two thirds of the domestic electronics servicemen employed in 1974 had left the industry by 1976.

This was a brilliant example of "Market Forces" at work. Only those technicians best fitted to learn the new technology survived and the industry adjusted its size to suit the work available.

Unfortunately, the new television sets that led to the shake out in the industry ten years ago are now ageing and are in need of more and more service.

What is more, electronics now feature in more than just the lounge room. Most kitchens now have a microwave oven and electronic timers in stoves and dishwashers. In the laundry, electronic controls are found in washing machines, tumble driers and even in electric irons. In the bathroom, hairdryers, towel rails and space heaters all feature electronic controls.

Where ten years ago the average domestic electronic inventory consisted of the kitchen radio and a TV in the lounge room (with perhaps a stereo record player for the more affluent), the list today includes video cassette recorders, hifi stereos, compact disc players, cassette tape players, video games, personal computers, electronic clocks and watches of various kinds, not to mention stoves, microwave ovens and even self-owned telephones. The list goes on.

Another aspect of electronic service is what might be called "small commercial" work. It covers the service of two-way radio equipment used on the 27MHz Citizens Band.

Although CB radio is often thought of in derogatory terms as the plaything of a certain class of teenagers, it has a much wider and far more legitimate application in the trucking industry and on farms. These users have come to rely on their CB radio for vital communications not able to be economically provided by the public network.

The service of CB radio has come to be entrusted to a few skilled technicians and a lot of unskilled salesmen. Much of the trouble attributed to the CB radio system can be traced to badly adjusted equipment, fiddled with by well-

meaning but incompetent persons.

Although today's electronic equipment is infinitely more reliable than that of ten years ago, the fact that there is now infinitely more of it means that overall service requirements remain at much the same level as before. And there are only one third of the servicemen available to do the work.

The need

In one way or another, we must train new technicians for the electronic service industry.

Ideally, these technicians would have a thorough basic knowledge of their subject and an ability to change specialities with only a few months retraining.

The rapid development of electronics in recent yeas has required technicians to retrain themsevles quickly and frequently. Any new training scheme must take into account this need to prepare technicians for rapid change and frequent moves into new aspects of electronics.

"At least half and possibly two thirds of the domestic electronics servicemen employed in 1974 had left the industry by 1976".

The most useful and successful technician will be the one who can adapt quickly whenever a new product or new technique is placed on the market.

The solution

It has become apparent within the electronic service industry that past and present training methods are wasteful and inefficient.

Within Telecom, the Armed Forces, the computer industry, the industrial control industry and other major areas of electronic service, trainees are all taught the same basic subjects and skills, but in a dozen different ways with a dozen different curricula. People in domestic electronic service learn the same initial arts and crafts, but in yet another environment.

From a national point of view, it would be more economical if all of these trainees could be taught the same basic subjects, given the same initial training, in the same way and to the same standard.

This training should, ideally, take the form of two years of full time study following the completion of secondary schooling. This course should cover all the basic elements of electricity and electronics, together with other skills which might be deemed useful though not truly a part of electronics.

These extra skills would include, among others workshop practice, metal and plastic fabrication, tool care and maintenance, first aid, report writing and interpretation of technical literature.

At the completion of the two year basic training, students would then specialise in their chosen subject. This might require further full-time schooling or on-the-job training with part-time schooling.

"The most useful and successful technician will be the one who can adapt quickly".

The important consideration is that after the two year full-time course, students would be properly equipped to take either a lower level job in the work force or to go on to higher levels of skills and/or employment.

It has been argued that the current complexity of electronics is such that two years is hardly long enough to teach all that needs to be taught. It is here that the secondary schooling system can be of great assistance.

In Tasmania, the School Certificate Committee of the Schools Board has suggested the introduction of electronics as an elective subject into Grades 9 and 10.

Although the proposed course is truly elementary, students completing the subject would have a good knowledge of electricity and should have saved about three months of the suggested two year course. It may well be that students gaining a good pass at Level 3 in the High School subject might save half of the first year of the full time course.

Conclusion

The lower echelons of the electronic service industry cannot afford to train new tradesmen and even large companies that can afford the training program would appreciate a common, uniform approach to the early stages of electronic training.

The ideal approach seems to be a two year full time program to parallel the Year 11 and 12 (matriculation) schooling.

Where it is considered that two years is not long enough to cover the desired subjects, some useful time could be saved by encouraging the development of high school electronics courses.

