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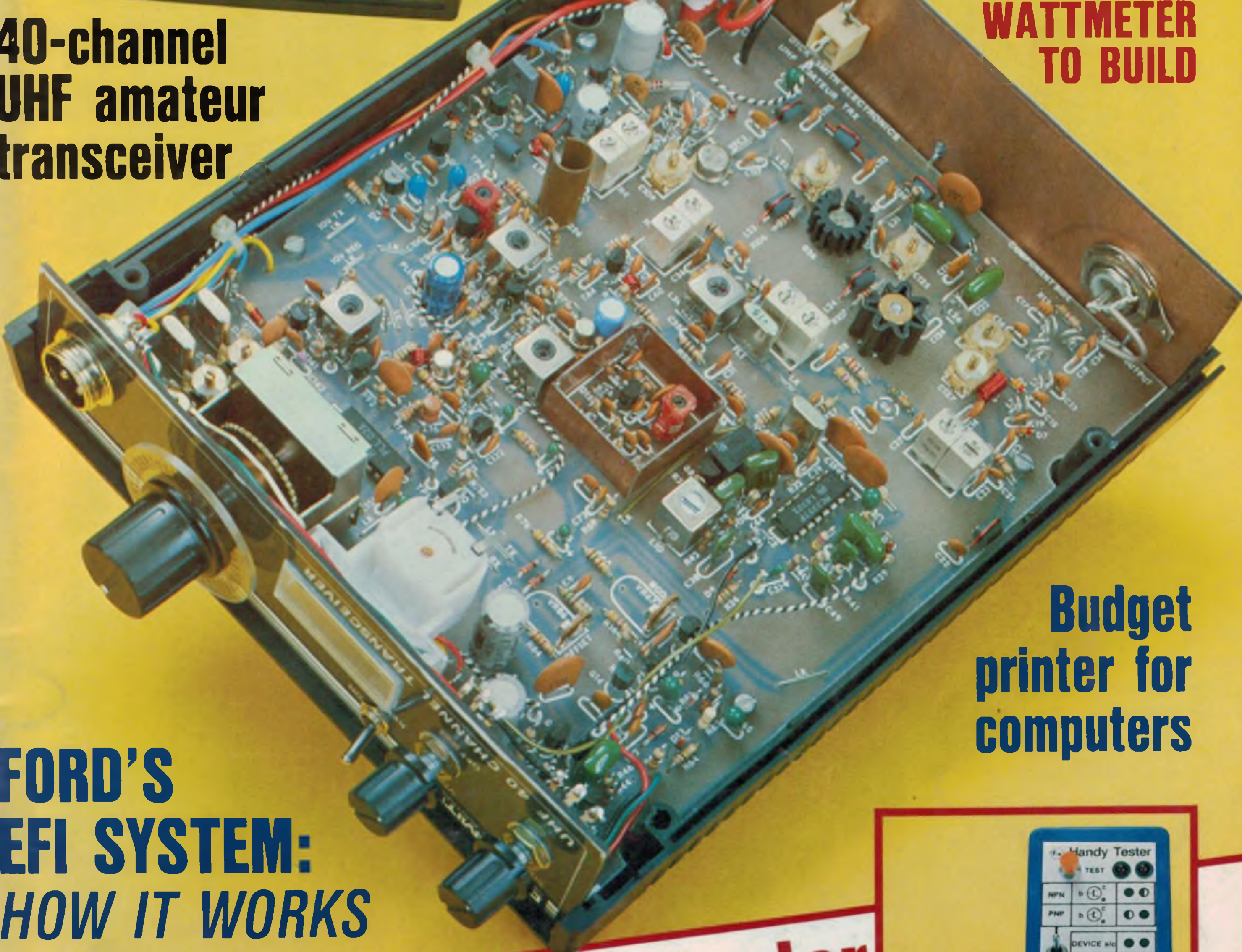
AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

SEPTEMBER 1983
AUST $2.10* NZ $2.60



40-channel UHF amateur transceiver

ELECTRONIC WATTMETER TO BUILD

Budget printer for computers

FORD'S EFI SYSTEM: *HOW IT WORKS*

In-circuit transistor tester

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AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 45, No. 9, September, 1983

On the cover

Featured this month is our 40-channel UHF amateur transceiver. Power output is 5W and there is provision for repeater operation. Details on page 72.

Features

Hifi, Video and Reviews

Projects and Circuits

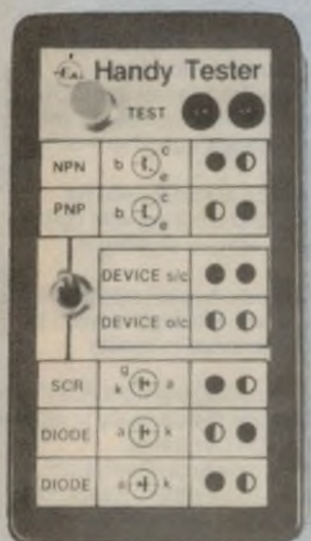
Personal Computers

Columns

Departments

EA Wattmeter

Check the power consumption of household appliances with the EA Wattmeter. It's accurate to 3kW and easy to build. Construction starts on page 54.



Transistor tester

There's no need to unsolder suspect semiconductors when you have our in-circuit tester on hand. Find out how to build it on page 62.

Dot matrix printer

Need a low-cost dot matrix printer? This printer mechanism and control board needs only a power supply and a suitable mounting. It provides upper and lowercase ASCII and special graphics characters. Details on page 100.

ELECTRONICS AUSTRALIA

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Editorial Viewpoint

Let's see old films at correct speed

Every now and again one sees a comment in the press that today's lifestyle is so much more frenetic than that of yesteryear and we are inclined to take such statements for granted. Yet when we see old films shown on TV exactly the opposite impression is given.

Apparently people in the "olden days" dashed about in a most energetic fashion, never pausing to rest. Their cars and machinery were surprisingly fast too, considering their stage of development. And even their conversation was quite uncharacteristic of today's manner of speech. In tender love scenes people in the old-time silent films jabbered like Rhesus monkeys rather than as normal human beings.

No wonder pornography never really caught on in those days. The juicy bits would have been over all too quickly!

What I am on about is the ludicrous practice of many TV stations of showing old-time films at 25 frames per second rather than the correct speed of 16 frames per second. Is it because the producers concerned don't know any better or are they doing it to provide comic relief?

The most blatant example of wrong speed projection is a recent "Weekend Magazine" segment on the ABC which featured 8mm colour film on motorcycle speed records. Normally projected at 16 frames per second, the showing of this film at 25 frames per second made the bikes look as though they were going at 400km/h. But the ABC is not the only offender in this regard. Most commercial stations are equally lax.

Ten years ago there may have been some justification for TV stations not showing films at the correct speed. To do the job properly required an expensive and complex step printing process which still produced an unnatural jerkiness in the motion of images on old films. But nowadays standards-converters using flying-spot scanners are readily available.

I can already hear some TV production people crying that such machines go for a quarter of a million dollars. Well to show old films correctly it is not necessary to go for the top-dollar machines which give correct colour rendition and so on. No colour is involved. Let's not hear the oft-trotted out excuse: not enough money.

As time goes on it will be natural for TV programmers to reach back into the archives to reveal Australia's rich film heritage. Let us hope that they do justice to the task and show the films at the correct speed.

Electronic ignition is reliable

You've probably seen some recent press reports that electronic ignition fitted as standard equipment to new cars is unreliable and expensive to replace. As far as we can determine, the truth is exactly the opposite. Our own company fleet has been typical in this respect with very little trouble experienced with electronic ignition. And changeover modules are low in cost. The record may be different for some imported cars but for the ordinary motorist electronic ignition represents one of the real improvements in recent years.

Leo Simpson

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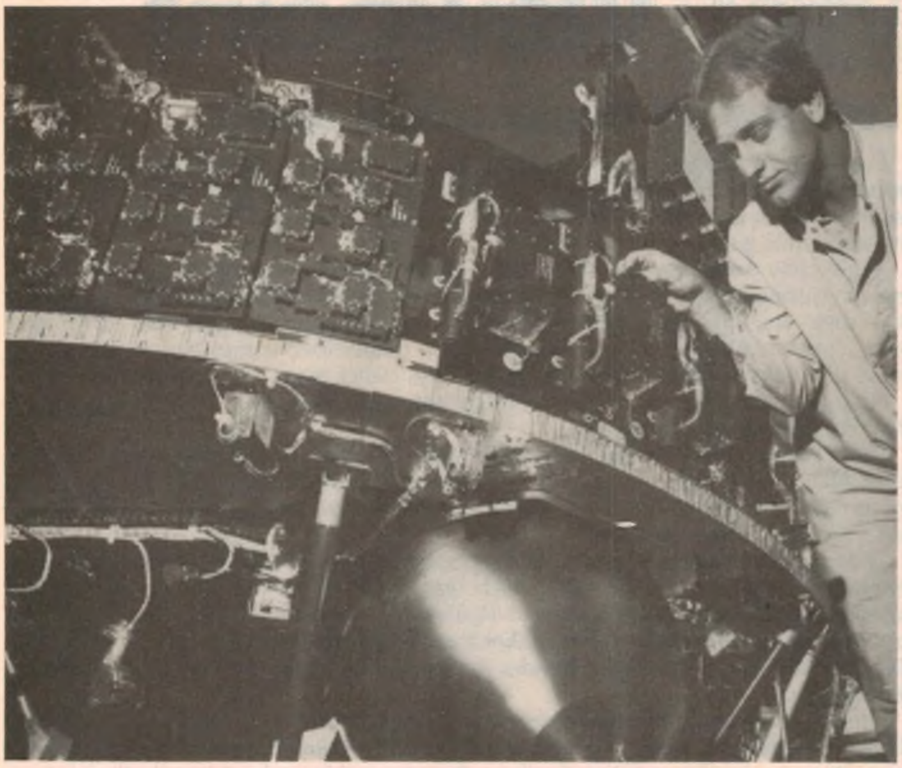
News Highlights



New technology for Hughes

Telstar 3, the first of three satellites built for the American Telephone and Telegraph Company (AT&T) represents a major change in signalling technology for manufacturer Hughes Aircraft Company.

The series will be the first Hughes satellites to use solid state power amplifiers rather than travelling wave tube amplifiers to transmit signals to earth. Like Australia's proposed domestic satellite the Telstar satellites are modified versions of the Hughes HS376S series. Telstar 3 will be the eleventh HS376S in orbit, and Hughes has orders for an additional 19 craft.

The solid state power amplifiers will allow Telstar 3 to carry nearly four times the number of channels as existing satellites.

F-18 electronics made in Australia

A contract has been awarded to Rockwell-Collins (Australasia) Pty Ltd for the supply of Identification Friend or Foe (IFF) equipment for the RAAF, the Minister for Defence, Mr Gordon Scholes, and the Minister for Defence Support, Mr Brian Howe, announced recently.

IFF equipment transmits special aircraft codes to allow radar identification of friendly aircraft in a hostile environment. It also allows automatic identification and altitude reporting of military aircraft, which is a mandatory requirement for civil air traffic control.

The equipment will be produced at the company's Lilydale plant in Victoria under licence from Italtel, Italy.

The licence would give Rockwell-Collins sole right to manufacture the equipment within the region, and could lead to significant export orders. In addition, the company's technology base and production capability would be enhanced.

The initial contract would be for $4.7 million, with the potential for follow-up orders valued at $1.4 million.

Mr Scholes said the new equipment will be used to update RAAF Macchi aircraft and for installation in the new P3-C and F/A-18 aircraft.

Ocean wave sensing buoy

An advanced ocean wave measuring system called WRANSAC (for Waverider Analyser and Satellite Communicator) is now available for use in Australia.

Developed by Dataware Development Inc, a Californian company, the system is able to provide precise measurement of wave spectra to assist in weather forecasting, shipping and fishing and construction of offshore oil platforms.

The use of satellite data transmission means that ocean wave data and buoy performance can be evaluated without delay, eliminating problems with line-of-sight transmissions to shore stations.

Australian agent for the system is Hawker Pacific Pty Ltd, 4-6 Harley Cres, Condell Park, NSW, 2200. Phone (02) 648 3555.

Readers wanted

The Royal Blind Society needs volunteers to help produce "talking books" for its clients. Volunteers would work at home, reading material onto tape for visually impaired students.

Electronics is one of the fastest growing areas of interest and the Society receives many requests for tapes of "Electronics Australia" and for Electrical Trades Course materials. There is also need for readers in computer science and law.

Volunteers are asked to submit an audition tape before commencing work. For details contact Jennifer Howley on (02) 747 6622.

Games therapy

Do electronic games turn children into mindless, slack jawed, pop eyed morons, totally dependent on their electronic "fixes"? Perhaps — but don't make too hasty a decision.

New research in Australia suggests that video games may play a role in the treatment of children with specific learning difficulties.

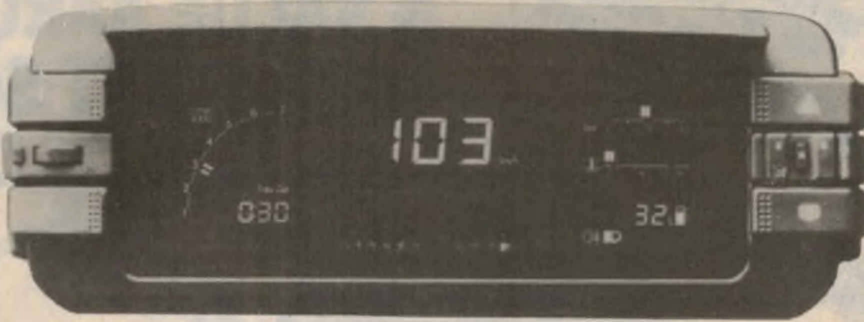
Research aimed at evaluating the effect of video games on response speed, manual dexterity, hand-eye coordination and attention span has indicated that video games practise can lead to improvement in all four aspects of behaviour.

The encouraging results of an independent research project are described by Shirley Goodhew in a paper to be presented at IREECON '83, the 19th International Convention and Exhibition of the Institution of Radio and Electronics Engineers Australia. The convention will be held at the RAS Showground from Monday 5th to Friday 9th this month and will include presentations of 260 papers from Australian and overseas authors.

Shirley Goodhew carried out the private research project prior to joining Rydalmere Hospital as an occupational therapist. The pilot study focussed on a 12-year-old with a history of poor motor coordination and learning difficulties. Therapy involved computer games such as the Atari CX2600 and the Fairchild Channel F System II.

"Engaging a child's enthusiasm and response increase motivation, an underlying factor towards success in therapy," she says. She considers video computer games to be a strong motivating force, and says that prolonged practise can encourage an increased attention span which leads to an improved capacity to learn.

The question now is whether this increase in attention span could be transferred to other tasks.

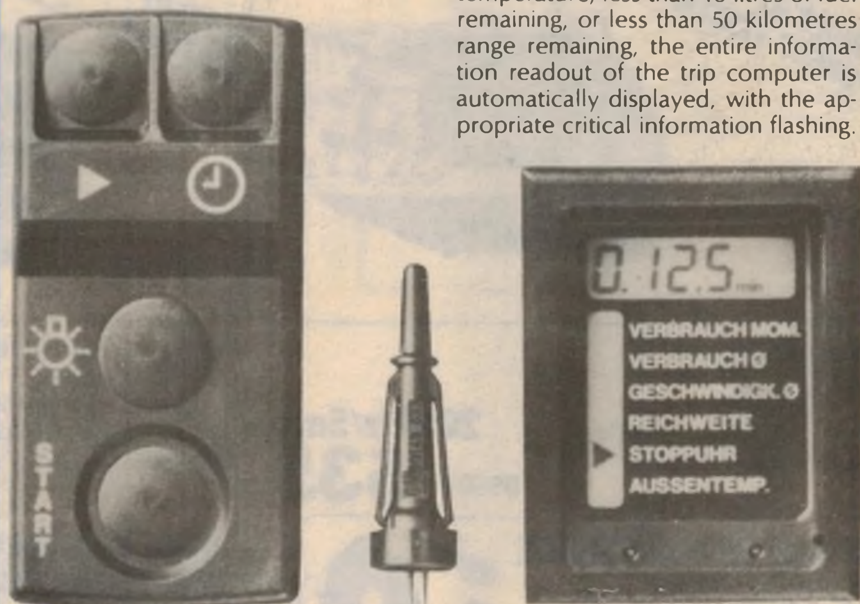


Bosch car computer

Bosch has become the first European automotive manufacturer to offer a fully electronic instrument cluster for passenger cars. The electronic instrument panel will be installed as standard in the Bosch Audi-Quattro vehicle (sold in Europe).

In addition to the functions of conventional instrument panels such as speedometer, tachometer and fuel gauge, a "trip computer" provides details of instantaneous and average fuel consumption, average speed, range on remaining fuel, elapsed time, and time of day. This computer information is called up by a rocker switch and displayed on a green fluorescent readout.

A "minimum display mode" can also be selected in which only road speed, distance and elapsed time are shown. In critical cases such as high engine temperature, less than 10 litres of fuel remaining, or less than 50 kilometres range remaining, the entire information readout of the trip computer is automatically displayed, with the appropriate critical information flashing.



Computer dog tag on test

The United States Army is currently testing a new electronic "dog tag" to simplify the complicated process of keeping track of troop movements. The tag being tested is made by Datakey Inc and consists of a 2K byte electrically erasable read-only memory embedded in a 50mm plastic key. This month a full 3500 man brigade will be equipped with the tags to test the idea under simulated battle conditions.

Currently each division of the US Army goes into battle with two 10 metre long vans full of IBM 360 computer equipment. If the exercise with the computerised tags is successful this equipment could be replaced with four microcomputers, each weighing 20kg.

Each soldier in the current exercise wears one of the tags, which store the traditional "name, rank and serial number", and can be read by a compact $US20 reader. A company clerk equipped with a hand-held computer, interfaced to a reader, can prepare basic reports within minutes which list the manpower available at any one site.

Troop transport and deployment will be simplified in the current exercise by using the information recorded on each tag to prepare passenger manifests for airforce transports. As the troops arrive the tags can again be read to provide the full capabilities of the arriving force. Battlefield assignments can then be made on the basis of this information relayed to a computer at headquarters.

Chillingly, the news report notes, "Tags from casualties will also be collected and a report with details to be sent to the next of kin will be generated in roughly half a minute."

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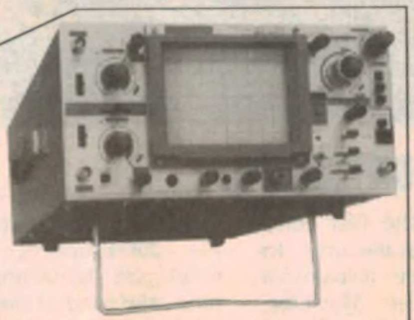

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News Highlights

Education in electronics

In the present economic climate many school leavers face a bleak future. Jobs are scarce, particularly for the inexperienced. So how can the school leaver gain experience? It's a vicious circle.

A group of 14 teenagers in the Strathfield, NSW, area recently faced just such a situation. All were unemployed and unskilled and despite many job applications, none had been successful in finding work.

They enrolled in a special work-skill course as part of a program titled "Transition Education" at the Strathfield Technical College. Upon completion of the course, the boys hope to find jobs in one of the many diverse areas of the electronics industry.

Already during the course — which lasts 15 weeks — they have gained extensive skills in the use of electronic components such as integrated circuits, resistors, capacitors, transformers, diodes and transistors; and each participant has built himself a one-transistor radio.

Innovation is the name of the game for the instructor, Mr Perkins, and his students. Together they have made radios, intercom sets, musical organs and digital clock/thermometers.

Visits to several electronics' factories are planned, with the boys hopefully able to undertake work experience with firms for a week.

Employers interested in hiring staff should contact their local CES office. For further information about Transition Education courses, young people should contact the principal of the Strathfield Technical College.

And the winner is . . .

Pictured above are, from left to right, Ted Fawle and Paul Dickson of Marantz (Australia) Pty Ltd and EA editor Leo Simpson at the drawing of the EA/Marantz Crossword Competition. The lucky winner is Peter Andrews, of Westmeadows, Victoria. Peter will receive a Marantz CD-73 compact disc player. Congratulations, Peter.

Wind power tests

The world's largest wind powered generator should start operating in Hawaii in 1985. The wind turbine, the MOD-5A, has a rotor over 100 metres in diameter and is expected to generate 7.3MW of electricity, almost double the power of existing machines running in the United States and the UK.

Britain's first experimental wind powered generator, a 200kW turbine at Carmarthen Bay, Wales, is back in action following a suspension of operation. The Central Electricity Generating Board dismantled the generator early this year after a similar machine in the United States shed one of its blades. According to the CEGB the British machine is in good shape.

"Chip pirates" get their desserts

Due to a strange interpretation of United States patent laws, integrated circuit manufacturers in that country are fair game for pirates who can run off copies of their silicon chip designs without contributing anything to their development costs.

The US Patent Office has ruled that designs are not patentable since patent law is concerned only with actual physical "inventions". Patent laws, according to the courts, protect only the hardware, not the expensive patterns from which the chips are created. "Chip pirates" can legally use chip designs by photographing the circuitry of a chip, enlarging the pattern, and making new etching masks.

But all that could soon change. A recently introduced bill, the "Semiconductor Chip Protection Act", if approved, would give a 10 year copyright protection to owners of chip patterns and require unwitting buyers of pirated chips to pay a licence fee to the originator for continued use of the design.

Works of literature are protected by copyright laws and inventions by patents, but integrated circuit mask patterns fall somewhere between the two, and require special legal treatment.

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See page 12 for

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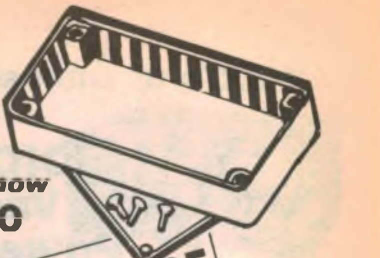

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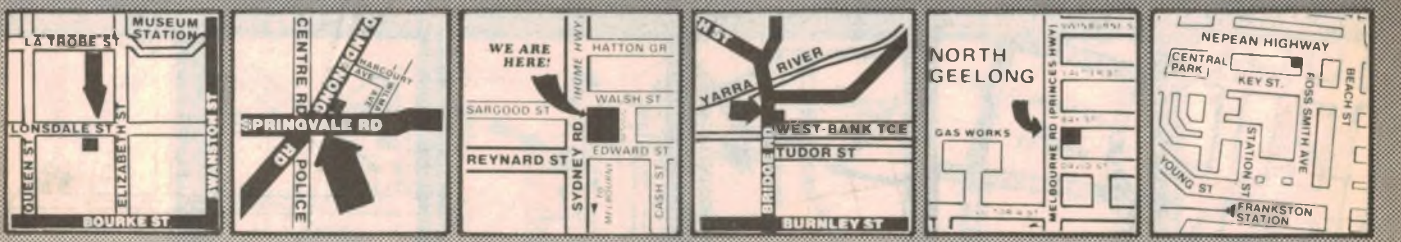

DICK SMITH Electronics

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When you place your next order you'll find a special note enclosed telling you all about our amazing new system.
We think you'll agree ... it's pretty special!

Dick Smith Electronics

Philips clinches Chinese order

Philips Telecommunications Manufacturing Company recently hosted a delegation from the People's Republic of China, here to examine the possibility of manufacturing Philips mobile radios under licence in China.

While in Australia the delegation visited Philips telecommunications manufacturing facilities in Melbourne and Sydney and were shown a wide range of Philips' communications installations in NSW, Victoria and Western Australia. The China Liaoning Foreign Trade Corporation Import Department has already signed an initial contract for 430 Philips mobile radio sets and orders for a further 1000 units are expected. The total order will be valued at around $A1.5 million according to Philips.

The mobile radio equipment will be used by vehicles and base stations in mines, shipyards and factories in Liaoning Province.

Shown above, Mr C. Bossers, chairman and managing director of Philips Industries Holdings Ltd exchanges business cards with Mr He Shang Ren, Madame Xie Yuan and Mr Liang Guotai of the Chinese trade delegation on their recent inspection of Philips telecommunications manufacturing and installations.

Electronics: an expanding industry

- Ellistronics has opened a new sales and warehouse centre in Mulgrave, Victoria. The new headquarters covers over 2000 square metres and includes a parking area. According to managing director Jock Ellis it will "handle everything electronic".

Ellistronics markets a wide range of semiconductors and other components, including devices from Fairchild and SGS-ATES, Cooper and OK Machine Co tools, Fluke and Hitachi test instruments and computers and peripheral equipment, as well as their own Versa brand of breadboards and components.

The new headquarters is at 797 Springvale Rd, Mulgrave, Vic. PHone (03) 561 5844.

- Jaycar Pty Ltd is expanding, with a new store now open at 121 Forest Rd, Hurstville, NSW. The phone number is (02) 570 7000.
- Fairchild Australia Pty Ltd has appointed Robert Ross as Application Engineer, Semiconductor Products. Ross has worked in the electronics industry for 18 years and has special expertise in automotive electronics. He will be responsible for all Fairchild engineering activities in Australia and New Zealand.

Bigger headquarters for DSE

Work has been completed on extensions to the North Ryde, NSW, headquarters of Dick Smith Electronics and the new and expanded service and kits departments are already in operation.

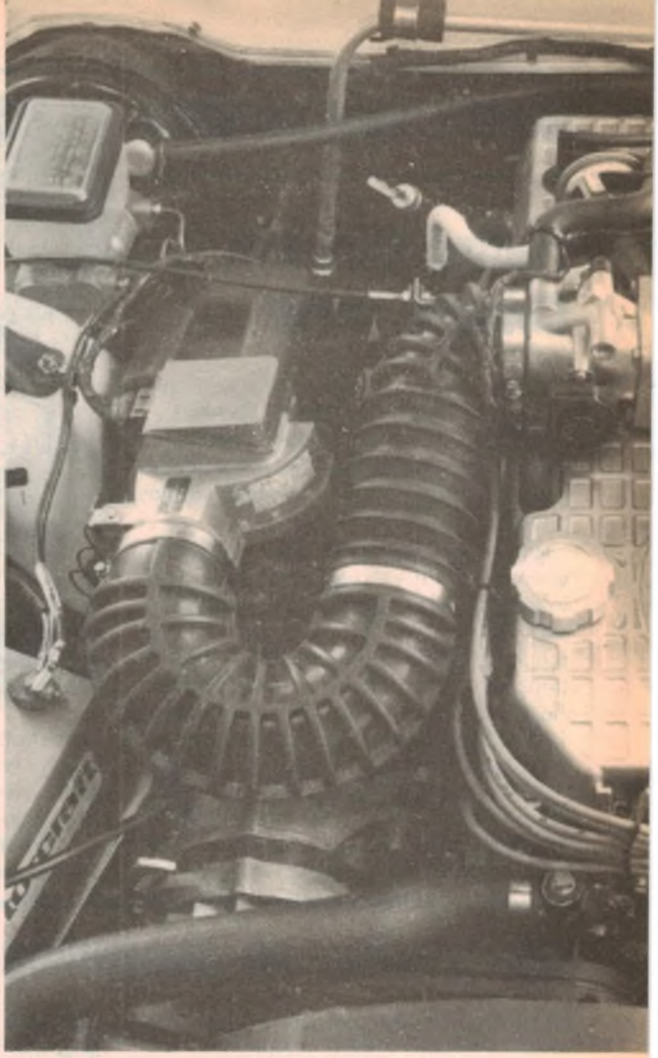
Over $2 million was spent on the extensions, which take the area of the headquarters from around 5000 to over 9400 square metres.

The newly expanded headquarters of Dick Smith Electronics at North Ryde, NSW.

The service department has almost doubled in size, allowing the installation of additional test equipment and a sound-proof testing and research laboratory. The mail order department has also been expanded and is now fully computerised. To speed orders on their way 250 metres of conveyor belts have been installed to move stock around the new warehousing and despatch areas.

Staff amenities have not been neglected, with the construction of a new staff recreation area "overlooking the staff swimming pool".

Electronic Fuel Injection: *How it works*

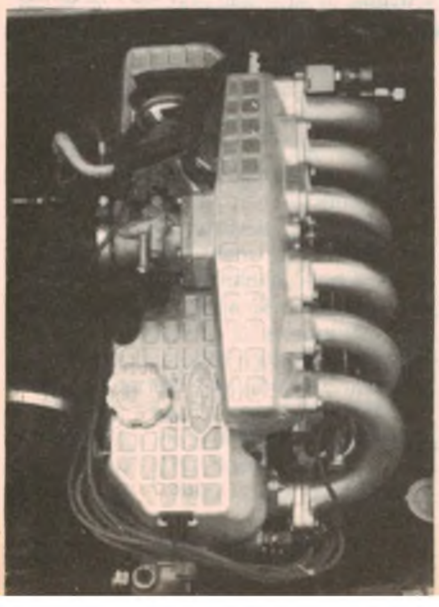


A revolution is taking place under the bonnet of the family car. Electronic fuel injection is replacing the time-honoured carburettor

by GREG SWAIN

Until fairly recently, auto manufacturers regarded electronic circuitry with a great deal of suspicion. They had their reasons. The high temperature environment that exists under a car's bonnet is no place for "sissy" electronic circuitry.

With the advent of improved circuit techniques and high-reliability components, that situation has changed. Electronic control of engine functions, until recently only available on expensive imported models, is now being adopted by local manufacturers for their family cars.



Perhaps the most widely publicised effort of late has been the fitting of electronic fuel injection to Ford Australia's 4.1-litre 6-cylinder engine. Ford designates the new power plant as the "EFI" engine and offers it as standard on ESP Fairmont Ghia and LTD models, and as an option on Falcon and Fairlane models.

For Ford, the adoption of EFI was virtually a matter of necessity. Consistent with world-wide trends and concern about fuel economy, Ford saw the demand for its V8 engine dwindle from 24.5% to 4.7% in just five years. This factor, coupled with the need to convert to 4-cylinder engine production to meet local content requirements, finally convinced Ford that the V8 "had to go". Production ceased in March of this year, although the decision was actually made about three years ago.

The problem for Ford was that it still needed an engine with V8 performance for its luxury Fairlane and LTD models, and for Falcon buyers who wanted extra performance for towing. So, concurrent with its decision to drop the V8, the company undertook a two-year program to develop a viable alternative. The EFI 6-cylinder engine is the result of Ford's efforts and, by all accounts, offers equivalent performance to the old 4.9-litre V8 but with dramatically improved fuel consumption.

A view of the EFI system, showing the plenum chamber and ram induction tubes.

Ford's EFI engine is likely to set something of a trend. The advantages of fuel injection are such that, over the next few years, we are likely to see it used in many more traditional family sedan models. In particular, General Motors-Holden's has announced plans to fit fuel injection to its Commodore and Camira models.

Compared to the more traditional carburettor, electronic fuel injection offers three main advantages:

- more precise metering of fuel according to the power demanded and engine operating conditions;
- more even distribution of fuel to the cylinders; and
- improved engine performance in terms of power and fuel economy.

Of these, the reason for the second listed advantage may not be readily apparent. The reason stems from the fact that, in a carburettor system, the carburettor must be positioned at the centre of the intake manifold. The cylinders at both ends of the engine block are thus further away from the carburettor than the two centre ones.

As a result, if the carburettor is ad-

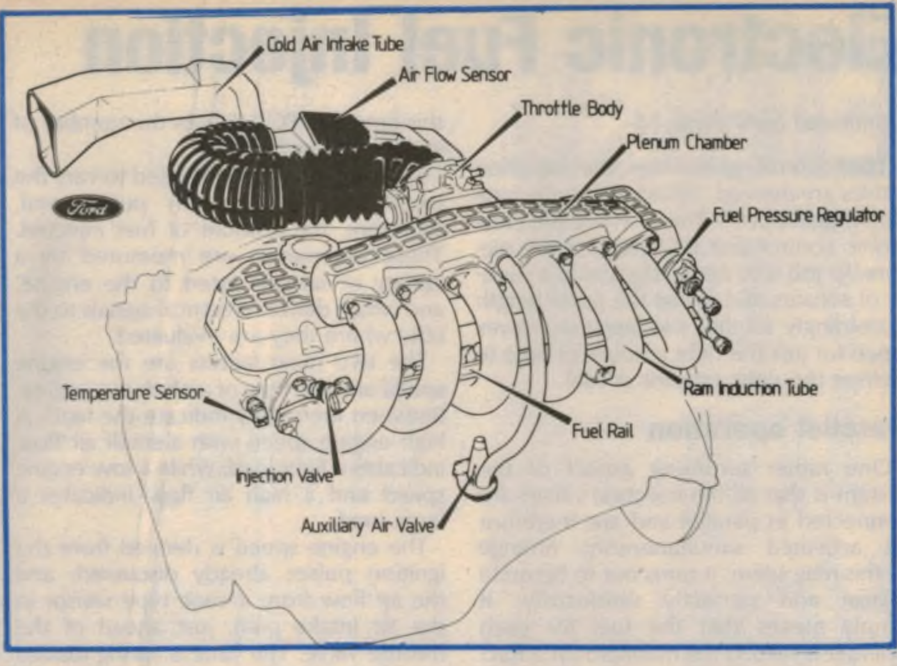
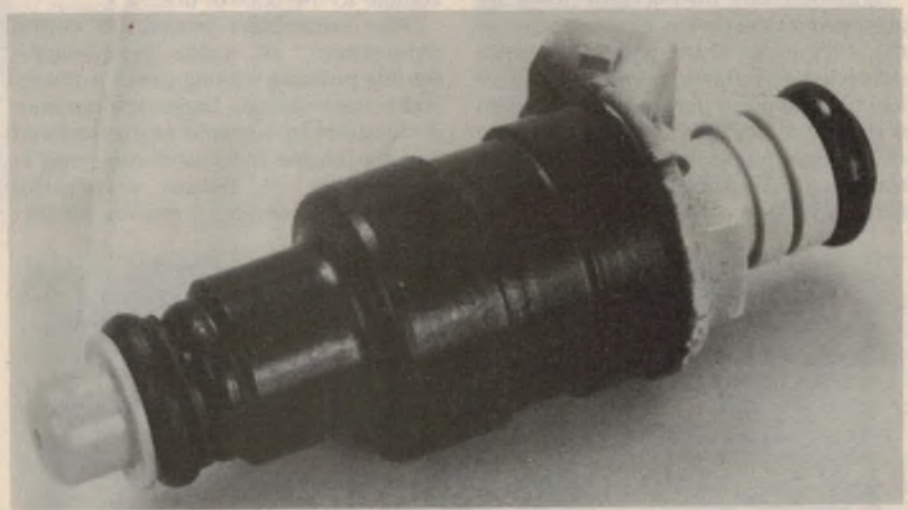


Fig. 1 (above): major components of Ford's EFI system. Note the fuel rail and pressure regulator. At left is a view of the complete engine compartment. The air flow sensor can be seen on the left.



A solenoid operated fuel injection valve, seen from the injection end.

justed to deliver an adequate amount of fuel to the end cylinders, it will invariably deliver too much to the centre ones. The result is uneven running and unnecessary use of fuel. Where the ultimate performance is desired, dual carburettors are sometimes used, an expensive and complex approach calling for very careful adjustment.

A fuel injection system overcomes this problem by delivering exactly the same amount of fuel to each cylinder, according to the moment-to-moment requirements.

The major disadvantage of fuel injection has, until recently, been its high cost. That situation is now changing. Whereas in the past fuel injection systems were controlled by mechanical means, low cost electronic control circuitry is now taking over. This circuitry monitors a host of engine operating parameters using various sensors and uses this information to control the fuel injectors so that just the right amount of fuel is delivered to the cylinders.

So let's take a look and see just how fuel injection works, with specific reference to Ford's EFI system.

Bosch LE II Jetronic System

The fuel injection system chosen by Ford is the Bosch LE II Jetronic system originally developed in West Germany. This system is supplied to Ford by Robert Bosch (Aust.) Pty Ltd and was jointly adapted by the two companies to suit Ford's 4.1-litre 6-cylinder engine. In fact, Ford is the first non-European manufacturer to incorporate the Bosch LE system in one of its engine designs.

Figs. 1 & 2 show the basic scheme for the Bosch fuel injection system. As can be seen, the major components consist of the electronic control unit, the fuel injectors, and the throttle body. Let's first consider the fuel supply and injection system proper, as distinct from the control system.

As shown in Fig. 2, the fuel is pumped from the tank and into a distributor pipe which feeds the injection valves, one for each cylinder. At the far end of the distributor pipe is a pressure release valve which allows the fuel pressure to rise to a certain level and ensures that this level is always maintained at the injection valves.

When the pressure tends to rise above the preset level the release valve opens and returns the fuel to the tank. The system is so adjusted that there will always be more fuel available than the engine is ever likely to require. Also, by circulating the fuel, a cooling action is provided which helps prevent fuel vaporisation and difficult starting under hot conditions.

The injection valves are solenoid operated and each is located in the inlet manifold immediately adjacent to the inlet valve for each cylinder. The solenoid operates a needle valve which is lifted by approximately 0.1mm, and the valve is designed to atomise the fuel as it is injected.

Continued on page 16

Electronic Fuel Injection

Continued from page 15

The control pulses for the injection valves are derived, initially, from the ignition trigger pulses. This is where the electronic control unit (ECU) enters the picture. Its job is to derive data from a variety of sensors and adjust the pulse length accordingly so that the injection valves open for just the right amount of time to deliver the right amount of fuel.

Parallel operation

One rather surprising aspect of the system is that all the injection valves are connected in parallel and are therefore all activated simultaneously. Strange as this may seem, it turns out to be quite logical and perfectly satisfactory. It simply means that the fuel for each cylinder is held in the manifold for a fraction of a second before its inlet valve opens, but the time is so short that this is of no consequence.

More precisely, the injection valves are activated twice during each rotation of the engine camshaft, with each pulse delivering half the required amount of fuel (ie, one pulse per rev). The problem is that, in a 6-cylinder engine, there are six ignition pulses generated for each rotation of the camshaft. Since we require only two injection pulses during this time, the ECU divides the number of ignition pulses by three.

Several paramaters are used to vary the length of the injection pulses and, therefore, the amount of fuel injected. These parameters are measured by a variety of sensors fitted to the engine, and which deliver electrical signals to the ECU where they are evaluated.

The two main factors are the engine speed and the flow of air into the engine. Between them they indicate the load. A high engine speed with a small air flow indicates a light load, while a low engine speed and a high air flow indicates a large load.

The engine speed is derived from the ignition pulses already discussed, and the air flow from a vane type sensor in the air intake path, just ahead of the throttle valve. The vane is spring loaded against the air flow and pivotted on a shaft which drives a potentiometer. Suitably connected, it delivers a variable voltage to the control unit.

Other paramaters sensed are engine temperature, air intake temperature, throttle position, starting switch position, and battery voltage. Engine temperature is measured by a simple sensor screwed into the engine block and immersed in the coolant. It houses a negative temperature coefficient resistor. Similarly, the air intake temperature is also measured using a negative temperature coefficient resistor, mounted just ahead of the air intake sensor.

The throttle position is sensed by means of two contacts – one which closes when the throttle is closed (the idle contact) and one which closes when the throttle is fully open (the full load contact). In between these two extremes, with neither contact activated, the control unit senses a "part load" condition.

The engine temperature controls the injection time under both running and starting conditions. When the starter switch is activated, and the motor is cold, the amount of fuel injected is increased, possibly by a factor of two or three times over that required when the engine is at running temperature.

Immediately after a cold start, a time delay circuit increases the injection period by between 30% and 60% above normal, according to the temperature, for about 30 seconds. After this period the amount of fuel is gradually decreased with increasing engine temperature.

Another warm up aid is called an auxiliary air device. This is actually an air bypass around the throttle valve and is controlled by a bimetal strip. When the engine is cold the bypass is open, producing in effect a partly open throttle by admitting more air. Since the extra air flow is sensed by the control unit, more fuel is also supplied. The bimetal strip is fitted with a heating element, and this is used to close the bypass after a prescribed time before engine heat takes effect.

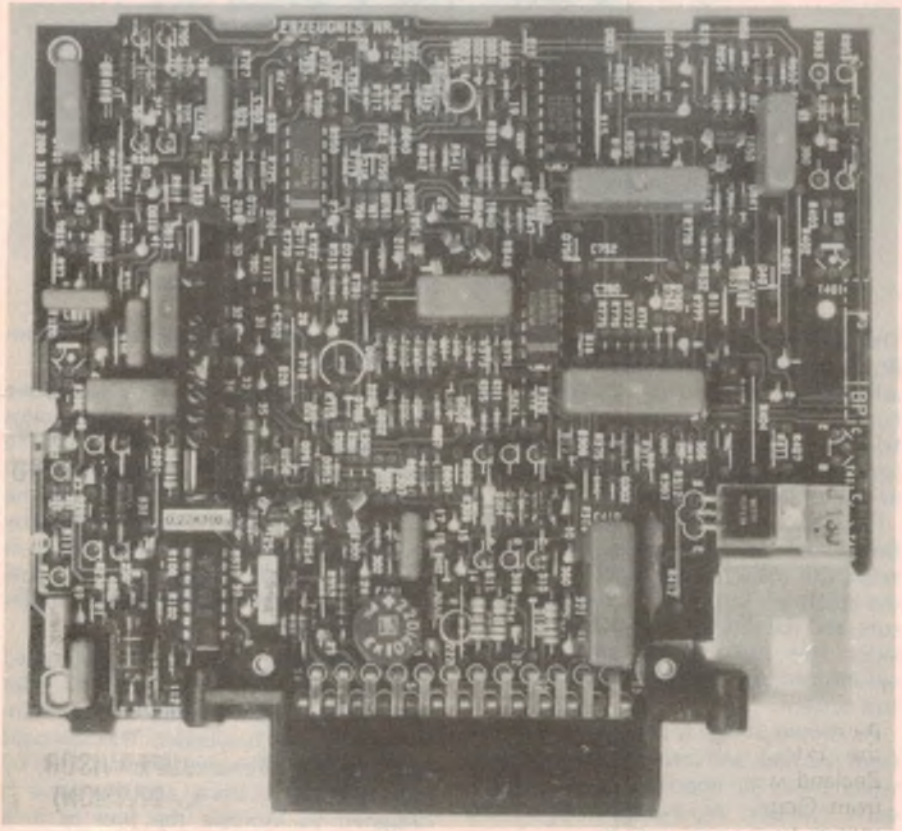
The air intake temperature sensor is used to maintain the desired air/fuel ratio regardless of the air temperature. Since cold air is denser than hot air, the amount of fuel required, for a given volume of air, will be less if the air is hot than when it is cold.

It is also necessary to apply a correction factor to take account of the battery voltage. This is because the operating time of the injection valves depends on the battery voltage – the lower the battery voltage, the shorter the injection time. To compensate, the battery voltage is monitored and the ECU adjusts the pulse length accordingly.

A number of other situations are also analysed by the control unit, and suitable commands initiated. For example, in the event of an accident, it is conceivable that the fuel pressure pump may continue working, creating a fire hazard. To overcome this the controller is programmed to switch off the fuel pump if the ignition remains switched on while the engine is stationary, as sensed by the lack of air flow.

Another possibility is to provide an overrun cut-out, and Ford has taken ad-

Continued on page 19



Heart of the EFI control system is this printed circuit board. It accepts data from all the engine parameter sensors and varies the fuel injection to suit.

KITS OF THE MONTH

ROD IRVING ELECTRONICS

425 High Street, Northcote 3070, Melbourne, Victoria. Ph (03) 489 8131. Telex No. 38897
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EA SEPTEMBER 83

SOIL HEATING UNIT $70

A little heat applied to the soil using this device may just do the trick. EA SEPT 83

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The unit described here will measure the power consumption of any mains appliance with a rating up to three kilowatts. It makes use of a special op amp called an "output transconductance amplifier" or OTA, for short.

EA SEPTEMBER 83

ON SCREEN GRAPHIC ANALYSER $109.00

The On Screen Graphic Analyser links your hifi to your TV set.
Features:
Six colour bar graph display (Standard PAL receiver).
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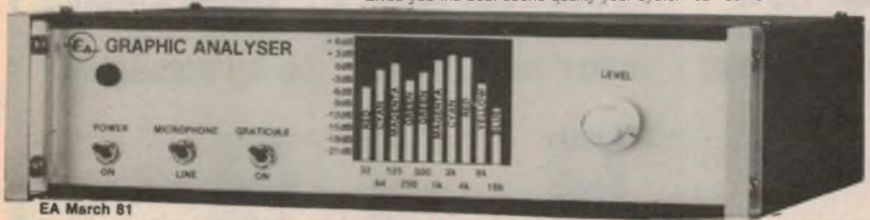


EA March 81

Touch-lamp Dimmer $20

The current cost of parts for this project is approximately

$20

for the Touch-lamp Dimmer and

$9

for the remote extension. Sales tax included.

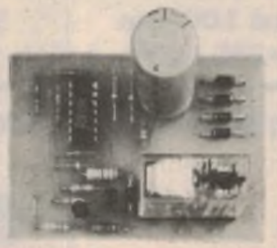
EA April 83

CAR BATTERY MONITOR $9.50

Flat Battery! Don't get left out in the rain. Install a voltage monitor which monitors the state of your battery at a glance. **EA. October 80.**

UNIVERSAL RELAY BOARD $13.50

Operating a relay to switch heavy current or mains voltages is a common requirement in electronic control applications. This project permits a relay to be switched in a variety of ways and from a variety of inputs. **ETI May 81**



LOW FUEL INDICATOR EA March 81

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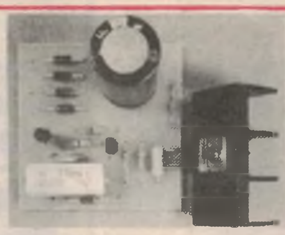

Here's an easy to assemble project for a simple speed regulator for miniature DC electric drills. **ETI July 81**

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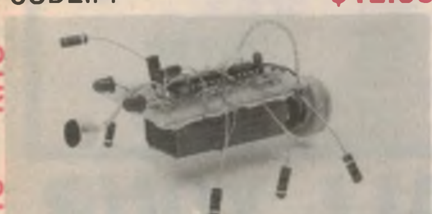

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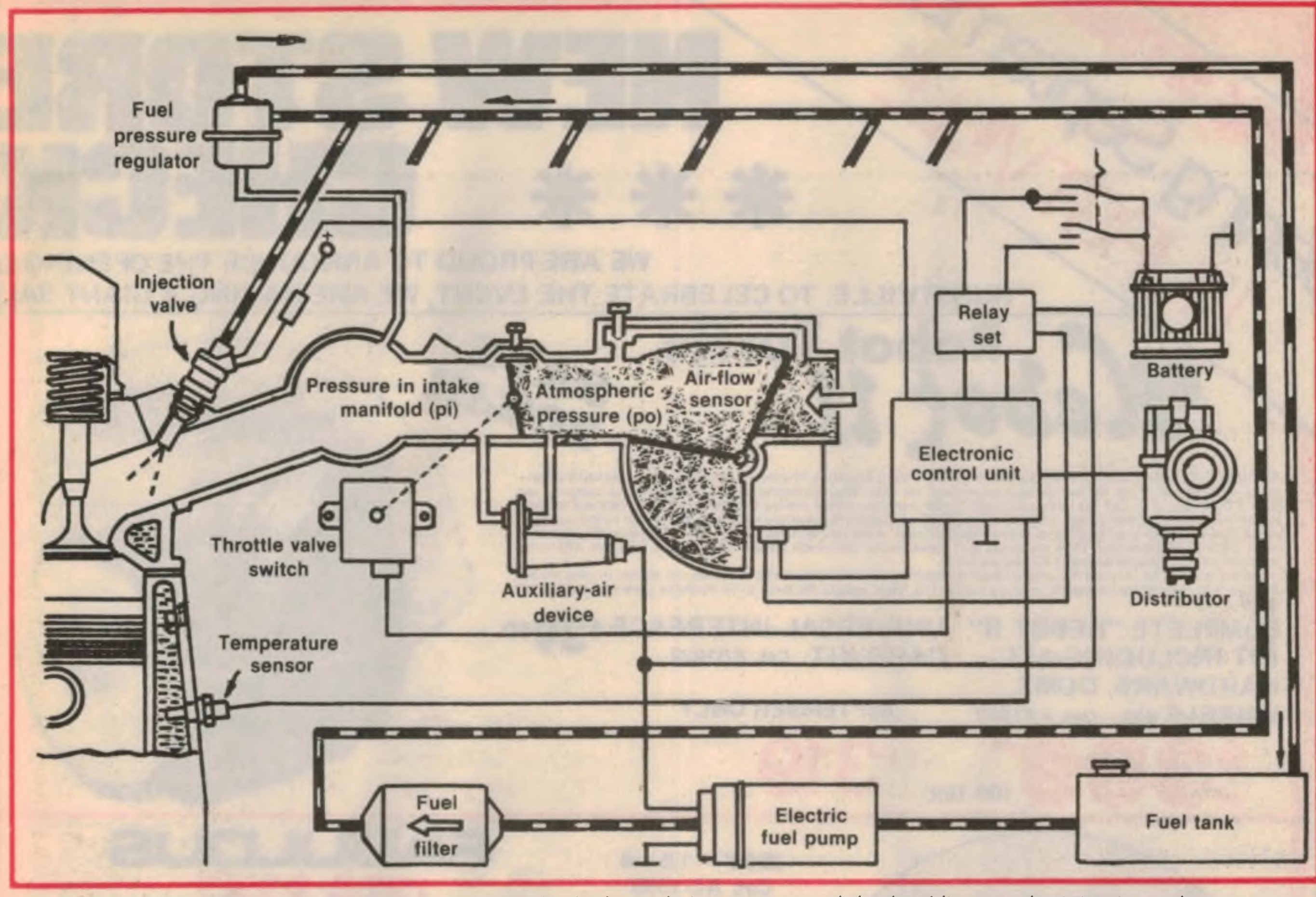

Fig. 2. A detailed diagram of the EFI system. Note the fuel circulation system and the feed lines to the injection valves.

Electronic Fuel Injection

Continued from page 16

vantage of this. If the vehicle is running downhill, with a closed throttle (idle contact closed) and the engine speed exceeds a certain value – about 2100rpm in the Ford engine – the fuel supply is cut off completely. It is restored immediately if the engine speed drops below this value or the throttle is opened. This contributes to a further worthwhile fuel saving.

Control unit

As for the control unit itself, the circuitry is all contained on a single printed circuit board and housed in a metal and plastic container located behind the left-hand cowl trim panel in the front passenger compartment. According to Ford, this makes the control unit easily accessible for servicing and at the same time isolates the electronic circuitry from high engine bay temperatures.

Serviceability is further enhanced by bringing all external connections out to a multiway socket mounted at one end of the board. If anything should go wrong, it's simply a case of unplugging the old board and plugging in a replacement.

To facilitate servicing, Ford has developed an electronic ignition and EFI diagnostic unit suitable for both roadside and workshop use.

So just how good is fuel injection, both as a broad concept and, in the specific case we are considering, involving Ford's application of it?

In general terms, Bosch suggest that fuel injection should, typically, result in a fuel saving of around 11% or, with over-run cut-off, up to 16%. This is averaged over typical mixed driving conditions, involving both city and highway driving.

In Ford's case, the company has been largely successful in producing a 6-cylinder engine with the performance of the old 4.9-litre V8. In fact, on the standard 0-100km/h acceleration test, the EFI Falcon 4-speed manual sedan is marginally quicker than the superseded V8 model, reaching 100km/h in just 10.1 seconds compared with 10.7 seconds for the V8 and 11.1 seconds for the 4.1-litre carburettor model.

Is is also interesting to note that, compared with the 4.1-litre carburettor engine, the EFI engine develops 20Nm more torque (325Nm at 2800rpm vs 305Nm at 2300rpm) and 13kW more power (111kW at 4000rpm vs 98kW at 3800rpm). According to Ford, the improved torque figure translates into superior top gear performance on long shallow grades and improved towing ability.

But it is the fuel consumption figures that are the most impressive. Measured according to Australian Standard 2077-1979, a Falcon 4.1-litre EFI automatic sedan uses 14 litres/100km city cycle and 10 litres/100km highway cycle. This compares to 19 litres/100km city cycle and 12 litres/100km highway cycle for the V8-engined car and represents an improvement of 26.3% in the city mode and 16.7% in the highway mode.

This reduction in fuel consumption is brought about by the more efficient distribution of fuel in the smaller capacity EFI engine, by design changes to the powertrain, and by the 136kg lighter weight of the EFI vehicle.

Unfortunately, the EFI option does not come cheaply. If you want EFI, then be prepared to pay $980 over the cost of the 4.1-litre carburettor engine. On the other hand, the cost of the EFI engine is about line-ball with the cost of the superseded 4.9-litre V8.

In the longer term, the cost of electronic fuel injection should come down, particularly as the competition "hots up". It will be interesting to observe the approach adopted by GM-H for its Camira and Commodore models.

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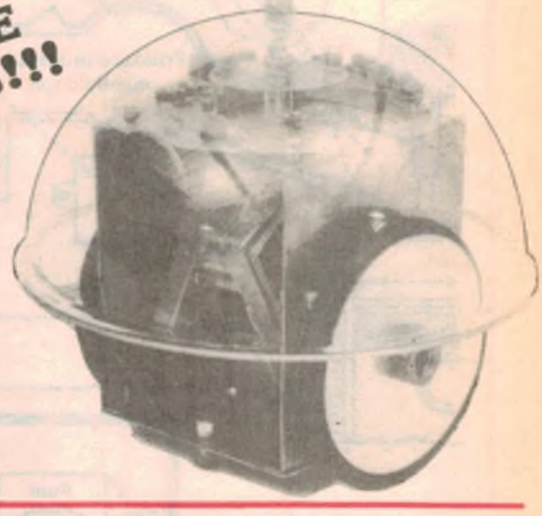

The HEBOT 11 turtle is not just a fun device, it is a positive aid to education, it takes programming out into the real 3 dimensional world instead of the flat two dimensional world of the VDU. When connected to the I/O ports of your computer and given a DC supply of 9–15V the turtle runs around under computer control moving forwards, backwards, right and left with independent control of each wheel, it has blinking eyes, will bleep with a choice of two tones and when ordered by the computer, presses down a pen to chart its progress and provide hard copy of the results of the program. When set free to run around the turtle discovers its enviroment. When the turtles shell bumps into an unmovable obstacle touch sensors send back data to the computer for it to calculate evasive or exploratory action.
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Ref: EA September 1981
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The people that came up with the game used a descriptive name which no-one else can use. It is a popular game and is well known under this name. Our game is similar to this game but - naturally - its electronic!! And, what's more, you can play against the machine - alone. Each XM7015 Codemaster measures 140(l)x85(w)x25(d) looks similar to a pocket calculator and runs off a standard 9V cell. Provision is made for a mains adaptor as well.
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* (For a further clue to the origin of this game read this page carefully)

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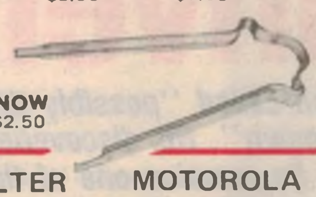

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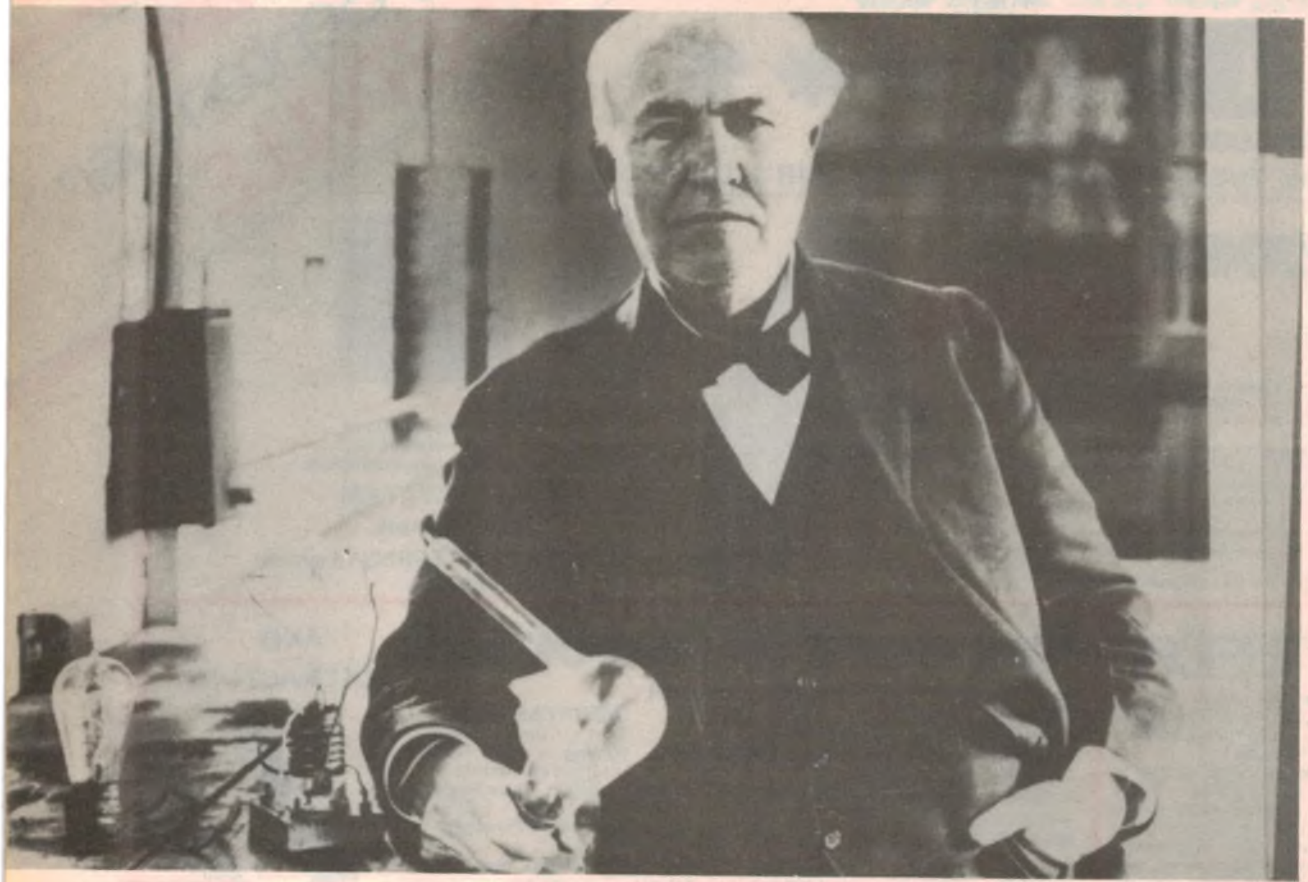
Right: Nikola Tesla's invention of AC generators, motors and a power distribution system laid the foundations of modern industry.

Edison, pictured with some of his early light bulbs. The two were to become bitter rivals in the AC versus DC controversy.



The inventive genius

Nikola Tesla has been called "possibly the greatest inventor the world has ever known". His discoveries form the basis of modern industry yet he remains one of the least recognised scientific pioneers in history.

by J. L. ELKHORNE

Through the years, power stations have generated as much controversy as electricity. Let us examine the problems men faced a hundred years ago.

The 1870s was an era of gas light and horse-drawn vehicles; what little electricity was used in industry originated on site. Before long, new forms of power generation and transmission would transform the nature of life – and two titans of electrical power would find themselves locked in a mortal combat that came to be known as "the battle of the currents."

The electric light in our homes and business which we take for granted today eluded scientific men for three-quarters of the 19th century. Humphry Davy demonstrated an electric carbon-arc lamp in 1808 but further development awaited a better power source. Then the dynamo emerged in 1831, based on Michael Faraday's discovery of magnetic induction.

The availability of ready power helped progress, but it was not enough. Scores of scientists and inventors tried to capture the elusive principle of incandescence; De La Rive in 1820, De Moleyns in 1841 and J. W. Starr in 1845.

Joseph W. Swan, in England, gave up in 1860 after 12 years of experiments. Arc lamps were developed by various practitioners of the electrical art, and became common in the 1880s.

Thomas Alva Edison superseded Farmer, Brush, Sawyer, Hiram Maxim, St George Lane-Fox, and Wallace. The "Wizard of Menlo Park", already wealthy and famous from previous work, turned his attention actively to the problem in September, 1878. Having witnessed the Wallace-Farmer arc light system, Edison told Wallace: "I do not think you are working in the right direction." He proceeded to work on the problem in his own fashion for two nights and said: "I discovered the necessary secret, so simple that a bootblack could understand it."

Edison realised that intense arc lights could not fulfill the requirements of ordinary household use. He also recognised that a corollary of practical home lighting was a distribution system running from a central station.