Information centre

Automatic retraction for car aerials

I noticed in a publication of yours, "Electronic Projects for Cars", that you included an automatic aerial retraction circuit. I would like to know if it is possible to modify the circuit for use with a radio which is fitted with a 12V power take-off for electric aerials. The power is switched through to the take-off when the radio is turned on and switched off when the radio is turned off.

At the moment, I have access to an aerial which has a six second operation sequence. Any help you can provide me with would be most appreciated. (A.M., Collie, WA.)

• There's no need to modify the circuit A.M. All you have to do is connect the circuit to the power take-off on your radio instead of to VACC/IGN. Trimpots VR1 and VR2 are then set so that the antenna fully extends (VR1) and fully retracts (VR2).

Information on loudspeaker systems

We are two HSC physics students currently researching for our "Electronics Option". We are experiencing difficulty in obtaining information in regard to answering some of the questions presented on our paper.

It would be much appreciated if advice on why it is necessary to use more than one type of speaker in a hifi system, and how high pass and low pass filters are used to connect the speakers to an amplifier, could be given. (J.L. & N.S., Doncaster, Vic.)

• It is customary to use more than one driver (loudspeaker) in a loudspeaker system because a single driver is unable to deliver an even response right across the audio spectrum. Instead, individual drivers are specially designed to operate over a limited range of frequencies only. Beyond its optimum operating range, the response of a driver becomes "peaky" (ie, very uneven) and tends to roll off fairly sharply.

In a 2-way (or two-speaker) system, for example, the "woofer" is designed to cover frequencies from about 20Hz to typically 1500Hz. After that, the "tweeter" takes over and covers the frequencies from 1500Hz to around 20,000Hz (a young person with normal hearing can hear frequencies ranging up to 16,000Hz or more).

In practice, the loudspeaker system is designed so that the woofer and tweeter overlap each other slightly in order to obtain a smooth transition from one to the other.

Now about those filters. In the above example, the woofer would be fed via a low pass filter to prevent frequencies above 1500Hz from reaching it. Similarly, the tweeter is fed via a high pass filter to keep out low frequency signals below 1500Hz. The filters are thus used to keep out signals which are outside each individual driver's optimum operating range.

Of course, we can use more than two drivers in loudspeaker systems. In fact, many systems use three or more drivers in order to obtain the desired level of performance.

Antennas for FM reception

I was interested to read your article on improving FM reception but one thing which wasn't mentioned was the polarisation of the transmitted signal.

We have trouble here with a distant station (about 90km) which has a vertically polarised signal and a bit of vertical wire is better than an outdoors horizontal antenna. There seems to be no way round the problem but to have two antennas with a switch. (E.M., Manly West, Qld.)

• It would seem that you have no choice but to add a vertically polarised antenna to your existing installation. This should be mounted on a 1-metre long horizontal arm bolted at right angles to the mast, so that the mast will not upset the gain and directional characteristics of the antenna. For the same reason, the feeder cable to the new antenna should be run along the horizontal arm.

To avoid mutual interference between them, the new antenna should be mounted at least 1-metre above or below the existing antenna. You can either use separate downleads or, better still, feed the antenna outputs to a combiner mounted on the mast.

Problem with Digtal Capacitance Meter

With reference to the Digital Capacitance Meter in August 1985, was there a design or print error? I missed several issues and so did not see any comments.

I constructed the unit and the only reading I can get is all zeros. The decimal point changes as ranges are selected and the regulator output is 4.9V. Your comments would be appreciated. Thanks for a good magazine. (A.A., Coonamble, NSW.)

• From your description of the fault, it would appear that the 74C926 counter is not receiving clock pulses. Thus, the fault could lie in either the reference oscillator (IC1b), the gating oscillator (IC1c), the 4017 (IC2), or the nulling circuit (IC3).

You can check the operation of the gating oscillator and IC2 by connecting a multimeter set to the 10V range to pin 5 or pin 9 of IC2. The meter needle should swing high every 0.5 seconds.

TV CRO Adaptor

I constructed this kit from a Dick Smith discount special and am very happy with its performance in the vertical mode. The horizontal mode refuses to work except for the zero line in the centre of the screen. Increasing the gain with a 3V 50Hz signal results in a few dots above zero but no coherency.

Removal of the lead going to the shield input results in a sine wave display which tears on gain increase. The sync control has little effect except for reducing the intensity of the display.

Checking has consisted of component locations, wiring to pots and replacement of the 555, 4011 and 4013 ICs, all with no result.