He outlined his grand plan – to electrify New York City – to a reporter and reckoned he could have his electric light invention finished in six weeks. His electric distribution system would duplicate the gas-distribution industry which then lit the cities. The true value in his skill lay not in developing an incandescent lamp, so much, as in the

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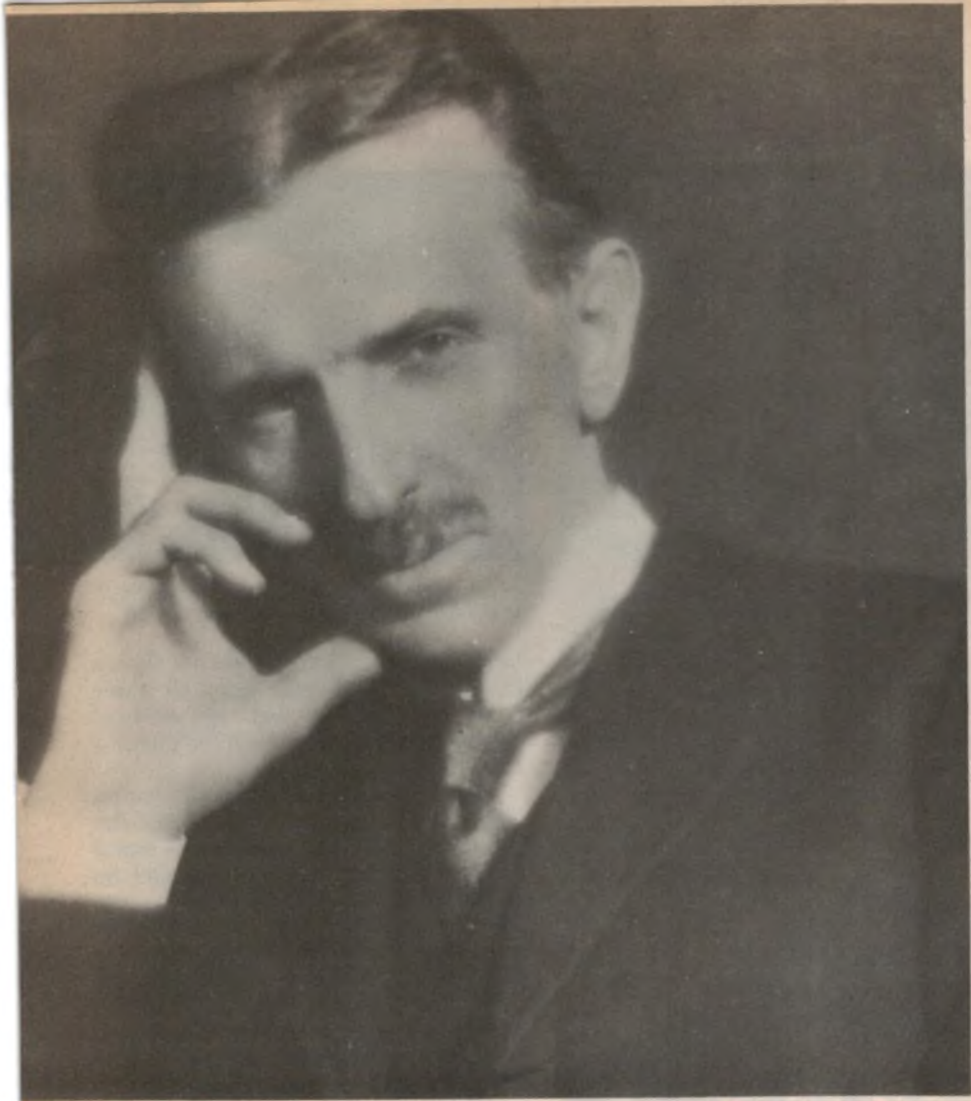


# of Nikola Tesla

concept of electric distribution.

Putting the cart before the horse, Edison launched an elaborate press campaign, essentially stating that the problem of electric lighting had been solved. In October, he carefully demonstrated a platinum-wire lamp. He had realised early on the necessity of a good vacuum for his lamp. He also knew, secretly, that his platinum-wire lamp was not the answer. Had he not turned it off after a short period of illumination, it would have burned out. But his showmanship convinced the public that the time had come.

Years later, one of his associates remarked: "Edison got himself into trouble purposely, by premature publication so that he would have a full incentive to get himself out of trouble."

That trouble of his own making brought him the backing of a syndicate of financiers. Even though no electric distribution system stood ready, gas company shares dropped some 12% during this hectic time. The capitalists who took a paper loss quickly lined up to support Edison in his quest for success and profit with the new idea.

By April, 1879, Edison found his platinum-wire lamps quite encouraging, "burning an hour or two" but tried many other substances. A demonstration for his backers was not a success, however. One of the financiers remarked that Edison "would have been better off to spend a few dollars for Starr's book on carbon vacuum lamps, rather than coming to the same stopping point after spending $50,000."

The breakthrough came on October 21, 1879, with a test of carbonised ordinary cotton thread – Coats cord No. 29. Notebooks attest to a continuous run of 13½ hours. Edison coined the term *filament* for his carbonised threads, and before long, had a filament of Bristol cardboard that burned 170 hours.

Although Menlo Park neighbours and railway passengers out of New York had seen brilliant lights at night, the public announcement of success waited until December 21, 1879. Almost three years of work on the principles of distribution followed. Edison's Pearl Street power plant officially opened on September 4, 1882 and initially had 59 household subscribers. The Pearl Street Station generated electricity from steam, but a hydroelectric plant also started operation in Appleton, Wisconsin in that year.

Tesla's first work was with telephones somewhat less advanced than this 1900 model.

Had Thomas Alva Edison but known it his troubles were just beginning. His "marvel of the century" would soon prove to be an expensive white elephant, obsolescent almost before it began, and surpassed within a decade by a man whom Edison would characterise as a continental playboy.

Nikola Tesla, Croatian-born engineer and scientist, had long sought the secret of alternating current. In February of 1882, a fateful year, Tesla hit upon the brilliant concept of the rotating magnetic field.

Alternating current seemed to ordinary men of the day as nothing more than a laboratory curiosity. Just as with the electric incandescent light, scores of inventors had tried and failed with it. To understand why Nikola Tesla succeeded, analysis of the man and his time is worthwhile.

Tesla was born on the night of July 9-10, 1856, the second son of a Serbian Orthodox clergyman. His birthplace, Smiljan, Lika, Croatia, lies within the borders of modern Yugoslavia.

Nikola's father, Milutin Tesla, had started a career in the military only to enter the church shortly after he married. As the Tesla line had always given a son to the church the family expected that Nikola would eventually become a clergyman. His older brother, Dane, had evidenced a brilliant mind, and would bring honour to the family as a scientist or engineer. However, Dane

Continued on page 24

The inventive genius of Nikola Tesla

Continued from page 23

died at the age of 12, the result of an accidental fall from a horse.

Nikola had proved to have an equally find mind and a keen insight. Although his inclinations were secular, Milutin Tesla remained adamant that Nikola would enter the church.

His work in school continually astounded his teachers, for he had the ability to do lightning calculations mentally. At one point he received a failing mark in an examination, for it was assumed that he had surely cheated. Only when he demanded another examination from the director of the school, and solved problems far in advance of his years did his mentors accept his astonishing talent.

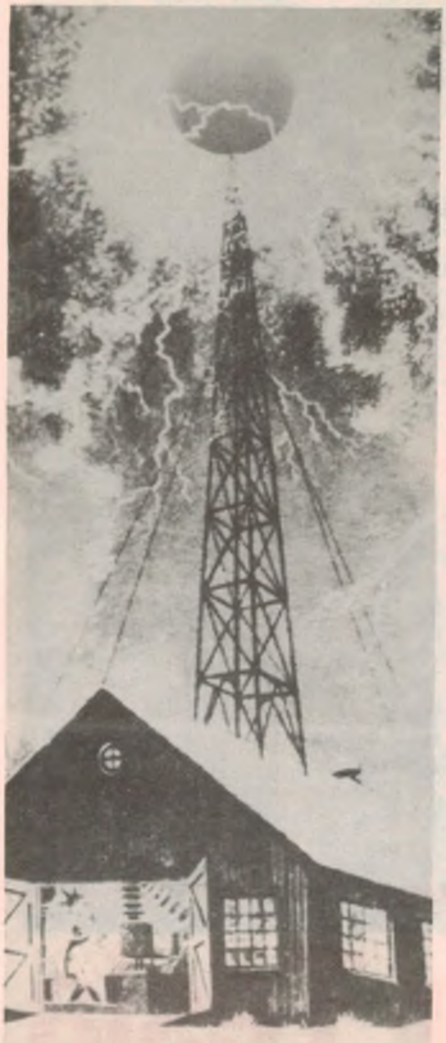
Academic work filled only part of his life. He haunted the woods near his home. It is said that he built a water wheel at a nearby stream when he was only four years old – perhaps foreshadowing his inventive abilities. On seeing a picture of the mighty cascade, he prophesied that he would "someday go to America and harness Niagara Falls."

Another of his childhood inventions was a popgun that fired a ball of wet hemp. These proved so successful that he manufactured and sold a number to his mates. A rash of broken windows ended this foray into business. His attentions were then captured by archery. He went from longbow to crossbows and arbalests of his own design.

At the age of 12, he made an unsuccessful parachute jump from the barn, using an umbrella. He proved the same as Leonardo da Vinci had, several hundred years earlier – the relative strength of materials can let you down rather abruptly. Despite his misadventures he devoured his lessons and when he was 15, continued his academic work at the Higher Real Gymnasium in Karlovac, Croatia.

He completed the four year course in three years. Whilst there, he lived with an aunt and her husband, a retired army officer. His aunt thought his slight frame a sign of delicate health and believed that heavy meals would harm him. Tesla remembered this period as the hungriest of his life and possibly this experience gave him a preference for lavish meals and fine wines in later life.

Nikola Tesla loved to take hikes along the snow-covered trails near Karlovac. One day, he began rolling snowballs down a snowy slope, trying to see how large one could get. He succeeded only too well, and watched in horror as an avalanche roared down the

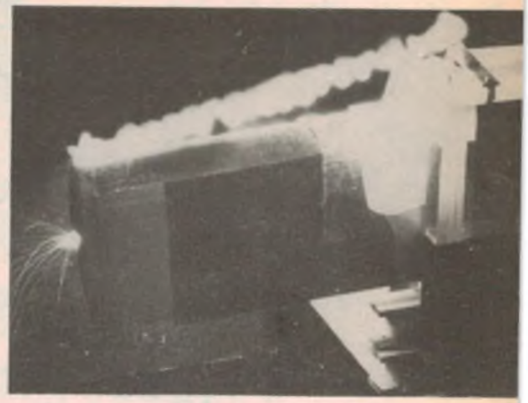


In 1899 Tesla began experiments in Colorado on wireless transmission of power, shown in this artist's impression.

moutainside. It diverted itself harmlessly in a field, narrowly missing some farm buildings. The young man was horrified at the near damage he had unwittingly caused – but recognised that a small action by a man could have great influence on natural forces. The thought that the tremendous power of nature could be harnessed and controlled by the relatively small efforts of men became a guiding force in his life.

During this period, he observed that lightning strikes preceded torrents of rainfall from the dark cloud masses, and speculated that the lightning itself triggered the rain directly. He would eventually succeed in creating an atmospheric mist artificially. In writing about the electrical control of the atmosphere, he would state: "The time is very near when we shall have the precipitation of the moisture of the atmosphere under complete control. . ."

On his graduation, he received a letter



Tesla coils are put to work today in simulating lightning strikes on aircraft.

from his father, urging him to take a hunting trip and relax from his three years of effort. Instead, he returned home and found the area in the grip of a cholera epidemic.

Worse than this, he also found that his father still expected him to enter the church. Now, Milutin Tesla knew that if his son did not do that, he would be expected to serve three years in the army. Too, he was concerned at Nikola's precarious health. But Nikola could not understand his father's worries. He only knew that he wanted to continue his technical training. He felt the army would be a waste of his education – and the obligations of the church would leave him no time to unlock nature's secrets. He fell ill.

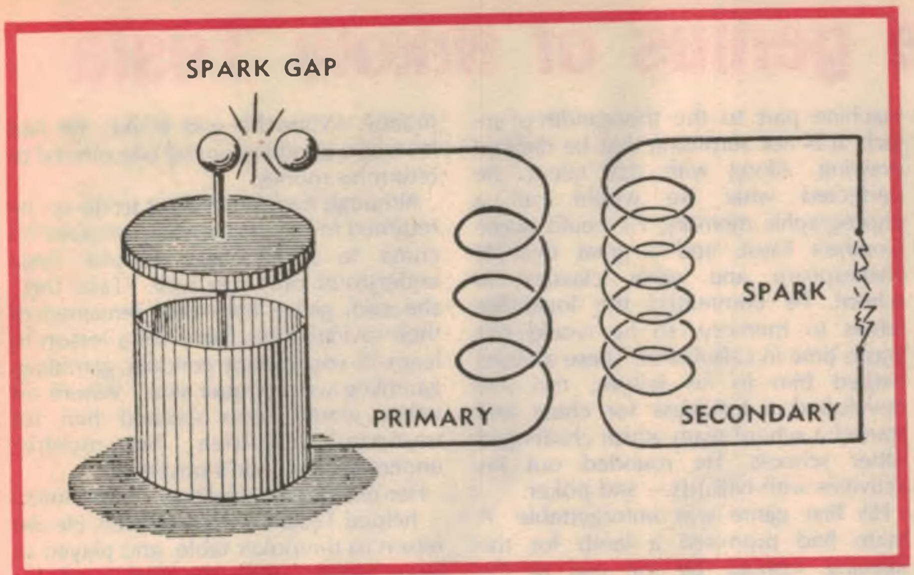
For week after week, one sinking spell led to another. Three years of undernourishment and his present spiritual anguish left him with no will to live. Doctors told the family that they should prepare themselves for his imminent death.

Milutin Tesla faced his own crisis. True, he had pledged Nikola to the church; but if the young man died, the pledge would be unfulfilled. Knowing the answer, he begged his son to tell him what would help him.

"I could get well," Nikola whispered, "if I could study engineering." His father made a solemn promise and in a short time, Nikola began to recover. In later years, he wrote that no magical event had taken place – instead, his mother had mixed a potent but unpleasant medicine so revolting that it forced his recovery.

Milutin Tesla sent Nikola away to the mountains to convalesce for some time. When he returned, the army had declared the young man unfit for military service on medical grounds. Whether the father's influence on family members in the army had anything to do with the decision is not known.

In 1875, Nikola enrolled in the



A contemporary drawing illustrates the principle of Tesla's high voltage transformers.

Polytechnic Institute at Graz, Austria. Chafing under all the lost time, he took twice the normal number of subjects, limiting himself to four hours' rest a night. In a year, he returned home with the highest possible marks. Instead of praise, his father reviled him for endangering his health. Years later, Nikola learned that the dean of the technical faculty had written to his father: "Nikola is a star of the first rank, but will kill himself from overwork."

Respecting his father's wishes, he returned to a second year at the Institute, limiting himself to a study of physics, mechanics, and mathematics. When he saw a demonstration of a Gramme dynamo, he remarked that the sparking at the commutator surely was a sign of power loss. His instructor, Professor Poeschl, patiently elaborated on the necessity of using a commutator to provide the useful direct current output.

Tesla responded that, by discarding the inefficient commutator, the inherent alternating current could provide more power. Everyone laughed, for they knew that AC was useless. Possibly, this belief dated back to Faraday's experiments, using a galvanometer. The indicator could only detect steady currents or momentary currents which reversed very slowly. It would remain perfectly quiescent (in the words of a 19th century academic) whilst to-and-fro currents of tremendous energy were circulating through the circuit to which it was connected.

Yet, Professor Poeschl took Tesla's intellect seriously enough to devote the next lecture to the young man's speculations on alternating currents. He concluded, however: "Mr Tesla may accomplish great things, but he certainly never will do this."

Popular wisdom went so far as to state that "the positive and negative cancel one another." Certainly, efforts by some inventors had not succeeded in developing a workable AC motor.

Tesla' conjectures were put in the same category as perpetual motion machines. Even though Tesla pointed out that AC would drive a passive load, such as a street arc lamp, and thus was doing work, no one accepted any further ideas

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The inventive genius of Nikola Tesla

Continued from page 25

of utility. Though Tesla bowed to the authority of his professor, the concept tantalised him. He imagined plan after plan and discarded them.

From his earliest years, Tesla had possessed an amazing gift of visualisation. As a child, anything he imagined seemed to appear before him, solid and as real as any object in the material world. It came as quite a shock to the little boy to discover that other people could not see his images. The unique talent had worried him and he'd tried to suppress it. Later, he discovered that he could put it to good use, although he no longer tried to get other people to see his projections.

Later autobiographical writings reveal that he perfected his engineering models in his mind. He claimed that "they were so real that he could see signs of wear, and in the case of rotating machinery, could actually tell whether or not it might be out of balance."

With a mind that could visualise a machine part to the thousandth-of-an-inch, it is not surprising that he disliked drawing. Along with this talent, he perfected what we would call a photographic memory. He could quote Goethe's Faust, and a great deal of Shakespeare and other classics. In school, he committed the logarithm tables to memory, so he would not waste time in calculation. These abilities helped him in his leisure, too. He developed a fondness for chess and started a school team which challenged other schools. He rounded out his activities with billiards – and poker.

His first game was unforgettable. A mate had promised a lamb for the fleecing. Instead, by the end of the evening, the lamb had won all – and then confounded everyone by returning, to the cent, what each had lost.

Tesla looked on cards simply as a relaxation. Time after time, he returned to the tables. One night, for some reason, his luck or his ability let him down. He lost hand after hand, and ended up betting the next term's tuition money. When he was broke, he had learned a good lesson: no one offered to return his money.

Although he felt reluctant to do so, he returned to him home and confessed his crime to his mother. Djouka Tesla understood only too well. "Take this," she said, giving him what remained of their savings. "You have yet a lesson to learn. If you cannot conquer gambling, gambling will conquer you." Where his father would have scorned him for immoral activities, his mother understood her son's obsession.

Her practical psychology – and money – helped Tesla to know himself. He did return to the poker table, and played as never before. After the final hand, his "friends" expected their losses to be returned, as usual. This time, Tesla kept the lot. He had won back what he had lost. The money his mother had advanced him was returned gratefully and he made a solemn oath never to play cards again.

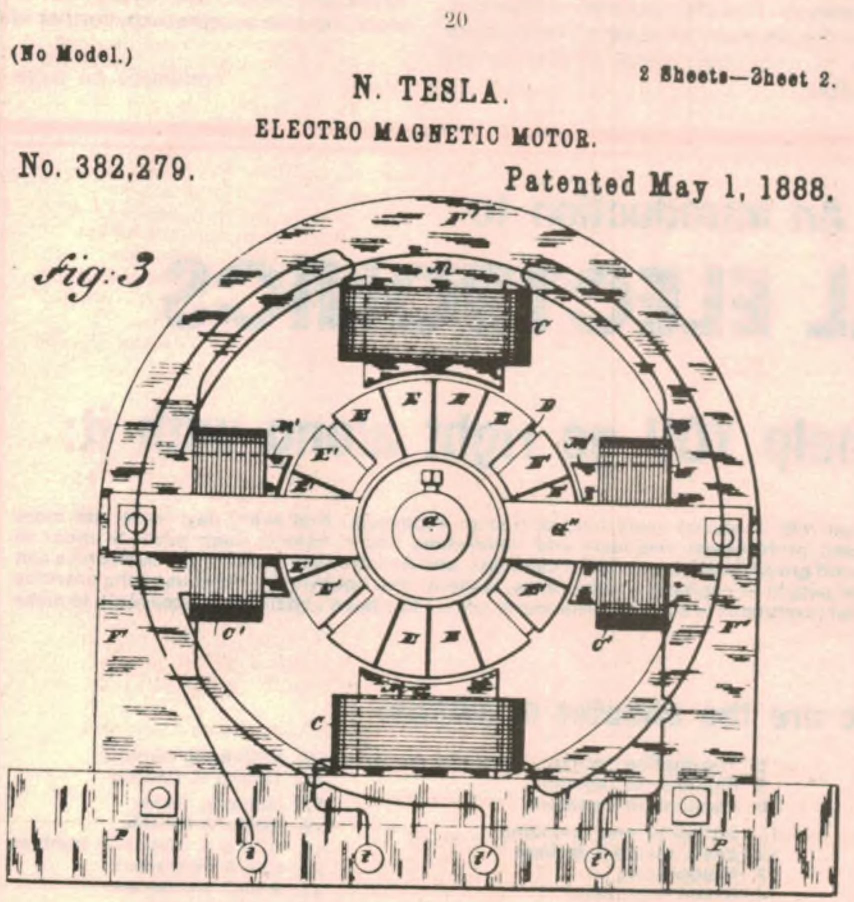
A little later, he completed his studies at Graz and took a job at a tool-and-die works in Maribor which manufactured electrical equipment. The money he saved enabled him to take a further year's study at the Unversity of Prague.

In 1881, he travelled to Budapest, in hopes of getting a position at the new telephone central office being built. His excellent academic credentials opened no doors for him. Instead, he was offered a lowly job at the Hungarian Government Telegraph Office. Forty years later, he wrote that it was "at a salary I deem it my privilege not to disclose."

"By an irony of fate, my first employment was as a draughtsman. I hated drawing; it was for me the very worst of annoyances."

Yet, Nikola Tesla's ability made itself evident; soon, he was promoted to more responsible work and finally made chief electrician to the telephone company. At the age of 25, he stood as engineer-in-charge of an entire system. His arduous schedule did include five hours of rest a night, two of them in sleep . . . He relaxed for three hours keeping up with the technical journals.

At this time, he invented what might be thought of as a "speakerphone," a type of loudspeaker device by which a number of people could listen to a telephone conversation. Tesla never bothered to patent this invention, although the telephone company did utilize it. Thirty years later, he remarked that it compared favourably with the current loudspeakers.



The principle of operation of three-phase AC motors is unchanged since Tesla's 1888 patent. Simultaneously he was issued patents for an AC generator, transformer and power distribution system.

Next issue: Tesla meets Edison.

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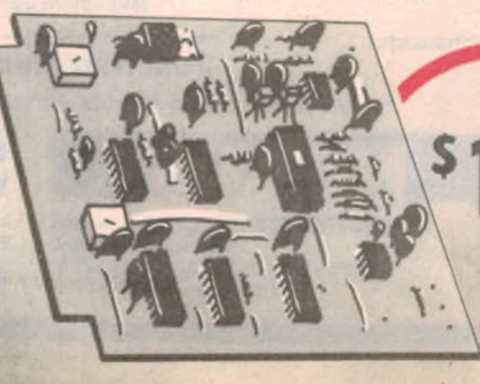

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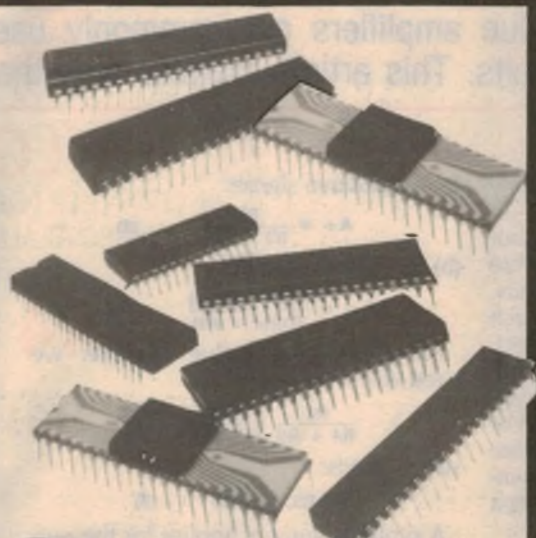

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A primer on precision rectifier circuits

Designing absolute value amplifiers

by **Dr. I. H. IBRAHIM**

Absolute value amplifiers are commonly used in precision rectifier circuits. This article explains how they work.

Absolute value amplifiers have many useful applications especially in measurement and control systems but very little attention has been given to the design and analysis of these circuits. Although most basic circuit blocks such as inverting and non-inverting amplifiers, precision half wave rectifiers, comparators and active filters have well known circuits, there is no established or well known circuit for absolute value amplifiers. This article introduces a simple, accurate and low cost circuit using a single operational amplifier.

Basic circuit

Fig. 1 shows a general amplifier configuration with resistors R2 and R5 and diodes D1 and D2 making up the feedback path. To simplify the circuit analysis, we shall assume that the operational amplifier is ideal and so are the two diodes.

The effects of the finite gain of the amplifier and the non-linearity of the diodes will be given later in this article.

Now the voltage at the non-inverting (+) input of the operational amplifier is equal to:

$$V+ = Vin \frac{R3}{R4 + R3} \qquad (1)$$

by normal voltage divider action. If Vin is positive, then diode D1 at the op amp output will be reverse biased and no current will flow through R1 (because the op amp acts to set the voltages at its inputs so they are equal).

The output voltage V_{01} is then equal to V+, as in equation one.

On the other hand if Vin is a negative voltage $-V_2$ then the output V_{01} becomes:

$$Vo1 = -V2 \frac{R1R3 - R2R4}{R1(R4 + R3)} \qquad (2)$$

This means that the voltage amplification of the circuit V_{01}/Vin will be:

(a) for positive signals

$$A+ = \frac{R3}{R3 + R4} \qquad (3)$$

(b) for negative signals

$$A- = \frac{R1R3 - R2R4}{R1(R4 + R3)} \qquad (4)$$

For an absolute value amplifier we need A+ = −A− or

$$\frac{R3}{R4 + R3} = \frac{R2R4 - R1R3}{R1(R4 + R3)}$$

which yields:

$$2R1R3 = R2R4 \qquad (5)$$

A similar argument applies for the output V_{02} which yields

$$2R1R3 = R5R4 \qquad (6)$$

From equations 5 and 6 we can see that for balanced outputs V_{01} and V_{02} the resistors R_2 and R_5 should be equal. On the other hand if the negative output V_{02} is not required then R_5 may be replaced by a short circuit.

Output impedance

The output impedance of the circuit is not constant but it depends on the polarity of the input signal. For example, consider the positive output V_{01}. When the input signal is positive, D_1 will be off and the output current is supplied via R_2, resulting in an output impedance equal to R_2. But when the input signal is negative, D_1 will be conducting and the output voltage will be dependent upon the output current "within the amplifier output current limitation". That is, equivalent to zero output impedance. This means, in practice, that if the circuit satisfies conditions 5 and 6 then it will perform absolute value amplification only if the output is connected to a very high load impedance.

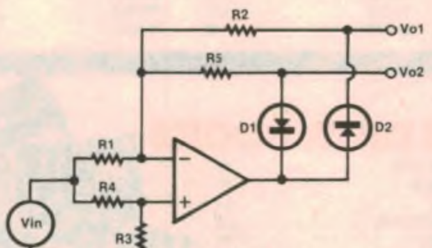


Fig. 1

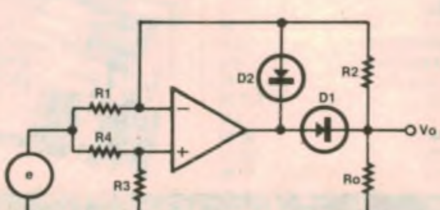


Fig. 2

In spite of the fact that the output impedance is not fixed, it is always possible to design an absolute value amplifier according to a given load impedance. For example, consider the circuit of Fig. 2.

Here the output is connected to a "matched" load resistance R_0. The circuit will have amplification factors of:

$$A+ = \frac{R3}{R4 + R3} \cdot \frac{Ro}{R2 + Ro} \qquad (7)$$

if the input is positive and

$$A- = \frac{R1R3 - R2R4}{R1(R4 + R3)} \qquad (8)$$

if the input is negative.

Equating A+ and −A yields the general condition:

$$R1R3\left(\frac{2Ro + R2}{Ro + R2}\right) = R2R4 \qquad (9)$$

The source impedance has no effect on the balance condition given by equation 9. But the voltage amplification of the current will drop by a factor

$$B = 1 + \frac{Rs(R1 + R4)}{R1(R3 + R4)} \qquad (10)$$

where Rs is the source resistance. Even when the circuit is supplied from an ideal signal current source with infinite internal resistance the balance condition will not be affected.

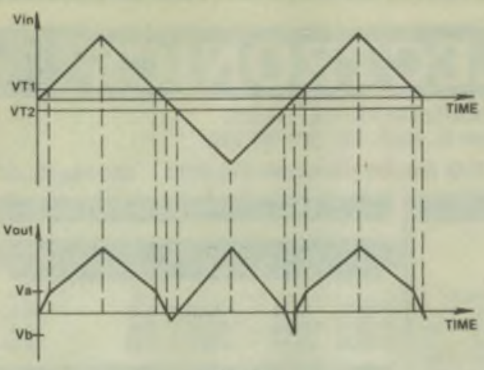


Fig. 3

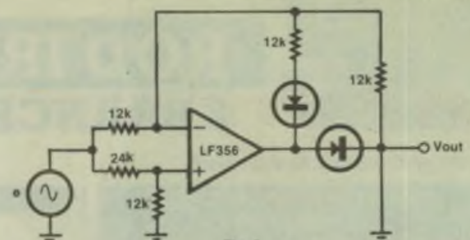


Fig. 4

The circuit above is a realisation of Fig. 2 while the waveforms at left demonstrate the response of the circuit when the input signal amplitude is small.

In this case, the output voltage will be given by:

$$V_o = |I_{in}| \frac{R1R3}{R1 + R4} \qquad (11)$$

Dynamic performance

The dynamic performance of the circuit of Fig. 2 is better explained by assuming a triangular waveform is applied to the input. We also assume that the diodes have voltage of V_T and that the amplifier has a DC voltage amplification of V_0 and a 3dB point of f_0 Hz. Therefore the open loop voltage amplification of the operational amplifier varies with frequency according to:

$$A = A_o\left(\frac{1}{1 + \frac{f}{f_o}}\right) \qquad (12)$$

and at frequencies much higher than f_0 we get:

$$|A| = A_o\frac{f_o}{f} \qquad (13)$$

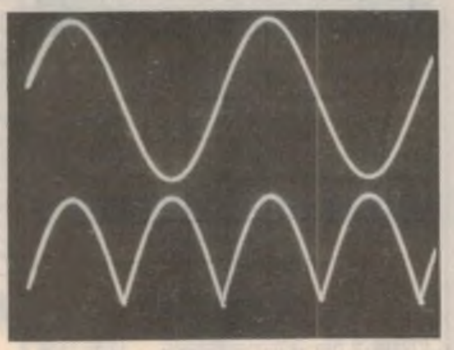
Fig. 3 shows the input and output waveforms. Due to the finite gain of the amplifier there will exist a certain minimum input signal level V_{T1} and V_{T2} at which the output of the op-amp is less than the conduction voltage of the diodes. In that case the output voltage of the absolute value amplifier does not follow the value given by the above equations but will show some sharp spikey waveform in the output voltage range V_a to V_b. That voltage range can be easily shown to be dependent upon the inverse of the amplifier gain as well as input and output offset voltages of the operational amplifier.

The most important thing to notice is that as the frequency of the input signal increases, the open loop gain of the op-amp decreases and thus V_{T1} and V_{T2} increases yielding an increase in the undefined voltage range V_a-V_b.

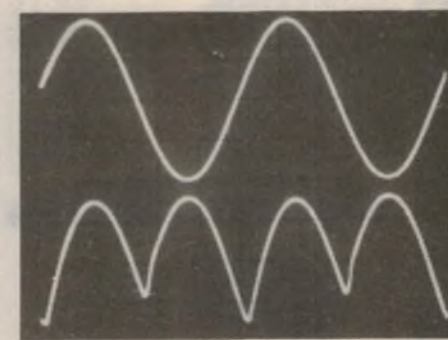
A practical example

The circuit of Fig. 4 was used as an experimental circuit and the input supplied with a sinusoidal signal. The circuit has a voltage amplification of 0.33.

Fig. 5 and Fig. 6 show the oscilloscope traces with an input signal frequency of 200Hz and 20kHz respectively. The upper trace in each photo shows the input signal while the lower trace shows the output. In both cases, negative spikes are present in the output signal but they have a higher magnitude at the higher frequency.



This photo shows the response of the practical circuit to a 200Hz sinewave signal: Upper trace, input, 2V/div; Lower trace, output, 0.5V/div.



This photo shows the response of the practical circuit to a 20kHz sinewave signal. Vertical scales are the same as for photo at left.

As such, the circuit of Fig. 4 is suitable for many absolute value amplifier applications such as full-wave rectification, AC/DC measurement circuits, control systems, frequency doublers, and AM detectors.

The distortion of the output waveform at high frequencies is typical of all rectifier circuits that employ operational amplifiers. However that distortion does not limit the usability of the circuit for most applications.

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P12062	20 Way Card Edge Conn	8.50	7.95
P12064	26 Way Card Edge Conn	8.95	8.10
P12066	34 Way Card Edge Conn	9.95	8.95
P12068	40 Way Card Edge Conn	11.50	10.50
P12070	50 Way Card Edge Conn	12.50	11.50

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P12081	10 Pin W.W R.A Header	6.95	5.95
P12082	20 Pin W.W Header	7.95	5.95
P12083	20 Pin W.W R.A Header	7.95	5.95
P12084	26 Pin W.W Header	8.95	7.95
P12085	26 Pin W.W R.A Header	8.95	7.95
P12090	34 Pin W.W Header	9.95	8.95
P12091	34 Pin W.W R.A Header	9.95	8.95
P12092	40 Pin W.W Header	12.95	11.95
P12093	40 Pin W.W R.A Header	12.95	11.95
P12094	50 Pin W.W Header	13.95	12.95
P12095	50 Pin W.W R.A Header	13.95	12.95

IDC SOCKETS

		PRICE 1-9	10+
P12100	10 Pin Socket	4.95	3.95
P12102	20 Pin Socket	5.95	4.95
P12104	26 Pin Socket	6.95	5.95
P12106	34 Pin Socket	7.95	6.95
P12108	40 Pin Socket	8.95	7.95
P12110	50 Pin Socket	9.95	8.95

CABLE PLUGS

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P12114	14 way crimp	1.95	1.50
P12116	16 way crimp	2.25	1.95
P12124	24 way crimp	3.95	3.25
P12140	40 way crimp	6.50	5.95

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P12152	14 Pin Component Carrier	1.95	1.70
P12154	16 Pin Component Carrier	2.25	1.95
P12156	18 Pin Component Carrier	2.75	2.50
P12158	20 Pin Component Carrier	3.50	3.10
P12160	24 Pin Component Carrier	3.95	3.50
P12162	28 Pin Component Carrier	4.95	4.50
P12164	40 Pin Component Carrier	5.95	5.40

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		PRICE 1-9	10+
P12170	25 Pin Plug Crimp	12.95	11.95
P12171	25 Pin Socket Crimp	13.95	12.95

CENTRONICS

		PRICE 1-9	10+
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P12201	36 Way Centronics SCKT IDC	13.50	12.50
P12203	50 Way Centronics Plug IDC	14.50	13.50
P12204	50 Way Centronics SCKT IDC	15.50	14.50
P12210	36 Way Solder Plug	15.95	14.50
P12211	36 Way Solder Line SCKT	15.95	14.50
P12213	36 Way Solder Chassis SCKT	15.95	14.50

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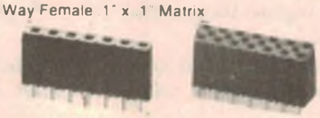
30 Way Male 1" x 1" Matrix

P12230	30 Way Single Strip Header	3.95	3.75
P12231	30 Way Oval Strip Header	4.95	4.75

30 Way Female 1" x 1" Matrix



P12234	30 Way Single Plug Header	4.95	3.95
P12235	30 Way Dual Plug Header	5.95	4.95

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P10881	DE9S	Female	9 Pin	4.50	4.00
P10882	DE9C	Cover	9 Pin	2.50	2.20
P10890	DA15P	Male	15 Pin	3.90	3.50
P10891	DA15S	Female	15 Pin	4.90	4.50
P10892	DA15C	Cover	15 Pin	2.50	2.20
P10900	DB25P	Male	25 Pin	4.90	4.10
P10901	DB25S	Female	25 Pin	4.95	4.50
P10902	DB25C	Cover	25 Pin	2.50	2.20
P10910	DC37P	Male	37 Pin	8.90	8.20
P10911	DC37S	Female	37 Pin	10.90	9.90
P10912	DC37C	Cover	37 Pin	5.50	4.90
P10920	DD50P	Male	50 Pin	12.90	11.90
P10921	DD50S	Female	50 Pin	14.90	12.90
P10922	DD50C	Cover	50 Pin	6.50	5.50

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P10920	20/44	.156"S.T.	7.95	6.95

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		PRICE 1-9	10+
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P10560	14 Pin	.35	.30
P10565	16 Pin	.40	.35
P10567	18 Pin	.50	.40
P10568	20 Pin	.50	.40
P10569	22 Pin	.50	.40
P10570	24 Pin	.50	.40
P10572	28 Pin	.60	.50
P10575	40 Pin	.70	.60

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P10626	16 PIN	1.90	1.70
P10628	18 PIN	2.00	1.80
P10630	20 PIN	2.20	2.00
P10632	22 PIN	2.40	2.20
P10634	24 PIN	2.60	2.40
P10640	28 PIN	2.90	2.70
—	40 PIN	4.40	4.00

WIRE WRAP SOCKETS

		PRICE 1-9	10+
P10579	8 Pin	1.20	1.00
P10580	14 Pin	1.40	1.20
P10585	16 Pin	1.60	1.40
P10587	18 Pin	1.90	1.70
P10590	20 Pin	2.20	2.00
P10592	22 Pin	2.40	2.10
P10594	24 Pin	2.50	2.20
P10596	28 Pin	2.80	2.40
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W12634	34	3.90	3.50	3.10
W12640	40	4.90	4.40	3.90
W12650	50	5.90	5.20	4.60
W12660	60	6.90	5.90	4.90

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P12264	34 Way Unprot. Header	4.95	4.45
P12270	40 Way Unprot. Header	5.95	5.25
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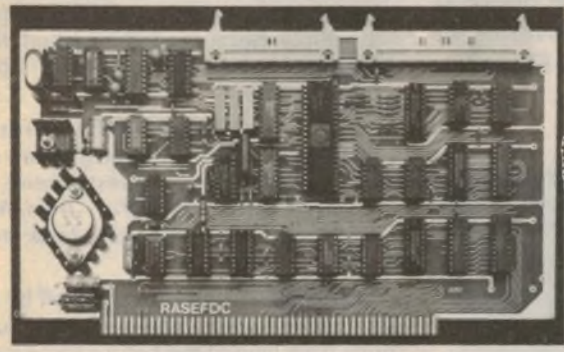

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1. Head seek testing
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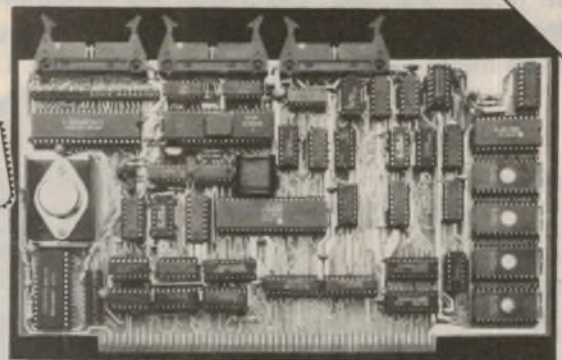

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Forum, Let's Buy an Argument —

Exactly 33 years ago, in September 1950, I stepped out of my circumspect role as Technical Editor to produce the first of these articles under the title "Let's Buy An Argument" — with a heading cartoon to suit. Since then, we've had 396 instalments, covering at least as many topics and occupying around 1200 pages. Phew!

At the time, when I first got "all het up" about subjects like direct-coupled audio amplifiers, I had no idea that the somewhat synthetic rage would be maintained for as long as it has. Maybe the credit/blame really belongs to the then-Editor John Moyle: he held my proverbial coat, thought up the heading and arranged for artist Tony Rafty to draw the cartoon that went with it.

Quite unintentionally, John even provided the inspiration for Rafty's drawing of an exasperated editor, as evidenced by the receding hairline and the absence of spectacles. In those days, I wore both!

In fact, I think John rather relished the idea of his Technical Editor taking a pot-shot at 'Braith (A.G.) Hull, who had formerly been his boss and had since become the proprietor of a rival magazine "Australasian Radio World".

At the time, the particular magazine, through its columns, was reflecting unbounded enthusiasm for direct-coupled audio amplifiers — in practical terms, the elimination of the coupling capacitor between the anode of the voltage amplifier and the grid of the output valve. According to supporters of the idea, the effect was an almost magical improvement in the tonal quality — a view expressed in ways that made some retort almost obligatory!

We had our say!

Sufficient to say, the published claims triggered the first instalment of "Let's Buy An Argument", which began thus, by way of introduction and opening par:

It may be Sydney's recent weather, it may be the effect of old age, or it may be the reaction to trying to live an ordered, respectable life. Whatever the reason, I find myself sour, ill-tempered and resentful. I want an argument and what better subject could a Technical Editor select than things that, to me, are the product of misguided technical enthusiasm.

Take direct coupling, for instance. I can't recall any other subject about which so much technical twaddle has been written. To listen to some enthusiasts, or to read their literary efforts, one would think that the elimination of one poor, inoffensive coupling condenser offered a cure for all the ills that ever beset an electronic amplifier.

They go into rhapsodies about "mysterious somethings", "magical qualities" and "amazing this and thats" ad nauseam.

In the following discussion, I asserted that, in the kind of circuits being talked about, the grid coupling capacitor became a liability only when it was part of a badly designed network. Further, that some who had made such a virtue of removing one capacitor hadn't even mentioned the other three that remained in the signal path: the HT and cathode bypass components.

In more general terms, I pointed out that the overall performance of a reasonably designed amplifier was likely to be way ahead of the signal source and loudspeaker with which it would normally be associated. If sensational improvements were to be effected, it would have to be in these areas, not in some minor detail of the amplifier circuitry.

This led to the observation — and remember this was 1950, before the LP revolution:

"To be quite practical, the distortion of a commercial record/pickup combination can be written down at say 10%. I know I haven't specified the kind of distortion or waveform or the frequency, but the figure will do as a mental reference.

"Then there's the speaker, which puts all kinds of beats and peaks into the response . . . let's put all that down to another 10%."

By way of further comment, I expressed mistrust of those who relied solely on their ears to judge performance, pointing out, for example, that an amplifier with a poor frequency response may be preferred, simply because it diminished the distortion content of the signal input source. I quote:

"I know only one approach that really works. You set up the loudspeaker on one side and as many test instruments as you can muster on the other. Then, like the old road sign, you Stop, Look and Listen!"

This theme was duly rounded off by an observation which, these days, would surely have landed me before some kind of an Equal Opportunities Inquisition:

"Ears are like women. They react favourably or otherwise but they seldom know why!"

There were a number of other grouches in that first instalment.

Some other hang-ups

I took a swipe at "purists" of the period who were hung up on audio phase, to the extent that some of them would have nothing to do with frequency compensation, filters or tone controls of any kind. They chose to ignore what had already happened to signal frequency (and phase) and simply followed the doctrine that flat was beautiful.

They also ignored the at-least-even chance that, in frequency compensating the signal to as near flat as possible overall, they would be helping rather than hindering the ultimate phase linearity. In one sentence:

"The purist is left in the position of eliminating phase shift in his own gear but jealously guarding the quantity inserted by those who handled the signal before him."

Amongst the other chips that stood exposed on the technical editorial shoulder was a certain impatience with unduly complex designs; ". . . anything that's too complicated isn't good enough".

The remark was directed mainly at contemporary discussion of TV receiver design for the next decade which (presumably) was calmly anticipating 25-tube basic receivers, plus 19-tube colour adaptors, plus still more circuitry for the associated FM sound channel. While the prospect of colour TV plus FM sound made titillating reading, the amount of circuitry involved certainly did not — an opinion that was apparently shared, at the time, by many local engineers.

As it turned out, Australian viewers

Where it all started . . .

were spared this kind of horror, because the arrival of colour television coincided neatly with that of solid-state circuitry, with its greater intrinsic reliability.

At the other end of the technical spectrum, impatience was expressed with those old-timers who, even in 1950, were still lamenting that modern radio receivers were "all right in a way" but they lacked the "sweetness" of an old-time crystal set. As I remarked:

"Pardon me while I tear out another handful of hair!"

The whole point was that, irrespective of the satisfaction of receiving signals from the "big smoke" on a home-made crystal set, those signals were invariably heard through a pair of old-time headphones, with high harmonic distortion and a frequency response curve that resembled the profile of Mount Cook. "Sweetness" indeed!

Theory and practice

Last but not least, a special piece of rage was reserved for those given to suggesting that: "Theoretically such and such is the case but, in practice, it does not hold good".

The target for this observation was not someone who is genuinely researching a discrepancy between what is observed and what is expected. It was aimed, rather, at those who are consciously short on theory but who try to compensate by discounting theory and emphasising their own (superior) "practical" background.

I maintained – and still do – that theory and practice are basically complementary, each an expression of the other. "To suggest a difference between the two is to admit that our theory is incomplete (or incorrect) or that our practical observations are at fault."

Thus unburdened, the first instalment of "Let's Buy An Argument" closed with the remark: "Thanks readers, I feel better now".

"Courteous" reaction

Not surprisingly, it produced quite a deal of reader reaction, but of the mainly courteous kind. There was support and there was criticism but nothing to suggest a whole regiment of readers "breathing out sulphurous fumes and writing with pens dipped in vitriol."

Some questioned my "guesstimate" of 10% distortion from a good/average phono pickup playing an average 78rpm shellac pressing but I was able to quote engineering sources which suggested that the figure might even have been conservative.

There was further discussion about direct coupling in the November issue, with specific reference to the much publicised Loftin-White amplifier using a 57 pentode to drive a 50 power triode – no grid or cathode capacitors but an 800V plate supply. That would be enough, in those days, to send any Loftin white!

References to theory v. practice, &c, continued through until the January 1951 issue but, in February, everything that had gone before was suddenly swamped by spirited debate on the problems of recording and reproducing highly complex waveforms from disc.

To put it into context, this was at a time when domestic tape recording was in its infancy and when John Moyle and I, along with a lot of other enthusiasts, were still involved in the thankless hobby of home disc recording.

The debate was triggered by a reference in John Moyle's "Off The Record" column to the ultimate impasse of a phono pickup being required to replay a square wave. Surely the stylus would have no option, he suggested, than to plough straight over or straight through the virtual 90-degree gradients presented to it by the groove.

At first glance, there seemed little doubt that a recording head could indeed cut a square wave pattern with sides almost at right angles to the groove locus. Being a driven device, the stylus could flip from side to side and maintain its displacement for the duration of each half-cycle of signal.

But someone else worked out that, even if a magnetic pickup could be induced to track such a groove, it would not generate a square wave, anyway, because the output from a magnetic pickup is proportional to instantaneous velocity, not to displacement. What one would get would be a differentiated version of a square wave – a series of spikes!

Confusion reigns!

That seemed to suggest a basic incompatibility between a magnetic cutter and a magnetic pickup. It gave rise to the thought that there might be a hitherto unsuspected advantage in crystal (piezoelectric) pickups, because they were displacement conscious.

Then what about crystal (piezoelectric) cutters? Would they also produce a groove compatible with the needs of crystal pickups?

On to this evident confusion, the first ray of light was shed by a Letter To The Editor from L.L. (Arncliffe, NSW). He had been moved to think about recorded square waves, not by John Moyle's article, but by an exactly parallel reference in a lecture by someone from HMV.

L.L. had worked out that, if the objective was to obtain a square-wave signal from a magnetic pickup, the waveshape engraved in the groove would have to be basically triangular in shape – not square at all. While tracing a "triangular"

Exasperated editor . . .

FORUM: Where it all started . . .

incline, the pickup would produce a constant voltage — the flat top of a square wave output signal. In suddenly reversing direction to trace the following slope, the pickup would produce a near-vertical change-of-polarity transient, followed by another flat and so on.

His suggestion made sense and put a big question mark over some of the earlier assumptions but, beyond that point, things seemed to get somewhat sidetracked.

Sorting things out

All this had happened before "Let's Buy An Argument" became actively involved but, in the February '51 issue, I did seek to gather the threads together. After all, I was supposed to be the Technical Editor!

Unfortunately, the result was very much a patchwork quilt, made all the more confusing by contradictory opinions quoted from two professional recording engineers. If the experts cannot agree . . . &c.

In truth, I had no ready-made answers either, but I did question the concept of a cutter flipping from side to side, between damping limits, and thus producing a square-wave groove modulation. Perhaps that would be indicative of an overload situation. Would it really happen that way under signal conditions?

What of the severe limitation on low frequency drive imposed by the 6dB/octave constant amplitude bass cut? "The accelerating voltages at low frequencies would be reduced and the cutter deflection made less abrupt.

And at higher frequencies: "Inevitably the condition will arise where the stylus just reaches maximum when it is time to go home again — the result, something like a triangular wave."

The answer emerges

As it turned out, I was on the right track but obviously groping. Hence the observation that followed:

Quite frankly, I don't know the exact quantitative answer to all this nor, I imagine, do very many other people in the everyday strata of engineers and enthusiasts. It would be marvellous material for a special research paper in the journal of the This-and-That Society.

What I didn't know was that a certain final-year engineering student had been motivated to investigate the matter and that a paper would be forthcoming in time for the April '51 issue. We were not able to reprint the paper in full but its contents were reported in "Let's Buy An Argument" for that month. Perhaps significantly, it brought the discussion to a full halt. No one seemed the slightest bit inclined to call into question the contents of the paper, or to buy an argument with its author; A.N.T. of Randwick, NSW.

After some lament about "woolly thinking", A.N.T. drew attention to the need to understand "the mechanical limitations which must be brought into the picture alongside electrical laws" . . . a most significant observation.

As a starting point, he showed the basic response curves for an ideal magnetic and an ideal crystal pickup. He then derived the complementary R/C filter networks which would be required to give each an effectively flat response when playing back a disc, cut in accordance with the standard (78rpm) recording characteristic.

Not incompatible

In practical terms, resonance and other effects would produce discontinuities in the natural response but, he said, to the extent that they can be compensated by suitable R/C filters, magnetic and piezoelectric pickups will provide output signals essentially similar in terms of frequency and phase response. Apprehension about basic incompatibility is therefore not justified.

Similar observations apply in reverse to the cutter. A basic requirement of a recording system is that its amplitude/frequency characteristic conform to an agreed standard. By the time appropriate compensation is applied to the drive system to ensure this end result, the type of cutter (magnetic or piezoelectric) would not basically affect frequency and phase response — or compatibility.

Ruminating reader . . .

On the subject of recording square-wave signals, A.N.T. stated as fact what I had tentatively suggested in the February issue:

"The imposition of the accepted amplitude/frequency characteristic together with the accepted recording levels, would keep the stylus within the range of movement where the constant velocity characteristic would be preserved . . . the original square wave impulse would indeed produce a triangular shape track."

Better than that, A.N.T. went on to calculate the gradient of the triangular slope relative to the groove locus, for typical records.

In a 78rpm recording, cut to the then current EMI standards, a square-fronted signal transient would produce a gradient of about 10 degrees in the outer grooves, gradually steepening to about 30 degrees approaching the label. In American practice, the gradients would be somewhat steeper, in the range 15-45 degrees.

As to the then new microgroove records, A.N.T. was uncertain. He felt that the gradients would be generally similar to American 78rpm figures, although he expressed some apprehension about the demands on tracking ability which might be occasioned by high frequency preemphasis. (What foresight!)

Quit arguing!

And so it was that A.N.T. resolved months of argument into one neat package, as under:

1. The concept of square wave groove modulation is basically a fiction. Within the constraints of lateral recording standards, a square wave input signal becomes essentially triangular in terms of groove shape, and therefore essentially trackable.
2. All cutting heads will behave in this fashion, providing they are compensated and operated in accordance with the accepted recording standards.
3. All pickups will tend to behave in a uniform manner, if they are compensated to complement the recording characteristic. What started out as a square wave will tend to be recovered as such, within the limitations of the overall system.

And who is A.N.T., the one-time engineering student who so neatly wrapped up that first major argument in 1950/51?

Well, he's now one of Australia's best known electronics engineers, a good friend and recognised worldwide for having sorted out the mysteries of vented enclosures: Neville Thiele.

What's more, he can still give good account of himself in a technical argument!

There's just one thing: if a square-wave signal produces a triangular-shaped groove, what kind of a groove would you get from a triangular signal?

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The economy scanner – with the deluxe scanner features! Made by one of the world's leading scanner manufacturers, the Bearcat 200FB is microprocessor controlled to give a 16 channel memory with thousands of frequencies accessible with push-button ease.
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- 16 channel memory
- Direct channel access – you don't have to step through other channels to reach the one you want.
- Automatic channel lockout and priority channel functions
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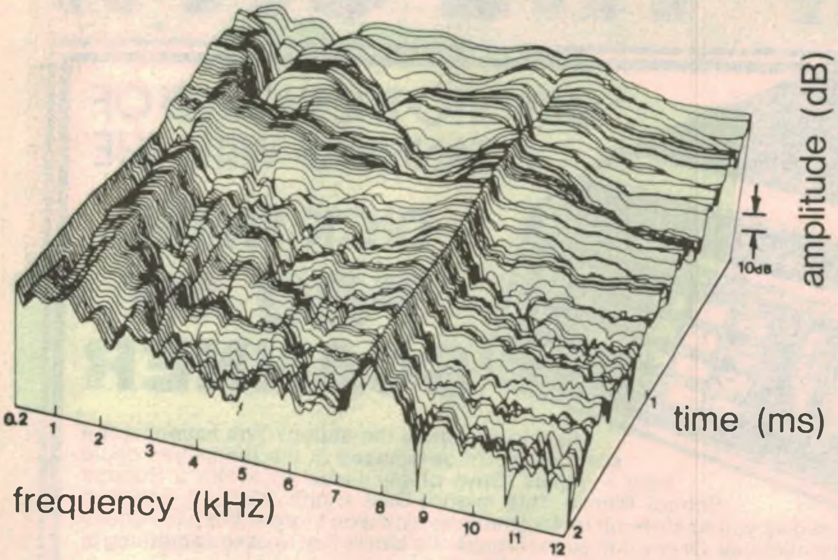
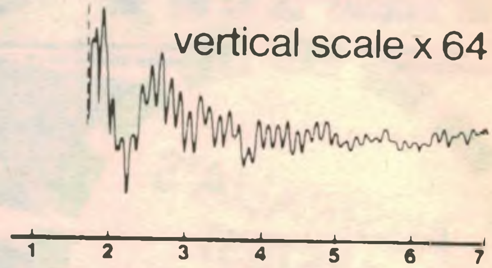
That's the Bearcat 200 ONLY **$369**

DICK SMITH ELECTRONICS

See page 12 for full address details.

A567/CT





Drawn on an expanded vertical scale for the time period 1.6 to 7 milliseconds after the drive pulse, the above plot shows an obvious resonance. In the contour plot on the left, of the same faulty unit, it appears as a prominent ridge at 7kHz.

KEF research culminates in the KM1

SUPER MONITOR

If you have $25,000 to spare, and you want to buy yourself a hifi birthday present to cap all birthday presents, you can invest in a pair of KEF's new KM1 monitor loudspeakers, designed in collaboration with the British Broadcasting Corporation. They were a star feature at the recent Chicago CES.

Perhaps, before actually ordering the KM1s, you had better check the available space in your listening room, because they are each about the size of a writing desk at 775mm (H) × 1342mm (W) × 662mm (D) and they each weigh about 120kg. On the other hand, they are available in a variety of finishes, "with customised hardware to special order".

Not only that, but you end up with a loudspeaker system which has a frequency response rating of 30Hz to 20kHz within ±2dB, a potential sound pressure level on program peaks of 120dB and a total second and third harmonic distortion of [illegible] than 1% at 96dB spl mean listening level, from 20Hz to 20kHz.

Not even the Jones' next door can top that!

Nor do you need fear competition from the Jones' exotic power amplifier. The KEF KM1 is an active system with inbuilt multi-unit power amplifiers offering more than 1200 watts of output power, plus "headroom" for program peaks, plus soft clipping, plus full overload protection, plus active equaliser/divider networks, plus "unique hybrid floating input circuitry", and so on.

But more of that later . . .

How many KM1s end up in American homes remains to be seen but any apprehension on that score will not be for the want of effort on KEF's part. The KM1 system had a special demonstration room, all to itself, in the Conrad Hilton Hotel, one of the venues for the Chicago CES.

Reportedly, it attracted a lot of hifi enthusiast "traffic", partly because of its imposing appearance, but no less for its distinctive combination of high available output and "musical" quality, as revealed by a variety of top-class digital recordings. Amongst other things, KEF engineers had room-equalised the system to be flat down to 20Hz.

by Neville Williams

As one observer remarked: "There are musical loudspeakers that aren't very powerful; and powerful loudspeakers that aren't very musical – but the KM1s have it both ways!"

KEF's less "powerful" – but more affordable – systems were on display at Chicago's McCormick Inn, in two forms: the "Reference" series and the more economically priced "Standard" series. KEF have tended to back away from the term "monitor" in recent years, because of its frequent misuse, but their "Reference" series is intended for that role, as well as for up-market domestic hifi.

Behind the entire KEF range, and particularly the new KM1 monitor, lies considerable experience and resource in the area of loudspeaker performance measurement – something that is important, not only for original design, but as a means of maintaining uniformity in production. An imaginative investment in research made more than 10 years ago, has paid off handsomely ever since.

A NEW APPROACH?

At the time, it was normal to measure, document and evaluate loudspeaker performance in the so-called "frequency domain": using a continuous input signal and plotting amplitude, phase, distortion, etc, against frequency. It was a tedious and not very conclusive procedure which, amongst other things, called for a free-space or a simulated free-space (anechoic) testing environment – the first not very practical, the second rarely affordable!

In the early '70s, faced with the need to up-grade their evaluation procedures, KEF engineers decide to pursue the alternative "time domain" approach. In this decision, they were fortunate to have the co-operation of the Department of Applied Acoustics at the University of Bradford, and early research reports on the work reflect this association.

In essence, the time domain method involves applying to the loudspeaker an electrical impulse of very short duration and recording the resulting acoustical output, as detected by a high quality microphone, located a short distance away.

Detailed mathematical (computer aided) analysis of the resulting acoustical transient can yield a great deal of information about the frequency response of the transducer in terms of both amplitude and phase. Effects needing correction can be highlighted, which might easily escape detection by ordinary continuous tone testing.

Importantly, the measurement environment does not need to be anechoic, the main requirement being that it be large enough to ensure that the response from the transducer will have died away before reflections arrive from adjacent surfaces. Practical measurement environments include the open air or very large rooms, with the equipment set up on a support tower.

CUMULATIVE EFFECT

The energy available from a single pulse is too small to produce a recording sufficiently free from background noise to permit proper analysis. To get around this problem, the test procedure involves applying as many as 500 identical pulses to the transducer, spread over about 10 minutes, to ensure that the noise level has subsided to ambient between each test.

The recordings are then digitised, stored in a computer memory bank and digitally added, or superimposed. Being quite random in frequency, phase and amplitude, the noise energy in each sample tends to cancel; by contrast, the signal components, buried in the noise, are substantially similar and in-phase, so that they tend always to add, gradually emerging from the noise as the addition proceeds.

In practice, it is possible to extract a reliable, averaged pulse contour having a signal/noise ratio of 60dB or more, depending on the equipment used. It can be retained in digital form for mathematical analysis, or converted to analog and pen-plotted for visual examination. Even without formal analysis, the plot of a loudspeaker's output, with transient input signal, can mean much to the practiced eye. In a very real sense, it is a visual soundprint!

The technique and the importance of loudspeaker pulse testing was explained to Australian audiences, some years back, by KEF Managing Director, Raymond E. Cooke. In a series of lectures in the major capitals, he gave a rundown of the pulse testing technique and emphasised its relevance to the then new "Reference" series of loudspeakers, in particular the Reference 104.

A prototype of the KEF Professional Series, model KM1. Features listed include:

- *Hybrid floating input circuitry, 1Hz to 100kHz ±0.1dB, less than 0.001% THD for 7V RMS input.*
- *Calibrated gain control.*
- *Adjustable low frequency cut-off and damping.*
- *Adjustable contour control for optimum mid/low frequency balance.*
- *Automatic soft-clipping limiter gives extra 6dB of loudness without significant extra audible distortion.*
- *Electronic overload protection.*
- *Active 3-way dividing/equalising circuits fed from separate power supply.*
- *Signal/noise ratio, 100dB.*
- *MF and HF drivers use magnetic fluid for voice coil cooling.*

He made the point that the transient nature of many sounds, and the requirements that loudspeakers be able to cope with such transients had been appreciated for at least 50 years. One early reference occurred in a paper by Rice and Kellogg describing their new and revolutionary moving coil loudspeaker — in 1925!

During the years that followed, continuing research established that, quite apart from the basic frequency/amplitude characteristic, the transient capabilities of a loudspeaker were subject to its phase characteristics and to cone (or other) motional resonance and break-up effects; furthermore, these effects could vary during the transient decay period, adding subtle "colouration" to the sound.