To get the trace to centre on the screen with the adjustment available on the 10kΩ trimpot at the input stage, the 15kΩ resistor had to be replaced with a 27kΩ resistor.

Note that, because the shield input is wired to the front panel, high voltages should not be measured with this device. This was not mentioned in the article. (R.S., Wembly, WA.)

• Your problem with centering of the trace was covered in the Notes and Errata for July 1983. This recommended decreasing the 180kΩ resistor in series with the 10kΩ trimpot to 120kΩ. Increasing the 15kΩ resistor as you have done would also have the same effect.

We suspect that the horizontal hold control does not have sufficient range to provide horizontal sync. This problem can be overcome by increasing the associated 47kΩ resistor to 82kΩ, as outlined in July 1983 Notes & Errata. Alternatively, if this change has already been made, try reducing the value back to 47kΩ.

Note that you may need to re-centre the display on the screen after these changes. Note also that the horizontal mode should be used only when displaying high frequencies. Because of the way in which the circuit works, any attempt to display a 50Hz waveform in horizontal mode will result in just a few dots as you have found.

Finally, the CRO Adaptor should not be used for displaying very high voltages. However, provided the gain control is turned right down, voltages up to 50V RMS can be safely displayed.

Heat controller drops out

I recently constructed the Heat Controller as described in the July 1984 edition of EA, and the errata of August 1984. There appears to be a small error in the parts list, incidentally, which calls for a 390Ω resistor with a 1W rating. Both your layout diagram and photograph indicate a 1/4 watt rating which is further confirmed by the hole spacings on the PCB.

After I completed construction of the unit, I switched it on for testing and it didn't work. I traced the problem to omission of a very small wiring link which on the layout diagram is adjacent to the 1MΩ resistor. I was concerned that the omission may have caused some IC damage.

However, after inserting the link and switching on again, the unit did work. Nevertheless, I think there are some anomalies in its operation. With a 10kΩ/V multimeter connected across the load, observing the LED for visual indication and having used a protractor to ascertain degrees of rotation, I have found that:

(1) Starting with the pot fully counterclockwise, the LED extinguished and there is no output for the first 60 degrees of rotation (no complaint on this aspect).

(2) The next 120 degrees of rotation is the unit's operating range. The lowest setting is about a 1 second on, 3 seconds off cycle. The highest setting is about 2 LED flashes on per second. The voltmeter needle of course will only drop part way down at this rate. Again, I have no real complaint about this aspect of the unit's operation. However, towards the end of the 120 degrees rotation, the unit begins to revert to the slower cycling rate.

(3) For the final 60 degrees of rotation, the LED stays on but the output voltage drops to zero.

It is this last point that has me concerned as I would have expected that with near maximum pot rotation and with a continuously lit LED, the unit would be in the "bypass" mode and produce mains output voltage. This would be very handy as my use for the unit is for variable control of an electric blanket. Mind you, it is mostly successful as I use the unit at its lowest cycling rate. However, I have to disconnect it for a fast warm up.

I might mention in passing that I tried 10 suppliers for IC2, the MOC3040/41 before I sourced one from Stewart Electronics in Huntingdale, Victoria. I also had some difficulty obtaining the .047μF 250VAC capacitor. I actually obtained one from the same company, but am unsure as to whether it is metallised dielectric and the consequences if it isn't. (S.F., McKeller, ACT.)

• You are quite right about the 390Ω resistor — it only needs to have a 1/4W rating.

Judging by your description of the Heat Controller, it is odds on that you have a power supply problem. When the LED is permanently on, the power supply is most likely dropping excessively. This would result in reduced current flow through the optocoupler diode which subsequently fails to trigger.

We note that you refer to the difficulty in obtaining a .047μF capacitor. In reality, the value should be 0.47μF, as orginally specified. If you used the smaller value this would explain why the circuit is not working properly.

Video fader streaks and flashes

I find that the Video Fader described in January 1986 works fine except for horizontal streaking and flashing to the right of high contrast areas such as light colour titles on a dark background. Can you offer assistance to eliminate this please? (M.H., Geelong, Vic.)

• We would be interested to know whether the problem you describe is occurring over the full range of fader operation, or only at the maximum brightness setting. Our circuit did not require full rotation of the fader control. Normal brightness was obtained at about the 75% position.

Operation beyond this point is unnecessary and may reduce picture quality.

Assuming that your problem occurs at normal brightness or during fading, there are a few possible causes. From your description of the picture, it appears that the image is "smearing". This is usually due to bandwidth limitations, attenuation of the high frequency components of the signal, or boosted low frequency components.