However, instrumentation difficulties had prevented loudspeaker manufacturers from coming directly to grips with such problems, forcing them, instead, to rely on inference drawn from routine continuous tone measurements. It was only in the '70s that resources had become available at a commercial level to take real account of transient behaviour.

PROBLEMS EXPOSED

At the lectures, Raymond Cooke showed pen-plots and expanded-scale plots which clearly exposed obscure resonance effects — in one case a 7kHz resonance involving the mass of the voice coil and the compliance of the neck of the cone (see diagram). Duly alerted, the designers were able to obviate the effect by modifying the voice coil.

With the expenditure of more computing time, Cooke explained, it was possible to compute and plot amplitude in dB against frequency in kHz for individual time segments of the decay period. As a further step, these plots could be juxtaposed to produce a complete simulated three-dimensional contour correlating amplitude, frequency and time during the decay period, as illustrated.

Raymond Cooke pointed out that this facility was particularly valuable for exploring the performance of complete systems, since it could show up graphically, reflections and vibration modes in the enclosure, as well as phasing effects between the drivers and even the need for manipulation of phase in the crossover network.

Unfortunately for Raymond Cooke, much of this occurred at a time when, in Australia at least, British hifi components were beginning to be squeezed by heavily promoted Japanese products and by an unfavourable shift in the Anglo/Australian exchange rate. So, while the technical fraternity was impressed, the mass market was headed in the other direction.

But pro-British sentiment is still strong, particularly in the area of loudspeakers and, with some easing of the exchange rate, and a bit of spit-n-polish on the product, the time may have arrived for a resurgence of British hifi. And that would include the thoroughly British firm of KEF Electronics Ltd at their thoroughly British address: Tovil, Maidstone, Kent ME15, 6QP, England!

BACK TO THE KM1 . . .

Getting back to the KM1, KEF say that it was originally developed to meet a need in the production and recording studios of the BBC (British Broadcasting Corporation).

In the context of pop and rock music programming, monitor loudspeakers need to operate at very high volume and the BBC has found that (and we quote): "many loudspeakers . . . although capable of commendably smooth, natural sound . . . are nevertheless too fragile to be used in pop studios".

On the other hand, says KEF: "there are numerous loudspeakers able to produce earth-shaking volume levels but with the disadvantages of irregular frequency response, poor transient behaviour, unacceptable colouration and severe non-linear distortion".

The KM1 was designed, they say, to provide the necessary sound pressure levels without sacrificing basic musical qualities: "The KM1 . . . can be used to balance a symphony orchestra just as well as a pop group . . . a very useful feature in multi-purpose studios".

It can also be used as an auditorium loudspeaker in small halls and theatres.

The Reference Series 105.2, KEF's top of the line model prior to the release of the KM1. The HF and MF enclosures can be orientated vertically and horizontally to optimise the listening "window". A range of timber finishes is available and a grille to cover the base unit only for the HF and MF units as well. The response is from 38Hz to 22kHz ±2dB and program power rating 200W.

Since early 1982, KM1 prototypes have been operating very successfully in the BBC's Maida Vale studios, which are used mainly for recording and broadcasting pop and rock music. The Chicago CES marked their first major public appearance, with the undertaking that commercial production would commence "shortly".

Present indications are that the first pair of KM1s will not arrive in Australia until early in the new year. After that, they will be obtained "on order" by KEF distributors here: Audioson International Pty Ltd, 64 Winbourne Rd, Brookvale, NSW 2100. Phone (02) 938 1186 and (02) 938 1195.

OTHER MODELS

In the meantime, an extensive range of more modestly priced KEF systems is available in Australia, ex-stock.

The range includes four "Reference" (monitor) systems ranging from the top-of-the-line Reference at $3760 per pair. This is followed by the Reference 105.4 at $2550 pp, the Reference 103.2 at $1220 pp and the Reference 101 at $980 pp.

In the "Standard" series, there is the 204 at $890 per pair, which supersedes the original and much esteemed Reference 104aB. Then follow the somewhat smaller 304 Ser II at $695 pp, and the Carina II at $595 pp.

In the under-20 litre group is the 203, the 303 Ser II and the Coda III. These can be used on shelves or on floorstands and are priced respectively at $580, $450 and $325 — all prices recommended retail, per pair.

Information about KEF products is available from selected hifi outlets or direct from Audioson International at the address given earlier.

Music Makers' portable cassette deck

Announced recently by Tradepower International Pty Ltd, the X15 Multitracker is described as "a mini recording studio with maxi facilities. Basically, it is a 4-track cassette recorder, with built-in mixer and capable of operating from its own batteries, an automative electrical system or an AC mains power pack.

There are two main linear level controls with bargraph level indicators, plus supplementary gain and pan controls for each track, plus bass and treble controls for each main channel. One or two tracks can be recorded at any time, while replaying the others, so that synchronised recording and overdubbing is possible.

Other facilities include soft-touch

transport controls, cueing, Dolby-B noise reduction and pitch (speed) control. The price tag is "under $800". The distributor's address is 45 Glenvale Crescent, Mulgrave 3170. Telephone (03) 560 9111.

Intended for use with PA systems and base station transceivers, this model 7-801 dynamic microphone has been released by Benelec Pty Ltd, PO Box 21, Bondi Beach, NSW, 2026. [Phone (02) 665 8211.] It is directional and includes a special "pop" filter.

HIFI & VIDEO EXPO '83

Queensland electronics enthusiasts can keep up to date with the latest hifi and video developments by going along to the Hifi & Video Expo '83 on September 9-11 at the Park Royal Motor Inn. The latest in compact disc hifi will be featured, along with VCRs, car stereo systems and computer games. For further details, Brisbane readers can contact Robert Woodland on 373 3383.

PHILIPS REPORT: CD booming in Europe

According to a Philips spokesman in Sydney, consumer and dealer demand for Compact Disc players, after the market launch in Europe, has far exceeded all expectations. Both players and discs sold out quickly at virtually all locations, despite the relatively high levels of supply to dealers.

An indication of consumer interest is given by average delivery times, which are stated by most dealers to be from four to eight weeks.

As a result of this extremely high demand, the initial CD market estimates based on experience in Japan have now been revised upwards. World sales of CD players up to the end of 1983 are now estimated at between 600,000 and 700,000 units, divided mainly between Japan and Europe, with the USA starting to play a part in the second part of the year. Total worldwide production capacity is expected to reach around 800,000 players by year-end.

Quality of Philips CD players, each of which is individually tested on delivery to National Organisations, has been found to be high, and well within the preset target figures. Initial indications of product reliability show a low service call rate. The production capacity is building up progressively in accordance with the planned schedule.

As well as Philips and Marantz, only Sony and Hitachi were present in the market during the initial European launch. Shipments have recently been started on a small scale by other brands such as Denon, Sanyo, Sharp, Thomson and Toshiba, and it is expected that around 20 brands will be represented by September/October 1983. Hitachi is now re-launching in the UK after its early quality problems, which led to the withdrawal of all models from the

NEW COMPACT CONCORD AUTO HIFI

The four new models comprising the 1983 range of Concord automotive hifi systems feature illuminated soft-touch function switches and indicators, and integral 25W per channel amplifiers in a chassis that is notably smaller than most other hifi units. All models feature a precision DC servo tape drive, while the two top models can be switched to provide 4 x 10W 4-channel listening, with provision for front/rear channel balance and connection of an external amplifier system, if desired. Two of the AM/FM tuners are analog, the other two are quartz-digital synthesised. For further information, contact Martin J. McMurray, General Manager, Sonic International, 4 Clarendon St, Artarmon, NSW 2064. Phone (02) 439 8900.

NEW MONITOR LOUDSPEAKER FROM AUDIOSOUND

Described as a high performance, two-way medium size loudspeaker system, the new Prague 8045 Control Monitor is intended for use in small studios and control rooms where sonic accuracy and high levels are required. Designed with the co-operation of Messrs Thiele and Small, the 8045 offers good LF response for its size and includes 3dB attenuators for MF and HF balance. From Audiosound Laboratories, 148 Pitt Rd, Nth Curl Curl, NSW 2099. Phone (02) 938 2068.

market; similar problems have been reported from Denmark, Switzerland and other countries.

The impact of the continuing extremely high level of demand has so far been to restrict the numbers of retail outlets for longer than was first planned. The dealers selected to handle CD are those with the best profiles in their areas as hifi and audio specialists.

Pricing of CD players has continued to be stable, following the same pattern shown in Japan. Most brands have set their price levels in line with those of the Philips players, while some others — notably Sony — are significantly higher.

Depending on the model, Philips CD players are priced between £498 and £528 in Britain, 6500-7300 FF in France, 2000-2200 DM in Germany, 2000-2350 HF1 in Holland, 189,000-210,000 Y in Japan and $800-$900 in USA.

Shipments of discs by PolyGram have fully matched the scheduled quantities, although the high demand has still resulted in shortages in some areas. One problem has been determining the likely demand for different titles, with no best-seller list yet available. PolyGram at present controls almost the entire disc market in Europe, with Japanese labels accounting for less than 10% of sales so far. World CD pressing capacity is expected to reach a level of 10 million discs by the end of 1983.

Feedback received from "CD Club" cards returned by player buyers has shown that, on average, consumers have purchased around seven or eight CDs at the same time as their players, compared with a figure of nine to 10 discs per player in Japan. These cards also show that around two-thirds of buyers are in the age group 25-45, with 99% of sales being separate players for addition to the existing hifi system.

Melbourne Hifi Show

Following the success of the 13th Annual Australian HiFi Show, held in Sydney in July, what is hoped to be an even bigger event is scheduled for presentation in the Melbourne Town House, 701 Swanston St, Carlton. The dates are: Friday, Sept 16, noon to 10pm; Saturday, Sept 17, 9.00am to 9.00pm; Sunday, Sept 18, 9.00am to 6.00pm. Entrance to the Show is free.

The many individual rooms throughout the Town House will allow companies to demonstrate their equipment under near domestic listening conditions and visitors may compare brands and performances without sales pressure. No direct selling is permitted at the Show.

Among the major brands represented will be Sony, Kenwood, Nakamichi, Bose, Denon, B&W, Yamaha, Marantz, Alpine, TEAC and Linn Sondek. There will be an audio clinic, live entertainment, prizes and a broadcasting display by 3 FCX FM. Details from Gary Cutler or Cathy Poppleton on Sydney (02) 997 1188.

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DOT MATRIX PRINTER
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Just a few short months ago we were selling printers of comparable quality and specification for around $1000. With the release of the exciting new SUPER-80 and our bulk purchase powers we are offering these for sale at just

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HURRY — LIMITED STOCKS!

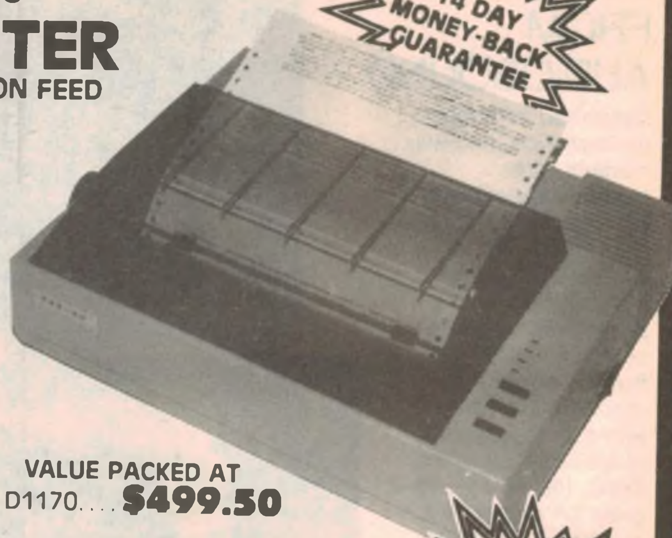
Operating under direct software control from any general purpose micro-computer, office computer, etc, the Super 80 is capable of **13 different print types** including emphasized **(letter quality).** Bit image graphic capabilities enable **extensive formating** and reproduction of **high resolution graphic images.**

Interfaced specifications

Interface:
Standard Centronics parallel. Optional RS-232C (SERIAL).
Data transfer rate:
4,000 CPS max.

Functional specifications

Printing method:
Serial impact dot matrix.
Printing format:
Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — vertical 8 dots parallel, horizontal 640 dots serial/line.
Character size:
2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix.
Character set:
228 ASCII characters; Normal and italic alpha-numeric font, symbols and semi-graphics.
Printing speed:
80 CPS, 640 dots/line per second.
Printing direction:
Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right.
Line spacing:
Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line:
Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The above can be mixed in a line.
Paper feed:
Adjustable sprocket feed and friction feed.
Paper type:
Fanfold. Single sheet. Paper width — 101.6mm (4") to 254mm (10").



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THE FANTASTIC MICROBEE IC HAS ARRIVED

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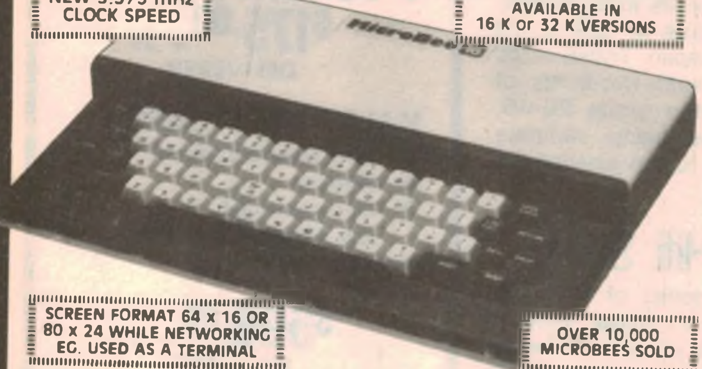

SCREEN FORMAT 64 x 16 OR 80 x 24 WHILE NETWORKING EG. USED AS A TERMINAL

OVER 10,000 MICROBEES SOLD

The all new Microbee IC has got to be the most value packed ROM based personal computer available today. **New enhanced basic** enables 64 x 16 or 80 x 24 screen format while networking and the clock speed is now **a zippy 3.375 MHZ** and over **$110** worth of software integrated in ROM i.e. the absolutely delightful **Wordbee** word-processor package or **Editor Assembly** plus all the other exciting features that have made the Microbee famous.

D 1020...... 16 K...... **$499.00**
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NOW WITH SCREEN INVERT FUNCTION AT NO EXTRA COST

HIGH RESOLUTION MONITOR

OVER 1000 SOLD

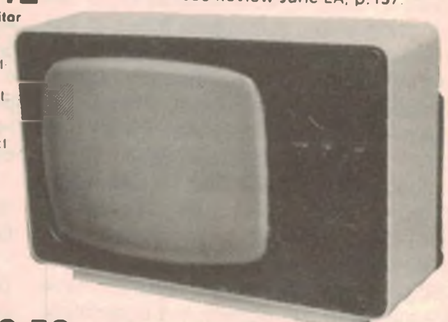
NO MORE HEADACHES AND BLURRED VISION

One of the hassles of sitting there for countless hours operating your computer is *eye strain* (anyone who has just spent 10 hours solid will agree!!) Well our fantastic new MICRON 12 High Resolution Green Phosphor Monitor has a 'reverse' or invert screen function where by simply rotating the contrast control anti-clockwise the screen information and background are reversed. This is especially valuable in poor lighting conditions.

MICRON 12

See Review June EA, p.137.

Green Phosphor Monitor
Features: 12" screen. Front controls: on/off, contrast/reverse, brightness. Power: 240V 50Hz or 12V DC. Input: RCA type. DC Output Jack: 12V 1.1 Amp — power your Micro direct without a power pack. Bandwidth: 10Hz to 20MHz the resultant definition is truly amazing for a low cost monitor.



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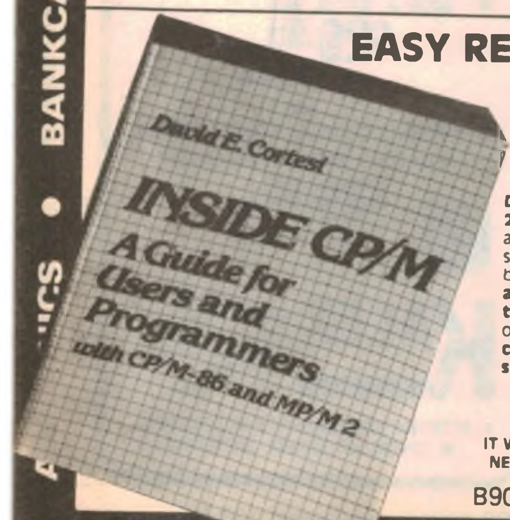
D1112.. **$199.50**

EASY READING GUIDE TO CP/M 2.2



FOR THE NOVICE AND EXPERIENCED PROGRAMMER ALIKE

Devoted primarily to CP/M 2.2 this manual is equally applicable to most other CP/M systems. Cortesi divides the book in two sections, an **absorbing, explanative, tutorial** covering setup and operating procedures and a **comprehensive reference section.**

As a learning tool — IT'S INVALUABLE
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At last a Data Cassette Recorder/Player you can afford. The Micron D 1120 is fully **adjustable azimuth** (absolutely essential in our opinion) and incorporates tailored audio frequency response audio stage together with low distortion.
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D1120 Micron Data Cassette **$49.50**

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Record clamps & anti-static mats

are they any good?

We have just had a look at two turntable mats and two record clamps to see whether they justify the claims made for them. Can they reduce static, rumble factor, stylus stall and improve stylus tracking and overall clarity? Read on.

At right is the Pod and below is the Michell record clamp. Both use a collet system to grip the turntable spindle.

The two mats we looked at were the Premierphile "Acoustic" mat and the Genie anti-static mat. And the two clamps were the Pod disclamp and the Michell record clamp. All except the Pod are made in England. The Pod is made in Canada but is promoted as a product of Monitor Audio Ltd, an English firm.

Let's have a look at each product in turn. Ostensibly, the Genie mat is just a disc of plain black felt about 3mm thick and 302mm in diameter. It is fairly light and weighs just 50 grams. To give it its anti-static properties, carbon fibres are woven through it.

By contrast, the Premierphile mat is much more substantial, weighing about 225 grams. It has a laminated construction with a solid rubber base and black felt top. It is about 5.5mm thick and has a diameter of 289mm which makes it easy to pick up the record. The Premierphile also has a slightly recessed centre section to allow for the extra thickness of records in the area of the label.

The Premierphile, like the Genie, is claimed to be anti-static. That meant that it had to be at least slightly conductive and we tested this with a 100VDC power supply and a digital voltmeter. This revealed that the Genie is relatively highly conductive and has a resistance from any two points on the mat of just a few megohms.

The Premierphile is much more of an insulator with resistances from any two points on the mat normally being in the range of several thousand megohms. Still, that is far more conductive than the average rubber mat and is evidently sufficiently conductive to remove static charges from one side of a record.

And in practice we were able to confirm that both mats do reduce static buildup on records. When you pick the record off the mat after playing there is not the characteristic "crackle" of static and the record does not grab the sleeve with alacrity as you slide it in.

What about the other claims though? The Genie, for example, claims to improve the rumble factor of the turntable by up to 70% and to "reduce stylus stall by gripping the record tighter than a conventional mat when the stylus is moving across the groove at a higher rate than along it".

The Premierphile claims are a little more vague but "the laminate construction ensures a reduction in lateral distortion and greatly improves stylus tracking" while tests have shown that the mat "improves the clarity of sound from the bass to treble".

While at first sight one tends to discount such claims as being outrageous, a little interpretation shows that there might be some basis in fact for the claims. The claim about improving rumble factor seems unlikely in that the mat would have to decouple the record from the platter. Frankly it seems that since the felt mat supports the record over its entire surface the effect would be just the opposite.

But what about the possibility of acoustic feedback via a direct air path from the loudspeakers to the record surface? Or from the speakers to the turntable base and thence to the record? Would the fact that the felt mats evenly support the record over its whole surface, rather than via a few concentric ribs on a conventional rubber mat, damp any tendency to acoustic feedback "howl".

If such a damping process did occur, the effect would be to reduce audible rumble somewhat and it would indeed improve the overall clarity of the sound reproduction.

It proved easy to test such a hypothesis and no special equipment was required, as we shall see.

No special claims are made for the two record clamping devices but, as we subsequently found, any benefit conferred by using either of the mats is augmented by the use of a clamp.

Both clamps make use of a collet arrangement to grip the turntable spindle and thus apply downward pressure on the record, to hold it more intimately in contact with the turntable mat. By doing so it can effectively flatten slightly warped records but it can do nothing for badly warped ones which have ripples.

The Pod is a plastic injection moulding with a sliding cylindrical section which tightens the collet. Its three feet are rubber tipped to avoid scratching the record label.

The Michell record clamp is a much more substantial affair consisting of a turned aluminium disc 86mm in diameter and slightly recessed on the underside. It has a knurled knob to tighten the collet and is easier to take on and off the record than the Pod.

Our method to test the mats and their effect on acoustic feedback (together with the clamps) was as follows. We used a typical domestic hifi system which had the loudspeakers mounted well away from the turntable in a large room. Nevertheless, as in most systems, it is possible to promote acoustic feedback if the volume and bass controls are sufficiently advanced although this is far above the level at which the system would normally be used.

By disconnecting the turntable from the mains supply and placing the cartridge stylus on the stationary record it is possible to test for the onset of acoustic feedback oscillation (howl) without being deafened by the program. So what we did was to make comparisons between the original rubber mat and the two anti-static felt mats, with and without record clamps.

We first set up the test with the original rubber mat which had concentric ribs. We advanced the volume control until the system was just on the verge of breaking into a continuous howl, as judged by thumping the system stand, walking heavily on the floor or tapping on the turntable base. Then without altering the settings, we repeated the test for one of the other mats and noted just how far the volume control could be advanced to produce the same condition.

We repeated each test with the bass control fully advanced, which produced slightly different results although the same trends were evident.

We found that both felt mats gave a significant improvement in reducing the apparent acoustic feedback for a given volume and bass control setting and, perhaps not surprisingly, the heavier Premierphile mat was the better of the two. We also tended to favour the heavier mat as it gives a better flywheel effect, particularly for the lighter turntables.

Next, we tried the effect of adding the clamps. Here we must note that for most turntables which have relatively short centre spindles, it is not possible to use the thicker Premierphile mat and the Pod clamp, because the collet will not grip the spindle. So in effect we tried three possible combinations: Genie mat with Pod or Michell clamp and Premierphile mat with the Michell clamp.

With the Genie mat both clamps gave an improvement but the Michell clamp was slightly better. The Michell clamp with the Premierphile mat was the best combination of the lot, by a clear margin.

We then followed the above round of tests by listening tests and while the results were less clear cut we can report that the same overall trend was clearly apparent. The higher threshold for acoustic feedback oscillation translates to quite audible improvements in the clarity of sound reproduction. This was not confined to the bass region but extends well above the midrange and even into the treble regions.

Finally, we should make some comment on the claim concerning "stylus stall". We have never experienced a record slipping on a ribbed rubber mat solely due to the drag introduced by the cartridge stylus although we think it is possible for some under-powered turntables to slow down ever so slightly on heavily modulated passages of a record. Again, we have not observed this effect.

However, if you are using a manual record cleaner and relying on the turntable to spin the record rather than doing it by hand, the record will stall when using either of these mats. So there is some slight inconvenience when using these felt mats. Also we would be inclined to use the vacuum cleaner occasionally on the mats to remove dust.

To sum up, using either of these felt mats with or without one of the clamps is likely to be a worthwhile addition to most high fidelity systems. And we preferred the Premierphile mat and Michell clamp as being the most effective combination and the better engineered.

Prices are as follows. The Genie mat, which will be sold under the Hunt brand name in future, is $12 while the Premierphile mat is $29.95. The Pod clamp is $25 while the Michell clamp is $35. We should add that we regard these prices as dear when the likely cost of manufacture is considered.

Our sample mats and clamps were supplied by Audio One, 71 Military Road, Neutral Bay, NSW. Phone (02) 90 6001. (L.D.S.)

Both mats use carbon fibres to provide conductivity.

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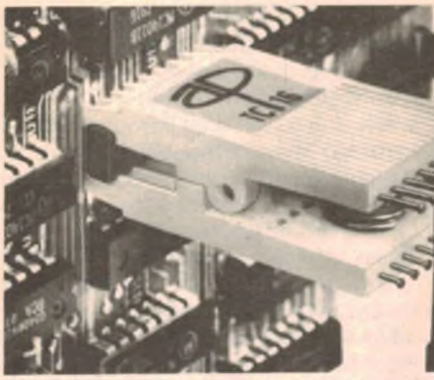
INTEGRATED CIRCUIT ACCESSORIES CABLE JUMPERS, IC TEST CLIPS, CONNECTORS, SWITCHES, HEADERS



IC TEST CLIPS — We've improved on the original

The Super-Grip II IC Test Clip has a narrow nose for fitting on DIP's on high-density boards. "Open-nose" design also permits probe tip access at DIP leads. New "duck-bill" contacts are flat, won't roll off narrow DIP leads. Contact comb fits between DIP leads, eliminates shorts. New "nail-head" contact pins keep probe hooks from sliding off. Offset pin rows allows probes to hang free on longer top row pins and not interfere with shorter lower row. Sizes to fit all DIP's (TC-14 fits 14-pin DIP etc.). Gold-plated or unplated alloy-770 pin contacts. Simplifies testing, trouble-shooting and QC inspection. Also available with long, headless lead pins for attaching cable connectors.

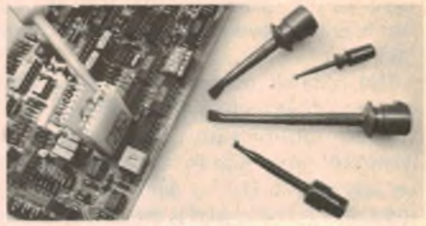
IC Test Clips — AP No.				IC Test Clips
Alloy 770		Gold-Plated		
Std.	Headless	Standard	Headless	
923695	923690-08	923743-08	923739-08	TC-08
923698	923690-14	923739-14	923739-14	TC-14
923700	923690-16	923743-16	923739-16	TC-16
923702	923690-16LSI	923743-16LSI	923739-16LSI	TC-16LSI
923703	923690-18	923743-18	923739-18	TC-18
923704	923690-20	923743-20	923739-20	TC-20
923705	923690-22	923743-22	923739-22	TC-22
923714	923690-24	923743-24	923739-24	TC-24
923718	923690-28	923743-28	923739-28	TC-28
923720	923690-36	923743-36	923739-36	TC-36
923722	923690-40	923743-40	923739-40	TC-40
923724	923690-48	923743-48	923739-48	TC-48
923726	923690-64	923743-64	923739-64	TC-64

LOGICAL CONNECTIONS

A P Logical Connections are a Test Clip/Jumper Assembly combined. They are ideal for microprocessor-to-logic analyzer connections. The Test Clip end is a pair of single-row socket connectors attached to the pins of a Super-Grip II Test Clip. The remote end is a DIP connector. Connectors are molded onto the 18" color-coded flat ribbon cable. Probe access holes in backs of all connectors. Factory tested.

LOGICAL CONNECTION (Test Clip and Jumper)		JUMPER ONLY (No Test Clip)
End	AP No.	AP No.
With DIP Plug	923884-16	922594-16
	923884-24	922594-24
	923884-40	922594-40
No DIP Plug	923880-16	922590-16
	923880-24	922590-24
	923880-40	922590-40

Suffix denotes No. of pins.



PROBE-IT Plunger-Actuated Probes

For hands-free testing, press caps to extend hook contact, hook it onto lead or wire under test and release it. Select from 4 sizes: Micro (1.63"), Mini (2.19"), Standard (2.38"), and Maxi (3.56"). Solder any length of stranded hook-up wire to contact under cap.

AP No.	Color Dash Code	Probe-it Model	Qty/ Pkg.
923830-	Rd,Bk,Bu,Gn,Yl,Wt	Micro	2
923835-	Rd,Bk,Bu,Gn,Yl,Wt	Mini	2
923840-	Rd,Bk	Standard	2
923845-	Rd,Bk	Maxi	2
923848	(One ea. of 6 colors)	Micro	6
923850	(One ea. of 6 colors)	Mini	6

BREADBOARD JUMPER WIRE KIT

350 wires cut to 14 different lengths from 0.1" to 5.0". Each length is color coded and segregated in convenient plastic box. Leads are stripped 1/4" and bent 90° for easy insertion. Wire is solid, tinned 22-gauge copper with PVC insulation. **JK1 Wire Kit . . 923351**

JUMPER WIRE PACKAGES

Shown above: individual packages with all wires same length and color in each package.

AP No.	Length (in.)	Color	Qty/ Pkg.
923345-01	0.1	(bare)	200
923345-02	0.2	Red	200
923345-03	0.3	Orange	200
923345-04	0.4	Yellow	200
923345-05	0.5	Green	200
923345-06	0.6	Blue	200
923345-07	0.7	Violet	150
923345-08	0.8	Gray	150
923345-09	0.9	White	150
923345-10	1.0	Brown	100

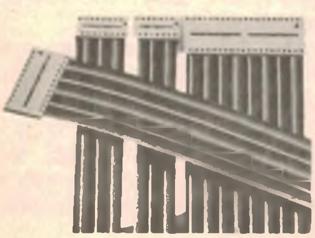
AP No.	Description
922576-20	20-pin conn.
922576-26	26-pin conn.
922576-34	34-pin conn.
922576-40	40-pin conn.
922576-50	50-pin conn.
922578-20	20-pin switch
922578-26	26-pin switch
922578-34	34-pin switch
922578-40	40-pin switch
922578-50	50-pin switch

INTRA-CONNECTOR and INTRA-SWITCH

Connector mates in-line with standard .1" x .1" dual-row socket connectors & headers. Right-angle pins permit probing or daisy-chaining. Intra-Switch permits in-line, on-off switching to test individual circuits. Switches actuated with pencil or probe tip.

DIP JUMPERS

DIP jumpers fit standard DIP sockets. Ideal for jumpering within PC boards; between boards, backplanes, and motherboards; I/O signals, etc. Connectors molded onto cable for optimum strain relief; factory tested; probe access holes on backs. Conductors: 28 AWG. Color-coded cable uses 10-color sequence.



Dip Jumper Connector on one end	
AP No.	No. Pins
924102-36	14
924112-36	16
924122-36	24
924132-36	40

Suffix in AP No. is length (-06 = 6 in.)

Connector on both ends	
AP No.	No. Pins
924106-06	14
924106-12	14
924106-18	14
924106-24	14
924106-36	14
924116-06	16
924116-12	16
924116-18	16
924116-24	16
924116-36	16
924126-06	24
924126-12	24
924126-18	24
924126-24	24
924126-36	24
924136-06	40
924136-12	40
924136-18	40
924136-24	40
924136-36	40

AP No.	Headers	No. Rows
929974	Female	1
929975	Female	2
929834-01	Male, straight	1
929836-01	Male, straight	2
929835-01	Male, rt. angle	1
929838-01	Male, rt. angle	2

MALE AND FEMALE HEADERS

Molded-in, straight and right angle male headers have 36 posts per row. They are stackable to make up matrices of .025" sq. posts on PC boards or to use as patchboards for discrete connections. All mate with female connectors on .100" spacing. Posts extend .235" and .100" beyond .100" sq. header for wire wrapping and soldering. "Break to row length" feature. Posts are alloy 770, unplated. Female headers also are stackable and mate with matrices of .025" sq. or round posts on .100" centers. 36 "tuning fork" contacts per row are molded into header strip with .100" solder tails for PC board mounting or cable attachment. "Cut to row length" feature. Contacts are alloy 770, unplated. Dual-row headers are ultra-sonically welded at factory.

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INTEGRATED CIRCUIT ACCESSORIES
POWERED BREADBOARDS,
TERMINAL & DISTRIBUTION STRIPS

ACE ALL-CIRCUIT EVALUATORS

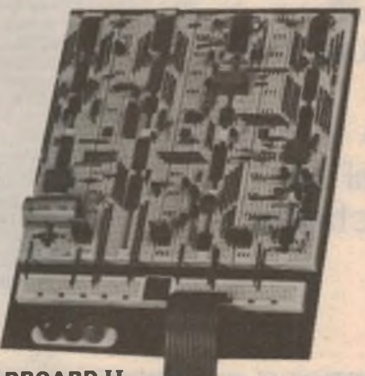
Two kits and five assembled breadboards for quick build-up and check-out of experimental circuits. All models have integral voltage distribution system with solderless, plug-in tie points on universal .100" x .100" matrix for excellent circuit design flexibility. These ACE's accept all DIP's, TO-5's, discrete components and solid wire patch cords to .032". Use buses for voltage, ground, reset and clock lines, shift command, etc. Five-way binding posts. Aluminum base serves as ground and has gold-anodized protective surface. Multi-tie-point terminals are non-corrosive nickel silver. Four rubber feet included.

Powerace 101
923101 . . . 120 VAC
923221 . . . 220 VAC

Powerace 102
923102 . . . 120 VAC
923222 . . . 220 VAC

Powerace 103
923103 . . . 120 VAC
923223 . . . 220 VAC

ACE 236



BREADBOARD II

Fully assembled. Unique system of 3 distribution strips, two levels of printed circuits and 3 binding posts. 18 buses are color coded and internally connected to 3 corresponding color binding posts. High distributed capacitance and low inductance design minimizes unwanted voltage spikes, provides superior low impedance system. Same solderless, plug-in matrix features as ACE's. Laminated NEMA G-10 glass epoxy; circuits and gnd. plane are 2-oz. copper; terminals are copper alloy 770.

AP No.	ACE's and Breadboard II	Tie-Pts.	DIP Cap.	No. Buses	No. Posts	Size (inches)
923333	ACE 200-K (kit)	728	8(16's)	2	2	4 9/16 x 5 9/16
923332	ACE 208 (assem.)	872	8(16's)	8	2	4 9/16 x 5 9/16
923334	ACE 201-K (kit)	1032	12(14's)	2	2	4 9/16 x 7
923331	ACE 212 (assem.)	1224	12(14's)	8	2	4 9/16 x 7
923326	ACE 218 (assem.)	1760	18(14's)	10	2	6½ x 7⅛
923325	ACE 227 (assem.)	2712	27(14's)	28	4	8 x 9¼
923324	ACE 236 (assem.)	3648	36(14's)	36	4	10¼ x 9¼
923605	BB II (assem.)	2696	36(14's)	18	3	7 x 9

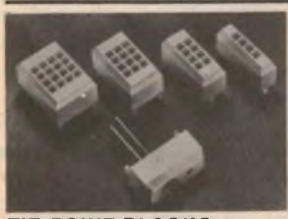
POWERACE POWERED BREADBOARDS

Fully assembled. All three Powerace models offer a new dimension in convenience for fast, solderless, circuit building and testing. Each incorporates two A P Super-Strips with 1680 plug-in tie points to hold up to 18 14-pin DIP's. Breadboards accept all DIP sizes including RTL, DTL, TTL and CMOS devices, TO-5's and discretes with leads up to .032" dia. Built-in groundplane — ideal for high-frequency and high-speed/low-noise circuits. Interconnect with any solid 20 or 30 AWG wire via plug-in tie-point blocks on panels. Operate on 200 to 240 VAC at 50 Hz or on 110 to 130 VAC at 60 Hz (with fused power supplies). Ripple/noise is ≤ 10 mV at full load. Dimensions of all three Poweraces are: 7.5" wide, 11.5" deep, 4.0" high at the rear, but only 0.75" high at the front for working-level convenience. Weights are approx. 2.5 lb. Complete operating instructions included.

POWERACE 101 — General purpose for all types of circuits. Power supply is regulated, adjustable from +5 to +15 VDC at 600 mA. Line and load regulation is ≤ 3%. O-15 VDC meter for monitoring power supply or circuits.

POWERACE 102 — For prototyping digital circuits. Power supply is regulated +5 VDC at 1 amp. Line load regulation is ≤ 1%. Built-in pulse detection with memory — combined with three buffered logic indicators, provide free built-in logic probe. Also contains two logic switches, four data switches, a clock generator and a one-shot pulse generator.

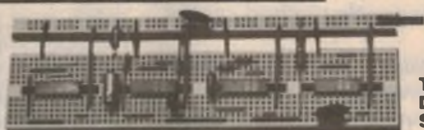
POWERACE 103 — Triple-output power supply for linear and digital circuits has outputs of +5 VDC at 750 mA; +15 VDC at 250 mA; and -15 VDC at 250 mA (±15-volt outputs track). Line and load regulation is ≤ 1%. Meter is built-in 15-O-15 VDC. Also contains two buffered logic indicators, two logic switches and two data switches.



TIE-POINT BLOCKS

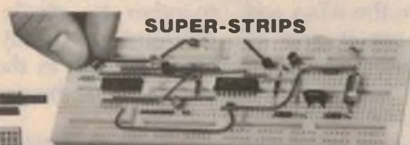
Four models available with .1" matrix of solderless, plug-in, 4-tie-point terminals for custom layouts, attaching relays, displays, in/out patching. LED block accepts 3/16" dia. bulb (not included). All have solder tails and mount by press-fitting into holes. Packaged 20 per pack.

AP No.	Tie-Point Blocks	Tie-Points
923297	TB1 (single)	4
923299	TB2 (double)	8
923301	TB3 (triple)	12
923303	TB4 (quad)	16
923305	LB1 (LED)	1
923306	Assortment: 4 each of above 5 styles	



TERMINAL AND DISTRIBUTION STRIPS

For building custom breadboards. Solderless, plug-in matrices on .1" x .1" centers that accept all DIP's, TO-5's, discretes and solid wire jumpers to .032". Terminal strips available in 4- and 5-tie-pt. single and dual rows. Distribution strips available with 2 or 6 buses. Includes integral, non-shorting mounting backing.



SUPER-STRIPS

Super-Strip universal, breadboarding elements have 840 solderless, plug-in tie points, integral, low-impedance distribution system, accept all DIP's, TO-5's, discretes and solid jumpers to .032". Hold up to nine 14-pin DIP's. Choice of contact finishes. Includes integral, non-shorting, instant-mounting backing.

CIRCUIT-STRIPS

Circuit-Strip duplicates the advantages of the Super-Strip but in a smaller size. Then it goes one better with a molded-in alpha-numeric grid for faster and easier identification of every tie point in your circuit. This makes labeling schematics easier in lab or training course, and simplifies troubleshooting. Circuit-Strip holds up to six 14-pin DIP's and is available with or without gold contact finish.

AP No.	Terminal Strips, Distribution Strips and Super-Strips	Buses, Terminals and Tie Points	DIP Capacity	Size# (in.) L. x W.
923273	217L Terminal strip	34 five-tie-point term.	2 (16's)	1.8 x 1.36
923269	234L Terminal strip	68 five-tie-point term.	4 (16's)	3.5 x 1.36
923265	248L Terminal strip	96 five-tie-point term.	6 (14's)	4.9 x 1.36
923261	264L Terminal strip	128 five-tie-point term.	9 (14's)	6.5 x 1.36
923289	264R Terminal strip	128 four-tie-point term.	9 (14's)	6.5 x 1.1
923285	206R Distrib. strip	2 buses of 24 tie points	....	3.5 x .35
923281	209R Distrib. strip	2 buses of 36 tie points	....	4.9 x .35
923277	212R Distrib. strip	2 buses of 48 tie points	....	6.5 x .35
923293	606R Distrib. strip	6 buses of 24 tie points	....	6.5 x .43
923252	SS-2 Super-Strip	128 five-tie-point term. &	9 (14's)	6.5 x 2.25
923748	SS-1 Super-Strip†	8 buses of 25 tie points	9 (14's)	6.5 x 2.25
923252	Circuit-Strip	94 five tie-point term. &	6 (14's)	4.9 x 2.25
923749	Circuit-Strip†	4 buses of 35 tie points.	6 (14's)	4.9 x 2.25

†Gold-plated copper alloy terminals. #Height of all strips is .32 inches.

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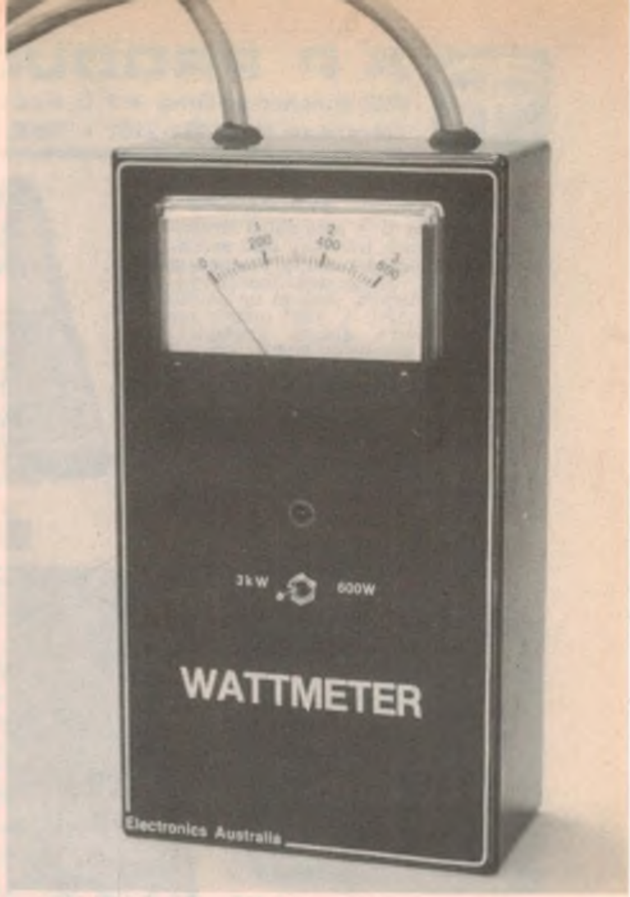
Measure your power consumption

Electronic Wattmeter

simple design uses an OTA



The unit described here will measure the power consumption of any mains appliance with a rating up to three kilowatts. It makes use of a special op amp called an "output transconductance amplifier" or OTA, for short.

by JEFF SKEEN & LEO SIMPSON

With the cost of electrical energy expected to rise relentlessly in the future, consumers will want to know how much energy each appliance uses. The first step in understanding energy usage is to measure the power required to run the appliance. Our wattmeter circuit measures the power used by any mains appliance including heaters, motors and transformer driven equipment such as TVs and microwave ovens.

Before we get started on the whys and the wherefores of the circuit and its operation, let us sort out a few terms. If we don't, some of our readers will be jumping down our collective throats for sloppy writing. That conjures up some interesting images, doesn't it?

For a start then, let us make it clear that power is not consumed, although it is common usage for people to talk of "power consumption" and power bills. Nor for that matter, is energy consumed; it is merely transformed from one form into another. So electrical energy can be transformed into mechanical energy by a motor and then into potential, kinetic or heat energy.

But as far as the practical person is concerned, once the appliance is turned on and current begins to flow, energy has been used or consumed and that is that. Never mind the laws of conservation of matter and energy and concepts of entropy. What is entropy anyway? We "dunno" but there seems to be a hell of a lot of it about and it's increasing all the time.

When we talk about power consumption we really mean the power "demand" or requirement of an appliance. And that power demand is the product of the voltage applied and current which flows. So for a 2400W radiator, the power demand is the product of 240VAC and 10 amps which flows when the switch is thrown. Simple enough, so far.

For the radiator example above it is a relatively simple matter to measure the current and voltage and multiply the two together to obtain the power being delivered (or used). But for other appliances, such as those using motors or transformers, this simple method cannot be used.

The main reason that the simple multiplication method will not work is that the current in loads such as motors or transformers is not in phase with the applied voltage. The current waveform "lags" the voltage waveform. We allow for this by introducing "power factor" into the calculation. This is the cosine of the phase angle between the voltage and current.

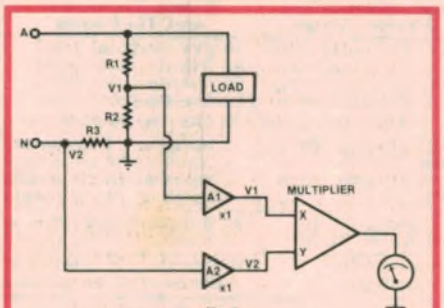


Fig. 1

This diagram illustrates the concept of the Wattmeter circuit.

With this factor in the calculation, the formula for power now becomes:

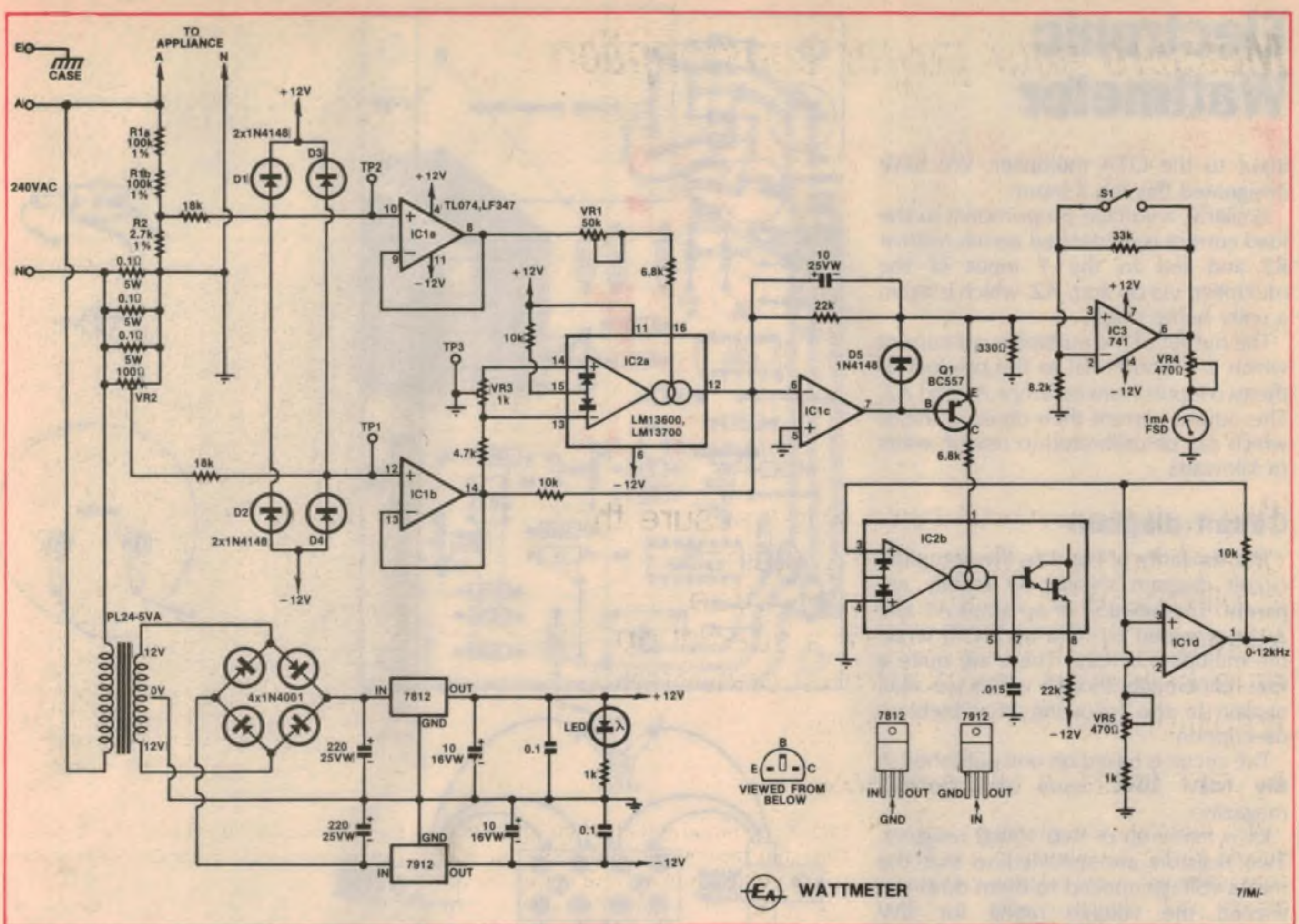
Power = V.I. $\cos\phi$

where ϕ is the phase angle and V and I are the RMS or effective values of these parameters. The "effective" value is important because it often cannot be measured accurately by moving coil meters.

Moving coil meters respond to the average value of the current through them and when they are used to measure sinusoidal waveforms (the 50Hz AC voltage waveform is a sinewave) the meter is calibrated to read the effective or RMS value. But if the waveform is not purely sinusoidal large errors will occur in the reading.

In practice, the 240VAC mains waveform can often be distorted and this can happen in many ways. For example, switching tones may be superimposed on the waveform or heavy transformer or Triac controlled loads may cause distortion by drawing rapidly varying currents during each half cycle. And as this implies, the AC load current waveform may be anything but a pure sine wave. For example, the current waveform for a transformer-driven appliance such as a TV set, VCR or stereo receiver will normally be a large spike in each half-cycle with a very high peak-to-average ratio. The current waveform for fluorescent light loads will be similar.

Similarly, the current waveform for a Triac controlled light dimmer will be



Electronic Wattmeter

The LM13600 is a dual OTA package one of which is wired as a current-controlled oscillator for an add-on watt-hour meter facility which will be published in a later issue. Note that the circuit is tied directly to the 240VAC mains.

heavily distorted, as the Triac chops the waveform every half-cycle.

Dynamometer

Up till now, the only instrument capable of making accurate power measurements under all the foregoing conditions has been the dynamometer. This is similar to a normal moving-coil meter except that it has two coils, one to replace the magnet in a moving-coil instrument.

The coils in the dynamometer are connected so that the magnetic fields they produce act to apply torque to the pointer. This torque is directly proportional to the product of the currents flowing in the two coils. So, in fact, the dynamometer is a device which can multiply two parameters, represented by currents, and display the result.

Used as a wattmeter for a single-phase 240VAC mains supply, the dynamometer is connected with one coil to monitor the voltage while the other coil monitors the load current.

One interesting point about the dynamometer is that the movement is usually highly damped so that the unit does not respond to rapid variations in the product of the two coil currents. Instead it responds to the average value of the products. In this respect the dynamometer can be regarded as an integrator as well as a multiplier. Dynamometers are usually very accurate, within ±1% of full-scale deflection.

Doing it electronically

The electronic equivalent of a dynamometer requires the use of a multiplier circuit. There are several ways of designing such a circuit but by far the most direct is to use a special type of operational amplifier known as an "output transconductance amplifier".

Well, what is so special about an OTA and how is it different from a normal op amp? An op amp is voltage-driven and its output is a voltage which is the product of the op amp gain (typically 100,000 or so) multiplied by the differential input voltage. So the normal op amp is a voltage amplifier with a fixed gain.

The OTA also has a differential input which is voltage driven but the output is a current. So instead of thinking in terms of voltage gain (ie, V/mV) for an OTA, we think in terms of "forward transconductance" which is expressed in millamps per volt or "mho" (ie, the reciprocal of "ohm"). The output current of the OTA can be easily converted back to a voltage by simply passing it through a suitable value of resistor.

There is nothing special about the fact that the OTA has forward transconductance (or g_m, as valve enthusiasts like to think of it) until you discover that the transconductance can be varied over an extremely wide range by a DC bias current. This bias current can be provided by a varying voltage source connected via a suitable series resistor. Thus, the OTA can be connected so that its gain is the product of two input voltages, ie, as a multiplier.

How the OTA is used in an electronic voltmeter circuit is depicted in Fig. 1. This shows a load connected across the active (A) and neutral (N) wires from the mains. The mains voltage across the load is monitored by op amp A1, via a voltage divider comprised of R1 and R2. A1 is a unity gain buffer stage which drives one

Electronic Wattmeter

input to the OTA multiplier. We have designated this the X input.

Similarly, a voltage proportional to the load current is developed across resistor R3 and fed to the Y input of the multiplier, via op amp A2, which is again a unity buffer stage.

The output of the multiplier is a current which is proportional to the product of the two inputs from op amps A1 and A2. The output current then drives a meter which can be calibrated to read in watts or kilowatts.

Circuit diagram

The similarity of Fig. 1 to the complete circuit diagram should be readily apparent. The function of op amps A1 and A2 is provided by IC1a and IC1b while the multiplier is IC2a. There are quite a few refinements though which we shall explain in the following blow-by-blow description.

The circuit is based on one published in the May 1983 issue of "Elektor" magazine.

R1 is made up of two 100kΩ resistors. Two resistors are specified so that the mains voltage applied to them does not exceed the voltage rating for ¼W resistors. R2 is a 2.7kΩ resistor and both R1 and R2 are specified at 1% tolerance to ensure accuracy.

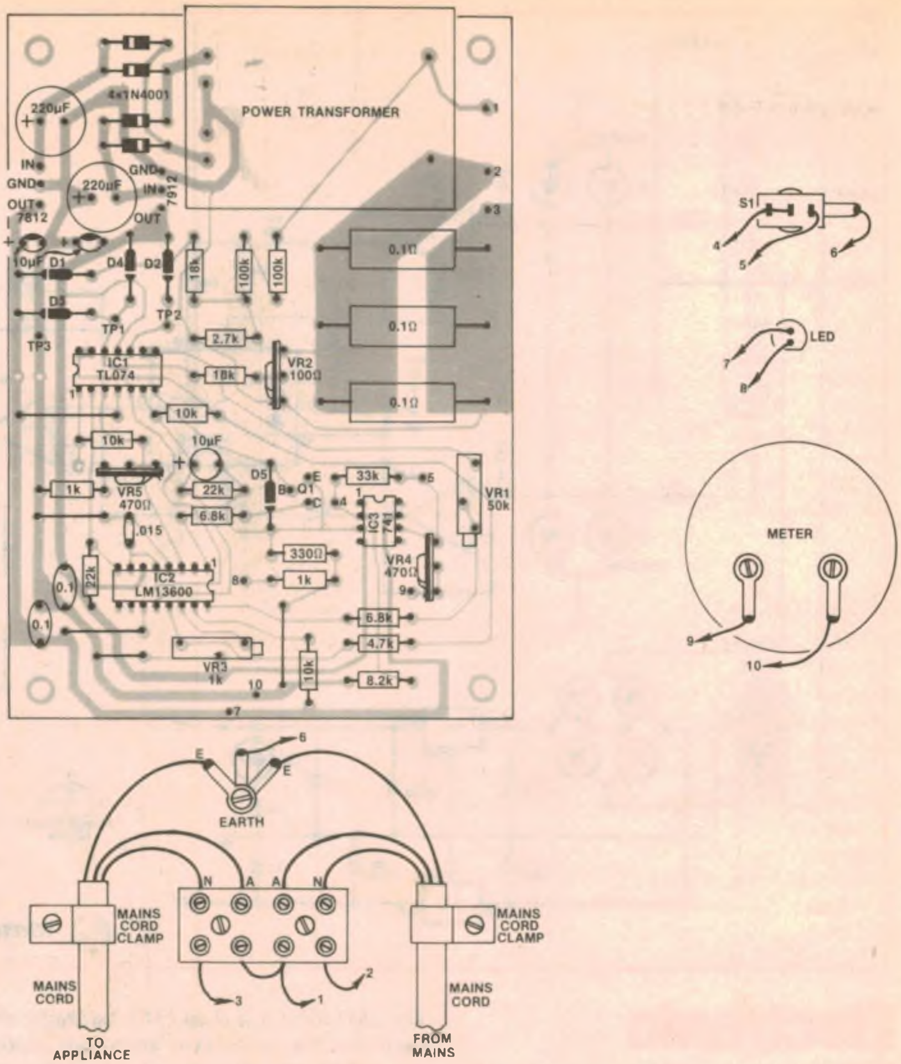
With 240VAC applied, the voltage across R2 is 3.2V RMS and this is fed via an 18kΩ resistor to the non-inverting input of IC1a. D1 and D2 provide input voltage protection for IC1a should the signal become excessive, as for example if a large transient voltage spike appears on the line.

As noted before, IC1a is connected as a unity gain amplifier to buffer the voltage signal. The output of IC1 is then fed via VR1 and a 6.8kΩ resistor to the bias input on IC2a.

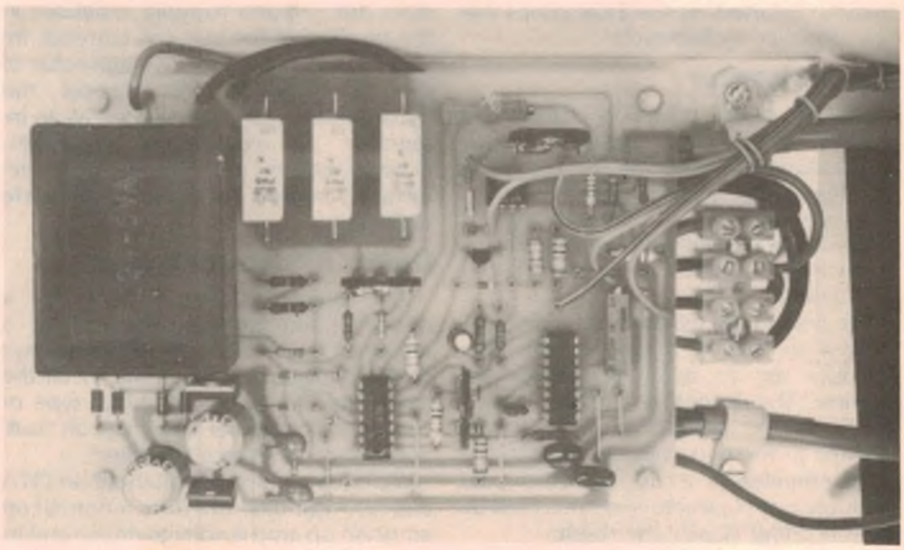
VR2 in conjunction with three parallel connected 0.1Ω resistors monitors the current drawn by the load. The signal from VR2 is fed via an 18kΩ resistor to the non-inverting input of IC1b which is also a unity-gain buffer. Its output signal is fed to the differential inputs of IC2a.

D3 and D4 protect the inputs of IC1b from excessive input voltage. In the same way as D1 and D2, they conduct to clip any signals which are in excess of 12.6 volts peak.

The output current from IC2a, which is a function of the product of the inputs at pins 13 and 16, is fed to a 10kΩ resistor to develop an output voltage. This is then fed to IC1c which has a gain of two and thence to IC3, the meter driving amplifier.



Note that R1a, VR2 and the three 0.1Ω/5W resistors must be left off the board until calibration has been completed.



IC3 has a switch across its 33kΩ feedback resistor so the gain can be changed from unity, giving a full-scale deflection of 3kW, to five, giving a full-scale deflection of 600W.

Q1, IC1d and IC2b are not essential to the operation of this circuit. They are included to provide for an add-on watt-hour meter which will be described in a later issue. Briefly, IC2b and IC1d form a current-controlled oscillator which delivers a signal frequency which is directly proportional to the power being registered on the meter scale. When this

Electronic Wattmeter

signal is fed to a suitable counter it is the basis of a watt-hour meter.

Q1 is a voltage-to-current converter for IC1c and diode D5 provides a forward current path to avoid reverse-biassing the base-emitter junction of Q1 when the output of IC1c is positive.

This concludes the description of the wattmeter circuit, apart from the power supply. This uses a transformer with a centre-tapped 24V secondary winding which drives a bridge rectifier and two 220μF/25VW filter capacitors to provided balanced supply rails of about ±17 volts. These are then regulated to ±12 volts DC with three-terminal regulators.

Construction

The construction of the wattmeter is straightforward but readers should note that when assembled and operating, the entire circuit may or may not be at full mains potential, depending on the correctness or otherwise of the mains wiring in the house or dwelling where it is used.

Because of this, the wiring of the wattmeter must be made on the assumption that it is all "live" and dangerous.

All of the circuit components with the exception of the meter are mounted on a printed circuit board measuring 100 x 140mm and coded 83wm8. This is housed in a standard plastic zippy box measuring 196 x 112 x 60mm.

No special order needs to be followed when assembling the PC board, although it is easier if some of the smaller components such as the wire links, resistors and diodes are mounted first. Take care with the orientation of

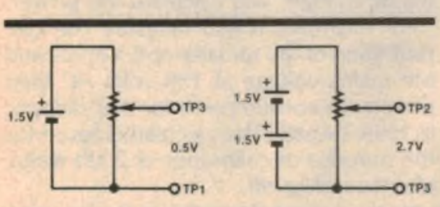
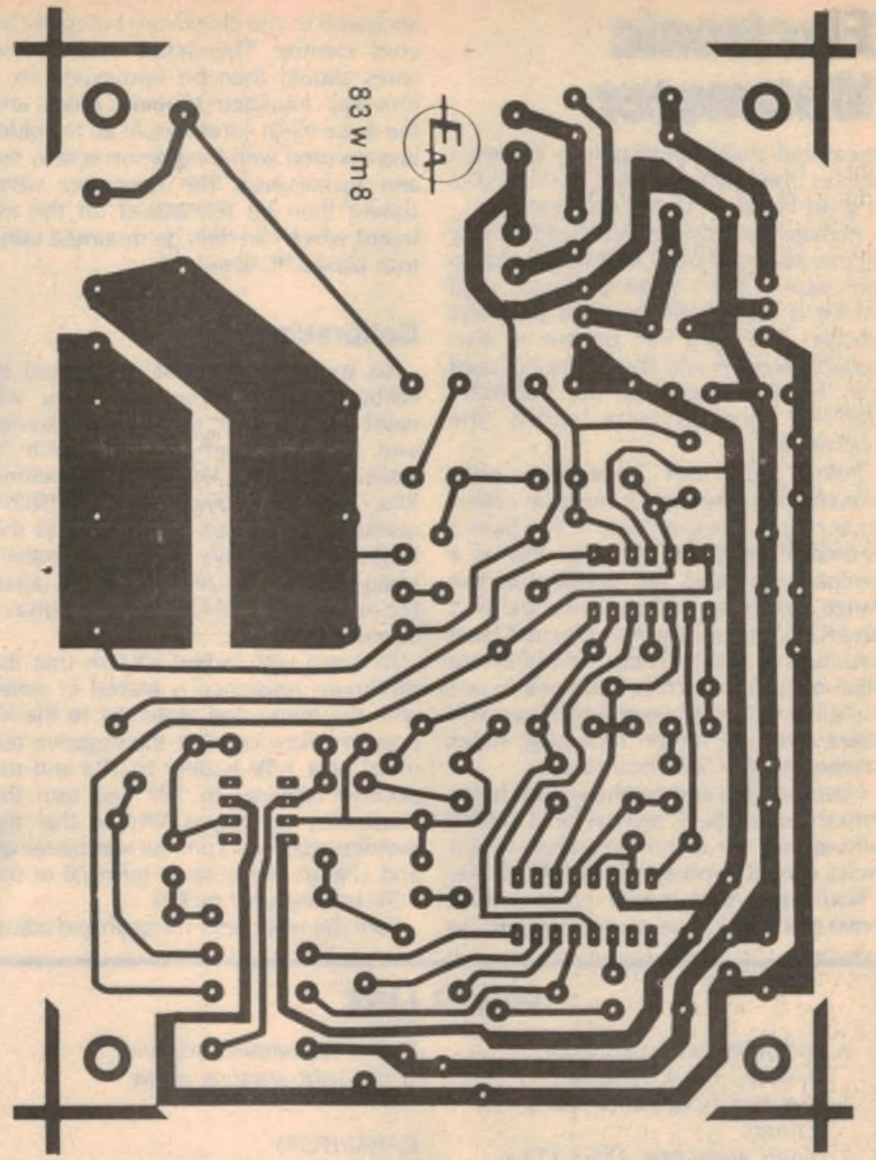
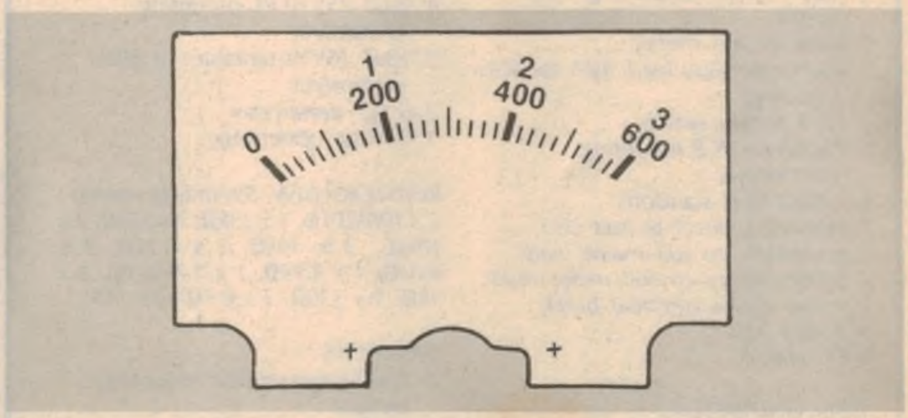


Fig. 2

polarised components such as the transistor, the diodes and electrolytic capacitors. No heatsinks are required for the three terminal regulators.



Here is the actual size artwork for the PCB and meter scale.



Omit these components

In order to be able to calibrate the unit it is necessary to isolate the circuitry from the 240VAC mains voltage. To this end, R1a, the three 0.1Ω/5W resistors and VR2 should be left off the PCB at this stage. When calibration is completed, these four components can be added.

With the assembly of the PC board complete it is most important that the remaining wiring details should be identical to those depicted on the wiring diagram we have included with this article.

When it is completed the wattmeter must have no exposed metalwork which is not earthed back via the mains. This means that not only must the metal baseplate of the case be earthed but so also must the metal bush of the range toggle switch.

Mains connection to the wattmeter is made via a three-core mains cord and three-pin plug and thence to a standard power point. The appliance to be

Electronic Wattmeter

measured then connects to a three-pin socket from the wattmeter, at the end of a short length of three-core flex.

Perhaps the easiest and cheapest way of providing the two cords required is to purchase a short mains extension cord which is fitted with moulded plug and socket. The cord can be cut to two suitable lengths and the remaining cord can be the source of the necessary 240VAC hookup wire within the wattmeter.

Before you start assembling components into the case it must be drilled to accept the power cords. If you have a Scotchcal label you can use this as a template to mark the position of the range switch for drilling. While we used an MU45 meter from Altronics and have produced a scale to suit, we are aware that many constructors may have to use a slightly different meter. For this reason there are no meter mounting holes marked on the Scotchcal label.

Having drilled and cut the various holes into the case, the Scotchcal label can be affixed and the meter and range switch holes cut into it using a sharp utility knife.

Both input and output cords should enter the plastic case at one end and be anchored to the aluminium baseplate by cord clamps. The active and neutral wires should then be terminated to a four-way insulated terminal block and the three-earth wires should go to solder lugs secured with a common screw, nut and lockwasher. The necessary wires should then be terminated on the PC board which can then be mounted using four plastic PC standoffs.

Calibration

No special equipment is required to calibrate the wattmeter but you will need a multimeter, three 1.5V batteries and two potentiometers with a resistance around 1kΩ. As noted before, R1a, (100kΩ), VR2 and the three 0.1Ω/5W resistors should not be installed at this stage, so that the PCB is essentially isolated from the 240VAC mains, apart from the transformer primary connection.

To begin with, adjust VR4 so that the maximum resistance is placed in series with the meter and switch S1 to the X1 position. Now connect the negative terminal of a 1.5V battery to TP3 and the positive terminal to TP2 and turn the wattmeter on. Adjust VR3 so that the meter reads zero. Turn the wattmeter off and change the positive terminal of the 1.5V battery over to TP1.

Turn the wattmeter on again and adjust VR1 so that the meter again reads zero. Adjust VR4 so that the wiper is set at about half rotation then repeat the procedure of connecting the positive terminal of the 1.5V battery to TP2 and TP1 and adjusting the respective trimpots.

Turn the wattmeter off, construct the calibration circuits shown in Fig. 2 and connect these to the indicated test points. Turn the wattmeter on and adjust VR4 for a meter reading of 3000W.

We estimate that the current cost of components is approximately

$65

This includes sales tax

That completes the calibration procedure except for the setting of VR2. R1a, VR2 and the three 0.1Ω/5W resistors can now be installed. The three latter resistors should be raised off the board by about three or four millimetres to avoid any possibility of charring the board when the resistors get hot. When a 10A load is connected, the three resistors will dissipate a total of 3.3 watts, which is enough to make them quite warm.

To set VR2 accurately, and thus take account of the tolerance of the current monitoring resistors, you will need a high current resistive load, such as a 2400W radiator, and a multimeter which can read up to 10 amps AC and 240VAC. Essentially what has to be done is to use the multimeter to measure the load current drawn by the radiator for a given mains voltage, and calculate the power.

For example, if you measure the current drain of the radiator at 8.4 amps and the mains voltage at 238 volts AC then the power consumption for that radiator is 1999.2 watts. The calculated figure for the purpose of calibration is 2000 watts, after rounding off.

Now connect the radiator to the wattmeter and adjust VR2 to give the calculated reading. Remember that VR2 is nominally in the neutral side of the mains circuit but it could be at full mains voltage. **This means that adjustment of VR2 must be done with a screwdriver with a fully insulated blade.**

If you do not have access to a suitable multimeter, VR2 should be set so that the wiper is all the way over towards D5.

That completes the description of our new wattmeter. The oscillator associated with IC2b need not be adjusted unless you build the companion watt-hour counter board which will be described in a future issue.

PARTS LIST

1 Printed circuit board, code 83wm8, 138 x 100mm.
1 Scotchcal front panel, 193 x 110mm
1 plastic zippy box, 195 x 113 x 60mm
1 MU45 1mA FSD moving coil meter
1 scale to suit meter
1 short extension lead, 10A capacity (see text)
1 SPST toggle switch
1 PL24/5VA PCB mounting transformer
4 12mm PCB standoffs
1 mounting bezel to suit LED
2 grommets to suit mains lead
2 cable clamps to suit mains lead
1 4-way mains terminal block
4 solder lugs
3 PC stakes

SEMICONDUCTORS
5 1N4148 diodes
4 1N4001 diodes
1 7812 three terminal regulator
1 7912 three terminal regulator
1 BC557 small signal transistor
1 TL074 operational amplifier
1 LM13600 or LM13700 transconductance amplifier
1 741 operational amplifier
1 red light emitting diode

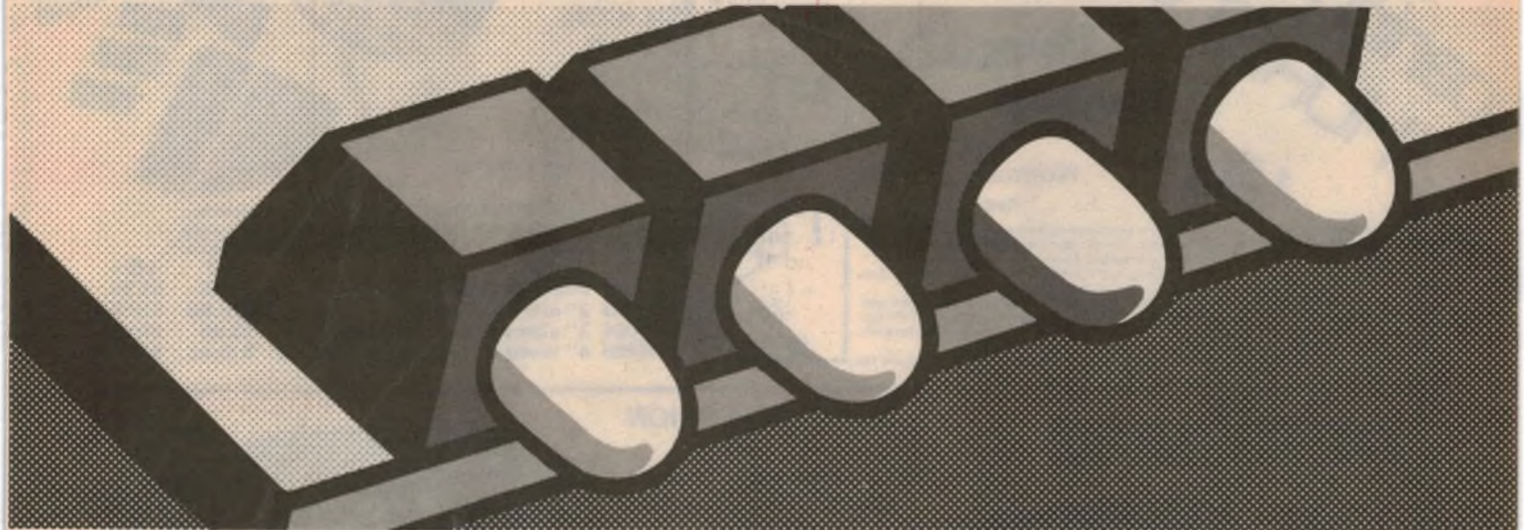
CAPACITORS
2 220µF 25VW PC-mounting electrolytics
1 10µF 25VW PC-mounting electrolytic
2 10µF 16VW tantalum or RBLL electrolytic
2 0.1µF greencaps
1 0.015µF greencap

RESISTORS (¼W, 5% unless stated)
2 x 100kΩ 1%, 1 x 33kΩ, 2 x 22kΩ, 2 x 18kΩ, 3 x 10kΩ, 1 x 8.2kΩ, 2 x 6.8kΩ, 1 x 4.7kΩ, 1 x 2.7kΩ 1%, 2 x 1kΩ, 1 x 330Ω, 3 x 0.1Ω 10% 5W.

TRIMPOTS
1 100Ω large vertical mounting trimpot
2 470Ω large vertical mounting trimpots
1 1kΩ multiturn trimpot
1 50kΩ multiturn trimpot

MISCELLANEOUS
Hook-up wire, machine screws and nuts, solder etc.

Shed new light on problems lurking around the corner.



Industry standard design, these indicators are T-1¾ (5mm) LED lamps assembled in black plastic housings that orientate the LED at right angles to the printed circuit board.

Designed to be used primarily as back panel diagnostic indicators and card edge logic status indicators, these power efficient LEDs provide:

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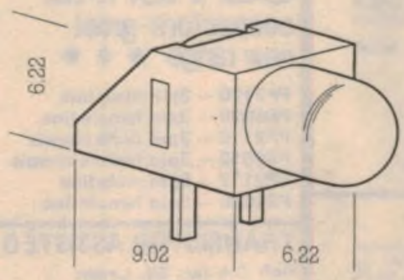
☐ a colour choice of high efficiency red, standard red, yellow and high performance green
☐ the option of an integrated current limiting resistor

HLMP-5000 series right angle LEDs from Hewlett Packard.



Please send me a T1¾ red, low current lamp plus a detailed data sheet.

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Company ______________________

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Application ______________________

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Resistance	200Ω	100mΩ	0.5% ± 1 digit
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20 000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell	90	0.1	2% ± 3 digits

Ref: EA June 1983

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- 4 Amplifier group delay, less than 0.075uS
- 5 Signal handling capability not less than 1.35 volts p-p. (Sync. is clipped first.
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SEE PAGE 21 FOR JAYCAR ADDRESSES AND PHONE NUMBERS

There is no need to unsolder suspect transistors!

Build an in-circuit transistor tester

by COLIN DAWSON

Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" checker such as the EA Handy Tester.

In the absence of a CRO, most hobbyists and servicemen rely on voltage measurements to locate faulty transistors. Even so, there are many situations where voltage measurements do not give a clear indication of faulty devices. Flip-flop circuits are just one example.

Another reason why voltage measurements may not be useful is that power applied to a faulty circuit may cause further damage. And while resistance measurements can be helpful in some instances, they do not always give clear cut results.

The EA Handy Tester overcomes these problems. It tests both NPN and PNP transistors in circuit at the press of a switch. There is no need to apply power to the circuit with the suspect components. As a bonus, the Handy Tester will test diodes and SCRs as well.

So instead of desoldering the component, all you have to do is clip three test leads to it (or two in the case of a diode). If the device checks OK, you simply unclip the test leads and move on to the next suspect. This method not only saves time but is also much kinder to printed circuit boards and components. Excessive heat can lift PCB tracks and damage components if you're not careful.

There are two LED indicators to indicate whether a component is "good" or "bad". When a good NPN transistor is tested, one LED flashes. When a good PNP device is tested, the other LED flashes. If the device is faulty, either both LEDs flash (device short circuit) or both are extinguished (device open circuit). What could be easier?

There is no NPN/PNP switch on the Tester – it automatically indicates the polarity of the transistor under test. The front panel artwork tells you which LED should be flashing for the given transistor type and, by comparing this with the indicator, you can identify the polarity at a glance. All you have to know about a transistor is which leads are its base, collector and emitter.

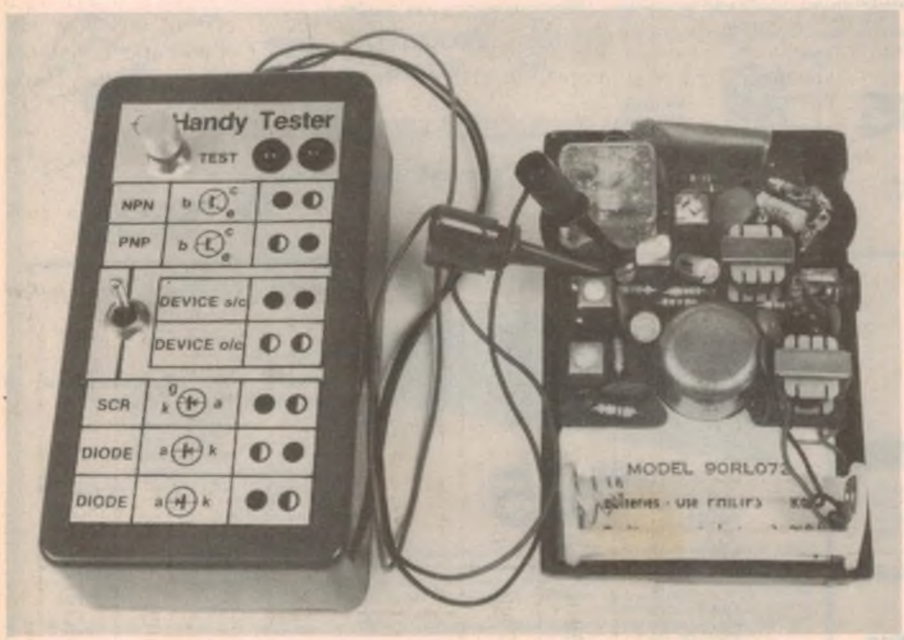
Note that the tester is only supposed to indicate that the transistor action is taking place – ie, base current causes the collector-emitter path to become a low resistance in one direction. It does not give any indication of beta or high leakage in a transistor. This is not a serious limitation as most faults are of the "go/no go" type.

Diodes and SCRs are tested in similar fashion – just compare test results with the front panel artwork. In the case of diodes, only two test leads are required. The Handy Tester will then indicate whether or not the diode is working and indicate its polarity.

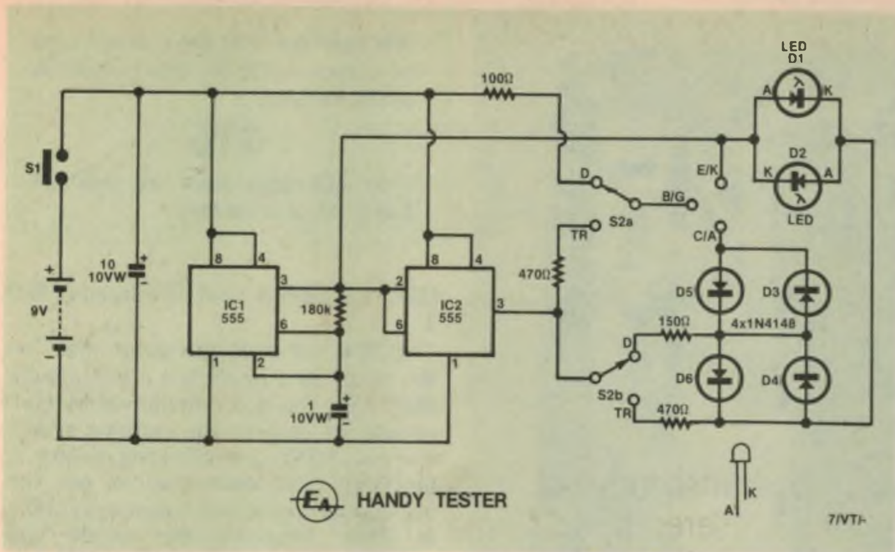
The principle of operation of the tester is fairly simple. The two LEDS are connected in parallel but with reverse polarity to each other. They are driven by a square wave oscillator with complementary outputs so that one LED will be on for each half cycle. The component under test is connected in parallel with the LEDs and, in the event of being forward biased or triggered, will shunt the LED current.

A good component will only conduct on positive or negative half cycles and will thus prevent one of the LEDS from illuminating.

A component which is short circuit will conduct on both positive and negative half cycles, diverting current from both LEDS. Conversely, a component which is



Checking suspect transistors in a circuit is easy with the Handy Tester. The front panel label indicates the various test results.



The circuit is basically a 2Hz oscillator with complementary outputs. It tests transistors, diodes and SCRs at the press of a button.

open circuit will not conduct at all and both LEDS will flash to indicate the fault condition.

How it works

The circuit is based on one originally published in the English magazine "Television" for June 1983. Their circuit used a 556 dual timer IC but we have adapted it to use two 555s since these are considerably cheaper and more readily available.

The way in which the two 555s are wired in this circuit is rather unusual. Instead of using the more familiar astable configuration, IC1 has been connected to operate as a Schmitt trigger oscillator with a 2Hz output frequency. Note that the discharge pin (pin 7) has not been used. Instead, the pin 3 output has been tied to pins 2 and 6 via a 180kΩ timing resistor.

Here's how it works. When power is first applied, the pin 2 trigger input of IC1 is held low by a 1μF capacitor and thus the pin 3 output is high. The 1μF capacitor now charges via the 180kΩ resistor and, after about 0.25s, the pin 6 threshold input reaches its critical value of two thirds supply (ie 2/3Vcc). IC1 now toggles and the pin 3 output goes low.

The 1μF capacitor now begins to discharge via the 180kΩ resistor until, after a further 0.25s, it falls to 1/3Vcc and IC1 is retriggered (pin 3 high). In this way, IC1 functions as a Schmitt trigger oscillator while ever power is applied to it.

The output of IC1 is used as one of the tester outputs (E/K) and is also used to control IC2. No timing network is used with IC2 – it operates simply as an inverter. When the input signal is high, the 2/3Vcc threshold is exceeded and IC2's pin 3 output goes low. Similarly, when the input signal is low, a trigger pulse is sensed and the output goes high.

In this manner, IC1 and IC2 produce complementary square wave outputs, each waveform having an amplitude of 9V RMS.

For the moment, assume that switch S2 is switched to the transistor (TR) test position. This will allow the output from IC2 to drive one side of the LEDs via a series 470Ω current limiting resistor. The other side of the LEDs is driven by the output of IC1, irrespective of the mode selected.

While one LED is forward biased the other will be reverse biased. Normally this is not an acceptable practice – LEDs can easily be destroyed by reverse biasing. The qualifier is that the reverse voltage becomes destructive only if it exceeds 5V. Because the typical forward voltage for a red LED is only about 1.7V, the voltage across the parallel pair can never exceed this value – regardless of the polarity.

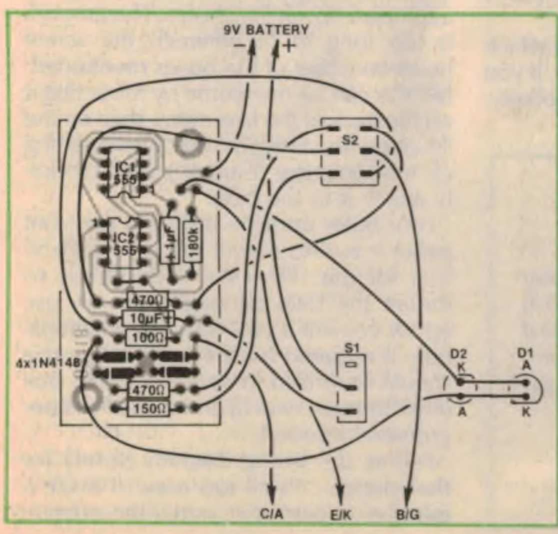
So as long as the test terminals are open circuit, the two LEDs will flash alternately on and off. When the output of IC1 is high, LED D1 is forward biased and therefore illuminated. When the output of IC2 is high, LED D2 is illuminated.

Suppose now that we short the emitter/cathode (E/K) terminal to the collector/anode (C/A) terminal. When the output of IC1 is high, current will be diverted through diodes D5 and D6 which together have a forward voltage drop of 1.2V. This voltage is insufficient to turn on LED D1 which will thus remain off. Similarly, diodes D3 and D4 conduct when the output of IC2 goes high, thus extinguishing LED D2.

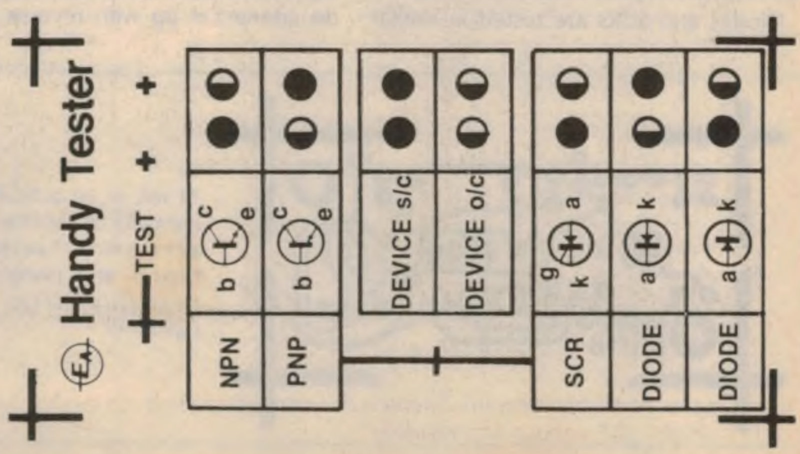
So both LEDs will remain off if there is a short circuit between the E/K and C/A terminals.

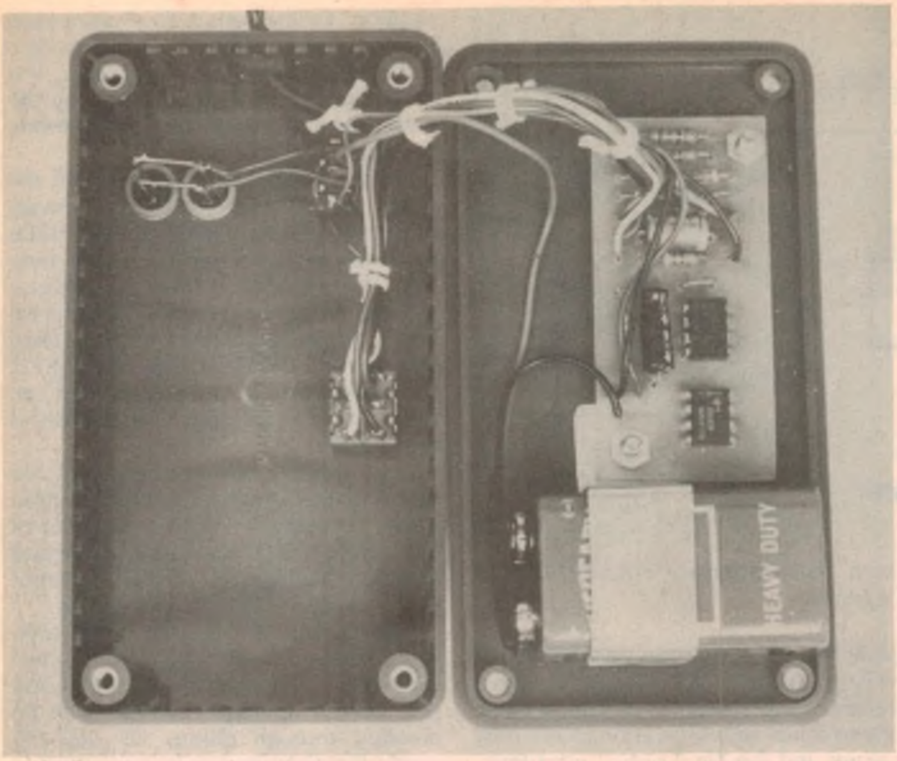
If we now connect a functioning transistor to the three test terminals, it will act as a short circuit between emitter and collector only during the half cycle for which it is forward biased. An NPN transistor is forward biased when its emitter is low and its collector and base high – ie, when the output of IC2 is high. In this condition, current will flow via diodes D3 and D4 and the collector-emitter junction of the transistor. Thus, for a good NPN transistor, only LED D1 will continue flashing.

Similarly, only LED D2 continues to



Construction is easy – just follow this wiring diagram. Below is an actual-size front panel artwork.





View inside the completed prototype. Make sure that you wire the two indicator LEDs up correctly, otherwise they could be damaged.

flash for a good PNP transistor.

What happens if there is a base-emitter short or a base-collector short in the transistor? If this is the case, the transistor will be unable to turn on and so both LEDs will flash to indicate an open circuit between collector and emitter. What this means is that the tester is unable to identify the specific fault condition. It simply tells you whether or not the transistor is actually working.

Some readers may be wondering why two back-to-back diode pairs are used in the circuit. Why not simply use one pair? The reason is that, by using two diode pairs, the circuit is rendered less susceptible to parallel resistances in the circuit under test. A low value resistance between the E/K and C/A terminals, for example, will have less voltage across it and thus less current will be diverted through it to upset circuit operation.

Diodes and SCRs are tested in similar fashion to transistors. However, to test these components it is necessary to switch out one of the back-to-back diode pairs. The reason for this is that, if we were to simply add a test diode in series with the existing "detour" diodes, the forward voltage drop would be around 1.8V. This voltage would, in many cases, exceed the forward voltage of the LEDs and thus the LEDs could never extinguish.

This brings us to the function of S2 — the mode selector switch. When S2 is switched to the "D" position, diodes D4 and D6 are bypassed, leaving only D3 or D5 plus the test component in the detour circuit. Connecting a diode with its anode to the C/A terminal will cause it to "short out" LED 2, leaving only LED 1 to flash.

However, it doesn't really matter which way round you connect the diode. If you do connect it up with reverse polarity, LED 2 will flash on and off instead of LED 1.

An SCR will have the same effect on the circuit as a diode but it will require triggering. This is accomplished by connecting its gate to the positive supply line via a 100Ω current limiting resistor. A functional SCR connected as per the front panel diagram will cause only LED 1 to flash. Swapping the anode and cathode connections will cause LED 2 to flash instead.

A Triac is tested in the same way as an SCR with its A2 terminal connected in place of the anode and A1 in place of the cathode.

Power for the circuit is derived from a small 9V battery such as an Eveready 216. Supply line filtering is provided by a 10μF electrolytic capacitor, while switch S1 switches the supply line to provide the test function.

We estimate that the current cost of components for this project is approximately

$15

This includes sales tax, but not the cost of a battery.

Construction

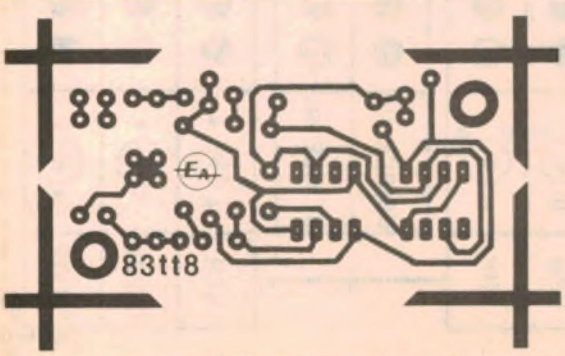
The printed circuit board (PCB) used for this project is coded 83tt8 and measures only 30 × 61mm. Only a few minutes work will be needed to solder the components in place, but watch the orientation — all the components except the resistors are polarised. Note that there is a link on the PCB next to IC2.

The Handy Tester is mounted in a small plastic utility box. Ours, measuring 112 × 62 × 31mm, was obtained from Jaycar. The UB4 plastic case (better known to us as the "second smallest zippy box") would be equally suitable.

The front panel artwork is made from "Scotchcal" material and can be used as a template for drilling holes. The artwork is too long to fit between the screw holes on either of the boxes mentioned, but this can be overcome by mounting it on the back of the box rather than on the lid. Spray the artwork with a hard-setting clear lacquer (eg, "Estapol"), then carefully attach it to the case.

Four holes must be drilled in the front panel — two to mount the switches and two for the LEDs. We used bezels to mount the LEDs although you can use epoxy cement if you wish. An additional hole is required for the test leads — this should be drilled in one end of the box (near the test switch) and a small rubber grommet inserted.

Follow the wiring diagram closely for the wiring — it's all too easy to make a mistake. In particular watch the orienta-



At left is an actual size reproduction of the PCB artwork. Finished boards and panels are available from kit suppliers.

PARTS LIST

- 1 printed circuit board, code 83tt8, 30 x 61mm
- 1 Scotchcal front panel, 49 x 96mm
- 1 plastic utility box, 31 x 62 x 112mm
- 3 small E-Z hooks; 1 red, 1 green, 1 black
- 1 DPDT miniature toggle switch
- 1 SPST momentary contact switch (click action type)
- 1 9V battery (Eveready 216 or equiv.)
- 1 battery clip to suit
- 1 rubber grommet (approx 8mm)

SEMICONDUCTORS

- 2 555 timer ICs
- 4 1N4148 diodes
- 2 red LEDS plus mounting bezels

CAPACITORS

- 1 10μF/10VW electrolytic (axial leads)
- 1 1μF/10VW electrolytic (axial leads)

RESISTORS

1 x 180kΩ, 2 x 470Ω, 1 x 150Ω, 1 x 100Ω

MISCELLANEOUS

Hook-up wire, machine screws and nuts, scrap aluminium (for battery clamp), solder, etc.

tion of the LEDs. As explained earlier in the text, unless they are wired with reverse polarity to each other, they could be damaged.

Once the wiring is completed, the PCB can be mounted on the lid of the case using machine screws and nuts. Two mounting holes are required and these should be countersunk so that the screw heads will not damage bench tops. The battery clamp is made from a small piece of scrap aluminium and is secured by one of the PCB mounting screws.

Use flexible multistrand wire for the test leads and make them at least 20cm long. We used small E-Z hooks (the ones with retracting hooks) to make the test connections – red for the collector, green for the base and black for the emitter connection. This works quite well and is easy to remember.

To check the Handy Tester, connect the battery and depress the test switch (S1). The two LEDs should flash alternately. Now short the E/K and C/A terminals. together and depress the test switch – the two LEDs should now be extinguished.

In use, the tester will give clear indications where the surrounding circuit resistances are 50Ω or more. It tends to give ambiguous readings when testing the output stages of audio amplifiers where the circuit resistances are lower than this.

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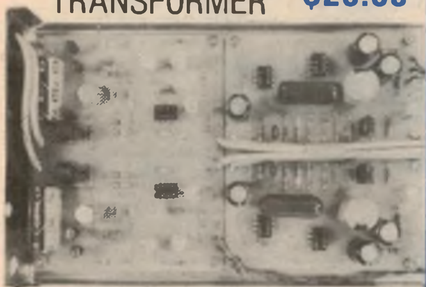

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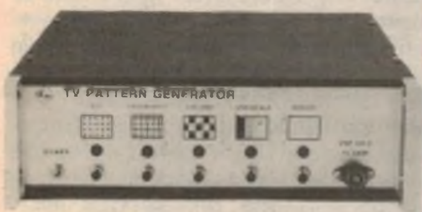

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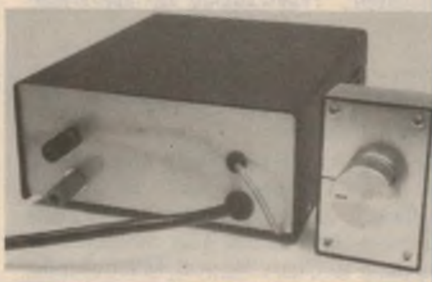

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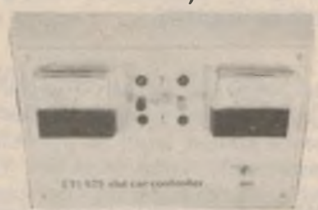

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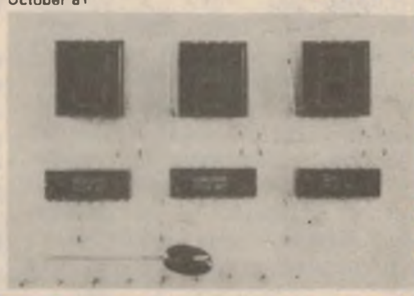

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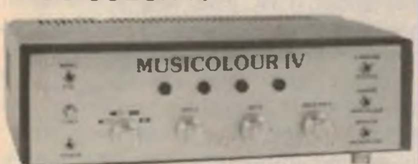

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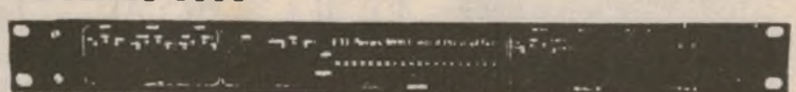

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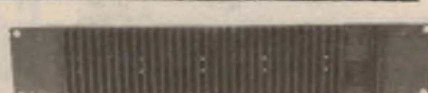

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MAIL ORDER — MAIL ORDER — MAIL ORDER — MAIL ORDER

The Serviceman

The corrosive spirit of in-house service

Readers may recall that, in my August notes, I described a tricky and somewhat mysterious fault in a Toshiba set and, in passing, mentioned that I had encountered another of these sets with an interesting fault, that I hoped to tell later. That story is my main one for this month.

In greater detail the set was a Toshiba 812, but which is also sometimes found under the Precedent label as a model GC181, particularly in motels. In fact, the set in this story came from the local motel. I also mentioned that these sets were somewhat notorious for using double sided boards with more than their fair share of dry solder joints, particularly involving the through-board connections.

Soldered joints have always been something of an enigma in electronics. Arguably the most reliable joints possible when properly made, they are equally about the most unreliable, frustrating, and expensive when improperly made. And in spite of the advances in modern production methods – or perhaps because of them – poor soldered joints seem to be just as prevalent as they ever were.

I am tempted to reminisce slightly at this stage, and I trust readers will bear with me. I'm not doing a Ronnie Corbett and wandering off at a tangent; the memories were stirred by the set in question and are quite relevant.

THE ART OF SOLDERING

My first introduction to soldering was as a very small boy when I watched a plumber wield a huge iron, heated in a brazier fired with scraps of wood from the building site. He used a stick of 50-50 solder and a liquid flux which gave off pungent and irritating fumes when the iron hit it.

I later learned that the flux was "spirits of salts" or hydrochloric acid to give it a more accurate name. Sometimes, as when working on galvanised iron, it would be used neat, and would froth and bubble on the metal before the iron hit it. For other metals, such as tin plate, brass, or copper, the plumber would "kill" it first by dropping scraps of zinc into a small jar of it.

Once again it would froth and bubble like a witch's brew until, finally exhausted, it would no longer respond to any more zinc scraps. This mixture was also used to clean the iron which would be taken from the fire, dusted to remove any ash – often with an expert flick of bare fingers – then plunged briefly into the mixture.

The result was a violent hiss as the hot metal hit the liquid, a plume of acrid steam, and an iron with a bright and shiny tip as it was withdrawn. Then the plumber would go to work and I doubt whether, so equipped, he ever made a dry joint.

Later, at a hobby level, making model boats and railway tracks, I learned the mysteries of plumber's soldering at first hand, and acquired a reasonable skill. But about that time I learned something else; becoming interested in radio I realised that soldered joints were used here too, but not the kind I was used to.

Spirits of salts, in any form, was absolutely taboo for radio work, due to its highly corrosive nature and the, often, fine wires and delicate components involved. Powdered rosin was regarded as the least corrosive flux, but also the least effective unless the metal was scrupulously clean. Other fluxes, such as Fluxite and Coraline pastes, enjoyed some popularity, but eventually gave way to plain rosin cored solder and, later, the activated cored solders.

But, through all the changes of fashion, the one golden rule remained; never use spirits of salts. Having been drummed into hobbyists and professionals alike, over many generations, it would seem to be unlikely, in this day and age, that there would be anyone who would be unaware of this taboo, even if he had never even used a soldering iron.

Or so I thought.

And so back to the Precedent GC181 and its reputation for dry joints. The symptoms were simple enough and virtually the same as in the previous story; complete frame collapse. Remembering that hassle, I wasted no time on the spot, but took the set straight back to the workshop; a wiser decision than I imagined as it turned out.

OUT WITH THE CRO

Setting the monster up on the bench, and remembering what I had learned about vertical waveforms from the previous job, the first thing I did was to stoke up the CRO and tackle the vertical amplifier module. My first check point was around the vertical oscillator and amplifier IC, IC351, a TA-7152P, and particularly the output pins, such as pin 5.

There was virtually no output here, and this led me to suspect that the IC might be faulty. A voltage check seemed to confirm this – pin 1, in particular, which should have had 4.24V on it, was reading only about 0.3V. This, and a few other measurements all seemed to point to the IC and I decided to replace this first.

I didn't have one on hand, but I ordered some in and they were promised for the next day. In the meantime I pulled the old one out – it was soldered in – and fitted a socket in its place. That meant I could go straight ahead when the new one arrived. When it did I plugged it in, switched on, and waited for a picture to appear. It didn't; all I had was the original bright line.

I went over the IC terminals again with the CRO and meter and came up with exactly the same results as before. Mentally kicking myself for jumping to conclusions I was forced to the realisation that there was nothing wrong with the original IC and I would have to look elsewhere.

The low voltage on pin 1 and a similar condition on pin 14 seemed to be the logical starting point. Both are fed from the same supply rail, an 11V zener regulated supply on the main board. Here the voltage is fed via the vertical hold control, a 150kΩ pot (R351), and thence to the vertical amplifier module. The supply rail then passes via a 130kΩ resistor (R345) to pin 14 of the IC and then via a 62kΩ resistor to pin 1 (R348).

My first suspect was the 130kΩ resistor which is common to both pin 1 and pin 14 and I lifted one end of this and checked it. It was well within tolerance so I checked its mate, the 62kΩ, which was also OK. While they were both lifted, I also checked the voltage at the input to this board, which is also designated pin 1, by the way, so let's not get confused.

The voltage here was close to 11V, which seemed logical enough except that it didn't explain where all the volts were going between this pin 1 and the IC pin 1. I refitted the two resistors, whereupon the voltage dropped at both pins to a fraction of a volt.

WHERE TO NOW?

So, if the two resistors on the vertical amp board were OK, and the IC was OK, what was there left? Probably the vertical hold control or its associated 11V rail. So I went back to this point on the main board, only to find that the 11V rail was spot on, and that I could measure 11V at the other end of the vertical hold pot, even with maximum resistance in circuit.

I went back to the input of the vertical board and checked the voltage again, and again there was only a fraction of a volt. So began the laborious task of tracing the circuit between these two points. And it was laborious because the copper track was quite long and circuitous, and included several through-board connections.

I re-soldered these as I came to them, and also used them as convenient check points to confirm that I still had the 11V. Eventually, of course, I had to find it. But it wasn't a through-board connection as I had expected, but a high resistance — rather than a complete open circuit — between two of them.

At this stage I wasn't very inclined to worry too much about the fine distinction between the two; I had already spent too much time on the job and the quickest way to cure the condition, whatever it was, was to simply bridge the two points on the board. When I did, all the voltages came back to normal and there was a full height picture on the screen.

And that was that. All I had to do was tidy up, let the set run on the bench for a couple of hours as a routine check, then take it back to the customer.

"Oh yeah?" as they say in the classics!

With the set running on the bench it didn't take me long to realise that all was still not right. Now that I had a picture I realised that it was suffering from erratic horizontal pulling. At first I thought it might be related to video content, which can make it appear erratic, but I could establish no such relationship.

In fact, at times the set would run perfectly for quite long periods, then would suddenly start pulling, bending, and generally misbehaving for no apparent reason. It was, as Bugs Bunny would say, "a revolting development".

Looking at the circuit I decided that I should first check out the sync separator. The sync separator is fed from the emitter of the first video amplifier stage, a 2SA495 transistor (Q201) from which there runs an even longer and more circuitous copper pattern than the previous one; this one is about 20cm long to a test point (TP31), and then runs another 5cm or so to a 470Ω resistor (R301), then to the differentiating network etc, and to the base of the sync separator transistor, Q301.

I put the CRO into action again and, using the double beam facility, checked first at the first video amplifier emitter and then at the input to the sync separator differenting network. These two waveforms should have been almost identical, because there is only a 470Ω resistor (R301) between them.

In fact, there was a marked difference. Not only was the amplitude at the sync separator end well down, but it was varying in sympathy with the picture pulling. At the output of the video amplifier, on the other hand, everything was rock steady. I shifted the probe from the sync separator circuit up to TP31, thereby eliminating the 470Ω resistor and leaving only copper pattern between the two probes.

But this made little difference. There was still a marked difference in amplitude, and still the variations accompanied the picture pulling. That meant only one thing; another fault in the copper pattern, possibly involving one of a couple of through-board connections.

I pulled the board out and prepared to re-solder these points as a first step. And that was when it hit me; as I applied the iron to the first joint there arose the unmistakable pungent, acrid smell of spirits of salts. No I'm not kidding! It was strong enough to make me cough and splutter and dash outside for a breath of fresh air.

I returned to the fray and tackled another joint. Any doubts I may have had the first time were quickly dispelled at this second attempt; there was absolutely no doubt about it; someone had been there before me with spirits of salts as a flux.

(See, I told you I wasn't doing a Ronnie Corbett.)

Anyway, I finished the soldering operation, but I wasn't really surprised when it had no effect on the fault; it was just as bad as ever. So I reached for the ohmmeter and measured between TP31 and the emitter of the video amplifier. Result — about 6MΩ. Little wonder we had sync problems.

As before, I didn't feel like mucking about trying to find out where the resistance was occurring, though I now had a pretty good idea why it was occurring. I simply strung a piece of wire between the two points and fired the set up again. Up came a perfect picture, with no sign of pulling, and with much more realistic waveforms on the CRO.

At this point, I pushed the set to one side and let it run while I tackled another job. And just as well I did. After about two hours the picture started pulling again and I pounced on it quick smart. This time it was the 5cm or so of track between TP31 and the 470Ω resistor.

I had measured this when I found the previous 6MΩ and it had read zero resistance, presumably because the set was cold. Now it read no less than 10MΩ! Another wire bridge was fitted, the set fired up again, and this time it ran for about a week with not so much as a flicker. So, for the time being, at least, it appears to be fixed.

NO GUARANTEE

Nevertheless, when I took it back to the motel proprietor I felt bound to warn him that I could not guarantee the job, or that other faults might eventually occur. And, since he seemed to be a reasonably bright sort of a bloke, I explained the reason. I also hoped that he might volunteer who had previously "serviced" the set. (I was sure it would not have been a professional serviceman.)

He was quite understanding about the situation and simply accepted that the set might have to be written off fairly soon. In the meantime he would keep it as a spare or for his own use. As to the other question, he could only speculate. He had only taken over the business a few months previously, so had no idea what the previous proprietor might have done.

But he did make the observation that he appeared to have been a pretty keen do-it-yourself type, doing most of the routine repairs around the place himself, with varying degrees of success. He made a reasonable job of painting, carpentry, and the odd plumbing job but — as I subsequently discovered — when he tried to extend the TV antenna distribution system, he made an unholy hash of it.

So, had he tackled the TV set with the same enthusiasm — and tools — that he had used for building maintenance? I think it is highly likely; in fact, I think it is even probable that from someone, even a professional serviceman, he had learned that these TV sets were prone to dry joints and that many faults could be cured by re-soldering the through-board joints.

So he did, using spirits of salts. Ouch!

THE CAT DID IT!

Talking of strange smells and corrosive substances, here is a similar story, this time from a reader, but one which involves a quite different cause. The reader is Mr C.F. of Croyden, Victoria, and he calls it "The Biodegraded Amplifier". This is how he tells it.

It all began when a friend decided to set up a budget stereo system. After his first El Cheapo amplifier died of self-immolation he bought a Playmaster Twin Forty kit, and asked if I would check over his work and help him set it up. I readily agreed — I had done this for a few other blokes and knew it was an easy kit to set up.

Construction went well, according to my friend. "It's easy — just follow the instructions and yer can't go wrong." And, indeed, he did do a faultless job — the soldering was first rate and every component was checked against the diagrams to make sure it was in the right place and the right way round.

The finished job had to be left for a while until we could arrange an evening to "fire it up" around at my place. In the meantime it was left sitting on the floor of his spare room. Unfortunately their cat was accidentally locked in the spare room also and, being unable to tell the difference between an open amplifier chassis and a litter box, did the dreaded deed and — er — urinated in it. (Koalas are not the only ones that . . .)

Came the appointed night and the owner grabbed the chassis and, grinning from ear to ear, presented it to me for the final check-over and start-up. It didn't take long for the grin to disappear; not only did it not work, but it smelt a bit odd. And the metalwork and some of the pots looked strangely corroded.

It was the pong that gave it away. After we worked out what had happened, the owner suddenly lost interest. "It's ruined," he said, and was surprisingly reluctant to even touch the thing. I assured him that it could probably be resurrected, but he was adamant.

After that the amplifier sat around in my spare room for about 12 months, but without the company of any cats. Then a relative needed an amplifier and its moment of truth had come.

The printed circuit board was washed down with warm water and dried with a hair drier, taking care not to cook the ICs or transistors, and then examined. Some of the wires were badly corroded, and a tag had come off one of the pots. The copper track had a greenish tinge in places but appeared to be intact and could be soldered over, so it looked a reasonable proposition for renovation.

But the first touch of a soldering iron persuaded me that it needed another wash. In fact the smell was never to leave it completely even after three good washes. With the corroded wires replaced and a few other tidying up jobs done, I soldered in the 100Ω test resistors and switched on. Nothing.

Disapointed, I prodded around aimlessly. To my surprise a transistor toppled over, the pigtails completely corroded. I started prodding systematically and found a total of three transistors that readily collapsed, one BC547 in each power amplifier, and a BC549 in the tone control section.

I replaced these transistors and the amplifier performed faultlessly. It was handed over to its new owner with the caution not to panic if it ever broke down — it would probably be that corrosive substance at work; but at least we would know what to look for.

Thank you C.F., for a most unusual story, particularly the fact that you were able to salvage the unit. I hope it has a long and useful life.

by GREG SWAIN

BUILD THIS: 40-channel UHF amateur transceiver

What would you say to a UHF amateur transceiver for less than $200? We say build it! Features include 5W output, provision for repeater operation, and 40 channels in the range 438.025 to 439MHz.

Here's a chance to break into a whole new world of amateur radio, where the operators are more relaxed, the antenna hardware is more manageable, and the risk of TV/audio interference is considerably reduced. The cost, at just $199, is about half what you might otherwise have expected!

There's a catch, of course: Instead of buying a shiny new transceiver in a sealed box, and putting it straight to air, the starting point is a packaged kit, requiring some 15-20 hours of assembly time, depending on your skill with a soldering iron.

The reward is the money which remains in your own pocket and the satisfaction of owning a "rig" which you've put together yourself – a rare distinction, these days.

There was a time when most amateur gear was "home brewed" – often in the most primitive sense of the term. Amateurs started out with an odd assortment of components, collected from every imaginable source, and proceeded to string them together in every imaginable way, until they worked. The results ranged, physically, from an untidy collection of bits and pieces to somebody's pride and joy but it was a lot of fun – and instructive fun at that!

What's more, it provided the basis for many discussions on air, as amateurs compared notes about their constructional successes and failures.

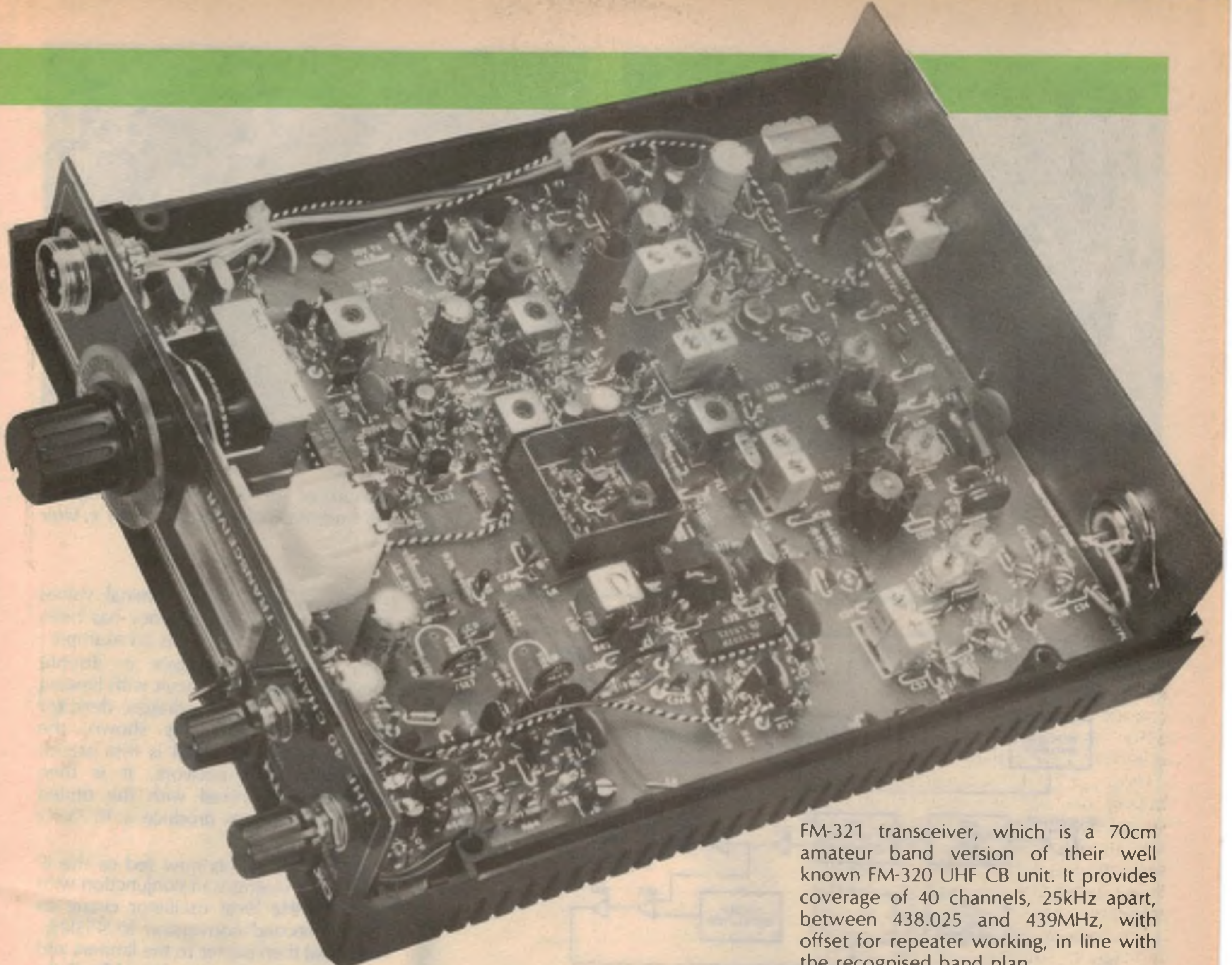
Unfortunately – in some respects – the technology of equipment being used on the amateur bands has long since outstripped the resources of the experimenter and his proverbial junkbox. Only in exceptional circumstances, nowadays, could an amateur even contemplate designing and building the kind of equipment that is in everyday use on the bands. Even packaged, pre-designed kits are no longer very viable commercially.

That is what makes this new kit for a 70cm amateur band transceiver especially interesting. While it is being marketed by the Dick Smith organisation, we suspect that, had it been evaluated on a purely hard-nosed commercial basis, it might never have seen the light of day.

As much as anything, it owes its existence to the personal commitment of Garry Crapp VK2YBX/T, General Manager of R & D at Dick Smith Electronics, and to a fellow amateur Gill McPherson VK2ZGE. Their stated objective was to promote amateur activity on the UHF bands in Australia.

In line with that objective, DSE undertook to back the project commercially and we agreed to run the necessary project description, beginning in this issue. Accordingly, we elected to assemble and test our own version of the new transceiver, and this is the unit pictured with this article (and on the cover).

The "six-metre" and "two-metre" VHF bands need no introduction to EA readers. In fact, just after the war, the



then Editors John Moyle and Neville Williams had almost nightly six-metres scheds across Sydney and with reader/amateurs in Canberra, Young and other centres to the west and north. This was before the days of repeaters and before anyone had to worry about TVI, as we do nowadays.

But, partly because of interference problems, VHF activity has since tended to concentrate in the two-metre band where, unfortunately, the behaviour of some operators – to say the least – does not reflect much credit on amateur radio!

The next logical option open to amateurs is the "70cm" UHF band between 420 and 450MHz, strategically placed so that it could conceivably be utilised by frequency triplers operating in conjunction with existing two-metre (144-148MHz) transmitters and transceivers. This technique is seldom used these days, however, the preference being for separate and distinct 70cm band transceivers.

While a certain amount of equipment has been adapted from surplus two-way systems and UHF CB transceivers, most amateurs currently operating on the band have simply saved up enough hard-earned cash to invest in a normal commercial transceiver, either a hand-held portable or a 12V system for in-car use. Quite a few such units are currently available from amateur equipment suppliers ranging from something over $300 for a personal portable to $700-odd for a car system.

As with the two-metre band, the "ultimate" transceiver is one capable of transmission and reception on crystal-locked frequencies right across the band with or without frequency offset for repeater operation and with all-mode facilities.

By nature, any such receiver is both complex and costly, and the more practical approach for most amateurs is to settle for FM operation only and an agreed system of channels identified by numbers and frequencies. These, along with associated regional repeaters, can then be accessed by more modest mobile FM transceivers and, in a more limited way, by small hand-held units.

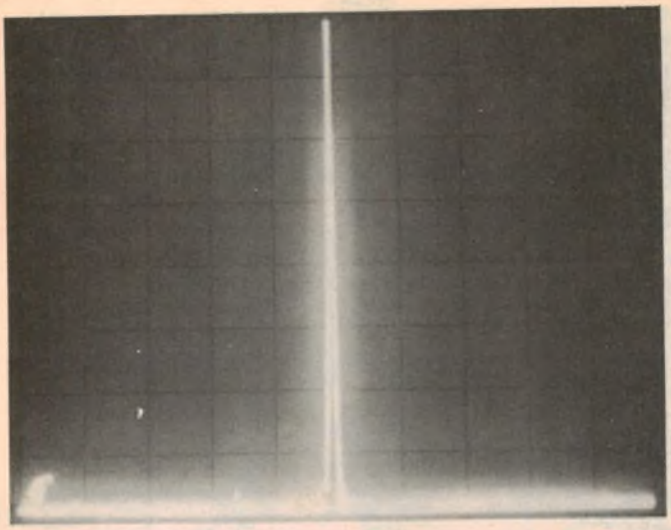
Possibly the most familiar example of this approach is provided by the Philips FM-321 transceiver, which is a 70cm amateur band version of their well known FM-320 UHF CB unit. It provides coverage of 40 channels, 25kHz apart, between 438.025 and 439MHz, with offset for repeater working, in line with the recognised band plan.

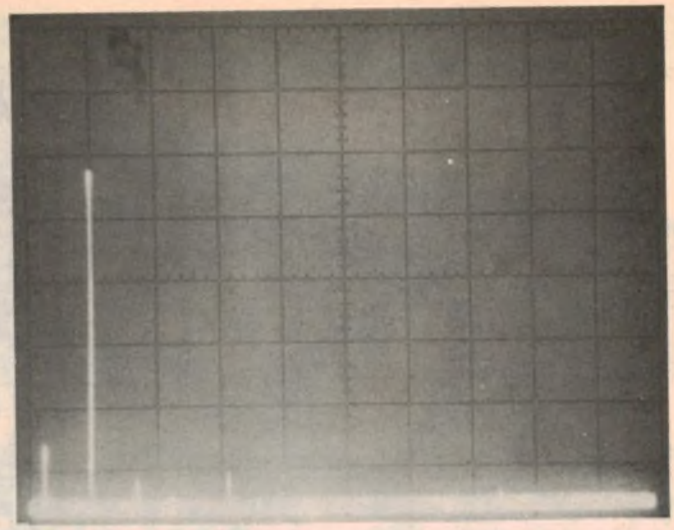
The new DSE kit design conforms to the same plan and is therefore fully compatible with commercial units like the FM-321, and with regional repeaters. It lacks one or two of the operator frills, like channel sequencing and control from the handset, but it will do the same basic job.

And the cost? Dick Smith Electronics advise that they will be selling the basic kit for $199. This price includes the cost of the microphone but not the S-meter or repeater facility. These latter two items are available as part of an optional "upgrade pack" which retails for $24.50 and also includes an extra 10.7MHz crystal filter to improve receiver selectivity.

The "Electronics Australia" unit has been fully optioned with the exception of the additional 10.7MHz crystal filter. Readers should note, however, that the various items in the upgrade kit are not regular catalog lines and are not normally available separately. Much the same comment applies to many of the other specialised components used in the transceiver.

We also took up the question of an





Taken from a spectrum analyser, these two photographs illustrate the low spurious radiation in the transmitter output. The photo at left is 1MHz/div (horizontal) and 10dB/div (vertical) with a filter bandwidth of 10kHz. The photo at right is 200MHz/div (horizontal) and 10dB/div (vertical) with a filter bandwidth of 300kHz.