It is unlikely that any of the sync stripping and reinsertion circuitry is at fault, since you have not mentioned any problems with loss of sync.

The problem is most likely to be associated with Q4, Q5, Q6 or Q7. It may be that one of the transistors is operating with reduced gain or bandwidth. Alternatively, one of these transistors may be incorrectly biased due to a wrong value resistor in the biasing networks.

Another possibility is that the burst blanking circuit is not operating correctly. Make sure that D9 is OK and has the correct polarity.

To test the burst blanking, set the fader to normal setting and disconnect the 33Ω resistor connected to the emitter of Q7. The picture should now be completely monochrome. If not, the blanking circuit (IC1, IC2 and IC3) is faulty.

Problem with Teletext decoder

I have recently purchased a Teletext Decoder kit from Dick Smith Electronics but, after completing the unit, have had nothing but problems with it.

Firstly, the screen pages will not stabilise, there are disrupted graphics and the counter will not stabilise. There is also a great deal of interference (vertical lines), even after attaching the 0.1μF capacitor between the modular housing and the case.

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Ref: Electronics Australia magazine - May, June & July 1986

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Input Sensitivity - Phone Inputs at 1kHz - 4.3mV (overload capacity at 1kHz 140mV) - Line Level Inputs - 270mV.
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I have tried the unit on other video recorders and TV sets and the same problems occur. I realise that you need a good quality signal so I purchased a 'Masthead Amplifier' to improve the incoming signal but this proved fruitless.

My next course of action was to write to EA concerning an article which covered the Teletext Decoder in its August and September issues 1985. Looking through your August edition on page 15 you show a photo of the kit fully built, but you also have extra wires running to IC19. It seems as if we were not told of the extra steps needed if you couldn't tune the kit perfectly.

The other thing I noticed was that capacitor C52 should have been where R63 is and vice versa. Also, the polarity of C52 is changed, as compared with the rear panel diagram on page 31. Is this correct and also should C49's polarity be reversed?

The other problem is that we have only a small indoor antenna and the slightest movement disrupts the counter and the graphics. How can this problem be overcome? Any help would be appreciated. (D.McG., Gordon Park, Qld.)

• Don't worry about the photograph in the August 1985 issue. It was of an early prototype and differs from the final version in some respects. The final version was shown in the September issue.

Capacitor C49 is indeed shown with incorrect polarity on the wiring diagram. However, while C52 and R63 are transposed on the overlay diagram as compared to the circuit diagram, this is of no consequence as the two are in series. The polarity of C52 is correct.

An indoor antenna will be quite inadequate for teletext reception (unless you live in a very strong signal area), and we suspect that this is the cause of your problems. Install a proper outside antenna and run coax cable between the antenna and the VCR so that RF noise from the teletext decoder will be shielded from the antenna input.

Secondly, do not use the masthead amplifier. These are only used when a good signal is available and only where there is going to be a large loss of signal in the lead between the antenna and the receiver; eg, with very long runs of coax cable or when numerous splitters are inserted in the signal path. Using a masthead amplifier on a poor signal is not the answer.

Playmaster AM/FM tuner

Some time ago, I constructed the FM IF strip described in Electronics Australia in July 1975, and connected it to the Audiosound FM front-end module reviewed in October 1975, page 54. At that time, I was content with mono output.

Now I am in the process of changing over to stereo and I have assembled the relevant components to add to the IF strip. Unfortunately, the July 1975 article omitted to describe how to adjust the oscillator frequency, the only reference being on page 38 at the foot of column three: "Only one adjustment is necessary which is the oscillator frequency, easily set up with the 4.7kΩ potentiometer".

Could you please tell me how this potentiometer is adjusted to the correct frequency? (W.S., Glen Iris, Vic.)

• It is quite easy to set the potentiometer. In the absence of test equipment, you simply twiddle the pot until you get stereo reception. This adjusts the VCO inside the MC1310P stereo decoder so that it locks onto the 19kHz stereo pilot tone.

Notes and Errata

PLAYMASTER STEREO AM/FM TUNER (December 1985-February 1986, File 2/TU/55-57): the following points should be noted in addition to notes and errata previously published:

(1) Diodes D7 and D8 are shown incorrectly oriented on the parts layout diagram. The circuit diagram is correct.

(2) The 1μF capacitor on the collectors of Q14 and Q15 is shown with incorrect polarity on both the circuit and layout diagrams.