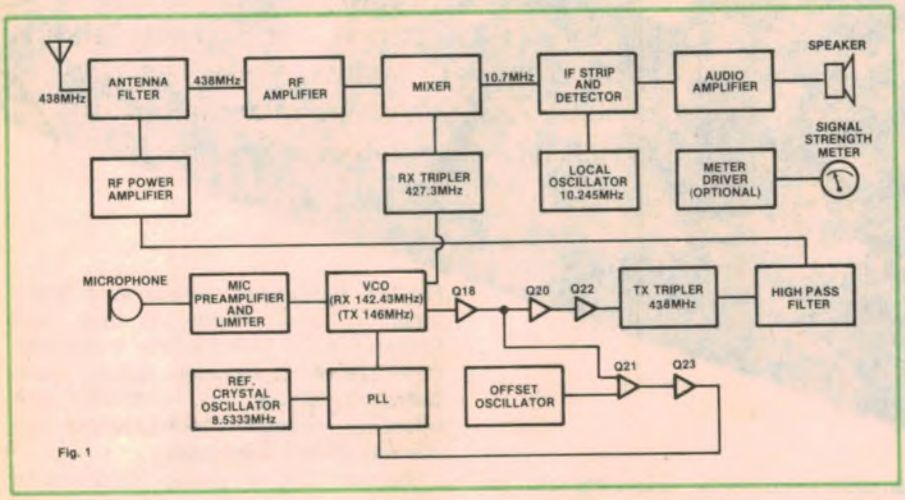


Fig. 1: Block diagram of the new UHF transceiver. The circuit is conventional and employs a phase lock loop (PLL) to provide 40 crystal-locked channels.

antenna system for use with the built-up kit. There is a certain frustration in owning a transmitter but no antenna, and also a certain risk if the constructor is tempted to feed it into the proverbial piece of "wet string" – in-built protection circuitry notwithstanding.

DSE has accordingly come up with a basic antenna construction kit involving a quarter-wave vertical radiator, gutter-grip mounting base and feed, a PL-259 connector and three metres of good quality coaxial cable. The system can be set up for either 438MHz amateur use of 476MHz CB, and will retail for $24.50.

So you should end up with a fully compatible 40-channel 70cm mobile FM system, with an RF output of about 5W and a receiver sensitivity of around 0.3μV for 20dB of quieting.

And what if it doesn't work, after all that? Despite its specialised nature, the kit still qualifies for inclusion in DSE's "Sorry Dick, it doesn't work" service plan. It may cost more (up to $50) and it may take longer (up to three weeks) but at least you won't be left in the lurch. But, enough of the preamble; let's get on with the circuit description!

How it works

By now, some readers will have taken a peek at the circuit diagram and blanched. But don't be intimidated. Let's go through the circuit logically, block by block, and see how it works.

Fig. 1 shows the basic building blocks of the new transceiver. The first thing to note is that both the receiver and transmitter sections employ a frequency synthesiser which comprises a phase lock loop (PLL) and frequency dividers to provide 40 crystal-locked channels. An 8.5333MHz crystal oscillator provides the reference frequency for the PLL which, together with the offset oscillator, sets the centre frequency of the voltage controlled oscillator (VCO).

Note that the 438MHz and related VCO and Rx (receive) tripler frequencies marked on Fig. 1 are nominal values only. The 438MHz frequency has been chosen merely to serve as an example.

The receiver employs a double conversion superhet circuit with limiting IF amplifiers and a quadrature detector for the FM mode. As shown, the incoming 438MHz signal is first passed through a filter network. It is then amplified and mixed with the tripled VCO frequency to produce a 10.7MHz IF.

This 10.7MHz IF is now fed to the IF strip which operates in conjunction with a 10.245MHz local oscillator circuit to provide second conversion to 455kHz. The signal then passes to the limiters and quadrature detector circuit and finally to the audio amplifier.

In the transmit mode, the offset oscillator and PLL set the VCO centre frequency to 146MHz. The output of the VCO is then amplified and tripled to 438MHz before passing to a high pass filter and the RF power amplifier stage. Finally, the signal is fed to the antenna filter circuit and thence to the antenna.

Note that the VCO runs at two different frequencies: 142.43MHz in the receive mode, and 146MHz in the transmit mode. The reason for this is that, in the receive mode, it is necessary tor the RX tripler to provide the 10.7 MHz offset frequency. Thus, the VCO runs 3.57MHz (10.7/3) lower in the receive mode, and is adjusted by switching in two different crystals in the offset oscillator.

Circuit details

Refer now to the circuit diagram. This clearly identifies all the major circuit sections depicted in Fig. 1. As with the block diagram, we'll consider the receiver circuitry first.

Text continues on page 78

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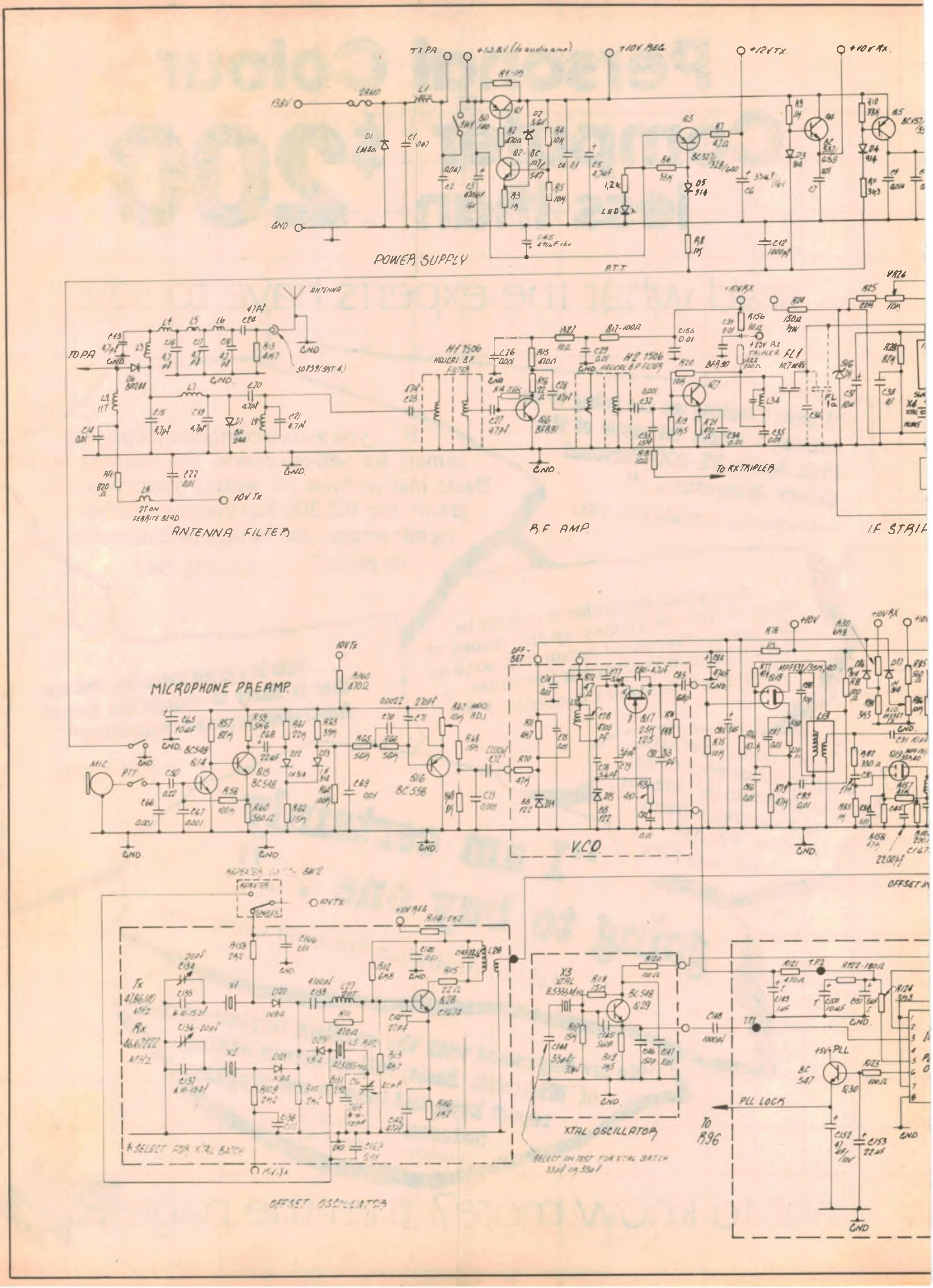

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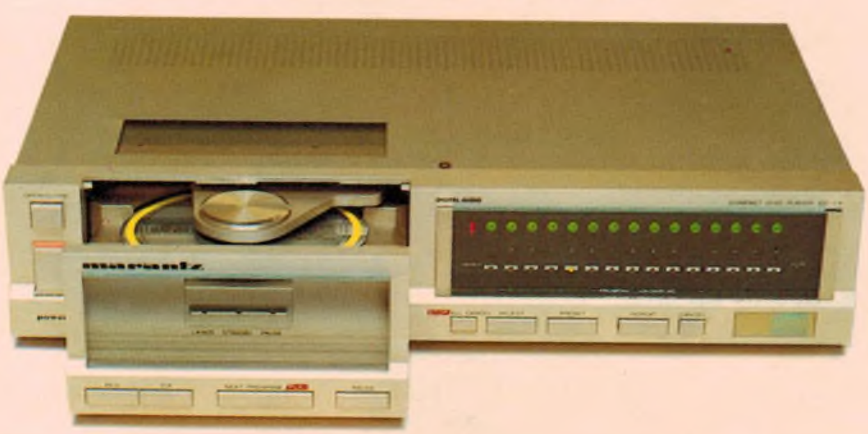

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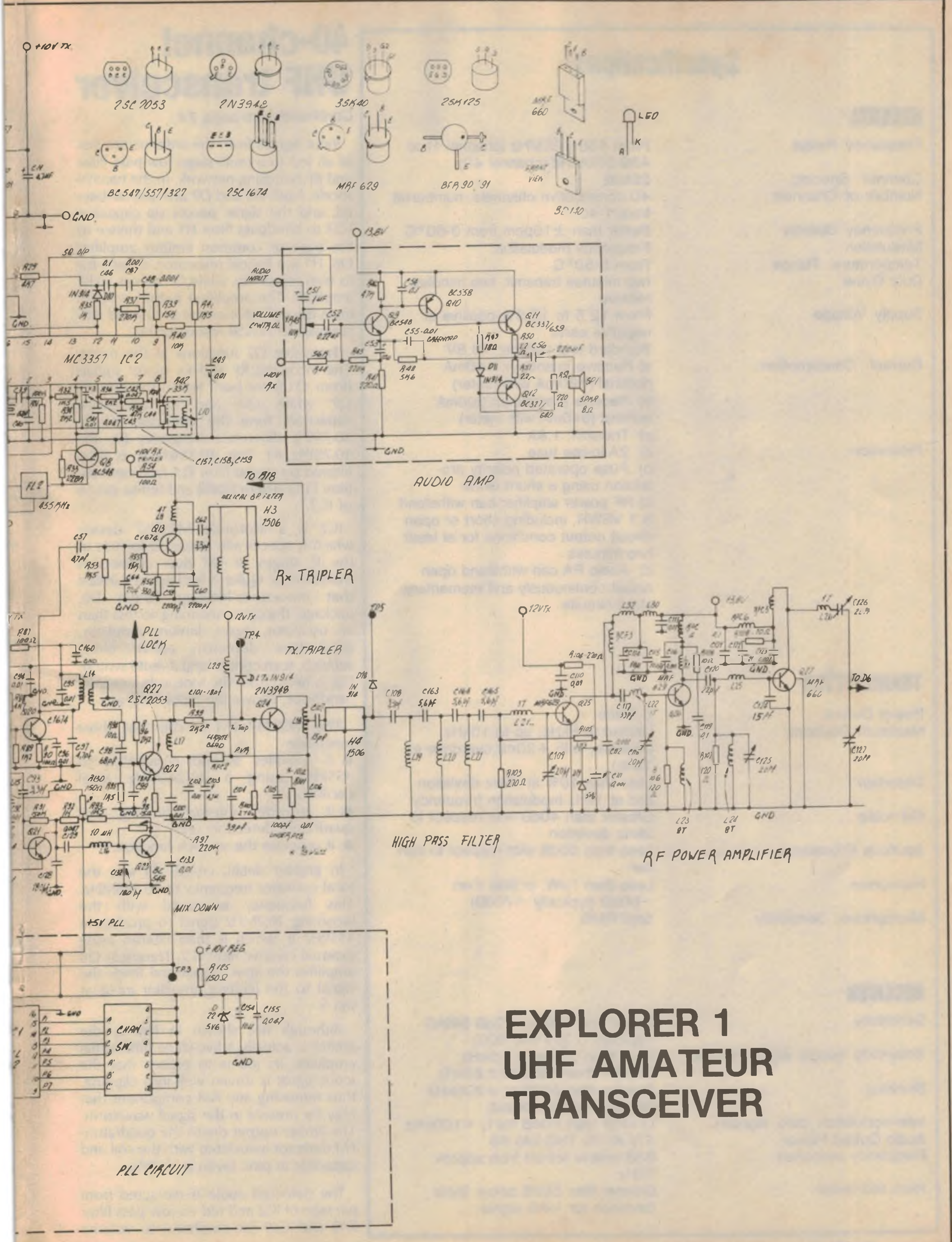


EXPLORER 1 UHF AMATEUR TRANSCEIVER

Specifications

GENERAL

Frequency Range	From 438.025MHz (channel 1) to 439.000MHz (channel 40)
Channel Spacing	25kHz
Number of Channels	40 consecutive channels, numbered from 1-40
Frequency Stability	Better than ±10ppm from 0-60°C
Modulation	Frequency modulation
Temperature Range	From 5-50°C
Duty Cycle	two minutes transmit, two minutes receive
Supply Voltage	From 12.5 to 16.5V, positive or negative earth Standard test voltage: 13.8V
Current Consumption	a) Receive (standby): 140mA nominal (180mA with meter) b) Receive (operating): 300mA nominal (340mA with meter) c) Transmit: 1.8A
Protection	a) 2A in-line fuse b) Fuse operated polarity protection using a shunt diode c) RF power amplifier can withstand 5:1 VSWR, including short or open circuit output conditions for at least two minutes d) Audio PA can withstand open circuit continuously and momentary short circuits

TRANSMITTER

Power Output	5 Watts
Maximum Deviation	Limited to 5kHz; up to 10kHz available, with +20dB overdrive at 1kHz)
Distortion	Less than 10% at 3kHz deviation and at 1kHz modulation frequency
FM-noise	Greater than 40dB with respect to 3kHz deviation
Spurious Emissions	Less than 60dB with respect to carrier
Harmonics	Less than 1μW, or less than −60dB (typically −70dB)
Microphone Sensitivity	5mV RMS

RECEIVER

Sensitivity	0.4μV into 50Ω for 12dB SINAD (typically 0.3μV into 50Ω)
Selectivity (single signal method)	Less than 6dB at ±7.5kHz Greater than 60dB at ±25kHz
Blocking	Greater than 50dB at ±200kHz (single channel method)
Intermodulation (two signals)	Greater than 60dB for f_0 +100kHz
Audio Output Power	1W at 1% THD into 8Ω
Frequency response	6dB/octave roll-off from approx 1kHz
Hum and noise	Greater than 50dB below 3kHz deviation for 1kHz signal

40-channel UHF transceiver

Continued from page 74

Input signals from the antenna are first of all fed to a multi-stage low-pass filter and RF switching network. In the receive mode, both D6 and D7 are reverse biased, and the signal passes via capacitor C23 to bandpass filter H1 and thence to the base of common emitter amplifier Q6. H1 is a helical resonator, chosen for its high selectivity, while Q6 acts as an RF amplifier. The amplified output is taken from the collector circuit of Q6 and AC-coupled to helical resonator H2.

Transistor Q7 functions as the mixer. The incoming RF and Rx tripler signals (from Q13) are both fed to the base of Q7 while L34 and its associated capacitors tune the collector to the 10.7MHz difference frequency (ie, the 10.7MHz IF). This 10.7MHz IF is then filtered by crystal filter FL1 (and optional filter FL1a where fitted) and fed to pin 16 of IC2.

IC2 is a Motorola MC3357 device which is specifically designed for use in the IF stages of FM dual conversion transceivers. Quite a lot happens inside that innocuous-looking 16-pin DIL package, the chip containing no less than an oscillator, mixer, limiting amplifier, quadrature detector, active filter, squelch, scan control and a mute switch. Fig. 2, taken from the Motorola Linear IC handbook, shows the block diagram.

The MC3357 FM IF chip has three functions:

- it provides second conversion to 455kHz using a 10.245MHz local oscillator;
- it provides internal limiting and quadrature detection; and
- it provides the squelch function.

In greater detail, crystal X4 sets the local oscillator frequency to 10.245MHz. This frequency is mixed with the incoming 10.7MHz signal to produce a 455kHz IF which is then filtered using external ceramic filter FL2. Transistor Q8 amplifies the filter output and feeds the signal to the limiting amplifier input at pin 5.

Although not shown in Fig. 2, the limiter is actually a five-stage differential amplifier. Its job is to ensure that the input signal is driven well into clipping, thus removing any AM component that may be present in the signal waveform. The limiter output drives the quadrature FM detector associated with the coil and capacitor at pins seven and eight.

The detected audio is extracted from pin nine of IC2 and fed via low pass filter R40 and C49 (de-emphasis) to volume control VR43. At the same time, a sample of the signal noise is coupled via C48 to an internal amplifier in IC2, the output of which is filtered by C47 and R37. In the absence of an audio signal, the increased noise level is detected by diode D10 and activates the internal squelch circuit.

As shown in Fig. 2, the squelch circuit controls an internal switch which shunts the signal across the volume control to earth. The squelch level is adjusted by potentiometer VR26 which sets the DC bias of the internal squelch amplifiers via pin 12. R28 and C37 determine the squelch delay.

Transistors Q9-Q12 form a fairly conventional audio amplifier. Q9 and Q10 both function as class A amplifier stages, with Q9 direct coupled to Q10. Q10 drives Q11 and Q12 which together form a fully complementary class B output stage with quiescent current set by D11 and R49 and bootstrapping supplied by R52.

Resistors R48 and R47 set the gain of the audio amplifier to 25 (ie, 5600/220=25) while capacitor C55 rolls off the audio response above 3kHz. Note that the bias for Q9 is derived via R44 and R45 from the +10V supply rail which is switched in when in the receive mode. In the transmit mode, the supply rail is switched out and the input to R44 is taken low to mute the amplifier.

Garry Crapp, VK2YBX/T

Gill McPherson, VK2ZGE

The designers of this transceiver

The "Explorer 1" UHF amateur transceiver was developed by Garry Crapp VK2YBX/T and fellow amateur Gill McPherson VK2ZGE.

Garry Crapp trained at AWA Research, North Ryde, for seven years before joining Dick Smith Electronics in 1976 as a service technician. He subsequently became Service Manager and is now General Manager for Research and Development at DSE.

Gill McPherson is a communications consultant with 20 years experience in the electronics field. He was originally trained by the Department of Civil Aviation and presently operates a research laboratory at Wedderburn to the south of Sydney.

Transmitter circuit

The transmitter action begins at the microphone input. Q14 and Q15 form a two-stage common emitter amplifier which provides substantial gain for the microphone input. The amplified input signal is then AC-coupled via C68 to limiting diodes D12 and D13 and thence to emitter follower Q16.

Q16 functions as a low pass filter with unity gain. The output signal is extracted from the wiper of trimpot R67, which sets the modulation deviation, and then applied to varicap diode D14 via R68 and C72. D14 is in the tuned circuit of VCO stage Q17 and thus frequency modulates the VCO according to the incoming signal voltage.

The VCO circuit is built around N-channel FET Q17. This is wired in grounded gate configuration and oscillates at a nominal 146MHz as set by frequency determining components L12 and C78. Varicap diode D15, in series with C78, tunes the oscillator to the exact frequency required, and is controlled by the output of the PLL.

The output of the VCO is now fed to a rather complex network consisting of transistors Q18-Q23, together with various tuned circuits. Q18 is a dual gate Mosfet transistor which buffers the VCO signal and passes it to tuned circuit L13. From there, the signal is split into two paths (see Fig. 1). One signal path goes to common emitter amplifier Q20 and thence to the Rx tripler (Q13), while the other path is buffered by dual gate Mosfet transistor Q19.

Q13, the Rx tripler, does exactly as its name implies – it triples the incoming VCO frequency to 427.3MHz. Because it is overdriven by the VCO, Q13 has an output signal which is rich in odd harmonics. The load circuit of Q13 – consisting of L11, C60 and the following helical filter (H3) – is tuned to accept the third harmonic (ie, 427.3MHz) and reject the fundamental (142.43MHz in the receive mode).

The signal output from the Rx tripler is coupled to the base of Q7 and mixed with the 438MHz received frequency to produce a 10.7MHz IF, as discussed earlier.

In addition to driving the Rx tripler, Q20 also drives common emitter amplifier Q22 via transformer L14. A rather clever, although fairly standard, circuit arrangement is used here to ensure that the transmitter does not produce out-of-band frequencies during channel switching. This arrangement involves deriving the base bias voltages for Q20 and Q22 from the PLL lock detector circuit.

It works like this. Pin 6 of IC1 (PLL02) controls transistor Q30 and is high only when the PLL is in lock. Q30 thus turns

Continued on page 80

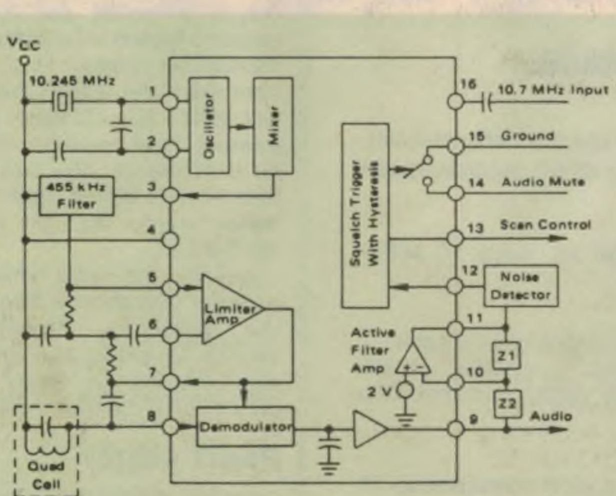


Fig. 2: block diagram of the Motorola MC3357 IC (reproduced courtesy Motorola Inc, USA).

40-channel UHF transceiver

Continued from page 79

on to provide DC bias to Q20 and Q22 only when the PLL is locked to the correct frequency. When the PLL is out of lock – as when switching channels – Q20 and Q22 are turned off to inhibit the transmitter output.

Transistor Q24 functions as the transmitter tripler – ie, it triples the 146MHz VCO output from Q22 to 438MHz. The tripled output is then filtered by helical filter H4 and fed to predriver stage Q25 via a high pass LC filter network. Diodes D17A and D18 are signal monitoring diodes used only during the alignment procedure.

Q25, Q26 and Q27 form the RF power amplifier stage. Q25 operates as a class-B predriver stage while Q26 and Q27 both operate in class-C with tuned collector loads. The RF output is then passed via diode D6 – which is forward biased on transmit – to the antenna filter circuit and, finally, to the antenna. Diode D7 is also forward biased in the transmit mode, thus preventing the transmitted signal from passing to the receiver input.

Frequency synthesis

The VCO is controlled by a frequency synthesis circuit consisting of crystal oscillators Q28, Q29 and the PLL (IC1). Q29 and crystal X3 form a standard Colpitts oscillator circuit which provides the 8.533MHz reference frequency for the PLL. This frequency is fed to pin 3 of the PLL (IC1) and divided by 1024 to derive an 8.333kHz reference (or "channel step") frequency which is applied to the internal phase detector.

Although it looks much more complicated, the offset oscillator (Q28) functions in almost exactly the same manner as Q29. Like Q29, it is wired as a Colpitts oscillator, the main difference being that it uses diodes to switch in three different crystals for the receive, transmit and repeater modes. When the transceiver is in the receive mode, for example, diode D21 is forward biased and the receive crystal (X2) is in circuit.

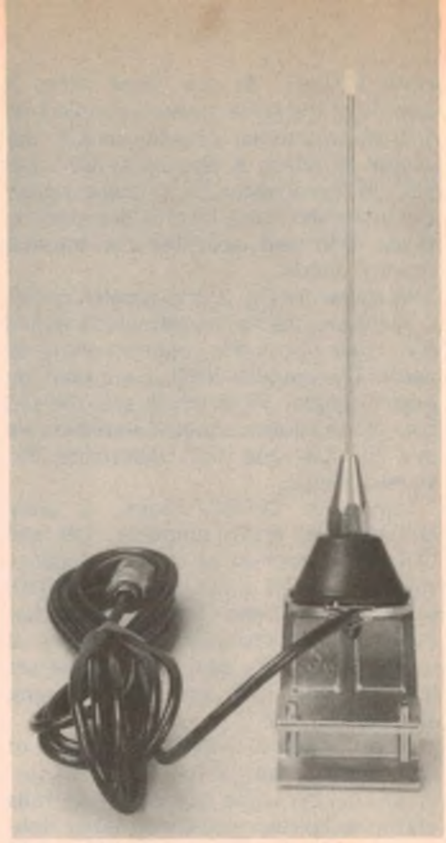
The transmit and repeater crystals (X1 and X5) are switched into circuit in similar fashion for the transmit mode, with switch S2 selecting between simplex and repeater operation.

The output of the offset oscillator is tripled by tuned circuit L28 and coupled to the emitter of mixer stage Q21. There the signal is mixed with the incoming VCO frequency from buffer stage Q19 and the output filtered by L16 and its associated capacitors to give the difference frequency. This signal is then amplified by Q23 and AC-coupled to pin 2 of the PLL via a .01μF capacitor.

The difference frequency on pin 2 is divided by an internal programmable divider, the division ratio of which is set by the channel selector. What happens now is that the PLL compares the divided frequency with the 8.333kHz reference frequency by means of an internal phase comparator, and produces an error voltage to control the VCO. This error voltage pulls the VCO frequency until the divided difference frequency equals 8.333kHz, whereupon a lock condition exists.

Control of the VCO is effected by means of varicap diode D15 as discussed earlier. The control voltage is derived from pin 5 of IC1 and takes the form of a pulsed DC output which is filtered by the following RC network (R124, C151, etc) and applied to D15 via R73.

An additional control voltage is also applied to varicap diode D14 in the VCO via R86 (the offset adjustment trimpot). R86 is adjusted during the alignment procedure to shift the VCO close to its operating frequency to reduce the change in lock voltage between the receive and transmit modes.



This optional UHF antenna pack is available from DSE for $24.50. It includes 3m of coaxial cable, UHF antenna base, UHF whip, PL259 coaxial connector and gutter grip mounting hardware.

Since the programmable divider in the PLL can only divide by an integer number, it follows that the VCO frequency must be some multiple of the channel step frequency (8.333kHz). This frequency is tripled in both the Rx and Tx tripler stages to provide the necessary 25kHz channel spacing.

It is also quite easy to understand how the 10.7MHz IF and 5MHz repeater offsets are obtained. The main points to remember are that the offset oscillator output is tripled and that the VCO output is tripled in both the receiver and transmitter stages. Thus, for simplex operation, the offset oscillator output will differ by 3.57MHz between the transmit and receive modes – ie, (47.86110-46.67222) x 3=3.57MHz. If this frequency is tripled again, as in the Rx tripler stage, we get the required 10.7MHz IF.

Similarly, the 5MHz offset required for repeater operation is derived by tripling the frequency difference between crystals X1 and X5 and then tripling the result in the Tx tripler stage – ie, (47.86110-47.3005) x 9=5MHz.

Power supply

A +10V regulated supply derived from Q1, Q2 and D2 supplies power directly to the VCO, offset oscillator, reference oscillator and PLL circuit. Q1 serves as a

UHF transceiver: pricing details

(1) BASIC KIT
Retail price: $199 for basic kit (inc microphone and assembly manual). Special price to radio clubs: $169 if five or more units are purchased with each order.

(2) UPGRADE PACK
Retail price: $24.50. Includes S-meter, repeater kit, extra 10.7MHz crystal filter, and a new front panel.

(3) UHF ANTENNA PACK
Retail price: $24.50. Includes three metres of low-loss coaxial cable, 1 UHF antenna base, 1 UHF whip (can be cut to amateur or CB frequencies), 1 PL 259 coaxial connector and gutter grip mounting hardware.

(4) SORRY DICK, IT DOESN'T WORK
Service price: $50. Repaired units will be returned within three weeks. All serviced units will be checked on a spectrum analyser.

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conventional series regulator while D2 sets the reference voltage at the emitter of error amplifier Q2. The voltage on Q2's base, as set by voltage divider R4 and R5, is compared with the reference voltage on Q2 which then varies the drive to Q1.

The +10V regulated rail is also switched to various other sections of the circuit by transistors Q4 and Q5, depending upon whether or not the transceiver is in the receive or transmit mode. When the transceiver is in the receive mode (ie, the PTT – press to talk – switch is open), Q4 turns on via D3 and supplies power to the receiver circuitry. At the same time, diode D21 in the offset oscillator is forward biased so that the oscillator functions with the receive crystal (X2) in circuit.

When the transceiver is in the transmit mode (ie, PTT switch closed), Q4 turns off and Q5 turns on to power the microphone preamplifier and to switch in crystal X1 (via D20) in the offset oscillator. A separate 12V supply is also switched by Q3 on transmit to supply power to the Tx tripler and RF predriver stages (Q24 and Q25).

The final two stages of the RF power amplifier – Q26 and Q27 – are run from the 13.8V supply side of switch S1. This is a perfectly satisfactory arrangement since Q26 and Q27 are normally biased off and only draw current when the PTT switch is depressed on transmit. At the same time, it also minimises resistance in the supply line to the RF power amplifier, thereby ensuring maximum output.

The receiver audio amplifier runs direct from the switched side of the 13.8V supply rail. Note, however, that the base bias to Q9 is switched by Q4, so that the amplifier only operates when the transceiver is in the receive mode.

At the time of writing, details for the S-meter driver circuitry were still to be finalised. The necessary circuitry will be described in a later issue of EA.

That completes the circuit description. Next month, we shall describe the construction of the new UHF transceiver and give the alignment details.

Circuit & Design Ideas

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

Electronic detent circuit

Most modern amplifiers incorporate a mechanical centre detent in the balance control to allow an even balance to be easily set. Unfortunately, this type of potentiometer is not readily available to the hobbyist, so the accompanying electronic detent circuit was developed. It lights a LED when the pot is in the centre position.

The system requires that the existing single balance pot be replaced with a dual type. This is connected between the main supply rail (V_{cc}), typically 12V, and chassis (V_{ee}). The wiper selects a voltage between these two limits and applies it to the inverting input of one op-amp (upper limit) and the non-inverting input of a second op-amp (lower limit).

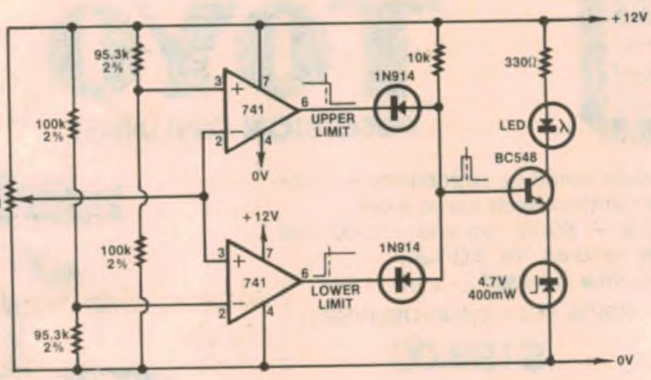
The LED is controlled by the BC548 transistor, the base of which is fed from the 12V rail via a 10kΩ resistor. This would normally turn the transistor on but the two diodes form an AND gate so that, if either op-amp is low, the base is pulled down and the transistor does not conduct.

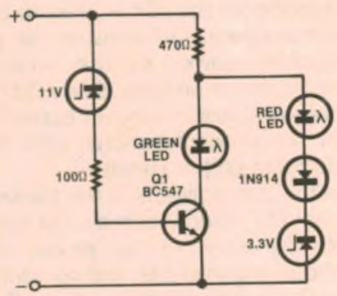
Thus, the transistor is turned on only when the output of both op-amps is driven high and this occurs only when the pot wiper is at, or near, its centre position. The actual degree of rotation over which the LED lights is determined by the dividing networks at the inputs to the comparators. For the values shown it is about 4°.

One of the values shown (95.3kΩ) is standard in the 2% preferred range, but may not be readily available. An alternative is to use a 100kΩ shunted by 2MΩ, which approximates the wanted value very closely. (2.2MΩ would still be acceptable.)

The 4.7V zener diode in the emitter of the BC548 is to ensure that the transistor is turned off when the op-amps go low, which is still about 2.5V above V_{ee}.

Mr G. Ingram,
Pagewood, NSW.





Battery indicator for small boats

This simple indicator is designed to minimise the risk of being caught with a flat battery in a boat. It gives a GO/NO-GO indication based on the battery voltage.

When it is connected to the battery, voltage is applied to both the 3.3V and the 11V zeners. If the voltage is above 11V, current flows through the 11V zener the 100Ω limiting resistor, and the base emitter junction of the DS 547, biasing it on and lighting the green LED.

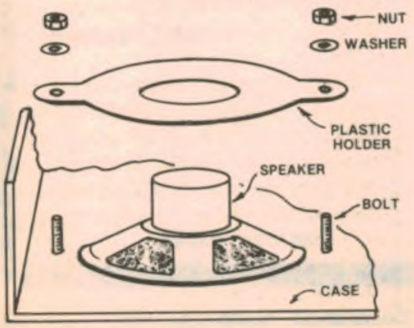
Under these conditions the red LED circuit is effectively by-passed and the red LED does not light. If the voltage falls below 11, Q1 turns off, the green LED is extinguished and current now flows through the 3.3V zener lighting the red LED.

This indicator is best housed in a waterproof case and mounted near the steering wheel where it can be easily monitored.

R. Williamson,
New Town, Tas.

Mounting small speakers

There is a frequent need for a simple, effective means of mounting small speakers inside project cases. The following method has proved to be more effective than just using washers and nuts, particularly with small plastic cases.



From a piece of plastic (from an icecream container) cut a circle having approximately the same diameter as the speaker and having two tags, diametrically opposite each other. Next, cut a hole in the centre of the plastic just large enough to fit over the magnet on the rear of the speaker.

A hole is drilled in each tag, and matching holes are drilled in the case. The holder may then be secured using machine screws with nuts and lock washers.

W. Elphick,
Wolumla, NSW.

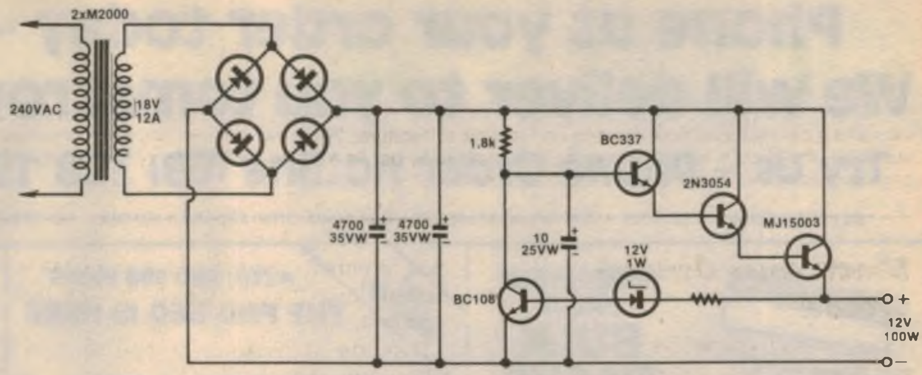
Transient muting for preamplifier

This circuit was developed for use with a stereo preamplifier to eliminate annoying switch-on/switch-off transients. It does this by shorting the preamp output during these times.

The normally closed contacts of a relay are used to short the output for two or three seconds after switch-on, and before complete switch-off by sensing when the regulated supply voltalge falls by three volts.

At switch-on the output is shorted by

Regulated enlarger power supply



For darkroom enthusiasts here is a regulated power supply design for the popular 12V, 100W quartz-iodine enlarger lamp. It will take care of most line voltage variations which otherwise play havoc with precision colour printing, by altering the "colour temperature" of the lamp.

The circuit uses two 18V transformers (Dick Smith type M2000) connected in parallel to give a total rating of 12 amps. These feed a bridge rectifier and the DC output is filtered by two 4700μF capacitors. A single 10,000μF unit would be better, but these are generally unavailable.

(Editor's note: Since the DC current is high, the associated 100Hz ripple current through these capacitors will also be high. If the unit is to be used continuously for long periods then the filter capacitors should have a total ripple rating of at least 10 amps.)

The regulated output is taken from a heavy duty power transistor, MJ15003, controlled by a 2N3054 and BD337 in a Darlington triple arrangement. The BC337 is controlled, in turn, by a BC108, the collector of which is fed from the main rail via 1.9kΩ load resistor.

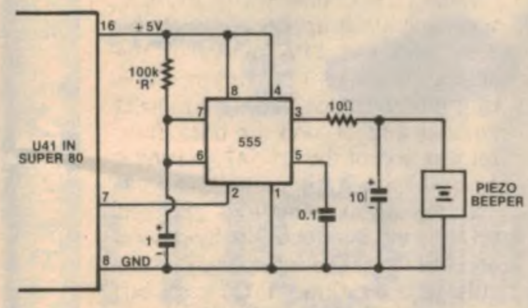
To provide the regulation necessary for accurate colour work the base of the BC108 is fed from the output rail via a 1.5kΩ resistor and a 12V zener diode. This gives an output voltage stability of 0.2% over a mains variation from 230 to 250VAC.

Note that the MJ15003 transistor, while capable of handling the power involved, should be provided with a large heatsink or, better still, a small fan. Do not be tempted to use a type 3055; it cannot handle the power.

Also, because of the heavy current involved, individual output transistors may deliver up to 0.5V above or below the required 12V. Quartz-iodine lamps are quite critical in regard to supply voltage if long life and colour stability are to be expected.

If adjustment is necessary to obtain exactly 12V, the zener may be changed and/or diodes connected in series with it until the correct output results.

D. Tischler,
Engadine, NSW.



Beeper for the Super-80

The addition of an audible signalling device to a computer can prove extremely useful. With it fitted, signalling instructions can be written into the program wherever it is desirable, and will attract the operator's attention when, say, a certain operation has been completed.

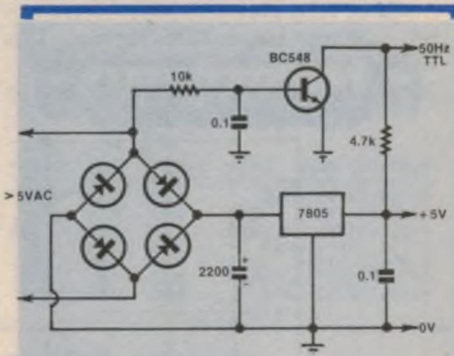
In the case of the Super-80 this is particularly easy to provide using a decoded input/output enable signal which appears at pin 7 of U41.

Only three wires are required to be connected to the Super-80; one for a 5V rail, one for ground, and one for the signal from pin 7. The connections are shown in the accompanying circuit.

Either one of the two codes may be written into the program for the beep; OUT 243,0 or IN (243).

The beep oscillator is built around a 555 and is quite straight forward. The 100kΩ resistor may be varied to lengthen or shorten the duration of the beep.

A. Harding,
Glenhuntly, Vic.



Mains derived TTL clock

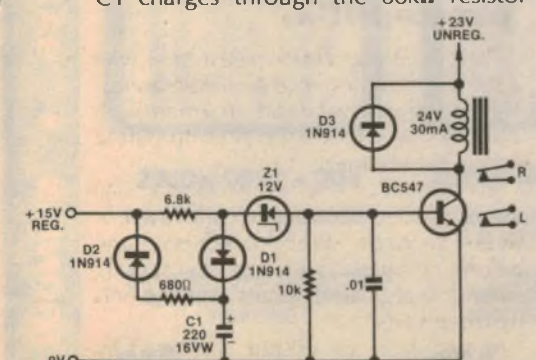
The accompanying circuit shows a cheap and simple method of deriving a 50Hz TTL level square wave as an "add-on" connection to a typical power supply; a simple 5V regulated supply in this case.

This circuit works by switching low whenever the selected transformer lead becomes more positive than ground. The high and low times are equal.

The prototype is being used as the "oscillator" for a simple real-time clock. The advantage of using mains frequency for clocks is that, over long periods, it is far more accurate than most cheap oscillators (eg, 555).

R. Sinclair,
Mt Waverley, Vic.

the relay contacts. The 220μF capacitor C1 charges through the 68kΩ resistor



and diode D1 until there is sufficient bias to turn on the 12V zener diode and hence the transistor TR1. This activates the relay and unmutes the circuit.

Diode D2 and the 680Ω resistor provide a quick discharge path for C1 so that the delay will be repeated even if the mains is switched on immediately after being swiched off. When the regulated voltage falls below 12V the zener ceases to conduct and the relay drops out, providing the required switch-off muting.

P. Allison,
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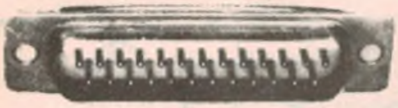

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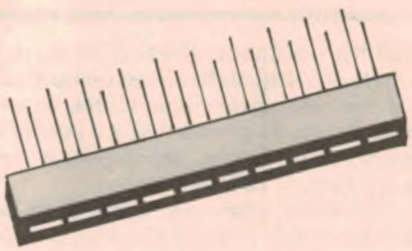

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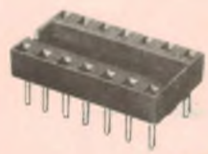

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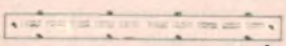

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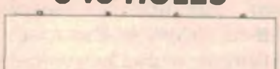

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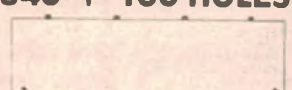

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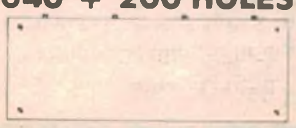

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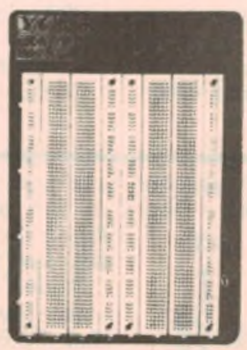

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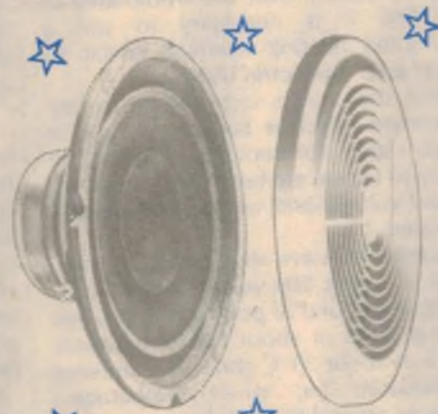

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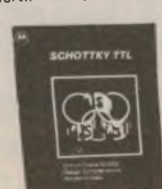

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Speed plant propagation with this . . .

Triac-controlled soil heating unit

by A. B. HOLLEBON

Have you ever wondered why those garden cuttings which you so carefully prepared take so long to show some sign of life? A little heat applied to the soil using this device may just do the trick.

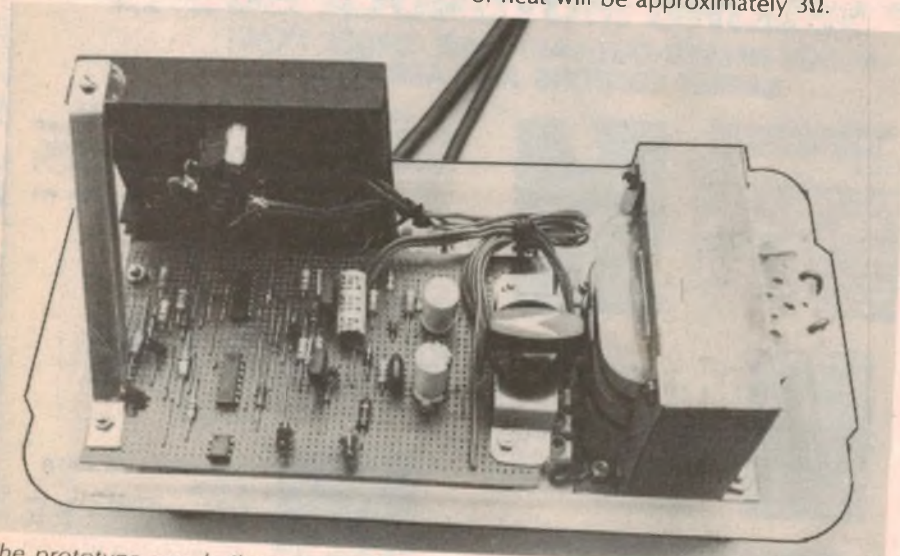
Most plants show optimum growth at some particular soil temperature and, for many common garden types, this is generally at about 22°C. If the potting mix or other growing medium in a cutting bed is maintained at this temperature for 24 hours a day, a spectacular increase in the rate of root and leaf growth occurs compared to that which is obtained under normal conditions, particularly during the cooler parts of the year.

A satisfactory method of heating the growing medium is to place a heating element in the bottom of a wooden cutting box containing a bed of potting mix about 25-30cm deep. The element must be placed as low as possible in the bed so that developing roots on the cuttings do not reach it. In order to achieve uniform heating over the whole area of the box it is necessary to use a distributed heating element similar to those used in electric blankets.

*18 Wendron St, Cloverdale 6105, Western Australia.

Since this unit is operated in an environment which is fairly moist and in which water is present it is necessary for safety to use an element which operates at low voltage and which is adequately insulated.

Experiments have shown that a power input of about 100 watts is required to maintain the bed of potting mix in a box with an area of about half of a square metre at about 20°C above the ambient temperature (ie, when temperature drops to around 0°C). If the transformer which feeds the heater has a secondary voltage of 18 volts, the resistance of the element necessary to generate 100 watts of heat will be approximately 3Ω.



The prototype was built on stripboard and housed in a water-tight plastic case. It speeds plant growth by maintaining the soil temperature at about 22°C.

An element with the required characteristics consists of about 50 metres of 10/0.2mm PVC insulated hook-up wire. If the cutting box is about 70cm square, the 50 metres of wire will just cover the bottom if it is laid out in parallel lines spaced 1cm apart. The wire should be firmly held in place by threading it through holes spaced 1cm apart in two pieces of light timber (70cm long) which are screwed to the floor of the box at opposite ends.

Temperature control

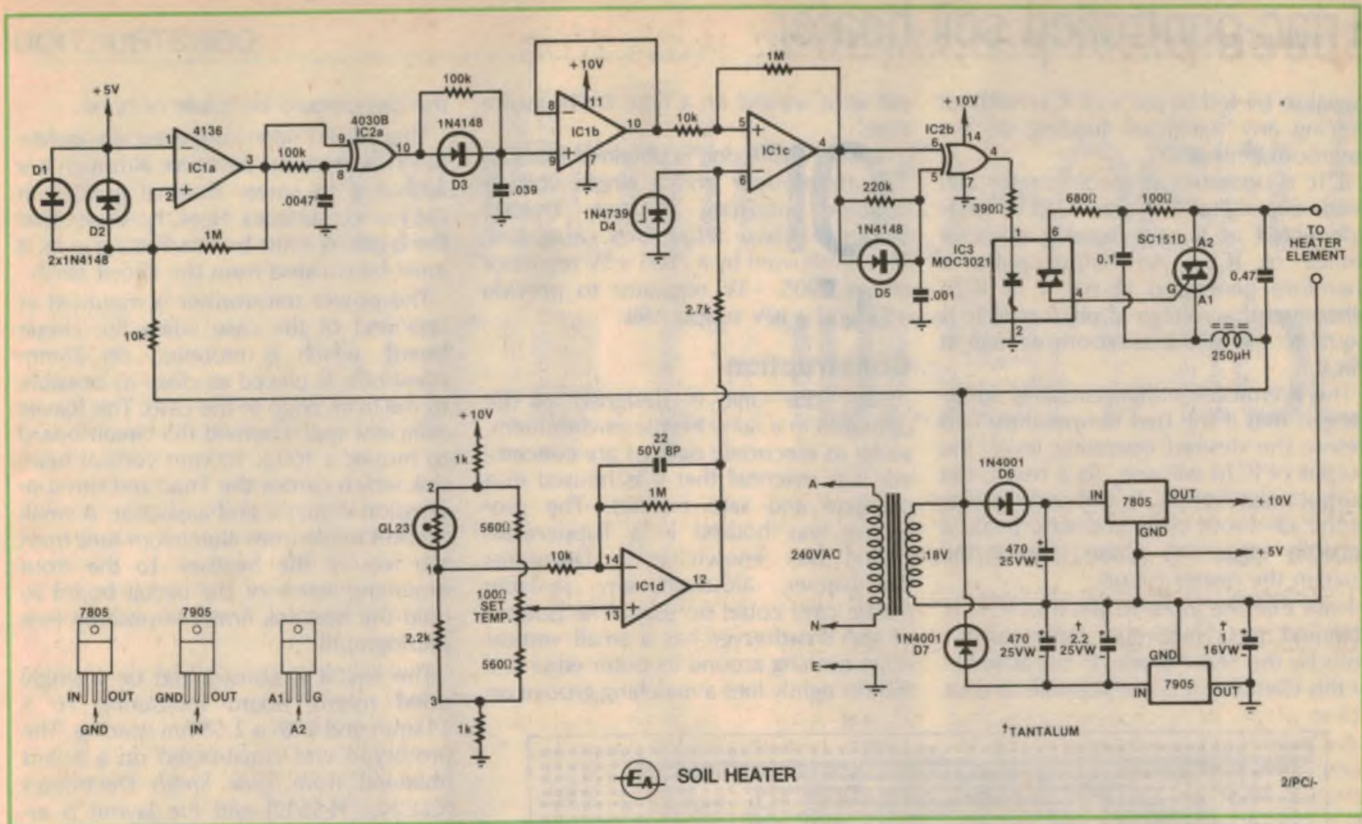
The cutting bed temperature is monitored by a thermistor sensor mounted in a probe which is placed in the bed at about the same depth as the bottom of the cuttings. Since there is a significant distance between the heating element and the thermistor, there is a long time lag between the application of power to the element and the arrival of heat at the sensor.

If a simple on/off thermostat switch was used to control the power there is the possibility that the system would go into oscillation with the temperature at the bed surface swinging alternately above and below the mean temperature by several degrees. It is therefore necessary to use a proportional control system where the rate at which heat is supplied by the element is proportional to the amount by which the bed temperature is below the required value. This ensures that the system approaches the correct operating temperature with no significant overshoot.

Control circuit

The circuit uses a GL23 thermistor to measure the bed temperature. The thermistor is operated in a bridge circuit and the bridge arms are such that the bridge is balanced when the bed is at the desired temperature. The bridge output is fed to IC1d which is connected as a differential amplifier with a nominal gain of 100.

Since the line from the thermistor probe to the control unit may be one or two metres long and may run close to the heating element, a significant 50Hz signal



The circuit uses a thermistor to monitor soil temperature and a Triac to provide phase control of the heater circuit.

may be present at the input of IC1d. In order to remove this unwanted component a 22μF non-polarised electrolytic capacitor is connected across the amplifier feedback resistor. The DC output from IC1d then goes to the inverting input of comparator IC1c via a 2.7kΩ resistor. Zener diode D4 clamps the input of IC1c to a maximum value of 9.1V.

The heater control circuit uses a phase-controlled Triac operating in a system which was fully described in "Electronics Australia" in November 1981 (Slide Cross-Fader and Auto-Advance Unit). For a detailed description of the mode of operation of this circuit it is suggested that the original article should be consulted. For those who do not have access to the November 1981 issue, the following brief description gives an outline of the system.

The 50Hz output from the power transformer secondary is clipped by two back-to-back diodes (D1 and D2) and fed to the squaring amplifier IC1a. The 50Hz square wave output from IC1a is then fed to exclusive-OR (XOR) gate IC2a with the signal going directly to pin 9 and also to pin 8 via an RC delay network. This gives a brief positive pulse at the output of IC2a each time the square wave output from IC1a passes through zero. The output of IC2a is thus a continuous stream of short positive pulses at a rate of 100 per second.

The voltage pulses from IC2a pass through diode D3 to charge a 0.039μF capacitor. During the time between pulses the capacitor discharges through a 100kΩ resistor which is connected in parallel with the diode. The input to pin 9 of IC1b is therefore a sawtooth wave with a frequency of 100Hz. IC1b is connected as a high impedance voltage follower which allows the sawtooth

PARTS LIST

- 1 stripboard, 76 x 153mm, Dick Smith Cat. No. H-5612
- 1 18V, 6A power transformer, Dick Smith Cat. No. M-2000 or equivalent
- 1 RM10 ferrite core, Radiospares Stock No. 228-258
- 1 GL23 thermistor, Radiospares Stock No. 151-029
- 1 case to suit (see text)
- 1 finned aluminium headsink, 100 x 100mm
- 50 metres of 10/0.2mm insulated wire
- 1 mains cord clamp
- 1 3-way terminal block
- 1 6-way terminal block

SEMICONDUCTORS

- 1 4136 quad operational amplifier
- 1 4030B quad exclusive OR gate
- 1 MOC3021 optically-coupled Triac driver
- 1 7805 3-terminal regulator
- 1 7905 3-terminal regulator
- 1 SC151D 15A Triac
- 4 1N4148 silicon diodes
- 2 1N4002 silicon diodes
- 1 1N4739 zener diode

CAPACITORS

- 2 470μF/25VW PC electolytics
- 1 22μF/50VW bipolar
- 1 2.2μF/25VW tantalum
- 1 1μF/16VW tantalum
- 1 0.47μF metallised polyester (greencap)
- 1 0.1μF metallised polyester
- 1 .039μF metallised polyester
- 1 .0047μF metallised polyester
- 1 .001μF metallised polyester

RESISTORS (½W, 5%)

3 x 1MΩ, 1 x 220kΩ, 2 x 100kΩ, 3 x 10kΩ, 1 x 2.7kΩ, 1 x 2.2kΩ, 2 x 1kΩ, 1 x 680Ω, 2 x 560Ω, 1 x 390Ω, 1 x 100Ω, 1 x 100Ω wire-wound potentiometer.

MISCELLANEOUS

Hook-up wire, machine screws and nuts, scrap aluminium, epoxy adhesive, silicone sealant, solder, etc.

The GL23 thermistor and RM10 ferrite core are available from Radiospares Components, PO Box 281, Subiaco 6008, Western Australia.

signal to be fed to pin 5 of IC1c without placing any significant loading on the sawtooth generator.

IC1c is operated as a comparator and feeds directly to XOR gate IC2b which is connected as a zero-crossing detector similar to IC2a. An output pulse is therefore generated at pin 4 of IC2b whenever the voltage at pin 6 of IC1c is equal to the falling sawtooth voltage at pin 5.

The thermistor bridge circuit is so arranged that if the bed temperature falls below the desired operating level, the output of IC1d will rise. As a result, the output pulse from IC2b will occur earlier in the sawtooth cycle and so provide a suitable trigger to phase control the Triac in the heater circuit.

Note that the input to pin 6 of IC1c is clamped to a maximum value of 9.1 volts by the zener diode. In the absence of this clamping it is not possible to start up the heater if the bed temperature is very low since the input to pin 6 of IC1c would be higher than the peak sawtooth voltage. Under these conditions no trigger pulse can be generated by IC2b and therefore no heating can occur.

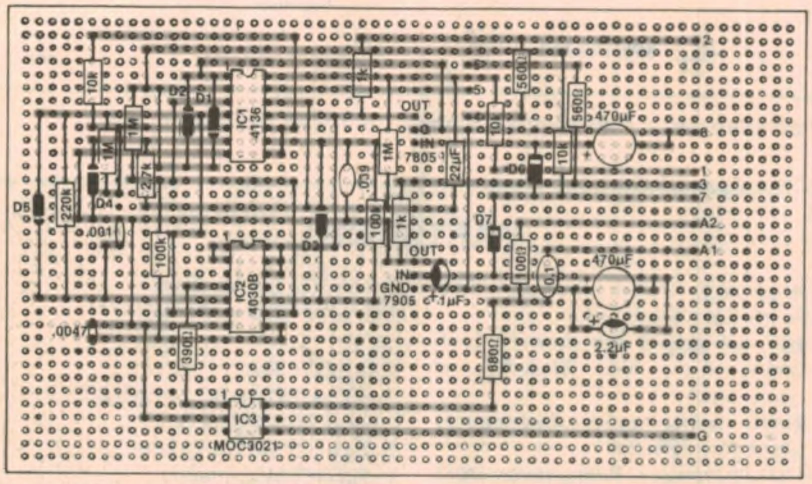
The output pulses from IC2b are fed directly to IC3 which is an opto-coupled Triac driver.

All phase-controlled Triac systems are potential sources of radio frequency interference and this unit is no exception. In fact, since it is constructed in an unshielded plastic housing and uses a 50-metre long heating element, it must be considered as a fairly effective interference generator. Fortunately, this problem is largely overcome by including a 250μH inductor and a 0.47μF capacitor in the Triac circuit. The inductor is required to carry the full 6 amps which flows in the heater circuit and consists of 25 turns of 1mm enamelled copper wire wound on a type RM10 ferrite core.

Power for the unit is obtained from an 18V transformer and a single voltage doubler consisting of two 1N4002 diodes and two 470μF filter capacitors. This is followed by a 7805 +5V regulator and a 7905 −5V regulator to provide +5V and +10V supply rails.

Construction

Since this unit is designed to be operated in a fairly hostile environment, so far as electronic devices are concerned, it is essential that it is housed in a practical and safe manner. The prototype was housed in a Tupperware plastic box known as a Decorator Breadserver, although any sealable plastic case could be used. The bottom of the Breadserver has a small vertical ridge running around its outer edge and this fits tightly into a matching groove on the lower edge of the cover to provide a watertight seal.



Follow this parts location diagram when wiring up the soil heater. Cuts in the copper pattern are easily made by hand twisting an oversize drill bit.

Even if a hose is played directly on the case no water penetrates the seal. The main power lead, the lead to the temperature probe, and the heater leads are all brought out through the floor of the case and these exit points should also be made watertight. A silicone sealing compound from your local hardware store can be used for this job.

Since the Tupperware plastic case tends to distort slightly under the weight of the power transformer it is necessary to run two lengths of 12.5mm aluminium angle along below the bottom of the case to provide sufficient rigidity. Four rubber feet about 25-30mm high are also attached to the bottom of the case to allow sufficient clearance for the leads which come down through the floor. In order to reduce corrosion problems, all screws which pass through the floor of the case should be made of brass.

There is no need to electrically isolate the Triac from the heatsink, although it is advisable to smear thermal grease on the mating surfaces. Note, however, that the heatsink must be left floating – ie, it must be isolated from the circuit earth.

The power transformer is mounted at one end of the case while the circuit board, which is mounted on 25mm stand-offs, is placed as close as possible to the front edge of the case. This leaves sufficient space behind the circuit board to mount a 100 x 100mm vertical heatsink which carries the Triac and the suppression inductor and capacitor. A small bracket made from aluminium runs from the top of the heatsink to the front mounting screw of the circuit board to hold the heatsink firmly in position (see photograph).

The circuit is constructed on a single sided matrix board measuring 76 x 153mm and with a 2.54mm spacing. The prototype was constructed on a board obtained from Dick Smith Electronics (Cat No. H-5612) and the layout is arranged to fit around the two small undrilled areas in this board.

The inductor is constructed by winding 25 turns of 1mm (18 gauge B&S) enamelled copper wire on the bobbin of a type RM10 ferrite core assembly. After assembly of the completed unit it is advisable to run epoxy adhesive around the windings and into the space between the windings and the two ferrite core sections. This ensures that the whole assembly does not vibrate noisily when the unit is delivering full power to the heating element.

All connections between the various sections of the unit and the external lines are made through two terminal blocks located on the floor of the case below the circuit board. In order to avoid any problems due to the presence of water, no plugs and sockets or other types of connectors are used in the heating element circuit.

Since the element only operates at a very low temperature it is quite practical to terminate it at the terminal block inside the case. There is then a continuous unbroken cover of PVC over the whole element system and there is no possibility of any short circuits or other circuit malfunction. For the same reason, the unit should be fitted with a long power cord so that the power connection will be made at a point which is well away from the area where water is likely to be present.