(3) The 2.2kΩ resistor shown connected to pin 9 of IC4 on the parts layout diagram is incorrect. The correct value is 100kΩ as shown on the circuit diagram.

(4) The anode of D9 should connect to the output of the +12V regulator, not to the AM +12V as shown on the circuit diagram for the AM Stereo Tuner. The parts layout diagram is correct.

In addition to the above, we recently had an opportunity to inspect a tuner which had been assembled from a Jaycar kit. Here's what we found:

(5) The four 5.6kΩ resistors connected from K0, K1, K2 and K3 of IC1 to ground may need to be increased to 15kΩ to increase the contact bounce time for the switches. Note that this modification is only necessary if the memory LEDs do not light or only light momentarily.

The resistors may need to be reduced again to prevent false triggering (station jumping) if the infrared remote control circuit is subsequently installed.

(6) The 560pF capacitor across L3 at pins 6 and 9 of IC5 may have to be reduced to 470pF to enable tuning of the coil.

(7) The 5.6kΩ resistors in series with VR2 and VR3 in the 9kHz notch filters may need to be reduced in order to obtain maximum null.

(8) For correct operation of the Seek control with FM, pin 12 of IC2 should be connected to ground (pin 7) via a 22kΩ resistor (any value between 10kΩ and 100kΩ will do). This resistor can be installed on the copper side of the PCB.

(9) The 220kΩ resistor at the base of Q5 may have to be reduced to as far as 47kΩ to provide correct sensitivity of the AM Seek control.

(10) Some readers may encounter problems with the AM local oscillator at the low frequency end of the band. This is due to excessive output from the oscillator forward biasing the varicap diode. The problem can be cured by reducing the nine turns of the feedback winding at terminals 5 and 6 of L5. Remove only a portion of a turn at a time and allow the pin 5 lead to exit from beneath the cylindrical ferrite ring covering the coil.

The best procedure is to determine how much of the winding needs to be removed to stop the oscillator altogether (ie, when the varicap voltage suddenly jumps to maximum) and then to wind about 0.2 of a turn extra on the coil. This done, check that the oscillator operates reliably over the entire frequency range and when the power is switched off and on again. If not, increase the winding on the feedback coil.

240V LAMP SAVER (June 1986, File 2/PC/45): Constructors should note that the circuit will not work correctly with a 1W zener diode. The 18V/400mW zener specified must be used.

Compact Disc Reviews

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SOUND QUALITY 1 2 3 4 5 6 7 8 9 10

This new (yet another) recording of the Emperor is just one of a whole series of new recordings made by Claudio Arrau for Philips. Among them are the Beethoven Fourth Concerto, the Diabelli variations and sonatas, with other works by Chopin and Liszt.

As the Emperor is perhaps the most popular of all the Beethoven concertos, it has tended to have a certain recorded sound over the years which has reinforced its familiarity. Those people who are used to this will appreciate this new recording. It has a very full reverberant sound under Claudio Arrau's interpretation which is enhanced by the quietness of compact disc.

For myself, I prefer a much closer miked piano with less reverberation and so this recording was slightly disappointing in this aspect.

The Staatskapelle (Dresden State Orchestra) under Sir Colin Davis is excellent. (R.L.C.)

TCHAIKOVSKY

Swan Lake (complete recording)
Boston Symphony Orchestra conducted by Seiji Ozawa.
Deutsche Grammophon CD 415367-2.
2 disc set. ADD 11/78
Playing time: Disc 1, 71 min 25 sec; Disc 2, 73 min 10 sec.

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

SOUND QUALITY 1 2 3 4 5 6 7 8 9 10

I have always found the complete Tchaikovsky ballets most delightful, particularly compared with the "popular" Ballet masterpieces. The message here then is that if you like the Nutcracker Suite or the suite from the Sleeping Beauty or the Swan Lake — don't buy them! Save your dollars and wait for the complete versions. Your reward will be tenfold. This two-disc set is no exception.

With these ballets it is Tchaikovsky's genius you are listening to and that in itself very often makes up for lesser components on the technical side. All versions I have heard seem quite different yet the enjoyment is never-ending. You will not be disappointed with this set. Though it is a dated analog recording, which is even a trifle harsh on occasions and lacking a little on deep bass, I can still recommend it for what it is, the complete recording. (R.L.C.)