The thermistor probe contains the thermistor and the 2.2kΩ resistor which together form one half of the bridge circuit. The thermistor is mounted inside a

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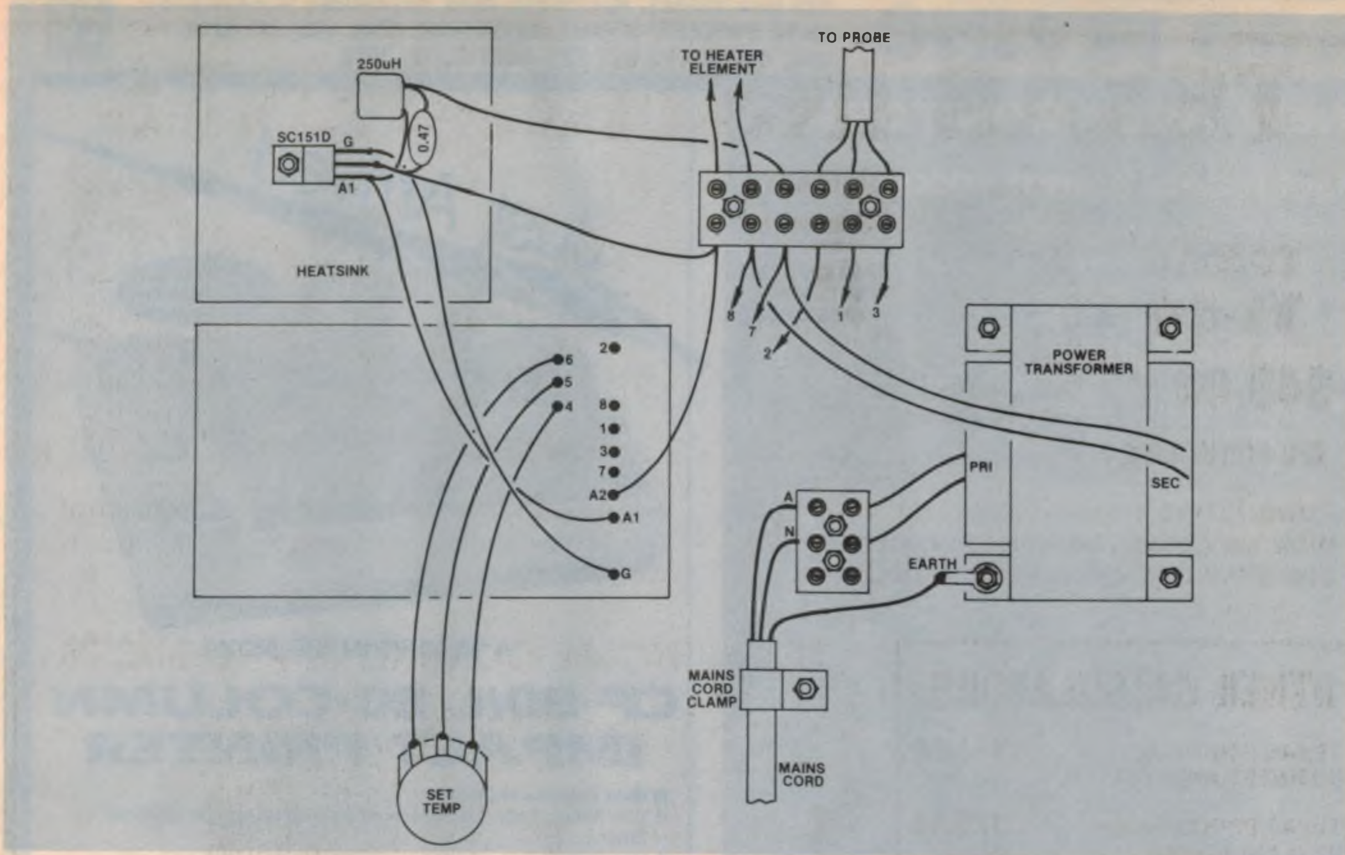

The Triac can be bolted directly to the heatsink provided the heatsink is not earthed. Keep mains wiring neat and tidy.

25mm length of 6mm copper or stainless steel tubing. The end of the thermistor should be located just inside the end of the tubing with the leads projecting from the opposite end. The tube should then be filled with epoxy adhesive to ensure that no water can reach the thermistor.

The 2.2kΩ resistor and the connecting cable are connected to the thermistor leads with short lengths of spaghetti tubing being used to provide insulation of each lead. The whole assembly is then slid into the end of a piece of 10mm tubing about 20cm long so that the thermistor mount projects about 6mm from the end of the larger tube. Epoxy adhesive is again used to make a seal between the two tubes so that no water can enter.

A length of light three core cable should be used to connect the probe to the control unit and a silicone sealant should be used to make a flexible waterproof seal where the cable leaves the end of the probe tube.

In order to provide for a range of operating temperatures a 100Ω potentiometer is included in the bridge circuit. This potentiometer is mounted on a small aluminum bracket about 20mm above the circuit board and connected by flying leads to the points marked 4, 5 and 6 on the circuit board. The bracket is held in place by the two circuit board mounting screws at the end of the board nearest to the power transformer.

Calibration

Due to the long time delay between the application of the power to the element and the arrival of heat at the thermistor sensor, it is not possible to carry out a quick calibration of the temperature setting potentiometer under actual working conditions. The most practical way to carry out the calibration is to roll the element into a coil and place it in a bucket containing about three litres of water. Place the thermistor probe in the water together with a thermometer and switch on the unit.

The equilibrium temperature will then be reached fairly quickly and, for a given potentiometer setting, the temperature should not vary by more than about half a degree over the whole 24 hours (provided, of course, that the ambient temperature is always less than the set point).

Note: There will be a significant energy cost in using this unit. We estimate that during winter on the east coast of Australia the energy consumption is likely to be about one kilowatt-hour in a 24-hour period. This means that the likely cost of running the unit continuously over a three-month period would be about $5 to $7.

We estimate that the current cost of parts for this project is approximately

$70

This includes sales tax.

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1. Functional specifications

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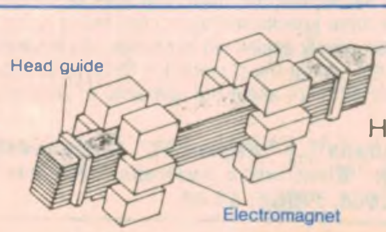
2. Mechanical specifications

Ribbon: Cartridge ribbon (exclusive use) black. *MTBF:* 5 million lines (excluding print head life). *Print head life:* Approximately 30 million characters (replaceable). *Dimensions:* 377mm (14.8")-W x 295mm (11.6")-D x 125mm (4.9")-Hincl, sprocket cover. *Weight:* Approximate 5.3Kg. (11lb). *Power requirement:* 100VA max. *Temperature:* Operating — 5 to 40 degree C (41 to 104 degree F). Storage — minus 30 to 70 degree C (−22 to 158 degree F). *Humidity:* Operating — 5 to 90% RH, no condensation, Storage — 0 to 95% RH, no condensation. *Shock:* Operating — 1G (less than 1 msec). *Vibration:* Operating — 0.25G, 55Hz max. Storage — 0.5G, 55Hz, max. *Insulation resistance:* 10 Meg ohm between AC power line and chassis. *Dielectric strength:* Between AC power line and chassis, AC 1KV (RMS) 50Hz or 60 Hz, during one minute and no abnormal condition shall be observed.

3. Interface specifications

Interface: Standard Centronics parallel. Optional RS-232C (SERIAL). *Data transfer rate:* 4000 CPS max. *Synchronization:* By external supplied STROBE pulses. *Handshaking:* By ACKNLG or BUSY signals. *Logic level:* Input data and all interface control signals are TTL level.



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by LEO SIMPSON

the regeneration control should be advanced to the point just below oscillation. This results in maximum usable gain and best selectivity (ability to tune closely spaced stations).

To sum it up, the interesting aspect of a regenerative circuit is that it can produce a good performance, in terms of stations tuned on both the broadcast and shortwave stations with a reasonable antenna, considering that it uses few components.

Our first hurdle in re-presenting the project in 1983 was the power transformer. The original circuit used a transformer with a 6.3V winding of around one amp capacity for the valve heaters and a centre-tapped 300V winding to derive the HT or "high tension" as it used to be referred to by electronics people in those good old days of yesteryear. These days, high tension is more usually regarded as a symptom of incipient mental breakdown.

While we did not seriously expect the major transformer manufacturers to have stocks of a suitable transformer, we did expect to be able to round up something from a "disposals" source. But no. There just did not appear to be any transformer even vaguely suitable from any source. Sure, we could have arranged for transformers to be specially wound and made available through one or more of the parts retailers but the inevitably short production run would make them expensive.

Our solution was to use two readily available low voltage transformers and connect them back-to-back. In this way, a 2155 transformer as made by Arlec Pty Ltd is connected in the normal way to provide 6.3VAC for the valve heaters from appropriate connections on the multi-tapped secondary winding, ie, from the 0V and 6.3V taps.

At the same time, we use low voltage from this transformer to drive the low voltage winding of another 2155 transformer. This second transformer will then develop a high voltage across what is normally its primary winding. This can then be connected to a silicon bridge rectifier and capacitor to provide the high voltage DC supply to one valve, the 6BL8.

By using the silicon bridge rectifier we were able to dispense with the valve rectifier and thus ease the heater current load for the first transformer. In fact, it is not until you go through an exercise such as this that you realise, once again, just how much power valves required. In this circuit for example, the 6BL8 requires 6.3VAC at 0.45 amps and around 180VDC at, say, 20 millamps total for an overall power consumtpion of about 6½ watts. Similarly, the 6X4 rectifier requires 6.3VAC at 0.6A, almost 4 watts.

This ploy succeeded. We ran the second transformer, as shown in the accompanying circuit diagram, with 8.7 volts fed to its 12.6 volt tap. Under no load conditions this should mean that about 166VAC is developed across the output "primary" winding but the loading effect of the circuit is fairly severe and the resultant DC voltage from the second filter capacitor is about right at around 170 volts. So far so good.

The next hurdle was also a transformer, that for the output stage. Again, such transformers now appear to be rare indeed. Our solution was to again employ a low voltage transformer, this time at Ferguson PF2851 or equivalent. This has an output of 12.6VAC for a mains input of 240VAC, giving a turns ratio of about 20, or 40 if referred to the 6.3V tap.

Thus if the primary winding is connected to the plate of the triode (pin 1) and the DC supply and the 6.3V winding is used to drive an 8Ω speaker, the load reflected to the triode plate will be the square of the turns ratio multiplied by the nominal impedance. This gives a figure of about 12kΩ which is higher than the original design figure of 8kΩ, as shown on the circuit, but it is not so far removed as to be unworkable.

In practice, it seemed to work quite well and was certainly comparable with an output transformer of the correct type which was "borrowed" from an old communications receiver. We also found that a pair of low impedance stereo headphones worked quite well and certainly more comfortably than the old fashioned high impedance types.

Continued on page 97

Valves are dead — but not forgotten

Continued from page 95

So much for the cobbled-up substitutions. Up to this point we had taken the attitude that, provided interested readers had access to parts such as tuning gangs and other hardware, the project could be made a working proposition. If all-new parts were to be employed then it would be an entirely different proposition and certainly not economic.

Unfortunately though, the circuit performance was not up to expectations. For a start, the hum level was much higher than we would have liked. We countered this by increasing both the filter capacitors to 47µF and by orienting the two power transformers so that the leakage fields cancelled but to no great effect. By today's standards there was too much hum although by the standards of the past it would probably have been judged as being satisfactory.

By way of example, many commercial valve mantel radios produced 20 years ago or more did have a higher hum level than is regarded as acceptable today.

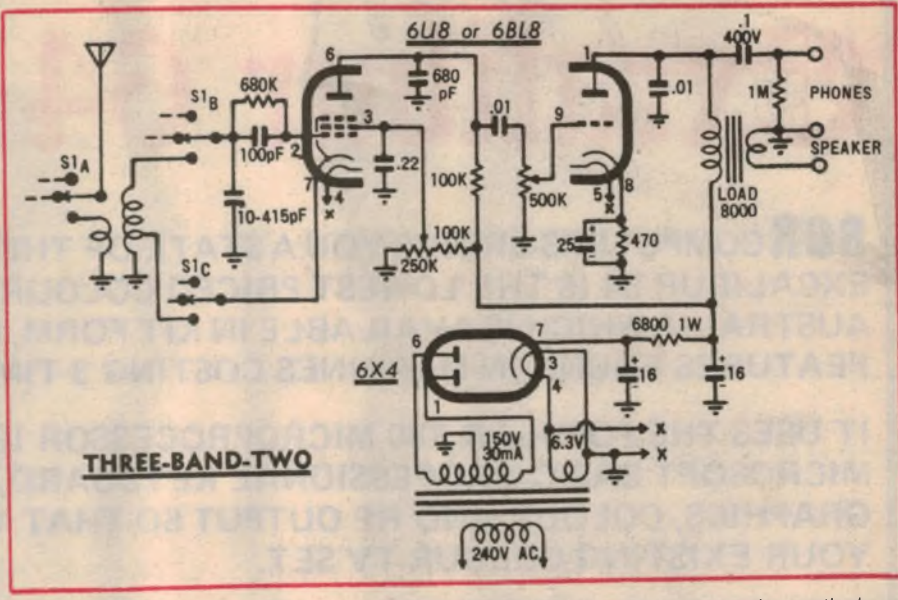
Other problems

Even so, hum was only one of the drawbacks. The main problem was lack of gain. The problem about this particular gutless wonder was that it was gutless. The problem appeared to be that the regeneration control was not working as it should. There appeared to be too much indirect feedback which made the circuit prone to oscillate too early. We tried countering this by shielding the valve, changing the wiring layout and by increasing the bypass capacitor at the screen grid (pin 3).

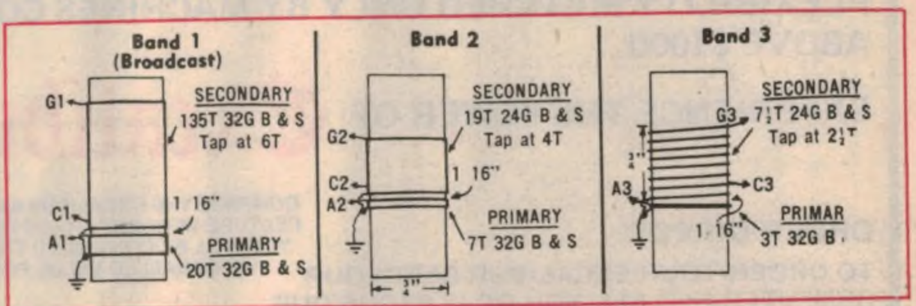
This did improve the situation but not by much. Further mods involved additional decoupling of the regeneration control and varying the taps on the antenna coil. In the end though, we "canned" the project. We are not saying that it can't be done – given time – but it was just not worthwhile. And we didn't have the time!

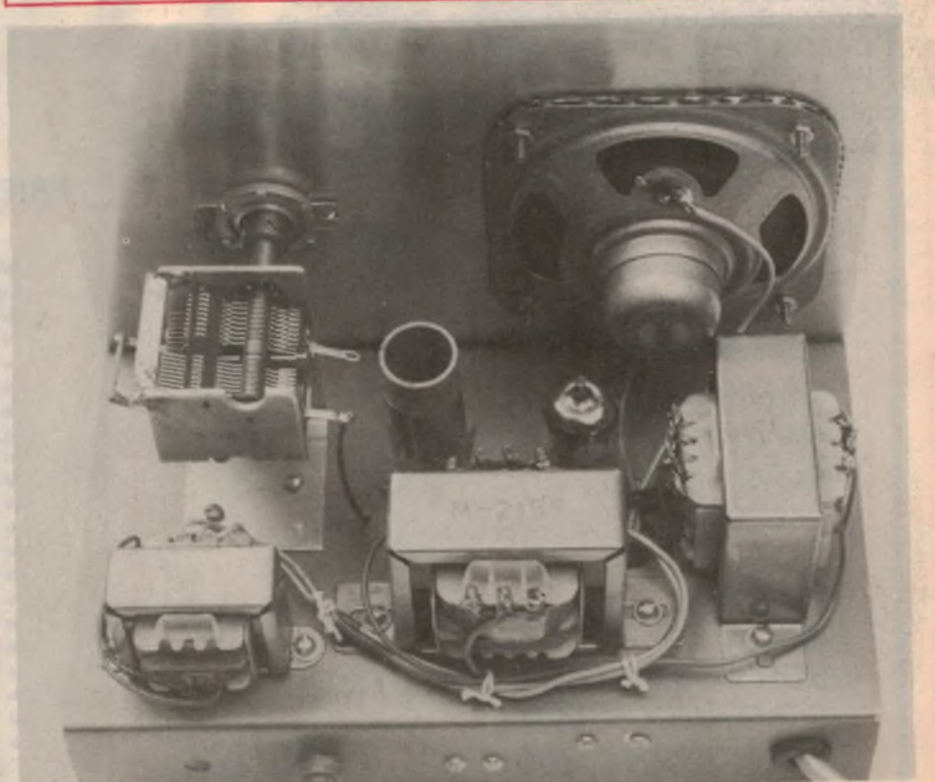
Our verdict must be as follows. If you have a boxful of radio parts that you are just itching to put back together in some sort of working order, you could have a go at the circuit as originally published. But on the basis of our results, don't expect too much. It is a lot easier and probably cheaper, even if you are delving into your junkbox for most of the bits, to go and buy a clock radio from your local supermarket.

So that's it. We have taken a nostalgic look at a possible valve project and have decided that they "have had their day" after all. RIP.



Above is the circuit of the original Three-Band-Two and, below the coil data, covering from 600kHz to 30MHz in three bands.





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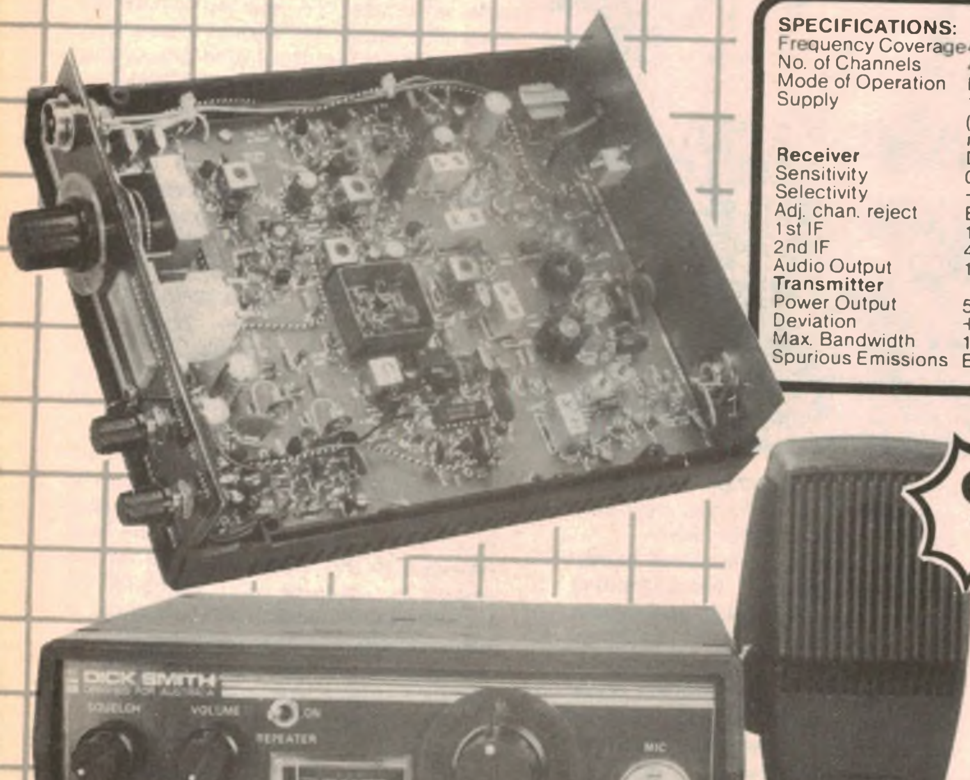

SPECIFICATIONS:

Frequency Coverage	438.025 – 439.000MHz in 25kHz steps.
No. of Channels	40
Mode of Operation	FM
Supply	13.8V DC (nom) @ 110mA rx mute, 250mA rx (150 x 290mA with upgrade kit fitted), 2A transmit (at 5W output).
Receiver	Dual Conversion Superhet
Sensitivity	0.4uV for 20dB quieting
Selectivity	+/−7.5kHz −6dB, +/−15kHz −60dB
Adj. chan. reject	Better than 80dB
1st IF	10.7MHz
2nd IF	455kHz
Audio Output	1 watt max.
Transmitter	
Power Output	5W (typical)
Deviation	+/−5kHz
Max. Bandwidth	16kHz
Spurious Emissions	Better than −60dB

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DICK SMITH Electronics

See Page 12 for address details

DSE A571/PAI

Valves are dead – but

Transformers for valve equipment are now very hard to obtain. It is possible to cobble

Just recently we considered publishing a project using valves as a last dalliance with these thermionic devices of yore. After all, most major kit and parts retailers no longer bother to sell valves and those that do have a limited selection. So we thought, "Let's do this project as a nostalgia item before it becomes too late". Well, the gist of this article is that it is already too late but not because valves are unobtainable.

We did not have a really ambitious project in mind either. Nothing like a high quality stereo valve amplifier or a general coverage receiver. No, we thought we'd just do a simple TRF receiver; something which does not use a lot of parts and is not too cranky to get going.

The project we homed in on was the "Three-Band Two", a valve receiver featuring a 6X4 rectifier and a 6BL8 (or 6U8) triode-pentode. Both these valves are still available and the circuit was actually quite a respectable performer. Last published in October 1966, the project must even then have been a "bit of a chestnut" and was an update of an earlier project published way back in May 1957.

The use of the 6BL8 triode-pentode was a little unusual in that the pentode was used for the RF stage and detector and the triode used for the audio stage. As a result, the power output was low but sufficient to drive a loudspeaker on local broadcast stations. For more distant stations a pair of high impedance headphones was recommended.

Really, by any standard, the Three Band Two must have been a "gutless wonder" and relied for most of its performance on the careful use of regeneration. Nevertheless, as some of our older staff members can testify, these little regenerative sets used to turn in a surprising performance and we had many enthusiastic letters commenting to this effect.

As a matter of interest, the circuit of the Three Band Two is published here and, as can be seen, it certainly does not use many components. For many readers though its operation is probably a mystery so we'll just run through it briefly.

The incoming signal is fed from the antenna via a tuned circuit which uses a switchable or a plug-in coil to the grid of the pentode (pin 2). Though this valve is intended to function primarily as a detector, an amplified version of the input signal is present at the plate (pin 6). Some of this signal is fed back to the grid/cathode input circuit, via the tap on the coil which connects to the cathode (pin 7). This trick is called regeneration. In this circuit the amount of regeneration is controlled by varying the voltage on the screen (pin 3) via a 250kΩ potentiometer.

Regeneration is in fact a form of positive feedback. That is to say, it increases the gain of the circuit and renders the tuning a good deal sharper (increasing the Q). If taken too far, regeneration causes the circuit to oscillate and the result is a heterodyne whistle. The heterodyne whistle is caused by the fact that the self-oscillating circuit beats with the incoming signal to produce an audible note.

In a gutless wonder such as this even the heterodyne whistle characteristic can be put to good use when listening to Morse code transmission on the shortwave bands when the stations are using an otherwise unmodulated carrier. By having the receiver detector adjusted for a weak oscillation, the code transmission could be heard.

To be usable, the regeneration control must operate smoothly so that when it is advanced the gain increases progressively and the sound quality changes gradually, giving adequate warning that the unit is close to the point of oscillation. And even when it does go into oscillation it should be controllable, without the risk of producing an ear-piercing scream.

When listening to transmissions which are modulated with normal programs,

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IF YOU ARE NOT FULLY SATISFIED WITH YOUR KIT, SIMPLY RETURN IT TO US WITHIN 7 DAYS IN ORIGINAL CONDITION AND PACKAGING. WE WILL CHEERFULLY REFUND YOUR MONEY – HOW CAN YOU LOSE?

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King Arthur could rely on his Excalibur and you can rely on yours! But if for some strange reason you cannot get it to operate and it is fully built using IC sockets, simply send us your complete board along with $95 and our service centre will repair it. Includes component cost.

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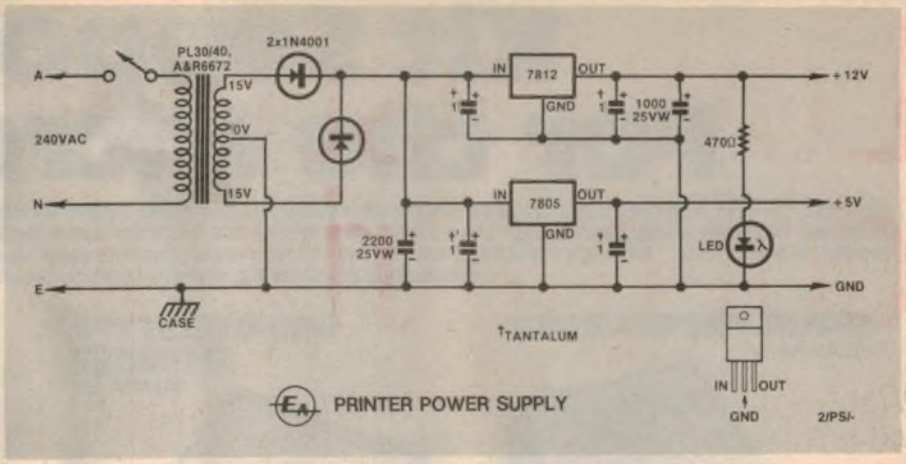
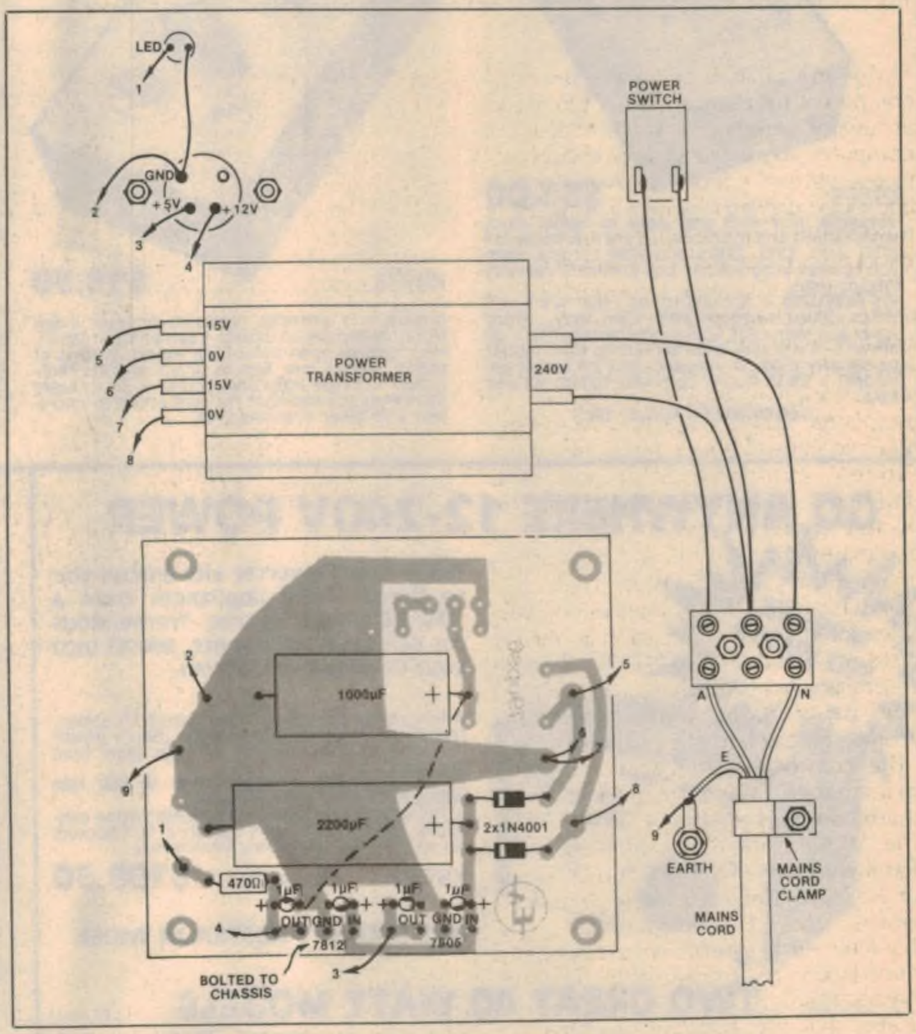
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

A number of special features are available, activated by sending a control character to the printer before text data is transmitted. Characters can be printed double-width for headings etc, or printed in red (with the use of a two colour ribbon). Characters can also be printed upside down.

Upside down printing may seem like more of a fault than a feature, but it does have a major application. The CBM printer can be mounted either horizontally, or vertically with the printhead above the paper. Naturally, when the printer is mounted in this way the normal print-out appears upside down. In this case the "invert printout" control character can be used to restore the normal orientation of characters.



The power supply for the printer uses two three-terminal regulators to provide +12V and +5V rails. Adequate heatsinking of the regulators is essential.



Printer power supply

Specifications for the printer indicate that peak power consumption is in the vicinity of 2.5A at 12V, but in practice this consumption only occurs when the printhead solenoids are fired. Because of the way the printer is designed this works out at around 700µs every 4ms, or less than 20% of the time. We have measured the average power consumption at less than one amp at +12V and 400mA at +5V.

With this in mind we decided that a special power supply design was not required. We adapted the power supply unit originally designed for the DREAM 6800 project and described in the June, 1979 issue of EA. The brief peak current is easily handled by a 1000µF capacitor across the 12V output, and re-mounting the regulators on the rear panel of the metal power supply box provides sufficient heatsinking. We have run the printer continuously for half an hour and more with this supply with no adverse effects.

The circuit and wiring diagram for the power supply are shown in the accompanying figure. The original circuit board is coded 79ups6, but only those components shown in the wiring diagram should be installed.

Further information on the original design of the power supply can be found in the article mentioned previously. Reprints are available from our reader service department at a cost of $3.00.

Alternatively you can use any other power supply which provides +5V at 400mA and +12V at one amp, or modify an existing supply as we have, to improve its peak current handling capability.

Whatever method you use, if you build a power supply take care with the mains wiring. The three core mains cord should be passed through a grommetted hole in the rear of the case and anchored with a cord clamp. The earth lead should be terminated to a solder lug bolted to the case and a three-way insulated terminal block used to connect the active and neutral conductors to the on/off switch and the primary of the transformer. All connections to the switch and transformer primary should be insulated with heatshrink tubing or similar.

Power connections to the printer assembly are made via a four-way Molex connector at the right hand rear of the controller board. The connector required is a Molex type 5276-04A, although if this is not available power leads could be soldered directly to the pins on the board. From right to left looking from the rear of the board, the connections are:

1	+5V
2	GND for 5V
3	GND for 12V
4	+12V

Between pins 3 and 4 is a blank location which ensures that the power con-

Kit Support For the Microbee

Altronics' unique combination as Australia's leading kit supplier and also as distributor for the sensational Microbee computer, allows us to present a range of unsurpassed quality kits suitable for use with the Microbee and other Z80 based microcomputers. Rather than just supply "a bag of bits", Altronics constructs the kits we sell and make improvements to ensure that you, the kit constructor have a professionally appearing, correcly functioning unit.

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(ETI JAN. '83)

K9668.................... **$55.00**

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(See Review ETI AUGUST 1983)

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Display RTTY encoded messages on your Video Monitor. Receive up to date weather information, International News before the Papers, all sorts of coded military info. Simple circuit uses PLL techniques ☆ Single PCB Construction ☆ Kit includes DB15 Plug and backshell for connection to microbee ☆ Shielded pretinned PCB.

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MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.
ALTRONICS' KIT features ☆ Gold plated edge connector and PCB huss ☆ Low age rate XTAL ☆ Sockets for all IC's ☆High Efficiency Transformer.

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☆ TWO GREAT 40 WATT MODELS ☆

GENERAL PURPOSE

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.

EASY CONSTRUCTION ☆ VALUE PLUS

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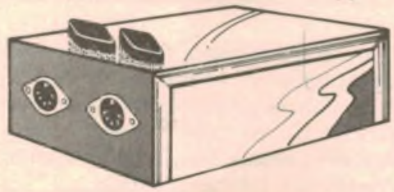

FLUORESCENT LIGHTING

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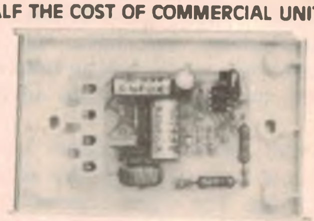
K6505...................... **$37.50**

PRESTIGEOUS NEW TOUCH LAMP DIMMER

HALF THE COST OF COMMERCIAL UNITS



Great new kit from EA. (April '83). Based on new Seimens ICS576A Light Dimmer IC.
Instantly turn lamps on and off with just a light touch on a wall panel, or provide mood lighting by touching the panel for a few seconds.
The Altronics Kit is complete in every way, including satin silver touch plates for that touch of class.

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This kit enables extra dimmer/switches to be installed in conjunction with the dimmer kit. Includes satin silver touch plate.

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- ★ Instant "ON" — no more flickering at switch on.

K6300 (10UP$4.50) **$4.95**

Low cost 40-column dot matrix printer

by COLIN DAWSON and PETER VERNON

Want a printer but don't want to pay big money? A 40-column dot matrix unit suffices for program listings and most program output, and this article shows how to put one together for $250 plus the cost of a power supply.

Shown here with a wooden base and paper holder, the CBM printer is a simple, cost-effective unit for use with any computer.

With the rapid drop in the prices of computers more attention is turning to accessory equipment which makes the computer more useful and convenient to use. After the basic cassette recorder and video display a printer is usually the most desired piece of equipment, and they too are coming down in price.

Dick Smith Electronics currently has a printer mechanism and control unit available which only needs to be plugged together and connected to a suitable power supply to provide a fast, easy to use printer. Both the mechanism and the required control board are made by the Citizen company of Japan and distributed under their CBM label. The printer mechanism used here is designated the DP-575L and the control board is the CBM-505-PF12.

Understanding these designations provides some useful information about the system. Firstly, the 575L printer mechanism prints 40 characters a line on plain paper 70mm wide, and returns "Home" on the left side of the carriage.

The control electronics are mounted on a separate 135 x 95mm printed circuit board designated the CBM-505-PF12. The "P" following the number indicates that this version of the board is designed for use with a Centronics-style parallel interface. The "F" indicates that the character set is for foreign use. Coming from Japan of course, this "foreign" character set is English. The "12" indicates that the board is designed to work with a +12V printer mechanism, although it also requires +5V for the controller electronics.

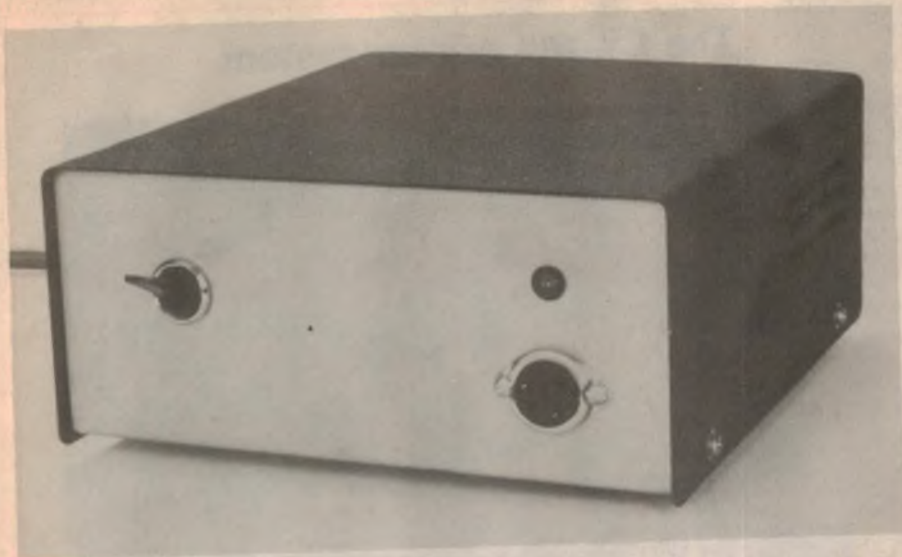
On the control board is a specialised microprocessor, an EPROM character generator and drivers for the print-head solenoids. The electronics take care of all the tricky details of synchronising movement of the carriage with printing, the timing of the solenoid printing action and the production of dot matrix characters. To the host computer the printer looks exactly like a standard Centronics peripheral.

Also on the control board is an input latch and a 40 character print buffer. Character codes from a computer are latched individually and stored in the print buffer, with the data transmission coordinated by the "handshaking" signals STB, BUSY and ACK. The contents of the buffer will be printed either on command or automatically when the buffer is full. The command to print the buffer contents is a Carriage Return character (OD in hex, 13 in decimal).

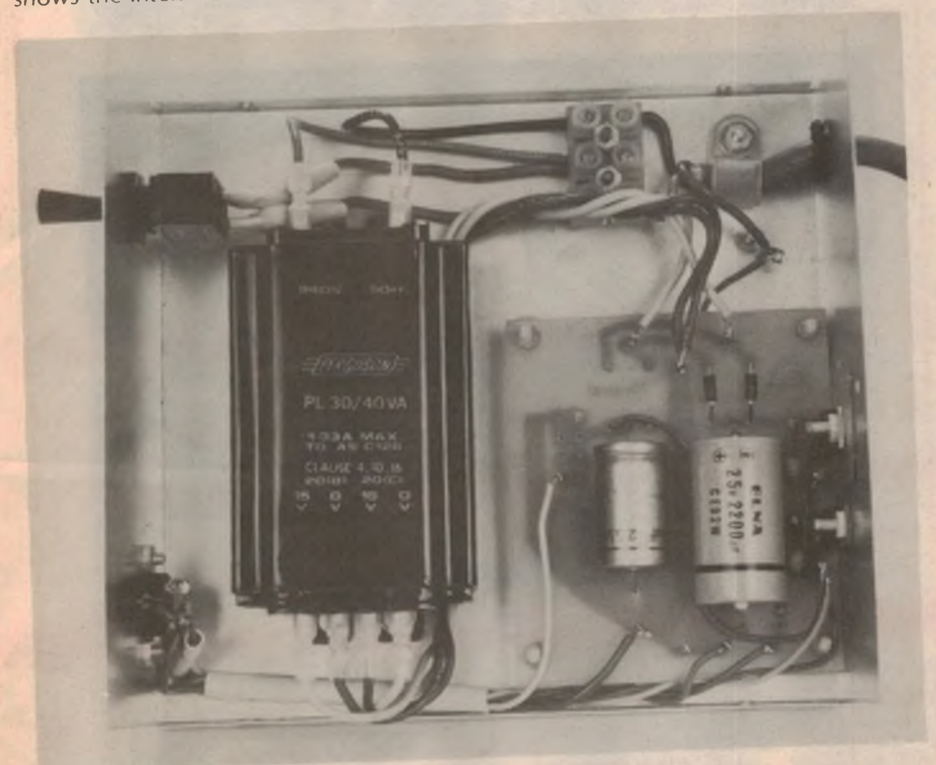
Printing speed is quite high enough for most applications, at around 1.2 lines per second. At 40 characters per line this translates to 48 characters per second. The noise level, even with continuous printing is not distracting, and provided the mounting arrangements are adequate vibration is not a problem.

Full specifications of the printer and control board can be found in the 30-page manual supplied with each unit.

The printer can produce the full ASCII character set in both upper and lower case, Greek symbols and a range of accented characters required by various European languages. Characters are formed on a 5 x 7 dot matrix (horizontal by vertical) and there are no descenders on the lower case letters such as "j". Print-outs are clear and easily readable.



The power supply circuitry is built into an earthed metal case. The photograph below shows the internal details.



nector cannot be incorrectly inserted. Our power supply connects the 5V and 12V grounds together at the plug on the front panel of the power supply unit.

Mounting and connections

As can be seen from the photographs, we choose a "bare bones" mounting scheme, with the controller board sitting on a 140 x 215mm wooden base and the printer mechanism on two wooden battens above the controller. Given the length of the flexible connector between the controller and the printer this is one of only a few possible configurations. Rubber "shock absorbers" on the printer serve to damp vibration against the mounting bolts.

The essentials of the assembly are quite simple although refinements can be added to suit your own requirements.

Our mounting scheme also includes a paper holder for the 70mm wide tally roll paper used by the printer. An unused paper roll has a diameter of around 75mm, so be sure to allow sufficient clearance for a roll of this size and ensure that the paper is free to feed cleanly into the printer.

We added two further refinements in the form of pushbutton switches. These switches serve to ground inputs on the printer cable for Reset and Line Feed.

While it hasn't happened to us, data sheets for the printer indicate that some fault conditions can cause the motor to stall. Pressing the Reset switch is the only remedy in this situation. A reset will clear the print buffer, set normal black characters (rather than any of the other printing modes) and clear the FAULT output signal provided by the printer to restore normal operation.

The Line Feed input in practice receives more use. A single brief pulse on this input will cause the printer to eject paper to create a new line. Holding the button down for a longer period will generate a continuous series of line feeds, handy for removing print-outs from the mechanism.

The Line Feed switch also serves as a printer test switch. If the printer is switched on with the line feed button held down it will enter a self test mode, continuously printing out the standard ASCII character set to verify correct operation. The only way to exit from this test mode is to turn the power off.

Apart from these two switches, connections to the printer follow the standard Centronics format. Four links on the controller board set the processor for use with the 757L printer mechanism. The links are set with small plastic shorting plugs installed on pairs of circuit board pins. Links J4, J5 and J7 should be OFF (no shorting plug installed) and link J6 should be ON (install the shorting plug). The links should be checked before the printer is used but the odds are that they will be set correctly on the unit as delivered.

We used a 36-way Centronics type connector (Amphenol Champ 36) to match the connector on the System-80 printer cable. The pin connections configuration for the 15-way connector on the printer controller board is as follows:

Pin number	Signal
1	STB
2	d0
3	d1
4	d2
5	d3
6	d4
7	d5
8	d6
9	d7
10	ACK
11	BUSY
12	FAULT
13	RESET
14	GND
15	FEED

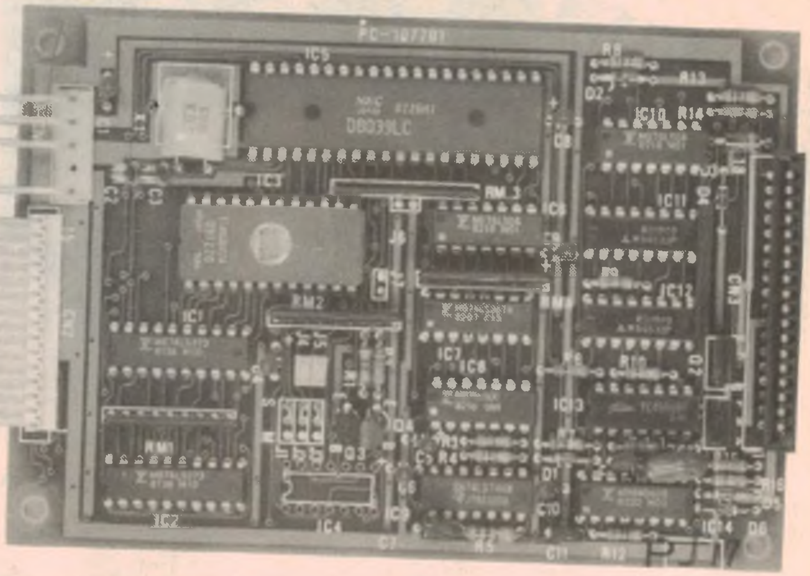
System-80 printer port

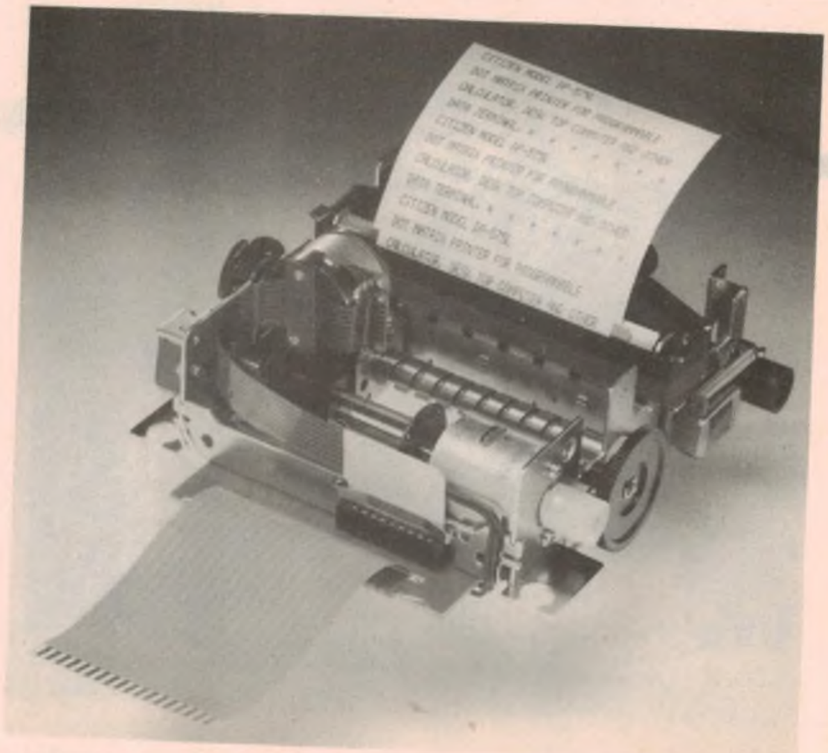
Wiring up the printer is a matter of connecting the appropriate pins on the printer control board to the Centronics connector to match the pin-outs of the interface of the computer that will be driving the printer. For reference the pin-outs of the System-80 Centronics printer port (in the expansion unit) are shown below:

Pin number	Signal
1	STB
2	d0
3	d1
4	d2
5	d3
6	d4
7	d5
8	d6
9	d7
10	ACK
11	BUSY
12	GND
13	N.C.
14	GND
15	GND
16	GND
17	CHASSIS
18	+5V, 80mA
19	GND
20	GND
21	GND
22	GND
23	GND
24	GND
25	GND
26	GND
27	GND
28	GND
29	GND
30	GND
31	INITIAL
32	ERROR
33	GND
34	CLK
35	TEST
36	+5V

Note that half the lines of the standard Centronics port are ground connections. When a long run of parallel cable is required (more than a metre) twisted pair connections are used to minimise noise. Each signal line is paired with its corresponding GND connection (pin 1 with pin 19 and so on). For shorter lengths of cable flat ribbon cable can be used, with all GND pins connected together to the printer signal ground.

The Citizen printer system





The top photograph shows the control board for the printer while directly above is a view of the printer mechanism.

Microbee printer port

The Microbee computer has a different style of interface. Assuming that you have the printer connector and associated components (optional on early Microbees) already installed, connecting the printer requires a 15-way DB15P plug. At the rear of the Microbee is a female 15-way D-type connector with pins arranged as follows

8	7	6	5	4	3	2	1
15	14	13	12	11	10	9	

(looking from the rear)

Connections of this port are shown below:

Pin number	Signal
1	N.C.
2	d7
3	d5
4	d3
5	d1
6	N.C.
7	ARDY
8	GND
9	N.C.
10	d6
11	d4
12	d2
13	d0
14	N.C.
15	ASTB

A bulletin in "Microworld Newsletter" gives the full details, but essentially the printer port of the Microbee is provided by a Zilog PIO (Parallel Input Output) chip with the addition of a monostable

LOOK AT THESE EXTRAS YOU GET WITH FLUKE MULTIMETERS

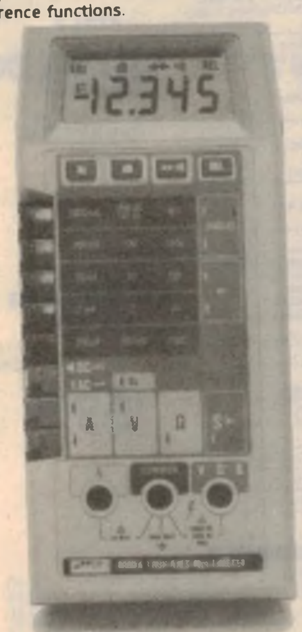
8060A OFFERS FREQUENCY, TRUE RMS & DIRECT dB

This remarkable state of the art DMM combines the accuracy and resolution of larger, more expensive instruments with the convenience of a hand-held instrument. Flukes own LSI/microcomputer design provides:

- Wideband true RMS AC measurements to 100kHz
- Frequency measurement to 200kHz
- dBm and relative dB
- 10μV sensitivity
- Direct resistance measurement to 300Meg
- Relative reference on any range or function
- Microcomputer-based self diagnostics

8062A

As 8060A above but without frequency and dB ranges. Provides true rms to 30kHz and relative reference functions.



	4½ Digit Resolution	Wideband True RMS AC	Continuity (Audible & Visual)	dBm, Relative dB	Frequency	Relative Reference (Offset)	Autoranging Megohms	Conductance	Constant-Current Diode Test	Self Diagnostics	Basic DC Accuracy
8060A	●	100 kHz	●	●	200 kHz	●	●	●	●	●	0.04%
8062A	●	30 kHz	●			●	●		●	●	0.05%

8024B OFFERS PEAK HOLD AND DIRECT TEMPERATURE

The 8024B state of the art multimeter offers two important extra features - peak hold and temperature. Peak hold is a useful tool for capturing and retaining elusive voltage or current surges long enough to check and record the displayed reading. If your work involves measuring temperature then connect a K-type thermocouple and you can get direct temperature readings (we have a range available specially to suit the 8024B).

- 11 functions including temperature with K-type thermocouples
- Peak hold on voltage and current ranges
- Logic detection and continuity
- Audible and visible indicators
- 0.1% basic accuracy, 3½ digit

IREECON SPECIAL A SOFT VINYL CARRY CASE INCLUDED IN PRICE OF HANDHELD MULTIMETERS ORDERED THIS MONTH

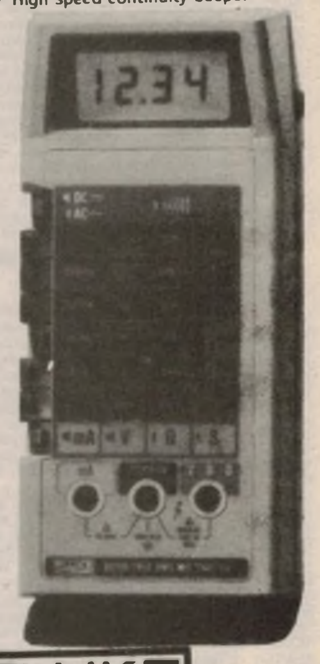
CHECK THE COMPLETE FLUKE 8020B SERIES

	DC Voltage	AC Voltage	DC Current	AC Current	Resistance	Diode Test	Conductance	Continuity	Logic Level	Temperature	Peak-Hold	DC Accuracy
8022B	●	●	●	●	●	●						0.25%
8021B	●	●	●	●	●	●		●				0.25%
8020B	●	●	●	●	●	●	●	●				0.1%
8024B	●	●	●	●	●	●	●	●	●	●	●	0.1%

8026A OFFERS TRUE RMS AND CONTINUITY TESTING

The 8026A is the latest addition to the Fluke range and offers the advantage of true rms readings on ac functions. While most meters measure ac voltages almost all use the average-sensing, rms-scaled technique. In many applications average sensing does not give an accurate result - especially with non-sinusoidal waveforms. If you work with motors or data transmission type circuitry, true rms is critical to your measurements. For quick circuit checking the 8026A also incorporates the Fluke high speed continuity beeper.

- 8 functions
- True rms AC measurements to 10kHz
- Conductance and diode testing
- High speed continuity beeper



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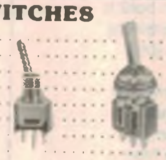
No. 1 FOR SWITCHES

MINI TOGGLE SWITCHES



SE0100	Mini toggle C&K quality SPDT	$1.70
SE0102	Mini toggle Standard quality SPDT	$1.25
SE0104	Mini toggle C&K quality DPDT	$2.10
SE0106	Mini toggle Standard quality DPDT	$1.60
SE0110	Mini toggle paddle C&K SPDT	$3.20
SE0114	Mini toggle paddle C&K DPDT	$4.10
SE0120	Mini toggle heavy duty DPDT	$2.75
SE0130	Mini toggle 4PDT	$5.00
SE0135	Mini toggle C&K Centre off DPDT	$2.70
SE0139	Mini toggle paddle C&K Centre off DPDT	$4.70
SE0140	Mini toggle-paddle C&K DPDT Spring return c/off	$5.50
SE0143	Ultra mini toggle DPDT	$1.70

TOGGLE SWITCHES

SE0150	Toggle switch SPST on/off	$1.05
SE0153	Toggle switch DPDT on/off	$1.70
SE0156	Toggle switch centre off	$2.40
SE0160	Toggle switch 12 volt Red Illuminated SPDT	$3.20
SE0180	Toggle switch SPST on/off 35 amp	$6.95
SE0600	Toggle switch 12v SPDT Illum Blue	$3.25
SE0601	Toggle switch 12v SPDT Illum Red	$3.25
SE0602	Toggle switch 12v SPDT Illum Amber	$3.25
SE0603	Toggle switch 12v SPDT Illum Green	$3.25
SE0610	Toggle switch SPDT Chrome lever 10A	$2.75
SE0612	Toggle switch SPDT Duckbill lever 10A	$2.75
SE0614	Toggle switch DPDT Black lever 16A	$2.75
SE0616	Toggle switch SPDT Black lever 10A	$2.75
SE0630	Toggle switch SPDT Red lever 10A	$2.25
SE0632	Toggle switch SPST Orange lever 10A	$2.25
SE0652	Toggle switch Electric Car Aerial spring	$3.95
SE0658	Toggle switch as used in cars. 3 position top position off, middle position — parker lights, bottom position — headlights	$1.50
SE0660	Toggle switch SPST on/off white	$1.95
SE0662	Toggle switch SPST on/off white — Arco	$2.50

PUSH SWITCHES

SE0200	Push switch mini push on SP	$0.50
SE0202	Push switch mini push off SP	$0.70
SE0204	Push switch mini push on C&K quality SP	$2.10
SP0210	Push switch mini SPDT momentary C&K changeover	$3.75
SE0215	Push switch Mini DPDT Alternate Action	$2.50
SE0229	Push switch Mini DPDT Momentary	$2.50
SE0250	Push switch std size SP push on/push off	$1.20
SE0252	Push switch std size SP push on	$1.20
SE0270	Push switch std size push on/push off DPDT	$2.40
SE0275	Push bank switch 4 way Isostat	$5.25
SE0290	Push switch SPDT Bedlamp type	$1.50
SE0295	Push switch DPDT Bedlamp type	$1.95
SE0310	Push switch DPDT Heavy duty foot type	$6.50
SE0315	Push switch Doorbell type	$2.50
SE0350	Push switch PCB mount DPST Red	$0.70
SE0351	Push switch PCB mount DPST Black	$0.70
SE0352	Push switch PCB mount DPST Yellow	$0.70
SE0353	Push switch PCB mount DPST Green	$0.70
SE0354	Push switch PCB mount DPST White	$0.70
SE0580	Push switch Alarm type illum 12v Red on/off	$13.95
SE0605	Push switch 12v SPDT Illum Blue on/off	$3.25
SE0606	Push switch 12v SPDT Illum Red on/off	$3.25
SE0607	Push switch 12v SPDT Illum Amber on/off	$3.25
SE0608	Push switch 12v SPDT Illum Green on/off	$3.25
SE0650	Push switch DPDT 240v red illum push on/push off	$3.95
SE0656	Push switch Push off 240v Arco type	1.50
SE1000	Push switch — PCB mount for ETI660 Computer	$1.90

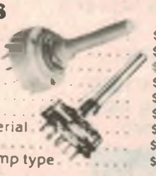
SLIDE SWITCHES

SE0400	Slide switch mini DPDT	$0.45
SE0410	Slide switch 2 pole 3 pos	$0.90
SE0415	Slide switch DPDT standard	$0.75

ROCKER SWITCHES

SE0509	Rocker switch DPDT Illuminated Red 240V	$3.20
SE0640	Rocker switch SPDT Illum red 12v	$2.25
SE0642	Rocker switch SPDT Illum blue 12v	$2.25
SE0648	Rocker switch SPST Appliance replacement	$2.75
SE0654	Rocker switch 2 switches in one housing both SPDT 240v 15A illum Amber	$3.95

ROTARY SWITCHES



SE1500	Rotary switch — DPST 240v 3A on/off	$0.80
SE1504	Rotary switch 6 pole 2 position — imperial	$1.60
SE1505	Rotary switch 4 pole 3 position — imperial	$1.60
SE1506	Rotary switch 3 pole 4 position — imperial	$1.60
SE1507	Rotary switch 2 pole 5 position — imperial	$1.60
SE1508	Rotary switch 2 pole 6 position — imperial	$1.60
SE1512	Rotary switch 4 pole 4 position 2 gang — imperial	$7.90
SE1514	Rotary switch 1 pole 12 positions — imperial	$1.60
SE1520	Rotary switch 3 pole 4 position ETI5000 Preamp type	$3.20

MISCELLANEOUS

SE0709	DIL switch 4 way mini dip switch	$1.70
SE0711	DIL switch 8 way mini dip switch	$3.00
SE0923	Micro switch 240v SPDT 10A	$2.50
SE0938	Mercury switch as used in Alarms	$1.40

MICROBEE

XE5000	Microbee 16K Plus	$469.00
XE5050	Microbee 16K IC	$499.00
XE5100	Microbee 32K Plus	$559.00
XE5150	Microbee 32K IC	$599.00
XE5200	Microbee 64K Plus	$699.00
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XE5255	Add On Disc	$559.00
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XE1205	Printer Cable Interface	$59.95
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XE5400	Micron Data Cassette	$49.50
KE7014	Light Pen Kit for Microbee	$18.50
KE7016	Video Amplifier Kit	$15.00

NEW

STAR PRINTER FOR MICROBEE

A top quality printer at an unbelievable price. The features speak for themselves.

Printing System	Serial impact dot matrix system
Interface	Parallel interface (TTL level) — Standard — Serial interface (RS-232C/Current Loop) — Option —
Character Matrix	Standard: 9 x 9 dot matrix Block Graphic: 6 x 6 dot matrix Bit Image: (7 or 8) x 480 dot matrix (Single density) (7 or 8) x 960 dot matrix (Double density)
Direction of Printing	Standard & Block Graphic: Bi-directional printing (logic seeking) Bit Image: Uni-directional
Number of Print Characters	80, 96, 132 characters (Enlarged Characters: 40, 48, 66 characters)
Printing Speed	100 Characters/second
Character Types	96: Standard ASCII Character Type 96: Italic ASCII Character Type 64: Special Character Type 32: Block Graphic Character Type 96: Proportional ASCII Character Type (option) 32: Proportional Special Character Type (option)
Character Size	2.4 (H) x 2.0 (W) mm (80 characters/line printing)
Character Pitch	10, 12, 17 characters/inch (for Enlarged Characters: 5, 6, 8.5 characters/inch)
Line Pitch	1/6, 1/8, n/72, n/144 inch line feed
Paper Feed System	Sprocket feed or Friction feed
Paper Feed Speed	10 lines/sec (at 1/6 inch line feed)

ONLY $650.00

Cat XE1200

PRINTER CONNECTING CABLE

XE1205

$59.95

NEW PRODUCTS

BE6063	Book Top Projects Vol 9 from ETI	$4.95
BE6021	Book Test Gear Vol 3 from ETI	$4.95
CE2810	Horn Speaker 25 watt	$42.50
LE0636	FX2243 Pot Core	$13.75
LE0637	Bobbie Suit FX2242	50

HI POWER PIEZOELECTIC BUZZER

This amazing little device will scare the wits out of any intruder. It operates from 7.5V—15V DC, it's water and dustproof and ideal for use in car and domestic alarm systems. Its sound output is an unbelievable 105dB at 3 metres, its operation frequency is 2800Hz and it draws a mere 250mA. Its size is 44mm high and 86mm wide at its base. The most remarkable thing is its price ... ONLY $19.95

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LATEST SOFTWARE FOR MICROBEE

Learning Can Be Fun Vol 2B	XE6223	$14.95
Learning Can Be Fun Vol 2C	XE6224	$14.95
Yahtzee (Card Game)	XE6966	$14.95
Morse Code Tutor	XE6880	$14.95
Log (General Purpose Index)	XE6890	$15.95
Prospector (Game)	XE6885	$14.95
Programming Hints	XE6895	$14.95
Merlin (Adventure)	XE6870	$25.00
Psychotec (Psychiatrist)	XE6875	$15.00

NEW BOOK WILDCARDS VOL 1 ... $15.00

6 HOUR TURNAROUND ON MAIL ORDERS

All PCB's from EA and ETI since 1975 are available from both our stores — ex stock.

Here is the full-size pattern for the power supply printed circuit board.

PARTS LIST

1 Citizen DP-575L printer mechanism
1 Citizen CBM-505-PF12 control board
1 Amphenol 36-way "Champ" Centronics style connector
1 4-way Molex female connector with polarising blank, type 5276-04A
1 30 cm length of 40-way ribbon cable or similar
2 momentary contact normally open pushbutton switches
1 140 x 215mm base board
2 20 x 20 x 215mm battens
2 brackets and one spindle for paper holder
2 140 x 40mm aluminium plates for front and rear of printer mounting

MISCELLANEOUS
Wood glue, carpenter's tools, Estapol, nuts and bolts, insulated hook-up wire, solder.