Concertos for flute, oboe and orchestra.
Antonio Salieri (1750-1825)
Concerto in C.
Domenico Cimarosa (1749-1801)
Concertante in G.
Carl Stamitz (1745-1801)
Concerto in G.
Aurele Nicolet, flute. Heinz Holliger, oboe.
The Academy of St. Martin-in-the-fields directed by Kenneth Sillito.
Philips CD 416359-2. DDD 6/85.
Playing time: 54 min 57 sec.

SALIERI

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

SOUND QUALITY 1 2 3 4 5 6 7 8 9 10

There is no doubt that Salieri's name might well have remained obscure had it not been for Peter Shaffer's brilliant play and subsequent film "Amadeus" which deftly follows his relationship with his rival, Mozart. Yet here is a composer who, in 1774, at the age of 24 had become court composer and director of the Opera in Vienna after the death of his teacher, Gassmann.

Cimarosa's development as composer also followed operatic rather than instrumental lines, but he was 23 before his first successful opera was produced in 1772. Many successes followed, making him a truly international composer.

Carl Stamitz differed from these two in that he was first and foremost a performer. Although he later became a fairly prolific composer, it was as a virtuoso violin and a viola player that he made his name.

This all digital recording is just typical of Philips CDs of the Academy — brilliant sound coupled with excellent playing. Nicolet's flute playing appears to be predominate though, particularly in the Cimarosa work. Possibly this is because this work was originally written for two flutes and is usually recorded this way. And, I must say, I prefer it with two flutes. Nonetheless, this recording captures the warmth and feeling of the three works and is to be recommended. (R.L.C.)

SIBELIUS

Symphony No. 1 in E minor, Op.39
Karelia Suite, Op.11
The Philharmonia Orchestra conducted by Vladimir Ashkenazy.
Decca CD 414534-2. DDD
Playing time: 56 min 40 sec.

PERFORMANCE 1 2 3 4 5 6 7 8 9 10

SOUND QUALITY 1 2 3 4 5 6 7 8 9 10

Jean Sibelius conducted the first performance of his first symphony on April 26th, 1899. It was greeted with enthusiasm and immediately pronounced the work of a master.

There are several reasons why Sibelius did not complete his first symphony until he was thirty three. As Brahms once ruefully remarked, the writing of a symphony after Beethoven's 9th was no joke, and Brahms did not finish his own first symphony until 1876 when he was 43 years old. Actually, Sibelius was no musical prodigy; he did not devote himself to music until he had demonstrated to his family that he would not be persuaded to take up a legal career.

This very new recording to me was "just right" and a sheer joy to listen to, both musically and technically. Ashkenazy's tempos sound spot-on for this exacting work and you can become truly absorbed in each movement. As an aside, I have always felt that the third movement with its exciting tympani rhythm from the fourth bar on should have been longer than just the five and a half minutes devoted to it by the composer.

Similarly, the Karelia Suite is another gem and shares the same enthusiasm. This disc will do justice to any good high fidelity system. Decca engineers have done a fine job. (R.L.C.)

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

August 1936

New ABC site: The general manager announced this week that the Commission has bought a new block of land in Sydney. The block is in Forbes St, opposite the Sydney Church of England Girls' Grammar School. It is roughly an acre and three quarters, which should provide room for extensions. The site is one of the highest points in Sydney.

Radio expert: Gwen Lammas joined 2UW a little over a year ago; she is an expert in a new trade which broadcasting has invented. It hasn't got a name, but gramophone cataloguer would about cover it. She set to work to catalogue the big 2UW record library, so that now all the records are in neat lines and properly accounted for in ledgers.

Newspaper transmission: The "Komssomoskaja Prawda" newspaper is being sent over the air from Moscow to Kiev in such a way that the paper may be reprinted without first taking a photograph of the received picture.

Wireless press camera: The Columbia Broadcasting System of America has developed a press camera to include a microwave transmitter with a range of five miles.

60kW transmitter: Our largest transmitter. To operate from N.Z. in December. This transmitter generates a carrier wave with a power of 60kW and has a modulation capability of 100 per cent.

For testing purposes, where it is not desirable to radiate the carrier, an artificial aerial resistance is employed. This has to be capable of dissipating up to 90kW to cover the modulation components. Water cooling is employed and by using an accurate water flow meter and sensitive indicating thermometers it is possible to check the power dissipation.

Roll your own: (editorial) It seems a long while since "having the wireless" involved visits to radio dealers for cardboard formers to wind coils on, and long arguments on the comparative values of various kinds of crystals. Children growing up now haven't the same incentive. In those days, you either made your receiver or you didn't have the wireless.