Power Supply

HARDWARE
1 case with lid, 160 x 70 x 184mm
1 PC board, 81 x 90mm, code 79ups6
1 transformer with 30V centre-tapped secondary at 1 amp DC or more, Ferguson PL30/40VA, A&R 6672, DSE M-6672 or similar
1 SPST mains toggle switch
1 3-way insulated terminal block
7 PC pins
4 Richo PCB supports
1 solder lug
1 4-pin polarised plug and socket
1 Mains cord and plug (preferably one-piece moulded type)
1 mains cord clamp

SEMICONDUCTORS
2 1N4001 silicon diodes
1 LM340T-5.0, regulator uA7805 regulator
1 LM340T-12, uA7812 regulator
1 LED and bezel holder

PASSIVE COMPONENTS
1 2200μF or 2500μF/25VW pigtail electrolytic
1 1000μF/25VW pigtail electrolytic
4 1μF tantalum electrolytic
1 470 ohm ¼ or ½W resistor

MISCELLANEOUS
Heatshrink tubing, hook-up wire, screws, nuts, lockwashers, solder.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~▒
THIS IS DOUBLE SIZE
¡NMOQ 3OISdՈ SI SIHꓕ ‘SdOO
THIS IS IN RED
°¿ꟻΩΗΣσχ¥×ө±÷πΛΘLβ§a̲o̲£¢½¼×¥₩ÁéèêëïîìÌó
óòõôúùûÜÝ¿ÑñEJiA#Bäàâã
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
```