Yet there is still a large army of thousands of what you might call purists who insist on squeezing the last drop of interest out of broadcasting; no factory made receivers for them. And this week we publish a novel supplement for the benefit of these home builders.

RADIO, TELEVISION and HOBBIES

August 1961

Compact turbines: An unusual firefighting tug boat of the United States Army Transportation Corps will get its water-throwing ability from a pair of Boeing gas turbine engines. Each pump will move 2,000 gallons a minute at a pressure of 150 psi. The automatic pressure controls will enable the unit to pump at any selected pressure up to 250 psi regardless of the number of firefighting hoses on the line.

TV standards problem: A few years ago BBC engineers achieved the "impossible" by successfully converting TV images from one line standard to another. More recently, the advent of video tape recordings has raised the problem of frame standards conversion; from 50 cps of Britain and Europe to the 60 cps of the U.S.A. Once again BBC engineers provided the answer.

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Colour Analyser: A colour computer which can analyse colours and register their values in both figures and graphs within two minutes has been introduced in Japan.

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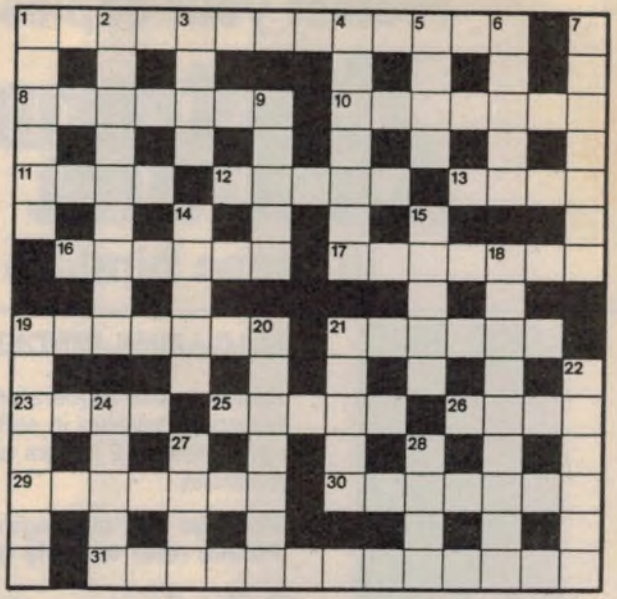

ACROSS

1. Special plug. (6,7)
8. Group of stations in a communications system. (7)
10. UV source. (7)
11. Average. (4)
12. Recorders can be _____ loading. (5)
13. Colour in test pattern. (4)
16. Oxide of silicon. (6)
17. Letter of phonetic alphabet. (7)
21. Erases. (6)
23. An EA subscription could be such. (4)
25. A burglar alarm system should detect this. (5)
26. Ratio used in AC theory, etc. (4)
29. Early experimental scientist. (7)
30. Beat. (7)
31. Part of a player. (8,5)

DOWN

1. Generator. (6)
2. Designation of a frequency band. (9)
3. Closed circuit. (4)
4. Element used with gallium. (7)
5. Shift to a particular frequency. (4)
6. Said of an appliance set to "stand-by". (5)
7. What sonar signals do! (7)
9. Country with large electronics industry. (5)
14. Subatomic particles. (5)
15. Scottish video engineer. (5)
18. Service aid. (9).
19. Possible state of telephone circuit. (7)
20. Access to external circuit. (4,3)
21. Remove insulation. (5)
22. Hazardous object for a satellite. (6)
24. Entry on a truth table. (5)
27. Primary colour. (4)
28. What chemistry students have in their crystal sets! (4)

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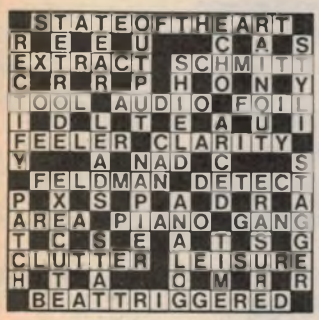

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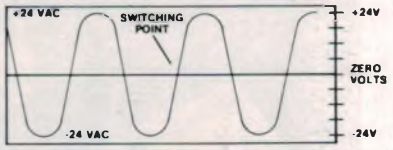

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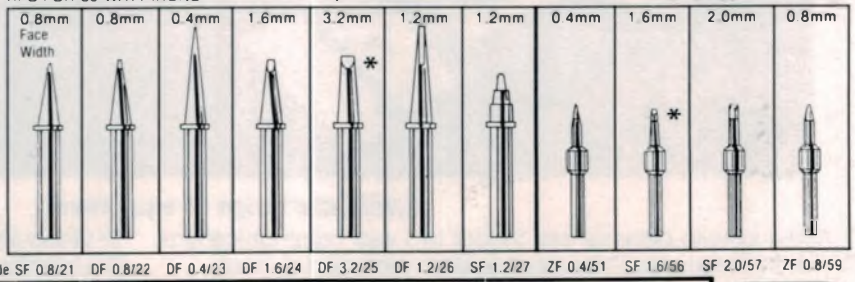

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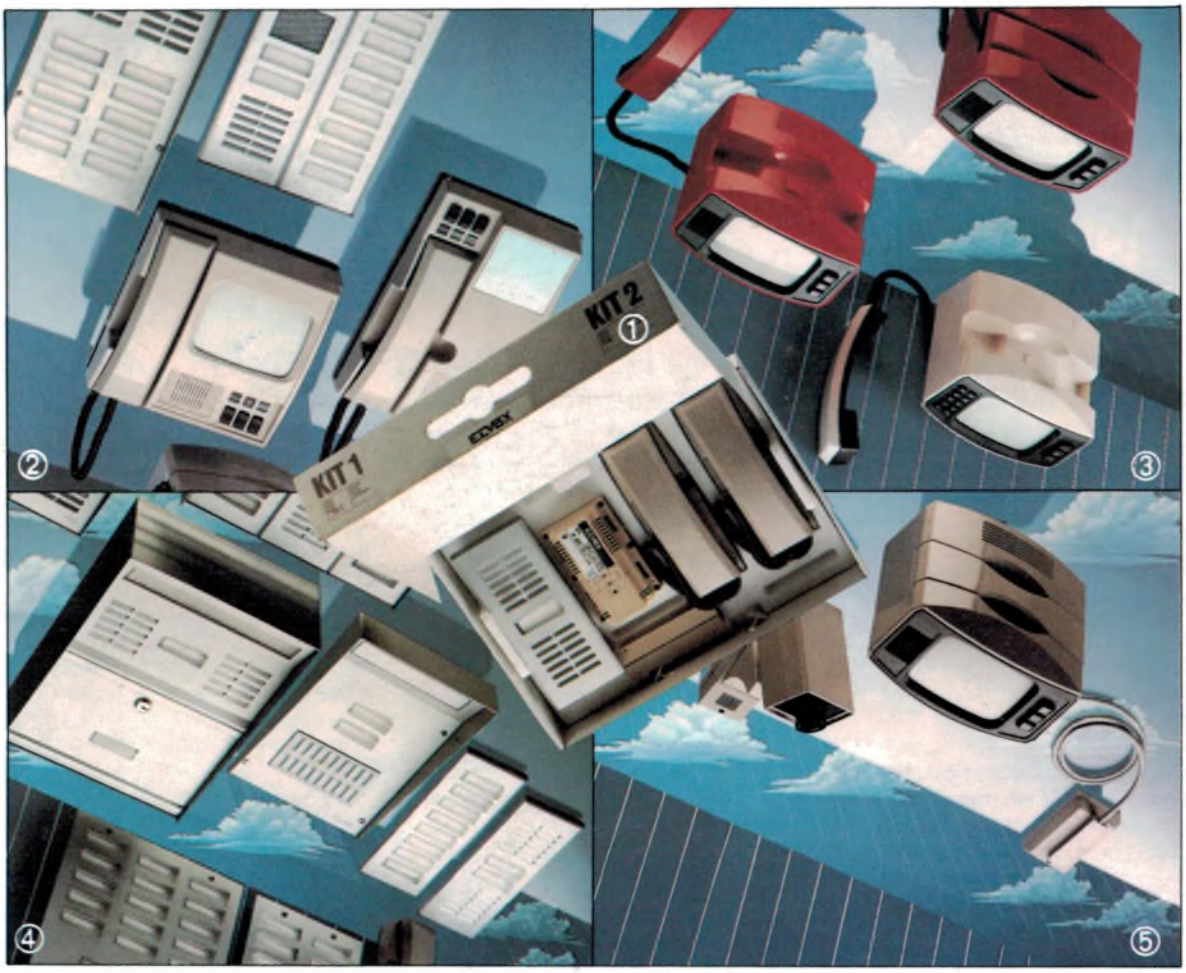

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