```
10 FOR X=32 TO 128
20 LPRINT CHR$(X);
30 NEXT X
40 LPRINT
50 LPRINTCHR$(14);"THIS IS DOUBLE SIZE"
60 LPRINT CHR$(18);"OOPS, THIS IS UPSIDE
 DOWN!"
70 LPRINT CHR$(19);"THIS IS IN RED"
80 FOR X=128 TO 255
90 LPRINT CHR$(X);
100 NEXT X
```

Above at left is a sample of the output of the printer, reduced by 10%. Program used to produce the sample is shown above.

We estimate that the current cost of the printer and supply configuration shown here is approximately

$300

This includes sales tax.

which converts the ARDY signal from the PIO to a STB pulse of the correct length. The Microbee bulletin suggests wiring an Amphenol 36-way connector to the DB15 plug which in turn connects to the DB15 socket installed at the rear of the Microbee.

Connection and use of a parallel printer with the Super-80 was described in the article on the Super-80 printer interface board in the May 1982 issue of EA.

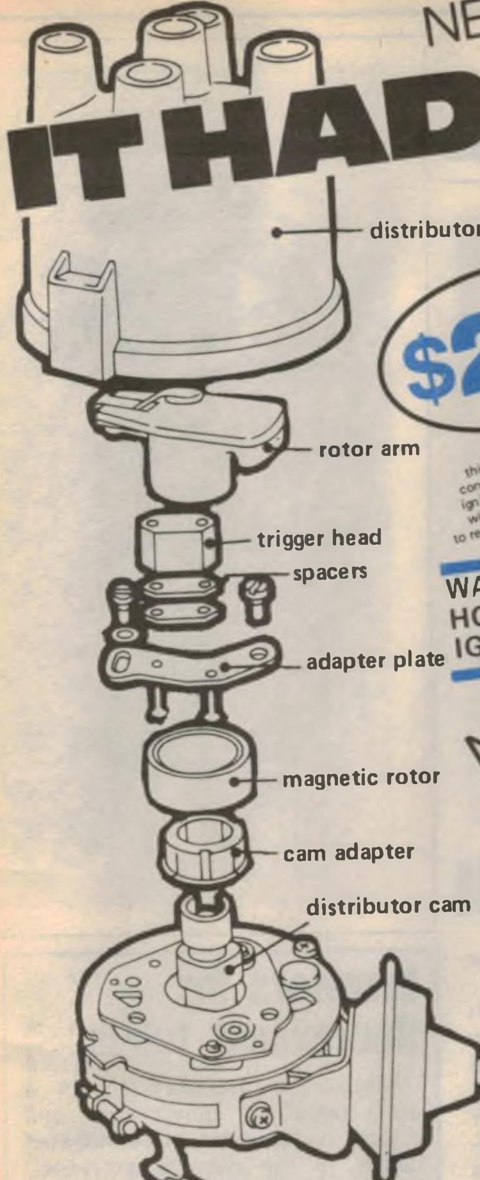
Using the printer

How you use the printer will depend on your computer and Basic interpreter. Standard Microsoft Basic includes the statements LPRINT and LLIST, designed to work with the normal printer port of the system running the interpreter. Listing 1 is a short test program which will run on the System-80 and TRS-80 machines to demonstrate some of the capabilities of the machine. Shown above is a 90% full-size reproduction of the print-out from this test routine showing the character set and some of the special features of the printer.

The Microworld Basic interpreter has the LPRINT and LLIST statements but also requires re-direction of input and output with the OUTL# statement. As initialised these statements will attempt to use an RS232C printer attached to the Microbee's serial port. The statement OUTL#1 will re-direct output to the parallel port, as described in the Microbee Users' Manual. The Super-80 computer requires a special printer drive routine, as described in the article previously mentioned.

NEW

IT HAD TO HAPPEN



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PLEASE NOTE
this system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

A professionally engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:

- HALL EFFECT TRIGGER HEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
- OVER 6 CAM LOBE ADAPTORS
- OVER A DOZEN DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
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- YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL
- BREAKER POINTS WHEN YOU SELL THE CAR!
- AS EASY TO INSTALL AS A SET OF POINTS!
- INSTRUCTIONS (SIMPLE TO FOLLOW) INCLUDED!

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
Cat. KJ6655

WATCH FOR NEWS IN "ELECTRONICS AUSTRALIA" TO SHOW YOU HOW TO ADAPT THIS KIT TO YOUR TRANSISTOR ASSISTED IGNITION — SIMPLE!!

NEW

80CPS Matrix Printer

SAVE $100

ONLY **$599**

NORMALLY $699

Magnificent 80 Character Second Matrix Printer! — WITH GRAPHICS CAPABILITY.
INCREDIBLE PRICE BREAKTHROUGH!!

We DARE you to compare with other units selling for well over $900!!
WHERE ELSE will you buy an 80 column (142 compressed mode) printer for under $700? Check the specs below and you must agree!!

FUNCTIONAL SPECIFICATIONS

Printing method	Serial impact dot matrix
Printing format:	Alpha numeric — 7 x 8 in 8 x 9 dot matrix field Semi graphic (character graphic) — 7 x 8 dot matrix Bit image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line
Character size:	2.1mm (0.083") W x 2.4mm (0.09") H/7 x 8 dot matrix
Character set:	228 ASCII characters. Normal and italic alpha numeric fonts, symbols and semi-graphics
Printing speed	80 CPS, 640 dots/line per second
Line feed time	Approximately 200msec at 4.23mm (1/16") line feed
Printing direction	Normal — Bidirectional, logic seeking Superscript and bit image graphics — Unidirectional, left to right
Dot graphics density:	Normal — 640 dots/190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190mm (7.5") line horizontal
Line spacing:	Normal — 4.23mm (1/16") Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216")
Columns/line	Normal size — 80 columns Double width — 40 columns Compressed print — 142 columns Compressed/double width — 71 columns The above can be mixed in a line
Paper feed	Adjustable sprocket feed and friction feed
Paper type	Fanfold. Single sheet. Paper width — 101.6mm (4") to 254mm (10")
Number of copies:	Original plus 3 copies by normal thickness paper

MECHANICAL SPECIFICATIONS

Ribbon	Cartridge ribbon (exclusive use), black
MTBF	5 million lines (excluding print head life)
Print head life:	Approximately 30 million characters (replaceable)

INTERFACE SPECIFICATIONS

Interface	Standard Centronics parallel
Data transfer rate	4,000 CPS max.
Synchronization:	By external supplied STROBE pulses
Handshaking	By ACKNLG or BUSY signals
Logic level	Input data and all interface control signals are TTL level

SUPPLIED WITH 48 PAGE MANUAL
AND 13 DIFFERENT PRINTING MODES
e.g. normal, condensed, enlarged, emphasised, underlined, italic, etc. And remember — GRAPHICS as well!

CALL IN NOW FOR A DEMO!

Cat. YM2400

COMPUTER SENSATION!

SPECIFICATIONS

CPU		6502
ROM		16K Bytes
RAM		64K Bytes
BASIC	Interpreter	More than 90 instructions stronger than those for Apple II
Video Display	Type	Memory mapped into system RAM
	Mode	Text, low-resolution graphics, high resolution graphics (3 modes are mixed)
	Screen Format	960 characters (24 lines, 40 columns)
	Character Set	Upper case ASCII, 64 characters
	Character Type	5 x 7 dot matrix
	Graphics Capacity	1920 blocks (low resolution) in 40 x 48 array, 53760 dots (high resolution) in 280 x 192 array
	Number of Colors	6 colors
Keyboard		49 alphanumeric and function keys
Cassette	Interface	Use various cassette tapes and cartridges
Software	Cartridge Interface	as data storage units
Printer	Interface	Connects to printers with Centronics I/F
Display	Interface	Connects to color TV or video display
Remote	Control Paddle	Used for education & entertainment
Speaker		8 ohm, 50mm, 0.25W
Power		A switching power supply is provided to convert AC power to required power supply
Dimensions		241 x 175 x 30mm

- 64K OF RAM SUPPLIED STANDARD all that you are ever likely to need
- Text, Lo and Hi resolution graphics STANDARD
- Video AND TV (RF) output STANDARD
- Easy-to-use manual included in the price (over 248 pages)
- Power supply included as STANDARD
- Centronics printer interface STANDARD
- Multitech BASIC is compatible with APPLE II BASIC. Most APPLE software will run on the Micro Professor Mk II

Only **$499**

MICRO-PROFESSOR II OUTSTANDING!

Low cost colour computer with APPLE compatibility*

Normally $658

SAVE $159

*Most Apple Soft II BASIC programs will run on the MPF II

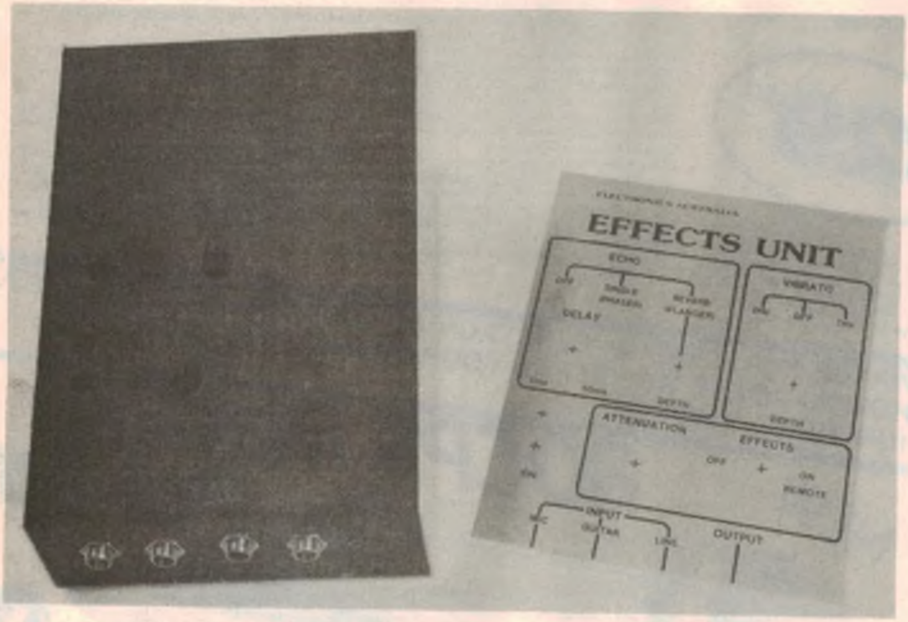
6 Colours

Cat. YC1300

SEE PAGE 21 FOR JAYCAR ADDRESSES AND PHONE NUMBERS

New Products...

Product reviews, releases & services



Jaycar kit for sound effects unit

Jaycar Pty Ltd now has available metalwork to suit the EA bucket brigade device effects unit (featured in the June 1983 issue).

The effects unit cabinet has been specially manufactured to conform to the design of the modified case used by the prototype and is supplied with pre-punched holes for all controls and input and output sockets. A silk-screened front panel to EA specifications is included. Dimensions of the box are 160 × 184 × 38mm (W × D × H at front) as specified in the constructional article.

Jaycar's kit for the Effects Unit costs $79 with an unmodified TU-04 box, or $89 with the specially made cabinet. The cabinet is available as a separate item for $29.50.

Also available from Jaycar is a new high performance, low cost piezo horn speaker. Two versions are available, one an 8.75cm square "super horn" for PA and disco use, with around 50W power handling capability, and the other a circular "hifi" version which is slightly less sensitive but has a smoother response curve. Both units are priced at $9.95.

For further information on either the Effects Unit or the new tweeters contact Jaycar at 125 York St, Sydney, or the Carlingford store. The address for mail orders is Box K39 Haymarket, Sydney, 2000.

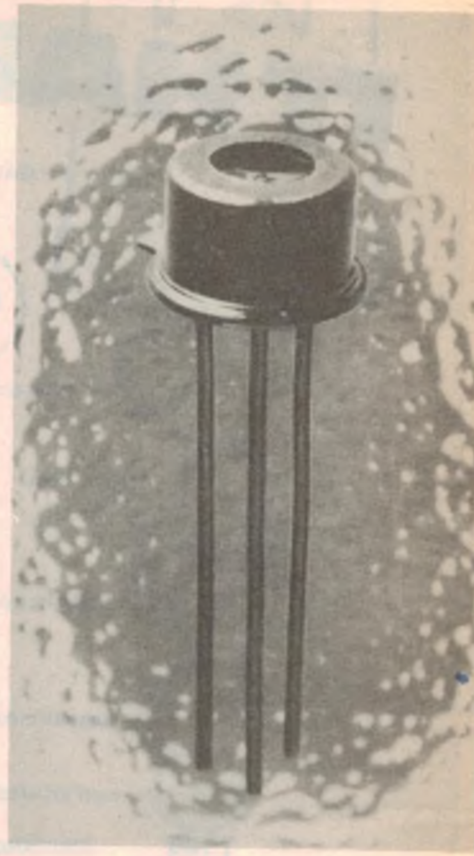
Battery-powered smoke alarm

A new battery operated smoke alarm just released in Australia can sense smoke, sound an alarm and automatically switch on a bright light to guide people out of the area.

The BRK Model 1200 from Pittway Electronics incorporates an ionisation chamber type smoke detector which activates a solid state 85dB horn alarm. A built-in 3.5 candlepower light (equivalent to a large torch) turns on automatically when the alarm sounds.

The detector is powered by a 9V battery with a separate battery for the alarm light. A pushbutton test switch allows all detector functions to be checked and a flashing LED indicates that the detector is receiving battery power. Normal battery life is quoted as one year, and should the battery require replacement the detector will beep continuously for at least 30 days.

Further information is available from Pittway Electronics Pty Ltd, 10-12 Prospect St, Box Hill, Vic 3128. Phone (03) 898 8787.



Inverters for fluorescent tubes

Selectronics, manufacturers of a wide range of transformers and wound components, have released details of the new "Invert-A-Lite", designed to operate standard fluorescent tubes from a DC supply.

The new inverters are available in ratings from 4W to 65W. The standard models are designed to operate from a 12V DC supply but other voltages in the range of 6V to 110V are available on application. The units are fully solid state and are encapsulated for ruggedness and resistance to moisture.

Features of the new inverters include screw terminals for easier installation, instant start, low current drain, high efficiency, need no for ballast or starter and reverse polarity protection.

As well as OEM lighting applications, Invert-A-Lite is ideal for caravans, boats, and incorporation in solar power systems, wind generators, and portable, standby, and emergency lighting equipment.

For further information contact Mr B Scott, Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater, 3151. Telephone (03) 762 4822.

JAYCAR

Sparkrite

The Brandleaders in Auto Electronics

Sparkrite SX2000

A Reactive Discharge System combines all features of the SX500 plus:

- Reactive Discharge electronics combining all the advantages of both Inductive and Capacitive Discharge for maximum spark performance.
- Gives the most thorough combustion of air fuel ratios especially current lean mixture emission controlled engines.
- Voted 'Accessory of the Year' and the best as tested by Popular Motoring Magazine.
- Patented clip-to-coil fitting.
- Systems Function Light as well as Static Timing Light.
- The ultimate brand leading contact-breaker triggered system.

$59 SAVE $10 $49

Quartz Crystal Clock movement

Cat. XC6000

NEW

$14.95

- Very compact and reliable
- Self starting one second stepping motor has strong torque
- Powered by 1.5V AA battery that lasts for a year
- Supplied with two sets of hands, one short and one long
- ± 15 second/month accuracy
- 56mm square, 15mm deep

Complete with data sheet, instructions and wall hanger bracket

IEC Cable Connectors

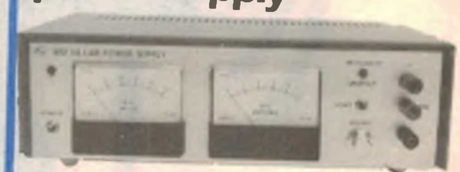
INCREASED RANGE

Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords. We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous.

Cat. No	Description	Price
PS4302	LINE CORD STRAIGHT ENTRY 2M	$3.95
PS4304	LINE CORD R/HAND ENTRY 2M	$3.95
PS4305	LINE CORD L/HAND 2M	$3.95
PS4306	LINE CORD STRAIGHT ENTRY WITH 240V PLUG 2M	$4.95
PP2302	IEC 320 CHASSIS PLUG	$2.95
WM4530	2 PIN 240V PLUG MOULDED TO 2M FIG. 8 7.5 AMP CORD BLACK IN COLOUR	$2.95

(Note: the first 5 items are grey in colour)

50V/5A laboratory power supply



Ref: EA May/June 1983

By far the most exciting high power supply we have seen! Using the latest switch mode principle, very little energy is wasted with high dissipation in the regulators — a cause of considerable heat dissipation and high hardware costs.

The Jaycar kit comes with every originally specified component down to the last nut and bolt. Also included are special Scotchcal meter scales. Beware of inferior kits that do not supply such components. (Not for sale as a separate item).

Cat. KE 1520 — $149.00

SPRAY ON CONDUCTIVE PLASTIC...

This handy 200 gram spray enables you to do all manner of things. You can spray sheets of Styrene foam and make them suitable for storing your MOS IC's. Far cheaper than other methods!! You can make conducting screens inside plastic boxes to shield RF. You can re-coat the back of CRT's. You can make conductive parts of equipment cabinets to reduce static. The paint dries to a hard varnish like film. Non-inflammable and Non toxic. Grab a can now. You never know when you will need it!

Cat. NA 1010 — $6.95

$6.95

Digital Delay Line KIT

400ms VERSION ONLY $449 COMPLETE

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low low price! The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from 0.32ms to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the freeze control.

All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated through' i.e. there are no wire links or link through pins. The whole of the memory whether for the basic 400ms machine or the fully expanded 1.6 second model all fits on the main board. The cabinet which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is psrayed with a durable black enamel. The kit is available for only $449 — compare that with inferior uints that can cost over $2,000!!

Cat KJ6621 — $449.00

FM Transmitter Module

We have been working on this one for years!! Basically we wanted something akin to the $6.50 kit "wireless microphone" transmitter but with greater signal strength and far, far greater frequency stability.

WE NOW HAVE IT!

Basically the (potted) unit measures a small 90 × 22 × 15mm and has connections for power, antenna and input. An AC signal between 20 and 15kHz will modulate the transmitter. The signal can be coded single or multiple frequency tone bursts etc.

FEATURES

- Ultra low noise output (−60dB or better attainable with a suitable tuner)
- Excellent frequency stability
- Not a kit — ready for immediate use
- Connections required
  (a) Power supply or battery
  (b) Antenna
  (c) Audio input
- Full instructions supplied
- Suits any application where a stable low noise FM link is required

SPECIFICATIONS

- Frequency — 88 – 108MHz adjustable
- Useable range — 50 metres
- Supply — 6 to 9V at 20mA
- Input sensitivity — adjustable — maximum 30mV
- Pre-emphasis — 50u/second standard
- Dimensions — 90 × 22 × 15mm (approx)

$49.95 Cat. DT5450

LOW COST DIGITAL MULTIMETER KIT

ONLY $45

Ref. EA March 1983 (This month)

Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low cost built-up units available. The DP2010 changed all that.

This kit, fully imported from the UK, uses the famous DPM-05 custom LCD/Voltmeter to achieve phenomenal accuracy at very modest cost!

All parts are included to complete the meter including an attractive and colourful front panel.

(a 9V battery is required)

Set of test probes to suit $2.95

Probe to suit Cat. WT5312 ONLY $2.50

Eveready 216 (red) 9V Battery Cat. SB2370 ONLY $1.40

$39.95

SAVE OVER $5.00!

DP2010 kit Cat. KJ7010 ONLY $45

SPECIFICATIONS

Function	f.s.d.	Resolution	Accuracy	Protection
Volts (d.c.)	2V	1mV	1% ± 1 digit	500V for
	20V	10mV	1% ± 1 digit	one minute
	200V	100mV	1% ± 1 digit	
	500V	1V	1% ± 1 digit	
Current (d.c.)	2mA	1uA	1% ± 1 digit	1A/250V
	20mA	10uA	1% ± 1 digit	
	200mA	100uA	3% ± 1 digit	
	2000mA	1mA	5% ± 1 digit	
Volts (a.c.)	2V	1mV	2% ± 5 digit	500V for
	20V	10mV	2% ± 5 digit	one minute
	200V	100mV	2% ± 5 digit	
	500V	1V	2% ± 5 digit	
Current (a.c.)	2mA	1uA	2% ± 5 digit	1A/250V
	20mA	10uA	2% ± 5 digit	
	200mA	100uA	4% ± 5 digit	
	2000mA	1mA	7% ± 5 digit	
Resistance	2K	1	1% ± 1 digit	260V
	20K	10	1% ± 1 digit	r.m.s.
	200K	100	1% ± 1 digit	
	2000K	1K	1% ± 1 digit	
Diode Test	2V	1mV	1% ± 1 digit	260V r.m.s.

AC VOLTAGE AND CURRENT RANGES

When S3a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

New components from Motorola

Motorola Inc has added a 250W NPN transistor to its range of RF components. The new device, designated the MRF448, is intended for operation in the 30MHz band with a 50V supply and offers a typical 14dB gain and 65% efficiency. Applications include high-power marine base station radio communications equipment.

Also recently announced by Motorola are two new infrared emitters for fibre optic systems (see picture at left). The emitters, MFOE1201 and MFOE1202, are said to be the first planar LEDs capable of data transmission at greater than 100MHz bandwith, and allow simplified fibre optic use in areas which previously required expensive edge emitting LEDs or laser diodes. The cost saving is attributed to the lower processing and assembly costs of planar devices.

Spectral response peaks at 820nm, the wavelength which suffers the least attenuation through medium length optical fibre cables. Power output is from 1 to 3.5mW and the devices are packaged in a TO-52 metal can which is said to fit commercially available fibre optic connectors.

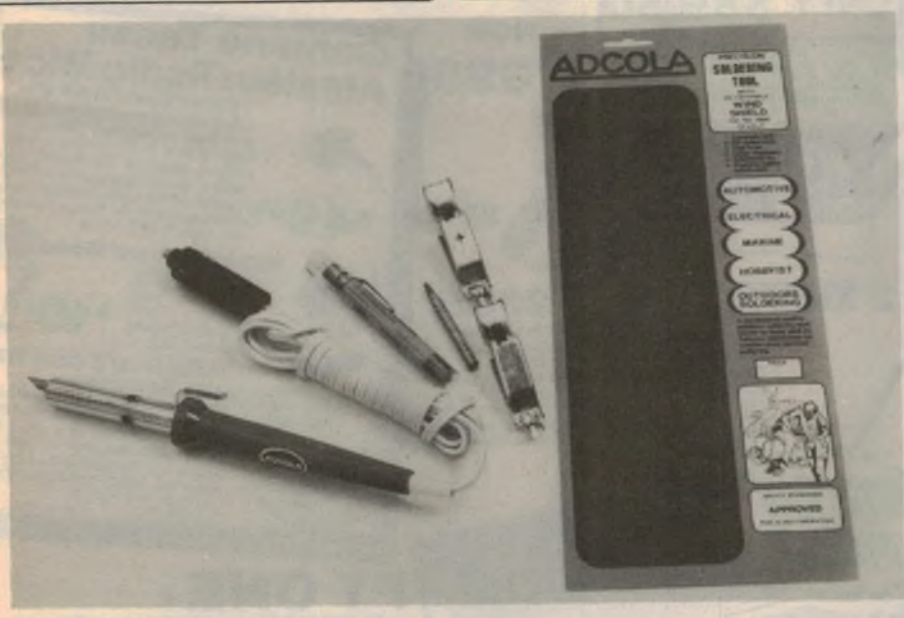
New VHF/UHF antennas

GFS Electronic Imports, of Mitcham, Victoria, recently announced the release of two new log periodic broadband directional antennas designed for use in a wide variety of VHF and UHF applications.

The Log-S Model has nine elements with an average gain quoted as 9dBi and a band coverage of 100 to 520MHz. Boom length is 1.02 metres. The Log-SP Model has a coverage of 65 to 520MHz and a quoted average gain of 11.5dBi. It has 13 elements and a boom length of 3.07 metres.

Both antennas are said to be suited for use with transmitters over the designated range, with a maximum input power handling capability of 200W. The Log-S Model is priced at $89 and the Log-SP at $125, both prices plus $10 freight, and are available exclusively through GFS and their agents.

For further information contact GFS Electronic Imports, 15 McKeon Rd, Mitcham, Vic. Phone (03) 873 3939. The postal address is PO Box 97, Mitcham, Vic 3132.



Soldering iron

The Adcola company recently released a soldering iron designed specifically for outdoor use, where the cooling effect of the wind can be a problem for conventional tools.

Originally designed for Telecom the Model S606/12 has a detachable ventilated wind shield which fits over the barrel, limiting heat dissipation.

The iron operates from a 12V battery and draws around 2A. It is fitted with a mounting clip, 3.3 metres of cord and a bevel-faced general purpose tip. An extra tip is also supplied for PCB work together with two battery clips and a car cigarette lighter socket adapter. A free solder dispenser with 14g of resin cored solder comes with the iron.

The S606/12 soldering iron is available from selected electrical retailers. For further information contact Adcola Products, PO Box 328, Mt Waverley, Vic, 3149. Phone (03) 232 0858.

radio proves it's value round-the-world flight!

HI POWER YAESU HF TRANSCEIVER

SP102

Features a large 120mm hi fi speakers with selectable low and high-cut audio filters, allowing 12 possible response curves. Headphones can be connected to the SP-102. Filter allows audio tailoring for each bandwidth and mode of operation. Two input jacks provided. Cat D-2883

ONLY **$72.50**

FT102 *

A fantastic new, super high performance HF transceiver has arrived. The FT102 has all the amateur bands PLUS the new WARC bands. Special high voltage JFET RF amplifier provides exceptional dynamic range - well beyond 100dB Adjustable Noise Blanker even works on the 'Woodpecker'. Three 6146B final tubes provide remarkable emission purity - plus big power 240W. Has IF Width and IF Shift and the best notch and audio peak filter you've ever heard. You must see this one to believe it! Cat D-2880

WAS ~~$1225~~ NOW **$1049**

*Optional FM Board. Cat D-2882 **$72.50**

FC102

This newly designed antenna tuner is ideally suited for use with the FT-102 station. Power handling capability of 1.2kW/ Bandswitch L-C pi-network will match a wide variety of antennas (including a single wire) to your transceiver. Cat D-2881

ONLY **$369**

The most up-to-date Communication radio in the world

FRG 7700/ SW

For the professional monitor or serious SWL! If you want the best, you want the Yaesu FRG 7700 SW. Complete shortwave coverage with ease of operation the others only dream about. Just look at these features:

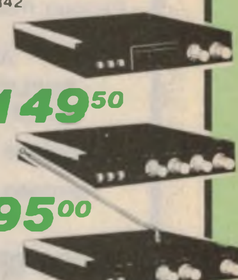
- 2MHz -30MHz continous
- ALL Mode - including FM (great for working with converters!)
- Digital frequency readout, with digital clock.
- Timer for turning receiver on/off plus control of external equipment (such as tape recorder).

Ask for a copy of our brochure showing you what the FRG 7700 SW can do for you. Cat D-2841

ONLY **$539**

FRG 7700 HF 150kHz - 30MHz version also available. Cat D-2840

Optional Memory Unit
Gives you single button re-call of any of 12 chosen frequencies, Simple connection, instructions included. Cat D-2842 **$149.50**

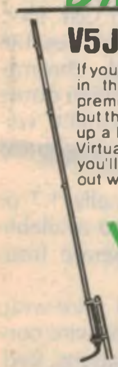


VHF CONVERTER
There's a lot more to listening pleasure than just the HF bands! Listen in to the exciting world of VHF radio; all the services, amateurs etc, etc 50-59, 118-130, 140-150kHz. Cat D-2844 **$149.50**

ANTENNA COUPLER
The FRG 7700 works with many types of antennas, but best with a low impedance one. This coupler ensures optimum performance always. Cat D-2843 **$95.00**

ACTIVE ANTENNA
Don't want to string up an antenna outside? Use the active antenna—powerfull preamplifier plus a whip antenna will pull in stations you didn't think possible. Cat D-2845 **$89.50**

INCREDIBLE VALUE ON ANTENNAS



V5JR 5 Band Vertical

If you're typical of most amateurs, you live in the suburbs where space is at a premium. You need an effective antenna but there are usually objections to putting up a beam. You need our V5JR vertical. Virtually unnoticable in your backyard, you'll be able to pursue your hobby without worry! Cat D-4305

VALUE ONLY **$99.95**

Tri-band Beam

Mini-Multi's MSC33 offers top performance 10, 15 & 20 metres and its compact design makes it ideal where space is a limiting factor. Durable and lightweight, it is ideal for rooftop or lightweight tower installations. Featuring separate and matched HI-Q traps for each band. It feeds with 50ohm coax and delivers maximum front to back ratio. The MSC33 has a SWR of less than 1.5:1 at resonance. Cat D-4303

- Maximum element length ... 6.3 metres
- Boom Length .... 3.8 metres
- Weight .... 8 kilograms
- Rated at 600 watts PEP
- Average gain 8dB

AMAZING VALUE **$349**

A thrifty HF Transceiver FT-77 *

Cat D-2915

With all solid state 'no-tune' circuitry, the FT-77 is ideal for today's amateur on the move. With Yaesu's new 'CAD/CAM' * circuitry it represents the 'state of the art' in reliability, simplicity and economy

- All amateur bands including WARC
- 12 volt operation (240V with optional supply)
- Nominal 100 watts output
- SSB & CW operation (FM optional)
- 0.3uV sensitivity (SSB & CW)

* Computer aided design, computer aided manufacture.

GREAT VALUE ONLY **$799**

FM Unit

Plug in PCB to give your FT-77 transmit and receive. Great with converters or for working W & K on 10m! Cat D-2918

ONLY **$44.95**

Marker Unit

Accurate marker to help you make sure you're not trespassing outside your band. An absolute must. Cat D-2919

ONLY **$15.95**

SAVE AROUND $120 ON THIS EXPERIMENTERS MOBILE RADIO

WAS ~~$169~~ NOW ONLY **$49.95**

Here's one for all the amateurs, servicemen, technicians etc. Famous National brand 9 channel 27MHz CB. Ideal for conversion to 10 meters, use as spare parts, experiment with etc. We over-bought on this model and we MUST reduce stocks—our loss is your gain. Take advantage of our mistake and save a fortune! Cat D-2500

WARRANTY NOT AVAILABLE THIS MODEL

ELECTRONICS

See page 12 for full address details

STOP PRESS: BUY NOW AT DUTY-FREE PRICES

* New Government regulations mean 30% duty must be added to new shipments of Amature radio transceivers.

MAIL ORDER
MAIL ORDER MAIL ORDER

7400

7400	27
7402	25
7403	25
7404	33
7406	37
7407	37
7408	27
7410	29
7411	29
7413	35
7414	35
7416	41
7417	41
7420	25
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7423	32
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74160	1 12
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74163	59
74164	66
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74166	99
74167	2 20
74174	59
74175	60
74176	1 20
74177	1 10
74180	45
74182	1 05
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74193	79
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74196	64
74197	63
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74199	1 60
74221	1 60
74251	1 35
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74290	67
74293	85
74298	66
74365	83
74366	83
74367	83
74368	83

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81LS97	1 85
81LS98	1 85

74F00

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74F109	96
74F138	1 58
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74F153	1 58
74F157	1 58
74F158	1 58
74F175	2 50
74F181	4 35
74F182	2 30
74F189	6 80
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74F191	3 60
74F194	2 16
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74F399	2 50
74F521	3 80
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74F534	3 60

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74S189	2 85
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74S257	93
74S258	99
74S283	1 60
74S287	2 50
74S288	2 40
74S289	3 10

74C00

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74C927	6 80
74C928	8 50
74C929	4 20
74C930	4 20
74C941	2 25
74C989	8 60

4000

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4002	26
4006	68
4007	25
4008	70
4009	66
4010	62
4011	25
4012	25
4013	31
4014	77
4015	65
4016	39
4017	56
4018	72
4019	44
4020	60
4021	79
4022	66
4023	29
4024	56
4025	28
4026	98
4027	39
4028	69
4029	84
4030	42
4031	3 25
4033	1 80
4034	1 80
4035	90
4040	65
4041	1 00
4042	65
4043	50
4044	50
4046	1 05
4047	80
4048	46
4049	35
4050	39
4051	72
4052	1 15
4053	80
4055	2 20
4060	1 00
4063	1 10
4066	40
4068	28
4069	25
4070	25
4071	27
4072	26
4073	28
4075	26
4076	82
4077	30
4081	25
4082	28
4085	60
4086	45
4089	2 10
4093	40
4094	70
4099	1 20
4104	2 30
4160	80
4161	1 10
4163	1 10
4174	80
4175	80
4194	80
4409	5 60
4411	10 50
4419	3 40
4469	13 50
4495	2 80
4500	5 80
4502	88
4503	68
4507	29
4508	1 20
4510	80
4511	80
4512	70
4514	1 70
4515	1 95
4516	85
4518	80
4519	68
4520	80
4521	2 00
4522	1 14
4526	1 10
4527	1 00
4528	84
4529	1 74
4531	1 04
4532	95
4534	6 00
4538	1 10
4539	60
4541	1 10
4543	94
4553	3 00
4555	60
4556	65
4558	1 40
4560	2 50
4569	2 10
4572	60
4583	1 00
4584	70
4585	82
4599	4 20

9000

9300	60
9302	1 10
9304	62
9307	1 50
9308	1 90
9309	64
9310	88
9311	1 69
9312	54
9314	59
9316	78
9318	1 40
9320	5 00
9321	88
9322	55
9324	78
9328	99
9334	1 18
9338	1 30
9340	2 85
9368	1 18
9370	94

LINEAR ETC

AD570	58 00
AD7524	14 20
ADC0800	14 90
ADC0804	5 50
ADC0808	12 60
ADC0809	8 00
ADC0817	13 60
ADC1210	58 00
AY 3 1015	6 50
AY 3 8910	10 00
BR1941	11 50
BR1943	12 00
CA3028	1 90
CA3036	4 50
CA3039	1 60
CA3059	4 50
CA3081	1 90
CA3130	1 40
CA3130T	1 50
CA3140	80
CA3140T	1 45
CA3146	2 20
CA3401	99
DAC0800	3 20
DAC0808	2 50
DAC1220	12 50
DM8121	2 50
DM8130	5 20
DM8131	2 95
DM8309	64
DM8310	88
DM8312	54
DM8316	78
DS8820	1 50
DS8830	1 70
DS8833	1 90
DS8836	50
DS8859	2 35
DS8869	1 80
DS75107	80
DS75108	1 20
DS75110	1 20
DS75150	1 20
DS75154	95
DS75451	60
DS75452	45
DS75453	80
DS75454	66
FD1771	21 00
FD1791	39 00
FD1793	39 00
FD1795	35 00
ICL7106	17 50
ICL7107	18 00
ICL7660	4 80
ICM7217A	17 50
ICM7218A	18 00
ICM7555	1 60
ICM7556	2 70
L120	2 25
L121	2 60
LF347	1 95
LF351	55
LF353	80
LF356	1 25
LF357	1 25
LF398	3 95
LF398H	6 50
LF13741	72
LH0002	10 95
LH0042CH	9 60
LH0070-1H	15 90
LH0071-1H	17 50
LM10CH	6 50
LM304H	2 95
LM307	50
LM310	1 95
LM311-14	1 20
LM318	1 75
LM319	1 95
LM322	1 95
LM325	4 50
LM329	80
LM334	1 60
LM3352	1 50
LM3362	1 50
LM349	1 65
LM358	65
LM358AN	1 40
LM374	4 80
LM377	2 10
LM380 8	1 20
LM380 14	98
LM381	1 80
LM382	1 50
LM383	1 95
LM386	72
LM387	80
LM394CH	3 89
LM565	89
LM566	2 00
LM567	90
LM1830	3 20
LM1886	6 00
LM1889	2 40
LM2917 14	2 10
LM3080	98
LM3089	2 90
LM3524	2 98
LM3900	49
LM3905	1 50
LM3909	1 00
LM3911	2 00
LM3914	2 95
LM3915	2 75
LM3916	2 80
LM4250	2 00
MC1350	1 38
MC1406	9 00
MC1445	3 90
MC1456	1 60
MC1466	13 50
MC1494	7 40
MC1495	7 20
MC1496	1 40
MC3340	1 40
MC3370	3 70
MC3470	9 00
MC3486	3 30
MC10116	1 40
MCM66740	16 00
MM5303	9 50
MM5837	2 50
MM58167	11 50
MM3001	16 50
MSM58372	12 50
NE530	2 30
NE558	1 90
NE571	1 90
NE5534	1 45
NE5534AN	1 85
OM321	11 00
OM335	19 50
OM350	9 50
SAB0600	6 50
SAK140	95
SN76477	5 65
SN76488	7 40
TA7205	1 85
TCA220	8 50
TL061	1 00
TL062	1 55
TL071	80
TL072	1 50
TL074	2 85
TL075	3 20
TL081	80
TL082	1 20
TL084	2 35
TR1602	7 30
TR1863	6 70
TR1983	9 00
UA301	48
UA303H	1 35
UA305H	1 25
UA308	58
UA311	62
UA311H	1 30
UA324	70
UA339	45
UA348	1 40
UA391	52
UA555	38
UA556	78
UA709	58
UA710	75
UA711	60
UA723	42
UA723H	1 30
UA725	2 50
UA739	99
UA741	79
UA741H	1 15
UA747	98
UA1458	50
UA1488	70
UA1489	70
UA2901	60
UA3086	50
UA4136	1 30
UAA170	4 60
UAA180	4 60
ULN2003	1 25
WD1393	65 00
WD1691	17 50
XR2206	5 95
XR2207	5 00
XR2208	3 20
XR2211	6 90
XR2216	2 80
XR2240	3 00
XR2243	3 00
8126	1 80
8128	2 40
8195	1 60
8196	1 80
8197	1 95
11C90	12 50
95H90	7 00

MICRO

2102	1 60
2112	7 50
2114	1 95
2532	6 75
2564	16 50
2708	5 90
2716	4 50
27128	55 00
2732	5 40
2764	9 50
2816	12 50
2911	32 00
2912	22 00
2920	108 00
4116 150NS	1 95
4164 150NS	7 50
6116P3	6 80
6502	9 45
6502A	9 80
6505	12 00
6507	8 64
6520	2 99
6522	7 90
6522A	10 80
6532	10 70
6545	19 80
6551	13 80
6800	4 90
6802	6 90
6808	4 50
6809	16 00
6810	3 20
6820	2 85
6821	2 70
6840	5 80
6844	12 50
6845	12 50
6847	7 50
6850	2 50
6852	2 70
6854	8 80
6875	10 50
68A09	29 50
68B00	6 50
68B21	3 90
68B40	7 80
68B45	16 50
68B50	3 40
68B54	12 00
8080	4 90
8085A	6 90
8086	53 00
8088	42 00
8155	5 20
8156	5 50
8185	35 00
8202A	57 00
8203	57 00
8205	117 00
8212	1 60
8214	1 60
8216	1 65
8224	4 50
8226	1 80
8228	3 50
8231	285 00
8237	42 00
8238	10 80
8243	3 00
8251A	4 90
8253	5 60
8255A	4 50
8257	6 30
8259	4 70
8271	97 00
8272	30 00
8273	49 00
8274	44 00
8275	45 00
8276	24 00
8279	8 40
8282	8 40
8283	8 40
8284	10 40
8286	8 40
8287	8 40
8288	25 00
8289	32 00
8291A	43 00
8292	35 00
8293	25 80
Z80CPU	5 40
Z80ACPU	5 90
Z80BCPU	11 00
Z80PIO	4 40
Z80APIO	5 80
Z80SIO	12 70
Z80ASIO	16 00
Z80CTC	5 30
Z80ACTC	6 50
Z80DMA	15 50
Z80ADMA	18 00
8741A	36 00
8748 8	26 00
8749	55 00
8755A	35 00

VOLT REGS

LM309H	3 90
LM317HVK	7 50
LM337T	1 20
LM337HVK	12 00
LM337K	6 50
LM338K	8 00
LM350K	6 30
LM350T	4 50
LM396K	18 90
LM79L05	60
LM79L12	60
LM79L15	60
SH1605	15 00
UA317T	85
UA317K	2 60
UA309K	1 80
UA494	3 20
UA7805	65
UA7805K	1 65
UA7806	75
UA7808	65
UA7808K	1 65
UA7812	65
UA7812K	1 65
UA7815	65
UA7815K	1 65
UA7818	70
UA7818K	1 70
UA7824	65
UA7824K	1 70
UA78H05K	7 50
UA78H12K	9 20
UA78HGKC	9 80
UA78L05	35
UA78L12	35
UA78L15	35
UA78M05	60
UA78M12	60
UA78P05K	15 70
UA78540	2 80
UA7905	72
UA7905K	1 85
UA7908	72
UA7908K	1 85
UA7912	72
UA7912K	1 85
UA7915	72
UA7915K	1 85
UA79HGKC	16 00
UA79M05	65
UA79M12	65

OPTO

4N25	98
4N26	98
4N28	98
4N32	98
4N33	1 30
4N35	98
MCT6	1 40
MCT2	95
FND357	1 60
FND500	1 45
FND507	1 60
FND800	3 50
TIL31A	2 50
TIL81	2 00
BPW50	2 00
CQY89	60
MOC3020	2 20
MOC3021	2 60
MAN72A	1 25
MAN74A	1 25
FCD820C	90
FCD825C	90
FCD850C	1 20
FPT100B	1 30
MSM3914	8 50
MSM3916	8 50

LEDS

TLG123 SGS	
3mm GREEN	16
TLR123 SGS	
3mm RED	10
TLO123 SGS	
3mm YELLOW	16
TLG113 SGS	
5mm GREEN	16
TLR113 SGS	
5mm RED	10
TLO113 SGS	
5mm YELLOW	16
20160	
RECT RED	25
20162	
RECT GREEN	25
20164	
RECT YELLOW	25
FLS010	
5mm LED CLIP	04

DIODES

IN4148	03
IN914	03
IN4001	05
IN4002	05
IN4004	05
IN4007	08
IN5404	16
IN5408	18
OA47	44
DA90	18
OA202	88
OA636	90
P600G	
6A400V	36
BAW62	30
BA102	70
OA91	20
OA95	25
IN3492	
25A100V	1 50
IN3492R	
25A100V	1 50
IN5060	30

BRIDGES

VJ448	
10A400V	1 80
BR154	
15A400V	3 10
BR254	
25A400V	3 95
BR354	
35A400V	4 50
P04	
6A400V	1 25
RS204	
2A400V INLINE	80
SB204	
2A400V	75
W04	
1 5A400V	40

ZENERS

IN4733A	
5 1V 1 WATT	18
IN4734A	
5 6V 1 WATT	18
IN4736A	
6 8V 1 WATT	18
IN4740A	
10V 1 WATT	18
IN4742A	
12V 1 WATT	18
IN5349B	
12V 5 WATT	70
BZX61/C75	
75V 1 3 WATT	80

TRANSISTORS

AC126	70
AC127	60
AC128	88
AC187	58
AC188	1 10
AD149	1 90
AD161	1 70
AD162	1 70
AF127	98
BC107	30
BC107B	35
BC108	30
BC108C	35
BC109	30
BC109C	35
BC177	35
BC178	35
BC179	35
BC212	20
BC318	15
BC327	15
BC328	15
BC546	15
BC547	15
BC547C	16
BC548	15
BC548C	16
BC549	15
BC549C	16
BC550	15
BC556	15
BC557	15
BC557B	16
BC558	15
BC558B	16
BC559	15
BC559B	16
BC637	35
BC639	30
BC640	30
BCY70	40
BCY71	44
BD135	33
BD136	39
BD137	40
BD138	40
BD139	32
BD140	32
BD233	40
BD235	42
BD236	42
BD237	44
BD238	44
BD262	75
BD263	75
BD437	46
BD647	1 98
BD677	62
BD681	60
BD682	60
BDV64B	3 10
BDV65B	3 10
BDY96	3 50
BDY97	3 50
BF115	57
BF167	57
BF173	60
BF180	80
BF184	70
BF198	22
BF199	22
BF337	50
BF458	51
BF459	51
BF469	80
BF470	80
BF494	27
BFY50	53
BFY90	72
BU126	1 87
BU208	2 15
BU326A	1 92
BUX80	3 50
MFE121	1 40
MFE131	1 40
MJ413	3 40
MJ802	3 75
MJ1001	2 50
MJ15003	3 65
MJ15004	3 65
MJ2955	1 04
MJ4032	8 32
MJ4035	7 60
MJ4502	4 10
MJE340	75
MJE350	85
MJE251	1 25
MJE700	51
MJE800	51
MJE2955	1 92
MJE3055	1 76
MPSA05	19
MPSA06	19
MPSA12	19
MPSA14	19
MPSA42	19
MPSA56	19
MPSA92	19
MPF102	56
MPF103	79
MPF105	79
MRF237	3 90
MRF454	29 00
MRF475	4 50
MRF901	2 80
TIP31	40
TIP31A	45
TIP31B	54
TIP31C	62
TIP32	44
TIP32A	56
TIP32B	58
TIP32C	64
TIP41	66
TIP41A	70
TIP41B	74
TIP41C	76
TIP42	60
TIP42A	76
TIP42B	80
TIP42C	82
TIP111	68
TIP112	75
TIP116	77
TIP117	83
TIP120	66
TIP122	72
TIP125	77
TIP127	94
TIP2955	1 20
TIP3055	1 20
2N301	3 90
2N697	42
2N918	42
2N2219	42
2N2219A	48
2N2222	42
2N2222A	48
2N2369	42
2N2484	42
2N2646	96
2N2647	1 60
2N2894	36
2N2904	45
2N2905	45
2N2905A	49
2N2906	40
2N2907	42
2N2907A	49
2N3019	46
2N3053	46
2N3054	1 74
2N3055	89
2N3302	39
2N3440	80
2N3441	2 50
2N3442	2 30
2N3563	18
2N3564	18
2N3565	18
2N3566	18
2N3567	18
2N3568	18
2N3569	18
2N3638	18
2N3640	18
2N3641	18
2N3642	18
2N3643	18
2N3644	18
2N3646	18
2N3702	27
2N3704	25
2N3771	3 20
2N3772	3 60
2N3773	4 30
2N3819	60
2N3866	86
2N3904	20
2N3906	20
2N4032	46
2N4033	70
2N4036	49
2N4121	20
2N4236	1 30
2N4237	1 10
2N4250	19
2N4258	22
2N4355	19
2N4356	19
2N4360	50
2N4401	18
2N4402	18
2N4403	18
2N4416	1 40
2N4427	80
2N5088	18
2N5089	20
2N5179	1 20
2N5190	72
2N5191	74
2N5192	61
2N5193	61
2N5195	65
2N5210	19
2N5245	70
2N5303	3 65
2N5401	20
2N5457	55
2N5458	55
2N5459	60
2N5461	66
2N5485	55
2N5486	55
2N5590	16 00
2N5591	17 00
2N5770	19
2N5777	96
2N5873	1 35
2N5944	14 50
2N5946	19 50
2N5961	19
2N6027	55
2N6084	22 00
2N6121	62
2N6122	60
2N6123	52
2N6124	60
2N6125	66
2N6126	58
2N6129	1 20
2N6130	1 40
2N6131	1 50
2N6133	1 60
2N696	90
2N918	45
2SA683	70
2SC1017	2 60
2SC1061	70
2SC1096	72
2SC1106	4 80
2SC1226	95
2SC1306	1 50
2SC945A	25
2SD350A	2 25
2SJ49	6 20
2SK134	6 20
3N201	1 80

SCR & TRIACS

C103D	65
C106D	80
C122D	1 60
C122E	2 00
C230D	5 90
Q4010L4	1 90
Q4015L5	2 70
Q6010L5	3 20
Q6015L5	3 50
Q6025H	9 80
S4015L5	2 20
S4025H	8 20
SC141D	1 30
SC146D	1 65
SC151D	2 20
ST2	55
ST4	65

TANTALUM

1UF 35V	19
22UF/35V	19
33UF/35V	19
47UF/35V	19
1UF/35V	20
1 5UF/35V	20
2 2UF/35V	22
3 3UF/35V	23
4 7UF/35V	41
10UF/35V	55

ELECTRO PCB

1UF/50V	15
2 2UF/25V	15
4 7UF/25V	15
10UF/25V	15
33UF/25V	15
47UF/25V	15
100UF/25V	16
220UF 25V	20
330UF/25V	25
470UF 25V	35
1000UF/16V	40
1000UF/25V	50
2200UF 25V	85

ELECTRO AXIAL

47UF/63V	19
1UF/63V	19
2 2UF/63V	19
3 3UF/25V	19
4 7UF/25V	19
10UF/160V	25
10UF 16V	19
10UF/25V	19
10UF/63V	20
22UF/25V	20
22UF/63V	20
47UF/16V	19
47UF 25V	19
47UF/63V	20
100UF 25V	20
100UF/63V	35
220UF 16V	20
220UF 25V	25
220UF 63V	50
470UF 16V	39
470UF 25V	42
470UF/63V	65
1000UF 16V	45
1000UF 25V	52
1000UF 35V	75
2500UF 16V	88
2500UF/25V	98
2500UF 35V	1 60
2500UF 50V	1 98
4700UF 35V	2 50

ELECTRO METAL CAN

2500UF/80V	3 50
4000UF 75V	5 80
5600UF 40V	3 80
8000UF 75V	8 95

ELECTRO BIPOLAR

2 2UF 50V	35
4 7UF 50V	38
6 8UF 50V	39
10UF 50V	40
22UF 50V	42

GREENCAPS

001UF 100V	12
0015UF 100V	12
0022UF 100V	12
0033UF 100V	12
0039UF 100V	12
0047UF 100V	12
0056UF 100V	12
0068UF 100V	12
0082UF 100V	12
01UF 100V	12
015UF 100V	12
022UF 100V	12
033UF 100V	12
039UF 100V	12
047UF 100V	14
056UF 100V	14
068UF 100V	18
082UF 100V	18
1UF 100V	18
15UF 100V	18
22UF 100V	18
27UF 100V	22
33UF 100V	30
47UF 100V	34
1UF 250V	85
2 2UF 250V	1 25
3 3UF 250V	2 30
4 7UF 250V	2 80
6 8UF250V	4 40
10UF 250V	5 90

GREENCAPS HIGH VOLTAGE

01UF 630V	22
022UF 630V	24
033UF 630V	26
047UF 630V	30
1UF 630V	38
22UF 630V	45
33UF 630V	46
47UF 630V	50

CERAMIC

1 PF	08
1 5PF	08
2 2PF	08
2 7PF	08
3 3PF	08
3 9PF	08
4 7PF	08
5 6PF	08
6 8PF	08
8 2PF	08
10PF	08
12PF	08
15PF	08
18PF	08
22PF	08
27PF	08
33PF	08
39PF	08
47PF	08
56PF	08
68PF	08
82PF	08

STYROSEAL

56PF 630V	25
68PF 630V	25
82PF 630V	25
100PF 630V	25
120PF 630V	25
150PF 630V	25
180PF 630V	25
220PF 630V	25

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Books & Literature

Engineer's reference book

ELECTRONIC ENGINEER'S REFERENCE BOOK edited by F. F. Mazda. 5th Edition, published 1983 by Butterworth & Co (Publishers) Ltd, London UK. Hardcovers, 195 x 255mm, 640 pages, illustrated with countless diagrams. ISBN 0 408 00589 0. Price in Australia $140.

How does one do justice to such a large and well produced reference in just a few paragraphs? I certainly cannot. I take my hat off to the editor of this book for actually having the courage to go ahead with it, knowing that, by the time it is produced, some of it will already be out of date.

Consider the chapter on capacitors, for example. This is entitled, "Dielectric Materials and Components" and is written by G. W. Dummer, who must be one of the foremost writers in the world on this subject. In 12 pages he has produced a concise and readable summary on the major types of capacitor and, as such, it is very useable. But because of advancing technology, it makes no mention of the recent release of Farad-size capacitors which are now being produced in Japan.

But apart from the obvious disadvantage of a book which attempts to deal with a a moving target (ie, advancing technology), each section fulfills its aim well, within the average space of about 10 pages. And for those readers who have access to the previous edition, the fifth edition has been substantially revised and rewritten to the extent that 32 of the 62 chapters are completely new.

I am not about to list all the chapter headings but a partial list will give some idea of the breadth of coverage: Series & Transforms; Statistics; The Ionosphere; Magnetic Materials, Printed Circuits; Semiconductor Diodes; Linear Integrated Circuits, Semiconductor Memories; Microprocessors; Filters; Forced Commutated Power Circuits; Control Systems; Antennas & Arrays; Fibre Optic Communication; Videotape Recording and Medical Electronics.

If your company library can afford it, this reference certainly should be obtained. (LDS)

For the amateur and SW listener

HF ANTENNAS FOR ALL LOCATIONS by L. A. Moxon, G6XN. Published 1982 by the Radio Society of Great Britain. Hard covers, 190 x 252mm, 260 pages. Illustrated with many diagrams and photographs. ISBN 0 900612 57 6. Price in Australia $15.00.

Practical books on antennas are published rarely so this text from the RSGB is particularly welcome. It is intended mainly for the amateur radio operator and keen shortwave listener in that, as the title implies, it presents antennas for the shortwave bands.

The 19 chapters of the books are split into two sections with the first 10 being devoted to the principles of antenna operation while the remaining nine chapters are under the heading "Theory into practice". The latter section presents designs for single element antennas, horizontal and vertical beams, large arrays, mobile antennas and of interest to home unit dwellers, "invisible" or concealed antennas.

The presentation of the book is eminently practical and highly readable. Any person interested in the general subject of antennas will find it a most useful reference. Highly recommended. Our review copy came from Technical Book & Magazine Company Ltd, 295 Swanston Street, Melbourne. (LDS)

Small business computer programs

BASIC FOR BUSINESS by Douglas Hergert. Published by Sybex Inc, California, 1982. Soft covers, 178 x 227mm, 223 pages, illustrated with charts and tables. ISBN 0 89588 080 6. Price $17.95.

Intended for the businessman who wishes to write his own Basic programs (which must be a fairly small group), this book covers familiar ground. Example programs are provided for cost of goods analysis, income analysis and simple book-keeping to introduce the reader to the fundamental concepts of programming in Basic in a business environment.

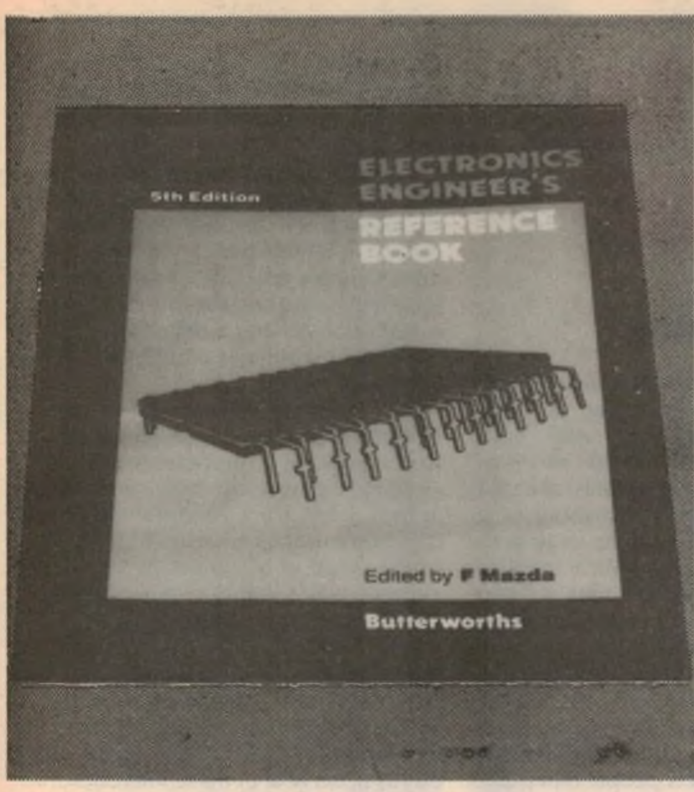
The emphasis throughout is on well-structured, modular programming techniques, and the author maintains that a properly written Basic program is as readable and understandable as a program in any language that supports structured techniques. His example programs however are not long enough or complex enough to illustrate his conclusion.

An unusual feature of the book is the discussion of some aspects of other programming languages, including Fortran, Cobol and Pascal in comparison with Basic. While sketchy the inclusion of this material is welcome as it avoids giving the impression that Basic is the only way to program a computer. Appendix B contains complete listings of programs in Cobol, Pascal and Fortran for invoices, sales reports and depreciation calculations respectively. Basic programs discussed throughout the book are intended to run on the Apple and TRS-80 machines.

The layout of the book follows the usual Sybex style, with a great deal of white space and programs highlighted by text boxes. Chapter headings include A First Look at BASIC, Beginning Concepts FOR Loops, Arrays, Subroutines and program structure and string handling, (seven chapters in all). Each chapter concludes with a series of exercises for the reader, with answers provided in Appendix A of the book.

"BASIC For Business" offers a readable, well-supported introduction to programming computers for some business applications. The emphasis is on more on

SEE PAGE 21 FOR JAYCAR ADDRESSES AND PHONE NUMBERS



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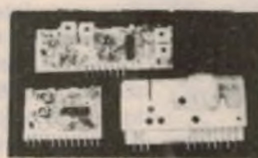

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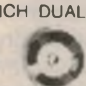

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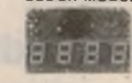

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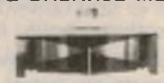

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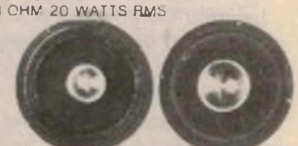

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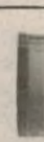

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Letters to the editor

Sunrise industries do need assistance

I refer to your editorial viewpoint in the June '83 edition "Sunrise Industries don't need tax concessions".

From the tone of this editorial one could easily conclude that somebody has left a virgin in charge of the most exquisite Bordello in town. However, on second reading (albeit after the high frequency components of my vision returned), I can almost see the look of impish delight as you tapped out this little gem. Let me then qualify for the "gotcha". I'll be the Guru that shouts for "Heisenberg" (of uncertainty fame).

As one involved in the electronics industry for over two decades, and as one who can lay claim to a modest amount of success in innovative and entrepreneurial activities, I find my impressions of what is required to produce success in such activities at variance with both those of yourself and current government practice.

Let me first deal with the substance of your editorial viewpoint, wherein you imply that the "artful dodger" is, and always will be, more than a match for our legislators and bureaucrats ("fiscal fiend"). Would you have us believe that such an inept "fiscal fiend" can be entrusted with the development of our national intellectual property resources?

Secondly, I suddenly find I do not fully understand what a "Sunrise Industry" is. You offer me two examples, the first Telectronics Pty Ltd, a company who over ten years ago had its "Sunrise" in a garage in the Sydney suburb of Chatswood; and secondly Applied Technology Pty Ltd, a company which must be admired more for entrepreneurial guts than innovative technology.

I would be amazed if a representative of either of these two companies would state publicly that his company would not have grown faster, made deeper market penetration, and have more mature products if access to considerably greater funding had been available.

My cry for "Heisenberg" in the opening paragraph is based on the fact that there is considerable uncertainty as to how to develop high technology industries. There are those amongst us who have done it, and those who have attempted and failed. As with most things the best lessons are learnt from the failures, but alas society looks to either the successful, or to academics who have neither tried nor failed, to light the way.

Crucial entrepreneurial skills are not learned. You cannot teach anybody how to smell the seeds of trouble, or how to manage hi-tech projects which seem to spend 90 percent of their time 95 percent complete. It is invariably the last little problem that runs a project out of money. It therefore takes a unique person to make the decision to cut the losses, or to pump in more money. Sadly, even an unlimited bankroll cannot guarantee success. It is people that make history, not money, and not necessarily people with money. It is, however, the latter that have the greatest chance in hitech ventures. The "Espie" report, I believe, should be examined by all for the purposes of comment and discussion. It is the first time such information has been encapsulated in such a compact form. We badly need to remove many of the gross inequities from the current "Industrial Research and Developments Grants" (IR&D) system. However, I will point out two major flaws that have been consistently pointed out to the IR&D board, and just as consistently ignored.

Firstly, the IR&D scheme both discriminates against and disadvantages non-academically qualified innovators. Secondly, the IR&D scheme discriminates against those without large sums of initial capital. Space precludes further detailed explanation of these issues. It suffices to say, however, that these two flaws on their own render the current IR&D act incapable of forming any useful tool for the solution of the real problems that attend industrial high technology corporate startups.

It should be evident that people, and the ideas of people, are just as surely a resource as the land. Nobody disputes the right of a government to foster good husbandry of the land, yet there are those amongst us who would dispute the right of a government to develop our second greatest resource – our people. It is an obligation upon any government to lay the foundations for the achievement of the maximum potential of all its country's resources. This includes land, stud animals, and innovators (there are approximately the same numbers of the latter two, but from an investor's point of view the animals are currently the best deal by far).

The Editor mistakenly implies that "export development grants" are a source of funding for "Sunrise Industries". To qualify for these grants you firstly need an exportable product, of some maturity (although to be fair, they do help toward foreign patents and intellectual property matters if such things are the produce of your company).

The export development grants scheme is designed to get companies into the exporting business. It pays for a significant portion of initial expenditure in trips, trade shows and the like. It also provides a bonus of a small percentage of the value of a company's increase in exports over certain periods of time.

This scheme is currently one of the most abused schemes I've ever seen. Its major beneficiaries are the so-called "export market development consultants" who charge grossly inflated fees for their uncertain services. The exporter then claims up to 80% of these fees back from the export market development grants board. Maybe it's good value if you are an exporter, but it looks as if the Editor's favourite "Sunrise Santa" is really the same inept "fiscal fiend" we saw above.

In conclusion I would ask the Editor what he thinks "artful dodgers" do with their ill-gotten gains. Perhaps he would be surprised to learn that a good deal of them are hard at work generating export dollars and jobs in the computer and electronics industry. If track records account for anything we should have less of the "fiscal fiend" and more of the "artful dodger", and maybe we should gently guide the "artful dodger" with a well designed capital gains tax, just to ensure that the starting up of companies with foreign acquisition in view is fairly low on the list of investment motives.

Anthony G. Furse,
Lane Cove, NSW.

A "thank you" from the caption centre

I am writing to thank you for the extensive coverage you extended to the Australian Caption Centre and its Supertext Subtitles service in the July 1983 issue of Electronics Australia.

The article by Philip Watson was very comprehensive. He had obviously undertaken considerable research and produced an item of interest to both the consumer and electronics engineer. Please extend our thanks to him.

Raymond Toms,
Manager Technical Services,
Australian Caption Centre
Sydney, NSW.

Aren't Scary Anymore" the book attempts to put the personal computer field in perspective, introducing the basic concepts in an understandable way and expanding on the fundamentals with chapters on computer applications in the home, school and business.

Some brief descriptions of various programs are provided in Chapter Two, "101 Things You Can Do with Your Computer Right Now", but this is not a programming textbook. Hardware and software are covered in a simple way, and a great deal of the book consists of information required by prospective purchasers of computers, including defining objectives, software availability, characteristics of video displays and keyboards and the availability of peripheral devices.

Chapter 10 is a survey of some of the currently available microcomputers and is right up to date, with sections on the IBM Personal Computer, the Commodore 64 and the DEC Rainbow 100. Portables are covered in detail, and each "mini-review" is organised to highlight physical characteristics such as video display format and keyboard, memory size and storage devices available, although the availability of software is also covered for each machine. This chapter would be a good starting point for anyone considering the purchase of a personal computer.

A glossary of terms and extensive index adds to the usefulness of the book.

Overall "Computers for Everybody" shows evidence of extensive research and a carefully thought-out approach. It is an excellent introduction to a sometimes confusing subject, at a good price.

Our review copy came direct from the publishers.

Word processing

INTRODUCTION TO WORDSTAR: by Arthur Naiman. Published by Sybex Inc, 1982. Soft covers, 179 x 228mm, 202 pages, illustrated with sketches and diagrams. ISBN 0 89588 077 6 Price $15.95.

WordStar, the popular word processing program from Micropro, is perhaps the closest approach yet to a standard for word processing on systems running CP/M, CP/M-86 and MS-DOS. If you've used it you either love it or hate it – it's a very powerful program, with many capabilities for editing and formatting text for printed output. All this power comes at a price, though – about six months learning how to use the system.

As the author of this book puts it "WordStar, Micropro's popular word processing program, like all of Micropro's software, is an impressive program but the manuals that explain it tend to be intimidating, repetitive and stuffy". While there is also a training manual supplied with the program, it is as much fun to read as any other "teach yourself typing" booklet.

This book aims to overcome those deficiencies and overall it is successful. In 13 chapters and seven appendices the author provides an introduction to word processing, an overview of the WordStar program and covers particular operations, in chapters arranged by function.

There are chapters on command menus, moving and deleting blocks of text, global searching of text files, searches, file handling, on-screen formatting and print commands. The Mailmerge and SpellStar auxiliaries to WordStar are also covered in separate chapters.

The text is clearly written and well laid-out, with examples of each operation highlighted in text boxes. Sketches and diagrams of simulated screens and key lay-outs enliven the text.

Whether you already use WordStar, have just started, or are contemplating purchasing the word processing program, this book will be an invaluable guide. Recommended.

Our review copy from ANZ Book Co, PO Box 459 Brookvale, NSW. (PV).

programming than business applications however and there is no mention of the use of "off-the-shelf" programs for word processing, data base management or spreadsheet calculations. The book could be useful for the newcomer.

Our review copy came direct from the distributors, ANZ Book Co Pty Ltd, PO Box 459, Brookvale, NSW, 2100.

Updated beginner's computer manual

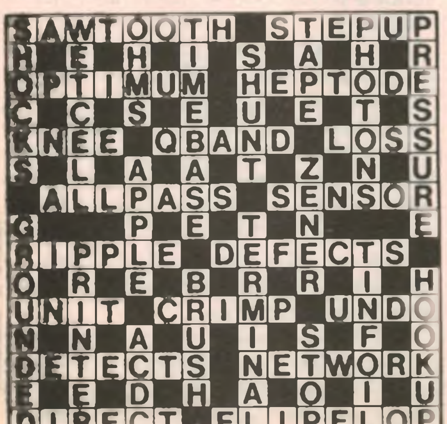
COMPUTERS FOR EVERYBODY: by Jerry Willis and Merl Miller. Published 1983 by ANZ Book Co Pty Ltd, Frenchs Forest NSW. Soft covers, 138 x 212mm, 262 pages. Illustrated with sketches and photographs, some in colour. ISBN 0 85552 126 0. Price $9.95.

This book was originally published in 1981 but has been completely revised and up-dated to reflect recent developments in the microcomputer marketplace. Intended for newcomers, it is a clear and comprehensive introduction to what computers can do and the issues involved in purchasing a personal computer.

From Chapter One, titled "Computers

Continued on page 122

Solution for August



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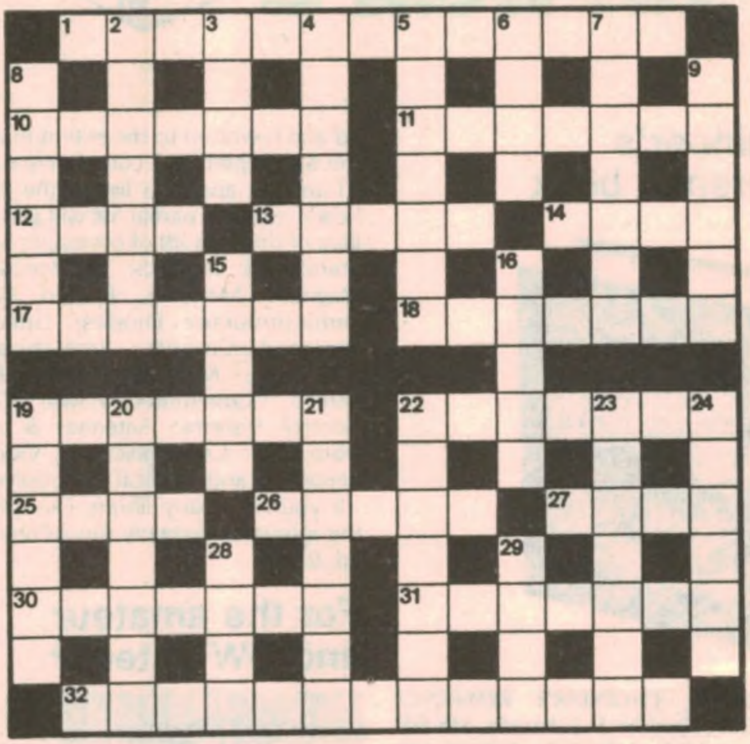

ACROSS

1. Desktop hardware. (13)
10. Effect of speed which changes frequency. (7)
11. Styli in Edison's day. (7)
12. Feature of a magnet. (4)
13. Sends out a radio signal. (5)
14. Operatic song. (4)
17. Natural substance once used for insulation. (7)
18. Critical summaries found in Electronics Australia. (7)
19. Donor impurity in semiconductors. (7)
22. Process of cell division. (7)
25. Musical work. (4)
26. Type of resin used to encapsulate electronic components. (5)
27. Feedback noise. (4)
30. Possible Lissajous figure. (7)
31. Surface growth on a crystal. (7)
32. Circuit which produces two different outputs from a single input. (5, 8)

DOWN

2. Term describing voltage at flashover. (7)
3. Instability in a TV picture. (4)
4. Material used in some phono cartridges. (7)
5. Check a program during operation. (7)
6. Nobel Prizewinner who discovered deuterium. (4)
7. Gain in volume. (7)
8. Modifies to make usable. (6)
9. Determines mineral content. (6)
15. Unrecorded cassette. (5)
16. Keep away from a vacuum? (5)
19. Electrodes. (6)
20. Type of suppressive circuit. (7)
21. Cryptographic codes commonly cracked by computers. (7)
22. Proponent of the electromagnetic wave theory. (7)
23. Important aspect of computer specification. (7)
24. Spreads out, in the manner of a lightning conductor. (6)
28. Chooses. (4)
29. Control on a television set. (4)

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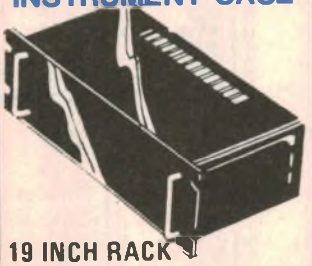

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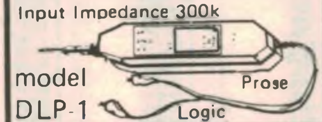

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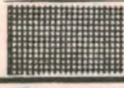

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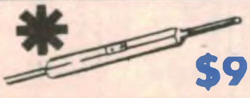

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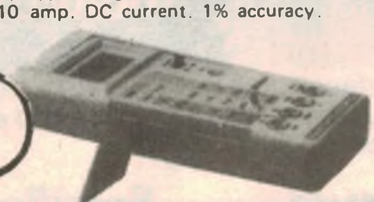

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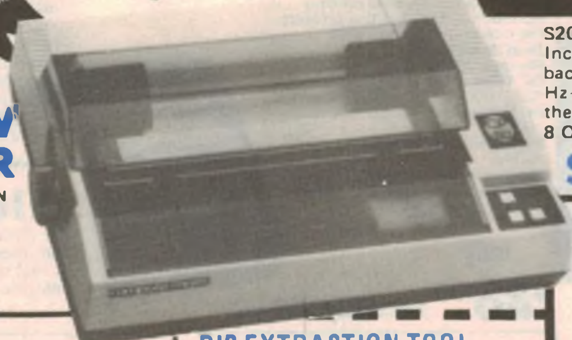

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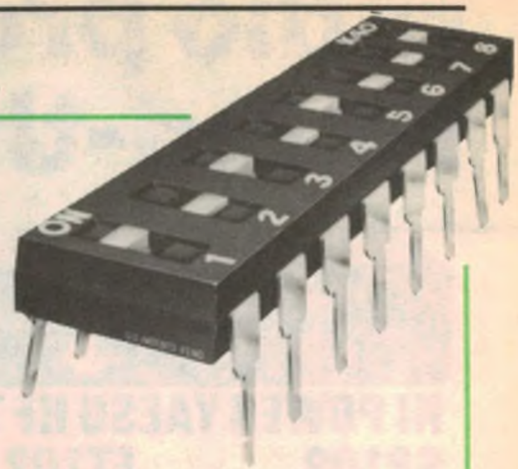
New Products...

Miniature DIP switch



Mayer Krieg & Co now has available a new miniature DIP switch made by American Research & Engineering Inc which is said to offer considerable advantages over conventional dual-in-line switch packages.

The new switch is the same size as a 16-pin integrated circuit avoiding air flow problems which can impede cooling in densely packed circuit boards and allowing the use of automatic insertion equipment during manufacture of PCBs using the new switches.

Each switch in the package consists of two gold-flashed sliding contacts for positive connection. The switch actuators are flush with the top of the cover to eliminate accidental movement of the switches (although this does mean that a small tool must be used to set the switch positions). The entire package is sealed, with a moulded-in lead frame and a moulded, ultrasonically welded cover.

Applications of the switches include computer and peripheral equipment and other devices which require programming switches.

For further information contact Mayer Krieg & Co, PO Box 310, Rydalmere, NSW, 2116. Phone (02) 684 1900.

Antistatic benches

Benches for electronics manufacturing and servicing are now being produced using a new static dissipating surface material made by 3M Australia. Integrated into a benchtop, the antistatic material is said to be able to reduce a static charge of 5000V to less than 100V in around 0.07 seconds, and resists most cleaning fluids, solvents and solder flux.

Duff Steel Industries, of Kirrawee, Sydney, recently introduced work benches incorporating the antistatic surfaces. Antistatic benches are currently available in 1.8 and 1.2 metre lengths with various combinations of cupboards, shelves, drawers, and electrical outlets.

For further information on the antistatic material contact 3M Australia, Pty Ltd, PO Box 99, Pymble, NSW, 2073. Phone (02) 498 9333.

LED indicators

Sloan of Switzerland has released a new range of panel indicator LED lamps, available in Australia through C&K Electronics (Australia) Pty Ltd. The Series 176 range provides a machined, chrome-plated body and bezel with a high dome plastic Fresnel lens. An "ultrabright" version is available, offering brightness levels of up to 500mcd.

Operating voltage is nominally 1.7 to 2V, although versions are also available with built-in resistors, to operate from 5V to 28V supplies.

Standard termination is by wire-wrap terminals or insulated stranded wire connections to customer specifications. Red, green and yellow LEDs are available, with lens in red, green, yellow, amber, white and clear. A panel mounting body and lens only version is also available, and is designated type 177.

For further information contact C&K Electronics (Australia) Pty Ltd, 15 Cowper St, Parramatta, NSW.

Motors for robots

Avtek Electronics has available a compact electric motor with an integral gearbox, said to be ideal for robots, toys and other mechanical projects. Although rated for 24V operation the motor gives good results with 12V, combining high torque with low power consumption. Price is $9.95.

Avtek has also been appointed a distributor for Daneva Australia Pty Ltd, providing a Sydney source of Daneva's data communications and computer peripheral products, including Western Digital components and boards and semiconductors from Sharp Corporation. For details contact Avtek, 119 York St, Sydney. NSW.

Amateur in Dick's

DON'T MISS
DICK'S GREATEST ADVENTURE

"THE EARTH BENEATH ME"
JOHN LAWS WORLD ON THE 0/10 NETWORK LATE SEPT. '83

SOLO AROUND THE WORLD BY HELICOPTER

He's made it

Just as we went to press, Dick Smith, VK2DIK, completed the final leg of his solo round-the-world helicopter flight by landing at the Bell Helicopter factory at Fort Worth, Texas USA.

During this long and gruelling flight, Dick captured several world records and 'firsts' including:

- First solo helicopter flight around the world.
- First single engined helicopter crossing of the Atlantic.
- First helicopter flight around the world not escorted by a fixed wing aircraft.

When asked 'Why?' Dick said that he wanted to find out how the early aviators felt. And despite the modern Bell Jetranger helicopter having all modern safety & navigational aids possible, Dick at times was absolutely exhausted from the sheer effort required in flying through strange areas.

Part of the problem was the fact that flying any aircraft into a foreign country requires the same amount of work - whether it is a tiny helicopter or a massive Jumbo. But on a Jumbo the tasks are shared. Dick did it all alone. Then, of course, there was the fatigue of flying over vast tracks of ocean.

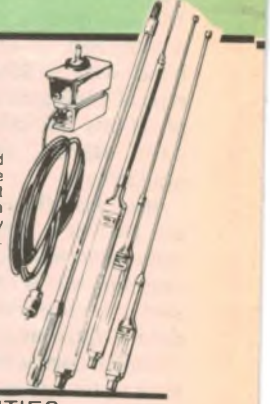
This is where amateur radio really came into its own.

"Every step of the way I was in contact with amateur operaters all over the world, I'd like to say a huge 'thank you' to all the amateurs who contacted me. And to those who didn't - but I knew were monitoring just in case, If ever it needed proving its worth to me, this flight was it. And yes, I will be QSLing all those contacted who send me cards. Just as soon as I get my feet back on the ground and have a chance to start answering the huge pile of mail that has built up since I left."

"Thank you amateurs."

Dick Smith

Yaesu Quality HF/VHF Mobile Antenna System



The fabulous Yaesu antenna system for HF and VHF. You buy the gutter mount base and 2 metre stub, and you're on air on 2m immediately. As you want the HF bands, simply buy that band resonator/antenna whip and screw it into the 2m stub. You only have to buy the whips for the bands you want. Go mobile with Yaesu.

RSM 2 - Gutter Mount	Cat D-4100	$29.95
RSE 2A Stub (2m antenna)	Cat D-4102	$12.95
RSL 145-6m/2m antenna	Cat D-4104	$32.50
RSL 3.5-80m antenna	Cat D-4110	$26.50
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Don't pay more! This amp does a better job and will cost you less. This is an all mode, high efficiency linear amplifier for 2 meters. 30 watts output with only 3 watts in. 13.8V DC supply makes it perfect for mobile use. Dual time constant for SSB or FM operation. Reverse polarity protection too. Works great with our FT-290R and FT-208B or any 2M transceiver with up to 3 watts out. The best value in Australia! Cat D-2546

30 WATTS

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TEN MEMORIES & SCAN FACILITIES
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COMPLETE WITH NICAD BATTERY & CHARGER

The FT-208 R transceiver brings a new flexibility to today's active 2m operator. An easy to read LCD display is coupled with a 4-bit microprocessor, bringing 10 memories and a scanning function. Because of LCD you get extra long battery life. Only with Yaesu can you get all the features at such an economical price. Cat D-2889

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A DC-DC convertor that simply plugs into your cigarette lighter. Gives 10.8V main power plus a separete charging current for the Ni-Cads. Use with FT208 & FT290. Cat D-2899

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You've dreamed of owning a transceiver like this. Now your dreams can come true!

Compare the Yaesu FT-ONE with other multi-band transceivers, you'll find it offers much, much more - and at a lower price! If you want a transceiver that commands the bands, you won't do better than buying your Yaesu from Dick Smith Electronics, Australia's leading factory-approved Yaesu agent with full back-up and service facilities. Cat D-2852

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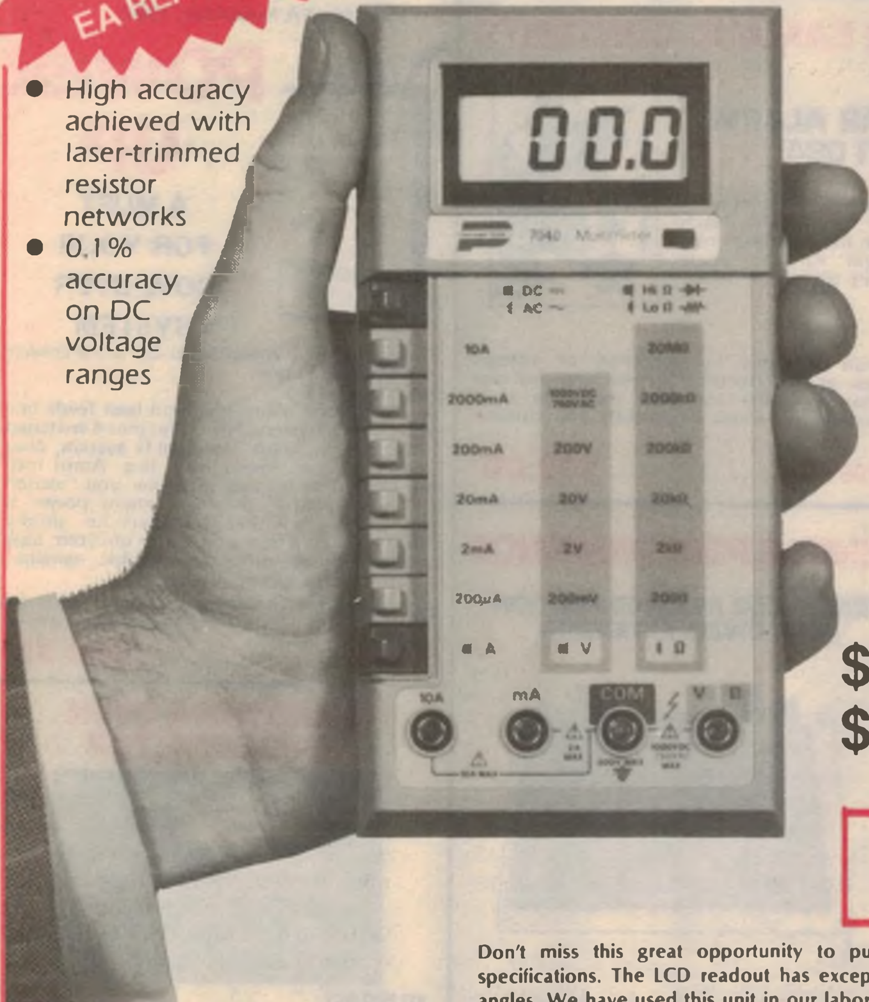
Model 7040



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Features:

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$99 tax paid
$87.75 tax excl.

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Don't miss this great opportunity to purchase a top-quality multimeter with excellent specifications. The LCD readout has exceptional clarity and is readable at extreme viewing angles. We have used this unit in our laboratory and we think it's a bargain!

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This offer is made by Parameters and is available only by ordering through "Electronics Australia". All mail orders will be despatched by certified post. Please allow up to 30 days for delivery.

Fill out the coupon at right. Cheques or postal orders should be made out to Parameters Pty Ltd. If not paying sales tax, please quote sales tax number or enclose a sales tax declaration on your letterhead. Send completed coupon to:

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Chippendale, NSW 2008

To Electronics Australia, PO Box 163, Chippendale 2008

Please send me ...... Parameters 7040 multimeter(s) at $99.00 each incl tax or $87.75 excl tax (includes post and packing).

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☐ **I enclose cheque/postal order to the value of $.......**

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(ETI JULY '82)

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☆ SEC Approved Transformer ☆ Screened Front-Panel ☆ Complete Kit as per ETI article, includes every last part.

K6265................only **$32.50**

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EA's BRILLIANT LABORATORY POWER SUPPLY

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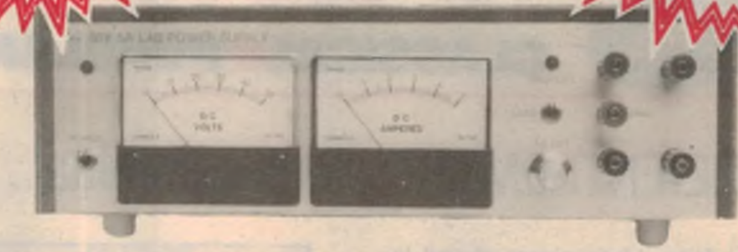

See Ea May and June 1983

Over the last 2 or 3 years we have had literally dozens of requests for a universal 5 amp Bench Power Supply Kit. Naturally we passed this on to the design team at Electronics Australia and at last it is now a reality. Just look at the design concept! A fully mains transformer isolated supply with a very clever "Switch Mode" low voltage circuit.
Most Importantly it's dead easy to build (ours worked first time!).

Specifications
Input 240V 50Hz
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GENUINE FIGARO GAS SENSOR

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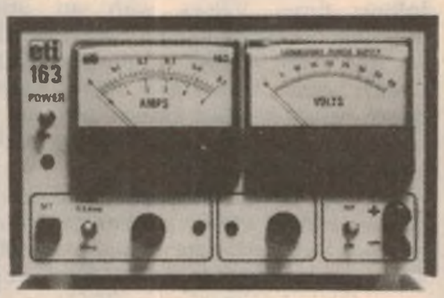

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Output voltage	0-40 V variable
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Output regulation	<50 mV at up to 2.5 A
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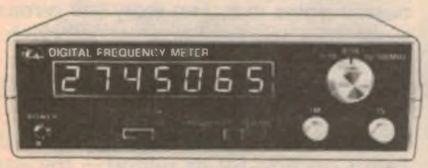

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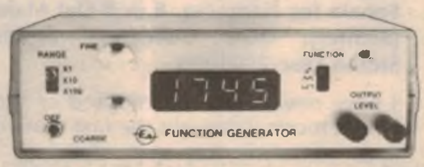

The most essential piece of test gear (second only to a good multimeter) on any hobbyist's bench is some kind of audio signal generator. This design utilizes the latest circuit techniques to produce stable, low distortion waveforms.

A truly versatile unit at a bargain price.

☆ 4 digit frequency readout (eliminates tiresome dial calibration) — typical accuracy ± 2% ☆ 3 overlapping ranges x1, x10, x100 ☆ 600 OHM Nominal Output — continuously variable 3MV — 2.5V P-P ☆ Distortion — sinewave : less than 0.7% @ 1KHz ☆ Linearity — triangle wave: better than 1% @ 1KHz ☆ Squarewave rise time — 6V/uz maximum output ☆ Amplitude stability — better than 0.1dB on all ranges.

With the exception of the display all components mount on a single PCB making this kit suitable for all constructors.

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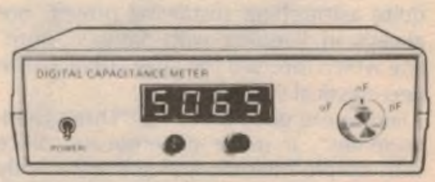

With Deluxe Instrument Case

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H0480 ABS Instrument Case.
This superb Test Instrument Kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 3 ranges.
Check values of unmarked capacitors, especially those little trimmers that are never coded.
Select precise values for filters and timing networks within ease.

☆ EXCLUSIVE TO ALTRONICS ☆

Each kit includes precision measured capacitors for accurate calibration of each range.

K2521..................... **$55.00**

REVIEWS OF RECENT Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

SATIE/ENTREMONT: "non-committal . . . note-perfect"

SATIE — Some piano pieces played by Philippe Entremont. CBS Stereo Digital Disc in an audiophile pressing. DCX37247.

The eccentric Erik Satie is nowadays remembered better for his caustic wisecracks than his music, though his early pieces, "Three Gymnopedies", are still heard fairly frequently.

He lived for most of his life in shabby rooms in a drab house in a down-at-heel neighbourhood. His early works show little originality but his later ones and his caustic comments had considerable influence on Les Six, that loose corporation of young French composers who dominated French music mostly in Paris during the 1920s.

He wrote much more piano music than I had imagined before I looked him up in the English Gramophone catalogue. This perhaps, because he earned his frugal living playing in a cheap Parisian cabaret. He wrote only little orchestral music, the best remembered being that to the ballet "Patade", in which he was the first composer to use a typewriter in the orchestra.

Entremont, in this recital of a selection of his piano music, runs the pieces almost chronologically. He starts with two little valses of quite staggering banality without a wrong note in either. Throughout the recital his piano has a quite astonishing sustaining power, not always in keeping with Saties's "pure" line which foretold the later arrival of the neo-classical school.

Entremont goes on to the "Three Gymnopedies", a more adventurous piece with simple melodic line and apparently unrelated accompaniments. He plays them dead pan, in strict time. They are really very slow valses; at any rate they're in ¾ time like so much of his other music. It is in these that the reverberative period of Entremont's piano is most noticeable.

It was about this time that Satie started to give his compositions ridiculous titles —"Pear-shaped Piece" (not included here). But it is exemplified by the three

next trifles named "On a Boat," "On a Lantern", and "On a Helmet". Then follow three Valses with an untranslateable title, each one sub-labelled His (or Her) "Taille" a portmanteau French word meaning I think, here figure, height or waist; His (or Her) spectacles or binoculars and, lastly, His (and again or Her) Legs!

The three fairly well known Grnossiennes come next, chiefly remembered for the fact that they were written without key or time signature or bar lines and with clown-like instructions written in over the notes. The next three pieces are not very good parodies, the first of Mozart, the second "Danse Maigre" — literally "thin dance" but he adds "in the manner of certain gentlemen". In the last, "Spain," he mocks, not very successfully, the Spanish-styled music of Chabrier, Debussy and Ravel. He continued to write clownish instructions over the notes.

The last of these little suites is titled "Before-After Thoughts". The recital ends with a First Nocturne (1919). I cannot attach the word "important" to any of these little efforts and it has always puzzled me that such an undistinguished composer should have had so much "claimed" influence on composers like Honneger, Milhaud and others although it can be easily spotted in the casual boulevardier jokings of Poulenc.

Entremont gives them all a scrupulously non committal performance, without a single wrong note anywhere. And that in itself is a little unusual. (J.R.)

PROKOFIEFF Piano Concerto: "spiky . . . noisy"

PROKOFIEFF — Piano Concerto No. 5 in G major, Sviatslav Richter (piano) and the Warsaw Philharmonic Orchestra conducted by Witold Rowicki. Visions Fugitives Nos. 3, 6 and 9 (Richter). Sonata for Piano No. 8 in B Flat Major (Richter). DGG Collectors' Series. Stereo Disc 2543 812.

I have never been enamoured of Prokofieff's music. I thought the first work of his to come my way quite delicious — the melodious and witty "Classical Symphony". Later his early piano concertos had many good points and what appeared to be a concise, logical new style. But, to my ear, he afterwards degenerated into mere spiky dissonances, driven along by a motoric percussive noise.

Also I fell for the attractive march from his opera, "The Love of Three Oranges". A few years ago I heard the complete opera in Madrid's tatty little opera house behind the Cortes building. It was presented by a Balkan company — I have forgotten which — and the march seemed to me to be the only attractive collection of notes in it. The story still remains a mystery to me because, although it was printed in the program, it was in Spanish, a language of which I know practically nothing.

The sound is particularly good in the Fifth Concerto for its period — the early '60s — and Richter deals masterfully with the villainously difficult solo piano part. The first movement is characteristically spiky, driven along with engine-like power and, I hardly need add, almost all stridently noisy. In its favour is the splendid discipline displayed by both soloist and the Warsaw Philharmonic under Rowicki.

The headings to the next two brief movements should convey their flavour to anyone accustomed to this composer's later style. They read "moderato

Reviews in this section are by Julian Russell (J.R.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

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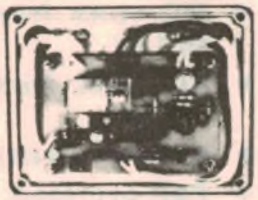

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K4330 .... **$29.50**

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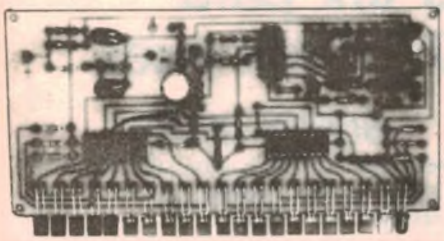
(SEE ETI AUGUST 1980)



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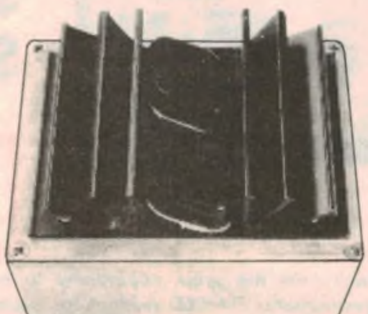

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ALTRONICS • SEE FREE PEN WATCH OFFER PAGE 49 • ALTRONICS

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FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 49 ben accentuato" and "Toccato – Allegro con Fuoco piu presto che la primo volta." Some relief is provided by a quiet larghetto – relief from what I consider otherwise as nothing but a noisy nuisance.

Three Visions Fugitives, Nos. 3, 6, and 9 seem deliberately to avoid anything in the way of an attractive progression, except the more lyrical Third, and one regrets the waste of Richter's illustrious technique on such tuneless sound. This side of the disc put me in such a bad mood that I couldn't bring myself to play the B Flat Major Sonata on the reverse till some other time. I haven't played it yet and look forward with some discomfort to a promised recording of the complete non-opera "War and Peace" which, it may be recalled, was misused to open the Sydney Opera House. (J.R.)

POPULAR CONCERTOS
"exquisite performance"

MOZART – Piano Concertos Nos .23, in A major K.488 and 27 in B flat major, K.595. Vkadimir Ashkenazy (piano) with the Philharmonia Orchestra conducted from the piano by Ashkenazy. Decca digital Disc SXDL 7530.

Here are two exquisite performances of what are probably Mozart's two most popular piano concertos. After having said that what is there to add? The very first bar proclaim the sumptuous sound of this digital recording. But care must be taken to adjust your volume control so that the entire wide range can be taken

in comfortably. This is particularly important in the two slow movements, where tone and treatment differ so widely from all the rest of the works that you might well be entering a new dimension.

Confining myself for a moment to the A major, Ashkenazy has been accused in some quarters of neglecting to decorate the last notes of the slow movement. I think otherwise. They do not sound the slightest bit bare. Indeed, under Ashkenazy's fingers the single notes fall so beautifully that I stopped breathing for fear I might miss a single sound – a rare experience at my age!

Everywhere the nuancing is perfectly handled, even though the soloist is conducting the accompanying orchestra from his piano stool. The first movement of both works is beautifully fluent, the A major sunny but still serene.

The finale of the A major is gay, that of the B flat joyous, almost jaunty. Everywhere in both works solo and accompaniment blend superbly. The slow movement of the B flat is extra sumptuous in tone. Decorations by the soloist are modest throughout. Ashkenazy never intrudes. My advice? Don't on any account miss this lovely disc. (J.R.)

BEETHOVEN SYMPHONY No 6
"could find wide acceptance"

BEETHOVEN – Symphony No. 6, "Pastorale". The Y Chamber Symphony Orchestra of New York, conducted by Gerard Schwartz. Digitally mastered stereo, DMS Delos D/DMS 3017. [From P.C. Stereo Pty Ltd, P.O. Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612].

Gerard Schwartz, the founding musical director and principal Conductor of the Y Chamber Symphony Orchestra of New York, makes no apology in his notes about presenting this symphony with a smaller than usual orchestra. On the contrary, he maintains that the Beethoven First, Second, Fourth, Sixth and Eighth symphonies "work" particularly well with an orchestra of between 39 and 42 players.

Perhaps it is significant that Delos have chosen this performance, along with the Beethoven Symphony No. 1 (Gerard Schwartz and the Los Angeles Chamber Orchestra) for inclusion in their first release of 15 Compact Discs for the World hifi market.

Historically, there is some argument as to whether the No. 6 "pastorale" symphony was composed in 1907 or 1908, but it was at a time when Beethoven's natural love of the woods was being heightened by a progressive loss of hearing and the embarrassment it tended to cause him in social situations. The Pastorale Symphony had its first performance on December 22, 1808, at a concert in the Royal Imperial Private Theatre-An-Der-Wien, Vienna.

Without, at this stage, having had an opportunity to hear the CD version, this new digitally mastered analog pressing leaves little to complain about. The quality is very clean and well balanced, the surface noise quite neligible and the sound texture agreeably transparent – an obvious benefit of a smaller orchestra. But, in no sense, should transparent be construed as a euphemism for "thin". That it certainly isn't.

There is a prevailing mood of relaxation in the first movement which, in English, can be titled "Awakening of Cheerful Feelings When Arriving in the Country". It sounds quite leisurely, although the 10' 10" which is occupies in this reading is relatively expeditious.

The second movement "Scene by the Brook" (12' 25") continues the mood of relaxation, as the composer lingers by the mountain stream, translating into sound what only his eyes can adequately appreciate.

On side two, movement three (5' 06") is in rather different mood, being inspired in part by Austrian tavern bands, which intrigued the composer not a little: "Merry Gathering of the Country Folk".

This is followed by an even shorter fourth movement "Thunderstorm" (3' 46"). I can't image Telarc digital letting this one get by without somehow turning it into yet another sonic drama but that is not the course chosen by Schwartz on Delos. Small or not, the orchestra gives it plenty of weight but it is a symbolic storm, not a cataclysm; the thunder, lightning and rain, pass as naturally as they came and lead to the final movement (10' 01"): "Shepherd's Song; Happy and thankful feelings after the storm."

As noted earlier, the sound is very clean, as also is the pressing itself but I should mention one thing: the dynamic range is very wide and, for proper enjoyment of the performance, you will need a quiet listening room to follow the softest passages into the remote stillness of the countryside. Either that, or the loud passages could reach embarrassing levels. In short, a recording that could find wide acceptance sonically and musically. (W.N.W.)

SIBELIUS – Symphony No. 2 in D Major. Toronto Symphony Orchestra conducted by Andrew Davis. CBS Masterworks Digital Disc D37801.

Sibelius is at present suffering from the neglect that usually follows for a few years the death of a great composer. For Sibelius was indubitably great. During his lifetime he completely changed the form of the classical and romantic symphony.

It was not a cosmetic alteration to the old but something entirely new. Before

Sibelius, symphonic form – based on first movement form – consisted of stating a theme, or musical phrase, then going on to develop it through various changes throughout the movement. Sibelius reversed the process after his first symphony. The first movement of the Second Symphony, under review, consists of short phrases made to combine into a "grand theme" at the end of the movement. The other three movements are conventional, by the way.

It was not until the great, if short, Fourth Symphony that he finally settled all his problems.

The Second Symphony, written in genial Italian surroundings, has none of the sternness of his later works. Many of them, according to the late Constant Lambert, suggested an unpeopled landscape. In a beautifully clear digital recording, it is admirably played by the Toronto Symphony Orchestra conducted by Andrew (not Colin) Davis.

A note on the record sleeve states that the recording was made "with the financial assistance of the Toronto Symphony Board of Directors and the Toronto Symphony Women's Committee." Judging by this one disc it should not have been necessary. The Toronto play well enough to provide excellent recordings for a major company without outside subsidy. They have certainly improved immensely since I heard them at the Commonwealth Music Festival in London a few years ago when they gave a very brash account of the Symphonie Fantastique of Berlioz under a Japanese conductor, I think Ozawa.

All the detail is comfortably audible in this excellent production and the orchestral balance is always scrupulously maintained. Moreover, Davis shows a perfect understanding of Sibelian style. Sibelius forsakes his geniality for a while in the second movement with mysterious pizzicatos like tiptoeing through a deserted graveyard in search of a tomb. Otherwise, its form is conventional. Davis makes good allowances for silence and handles his band with true Sibelius discipline.

The third movement starts with a sudden change in dynamics at a fleet pace. This is interrupted by a lyrical trio and the work finishes with a briskly presented Finale. Altogether a most impressive exercise and worth a place on any Sibelius admirer's shelf. (J.R.)

★ ★ ★

HOLLYWOOD SINGS. Twenty hits by stars of the silver screen. EMI Mono, EME-180. Now released through the World Record Club as R-10850.

This is an album of American movie history, if ever there was one. Comprising 20 tracks in all, it carries the voices of actors and actresses who were in the spotlight in the 1928/31 era, when films made their historic transition from silent to sound.

Glancing down the track list, one can spot names like Bing Crosby, Al Jolson,

"RELAXING MUSIC"

SONGS OF THE SOUTHERN CROSS. James Galway, flute, with the Sydney Symphony Orchestra conducted by David Measham. Stereo, originally released as RCA VRL1 7371. Now distributed by the World Record Club as R-093-98.

According to the jacket notes, the items on this album were recorded at the Sydney Opera House in 1979, during James Galway's tour for the ABC in that year. But, while it has been around for long enough to have been re-released through the WRC, don't discount it on that score. It makes very pleasant listening indeed.

The title "Songs of the Southern Cross" simply signifies some kind of link to Australia/New Zealand, even one as tenuous as the contribution which "The Carnival is Over" made to the worldwide acceptance of the Seekers. But here's the complete list, each item covered by a brief explanation on the Jacket:

Waiata Poi – I Started a Joke – Jamaican Rumba – 2000 Weeks – I Know Now – Waltzing Matilda – Molly on the Shore – The Carnival is Over – The Silver Stars Are in the Sky – The Long White Cloud – Thredbo Suite – "Rush" Theme.

Considerable imagination has gone into the various arrangements and, as usual, Galway's technique on the flute is superb. Add to that a technical quality which catches one's attention in the opening phrases and lives up to that promise right to the end.

As an album of simple, tuneful, relaxing music, this would take a lot of beating. (W.N.W.)

Records & Tapes — continued

Marlene Dietrich, James Stewart, Schnozzle Durante, Gloria Swanson, Bojangles Robinson, Janet Gaynor, Rudolph Valentino and Charles King. On side 2 is a further batch of film veterans.

Compiled by Kevin Daly from his own and other collections, the recordings are mainly transcriptions from the original sound tracks, although some come from 78rpm discs that were current at the time. Detailed notes list the source and date of each recording and comment on the background of the star and/or film. It certainly had the potential to stir memories that can reach back that far.

But, if nostalgia leads you to buy the record, your nostalgia had better be prepared for a bit of a bump. The heroes and heroines of 1928 sound a pretty odd lot through the ears of 1983. Perhaps it isn't surprising: up until that time, their task was to look the part; suddenly they had to start talking and, if they could warble a recognisable tune as well, that was a bonus.

But dismay! The demure, desirable Janet Gaynor sings like a sub-teen kewpie. And, horrors! The voice of Rudolph Valentino, transcribed from a 1923 Brunswick disc, reveals why he was so fortunate to have missed out on the talkies! Amongst the few who come across well are people like Harry Richman and Lawrence Tibbett, who were singers first and actors second.

As for the sound quality of the recordings, it is quite dull, partly because of the age of the source material and partly, I suspect, because filtering has imposed a "mellow" uniformity on the sound. You may be able to enhance it a bit by adjusting your bass and treble controls on a track-to-track basis. (W.N.W.)

* * *

JULIAN BREAM Plays Granados and Albeniz. Music of Spain Vol 5. RCA Red Seal digital stereo ARC1-4378.

This solo recital was recorded in Wardour Chapel, Dorset, England during June and July 1982. According to a jacket note it was recorded using a Mitsubishi MX-80 digital system and Neumann SM-69 microphones. The result is a very intimate, close-up recording which not only catches the sharp transients of the plucked strings but also the incidental finger noises.

Side one is devoted to the music of Granados, transcribed by Julian Bream: Dedicatoria (from Cuentos para la Juventad) – La Maja de Goya (Tonadilla) – Danza Espanola No. 4 (Villanesca) – Valses Poeticos – Danza Espanola No. 5. Playing time is a generous 30 minutes.

On side two are selections from Albeniz, also transcribed by Julian Bream: Mallorca, Op 202 – Suite Espanola Op 47: Cataluna, Granada, Sevilla, Cadiz – Cordoba (Cantos de Espana. Op 323, No. 4). Playing time on this side is 32 minutes.

Without professing any special knowledge of Spanish music, I couldn't help but feel that Bream's approach to Granados on side one was a trifle hesitant to begin with, then somewhat clinical before he entered into the spirit of it. Albeniz, on side 2, seems consistently more spontaneous. At least, that's the way it appeared to me.

Basically it's an album intended for students of the classical guitar and for listeners whose interests lie in that direction. But, for the non-expert, it's beautifully recorded and very pleasant listening and – dare I suggest it – delightful as subdued background music. (W.N.W.).

Pleasant, relaxed listening . . .

THIS IS DIGITAL RECORDING. Orchestral with Manuel and Franck Pourcel. Digitally mastered stereo, originally from EMI as EMC-2718, now released through World Record Club as R-09868.

Dated 1979, this "Studio 2" release would scarcely be selected, in 1983, as an example of modern, digitally sourced recording; many others have been released in the meantime, with digital mastering virtually established as normal and routine.

This is not to say that the recording is poor, even if the strings are a trifle edgy. It's just that the title "This is Digital" is no longer appropriate as a reason to purchase. That would depend on the contents, which some may find very much to their liking.

Side 1 is provided by Manuel and an orchestra which is not identified: El Ranch Grande – Yellow Bird – Ob-La-Di, Ob-La-Da – Eso Es El Amor – Barcarolle (from "Tales of Hoffman") – Don Vallero, It Was Nice To See You.

Side 2 features Franck Pourcel and the National Philharmonic Orchestra presenting: Carmen Overture (Bizet) – Tango (Albeniz) – Ritual Fire Dance (De Falla) – Intermezz from "Cavalleria Rusticana" (Mascagni).

Recorded originally at EMI'S Abbey Road Studios, the mood overall is pleasant and relaxed, without ostentation. Total playing time is about 30 minutes. (W.N.W.)

KEEPING FIT

AEROBIC GLOW, Fitness in Action, featuring Vickie Hanson, music for aerobic exercises, with superimposed calls. Stereo, Dayspring DST-4111. [From World Records Aust, 18-26 Canterbury Road, Heathmont, Vic 3135, Phone (03) 729 3777.]

This is the second such album I have had in recent times, which would seem to suggest a "get fit" wave among young American Christians.

Supplied with the album is an illustrated booklet, which explains how to monitor your heart rate to ensure that the objective is being attained without harmful stress.

It listed the 12 music tracks and the exercise movements which are called for in each – an average of about eight per track. The exercises are identified in alphabetical order on page three and illustrated on the following pages. In all there are 63 of them, which accounts for my bewilderment when played through the first side and heard Vicki Hanson calling out all these strange names: Jumping Jack, Pretzel, Pike Over, Star-knee Lifts, Floor Sweep, Jog Claps and so on.

By the time you got all those right, your memory would have had a workout, along with the rest of your body!

The music tracks are from Popular World group albums, carrying a Christian message but, of course, selected for their appropriate and strong rhythms. They serve the purpose well and the sound quality is excellent but the voice-over insructions make them suitable only for the intended purpose.

I guess that the album could be used for individual exercises but the clear assumption in the instruction book is that it will be used by women organised into groups to suit their own convenience. Playing straight through the album provides for seven minutes of warm-up exercises, 20 minutes of more strenuous activity and six and a half minutes of cool-down routines.

So there it is, ladies: the next move is up to you! (W.W.W.)

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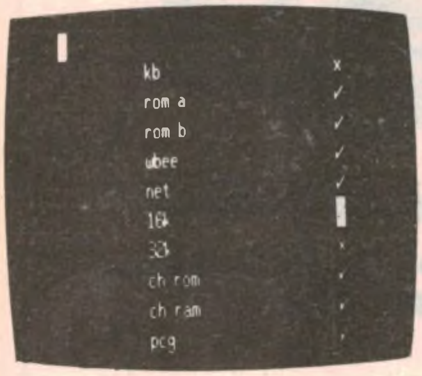

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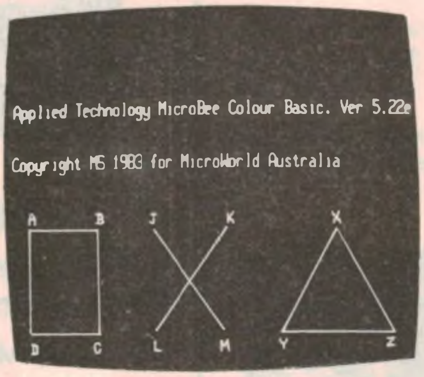

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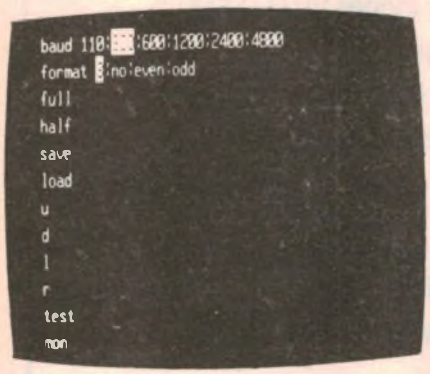

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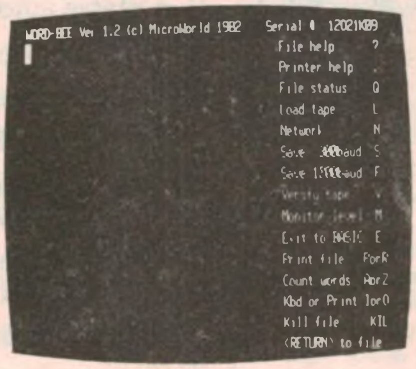

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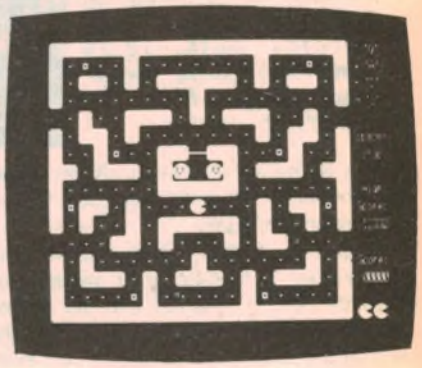

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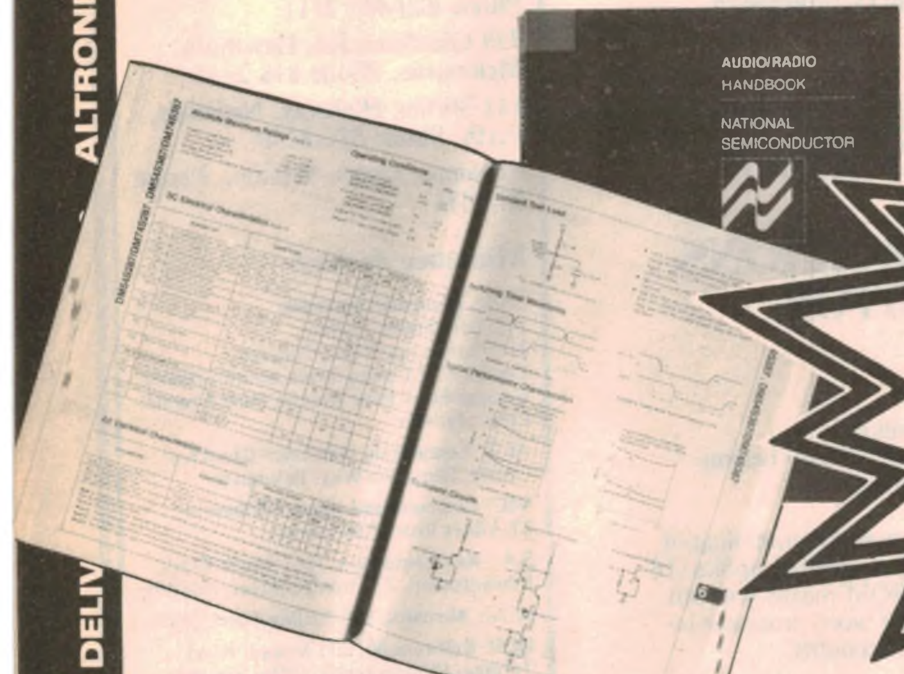

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While developing this state-of-the-art technology, National met the problems of industry standardization by proposing and utilizing new terminology and symbols to make all memory data sheets consistent. Hence, a cohesive, 464-page databook that includes selection guides, diagrams, and test characteristics for RAMs, EPROMs, MOS ROMs, and magnetic bubble memories.

B1025.......(464 pages)....... $9.95

Shortwave Scene

by Arthur Cushen, MBE

English identification from Latin American stations

For the new shortwave listener Latin American station identification is difficult when announcements are in Spanish, Portuguese, or a local dialect. The recent introduction of English identification by some stations will help the new listener.

Latin American stations are generally broadcasting to a local audience, and seldom announce in English, but two stations have recently added English identification. The new Costa Rican station, Radio Impacto on 6150kHz, has been heard with an English announcement at 0800UTC which states; "Radio Impact Costa Rica's new radio station can be heard on 6150kHz in the 49-metre band, we would be delighted to receive listeners' reports on the quality of our radio signal abroad. Write to us at Radio Impact, Box 497, San Pedro Costa Rica". In the Spanish announcement the station gives its location as San Jose but the English announcements give the address as San Pedro, which is about 20km from San Jose.

A Venezuelan station with an English announcement is Radio Tachira on 4830kHz heard opening at 0900UTC. Following the Venezuelan national anthem and Spanish announcements, this announcement has been heard; "This is Radio Tachira celebrating the 300 years and the birthday of the man who gave us our freedom, Simon Bolivar. Station YVOA 1000kHz medium-wave serving the metropolitan area of San Cristobal, and YVOB 4380kHz (actually 4830kHz) international band of 60 metres to Venezuela and all the world from San Cristobal, capital of the Tachira state in Venezuela, South America." This station provides very good reception during the first 30 minutes of their transmission and these two stations with English announcements should help the newcomer more easily identify Spanish speaking broadcasters.

TESTS FROM GABON

The announcement by Radio Japan that they intend to use relay bases in Europe, Africa, South East Asia, and Central America has been followed by tests from Africa No. 1, at Moyabi in Gabon. This was the first test of a series, and the transmissions were well received in the South Pacific area when using 15405kHz. The test transmission was at 0500-0530UTC and consisted of recorded music with a six language announcement after each musical item. The announcement in English was; "This is International Transmission Centre at Moyabi Republic of Gabon Africa." A similar announcement was given in Japanese, French, German, Spanish, and Afrikaans. The test transmissions also used frequencies beamed to Europe: 0700-0730 on 17825; 1000-1030 on 15445; and 1725-1755 on 21485kHz.

NEW SCHEDULES

AUSTRALIA: VL2UV, University of New South Wales, operating on 1692kHz now broadcasts daily Monday-Friday 0845-1100UTC. The power is 500W, and a repeater station which operated on 1720kHz serving the eastern suburbs of Sydney has recently been withdrawn.

PERU: Radio Huanta 2000 operating on 4755kHz now opens shortly before 0900UTC. In a verification letter the station advises that they have a second transmitter using the slogan Radio Cobriza 2000 on 4925kHz with a power of 500W.

PHILIPPINES: FEBC Manila has been heard using 11850kHz with news in English at 0900UTC. This frequency has not been announced, but better reception is observed on 11890kHz with the same program beamed to Australia. The frequency of 11890kHz is actually in operation 0500-1000UTC, with 21515 at 2300-1000UTC beamed to eastern Australia.

NEW ZEALAND: The Broadcasting Corporation of New Zealand advises that the External Service of Radio New Zealand will use only two frequencies from October 29, when New Zealand moves to daylight time. The transmissions will be at 1700-1115UTC on 15485 and 17705kHz.

UNITED ARAB EMIRATES: Dubai has several transmissions in English which are now on new frequencies, the broadcast 0330-0400 is on 11730, 15430 and 17775kHz; and from 0530-0600 the frequencies 17775, 17830 and 21700kHz are used. A later transmission in English, 1015-1045, is on 17775, 21655 and 21695, and on Friday, Saturday and Sunday is extended to 1100UTC.

CALLING NEW ZEALAND

Radio Monitors International, the weekly program for short-wave listeners, broadcast over the facilities of the Sri Lanka Broadcasting Corporation, is to devote the Sunday, October 23 program to a special feature on New Zealand. The broadcast is heard at 1100UTC for 30 minutes on 11835, 15120 and 17850kHz.

The "Calling New Zealand" feature will include a contribution from Wally Singleton of the New Zealand DX Radio Association, looking back on their 50 years of service to radio listeners, while Arthur Cushen will look at the activities of the New Zealand Radio DX League and the umbrella organisation, the South Pacific Association of Radio Clubs. The "Calling New Zealand" feature will be put together in the RMI studios in Poona, India, by Adrian Peterson.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

Five new computers from Tandy Electronics

Tandy's Micro Color Computer, the Model 10, offers colour computer power for $199.95 and will run most 4k TRS-80 Color Computer programs.

From their recently opened headquarters at Mt Druitt, NSW, Tandy Corporation has launched a range of new products, with releases of computers priced from $99 to $7000 plus an array of software for new and existing machines.

Lowest cost new model is the PC-4 "pocket computer" ($99.95), a compact handheld machine with features similar to earlier, higher-priced "handhelds". The PC-4 measures just 16.5 × 7 × 1cm (W × D × H) and includes a 53-key alphabetic keyboard plus a 10-key numeric pad. Programs are displayed on a 12 character liquid crystal display which can scroll horizontally to display lines of up to 62 characters.

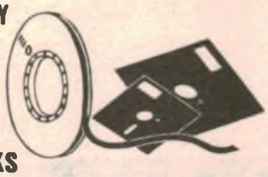
The PC-4 is programmed in Basic, with Edit and Debug modes provided to assist the development of software. Up to ten programs can be maintained in memory at any one time and called up by a single key-press. Power is provided by two lithium batteries (not included in the price of the machine). Peripherals available so far include a 1K memory expansion module, cassette interface and a 20 character per line thermal printer.

The Tandy MC-10, the second new release, should make quite a dent in the "under-$200" computer market. The "Micro Color Model MC-10" is aimed squarely at first time computer buyers and will run most of the programs of Tandy's 4K TRS-80 Color Computer – at half price.

Dimensions of the MC-10 are 20 × 18 × 5cm (W × D × H) and it comes with a 48-key pushbutton-style keyboard (including a space-bar) and a built-in RF modulator for connection to any colour television set. The circuitry is based on the Motorola 6803 mnicroprocessor and the 6847 Video Display Generator chip, with 4K of programmable memory expandable to 20K by means of an external RAM module. A cassette interface and serial port are standard.

Text and "chunky graphics" can be displayed in eight colours on a 32 × 16

continued on p.140



Five new computers . . .

from page 138

line screen and a sound generator is built-in, making the MC-10 well suited for games, self education and hobbyist use. Best news of all is the price, $199.95.

Mentioned briefly in this column last month, the Tandy Model 100 was also officially launched at the new headquarters. Billed as a "Micro Executive Workstation", the model 100 features a full-size typewriter keyboard and an eight line LCD screen and comes with software in ROM for a range of business tasks.

Five programs are provided, called up from a menu of functions. A TEXT program allows the Model 100 to be used as a word processor, storing information in a battery-powered memory which can be expanded to 32K. SCHEDL, also included, serves as a memo file, enabling the user to locate and display dates, times, appointments and any other information recalled from a data file.

The ADDRESS program is more specialised, with features that allow easy access to names, telephone numbers and addresses stored in the computer's programmable memory.

As might be expected, the built-in modem of the US machines has not been included in the Australian version. Instead there is an RS232C serial intrface for connection of an external modem, although the TELCOM program has been retained, allowing communication with a host computer over the phone lines.

The fifth "program" is a full-featured Basic interpreter so the user can write his or her own software. User programs can take advantage of the model 100's dot-by-dot graphics, programmable function keys and a 10-key section of the keyboard which can be defined as a numeric pad.

Measuring 30 × 21 × 5cm and weighing 1.8kg, the model 100 can be powered by four "AA" batteries for approximately 20 hours of operation or by an optional AC adapter. Built-in Nicad batteries maintain the contents of memory for up to 30 days even with the power switched off.

The most disappointing aspect of the model 100 is the price. An 8K version of the portable will cost $1099 and a 24K machine is priced at $1399. Either version can be expanded to a maximum of 32K of RAM with add-on 8K modules available at $169.95 each, plus installation costs.

Concentration on portables and the low end of the market has not hampered Tandy's efforts in the small business microcomputer field, as demonstrated by the release of two new desktop machines, the Model 4 and the Model 12.

The Model 4 is available in both 16K cassette-based versions and 64K disk versions, with one or two 13cm minifloppy drives built into the cabinet. The system can run existing TRS-80 Model III software or, with disks, programs under the new TRSDOS, LDOS and CP/M Plus operating systems. CP/M Plus and CBasic software specifically for the new machine "will be available shortly" says Tandy.

Features of the disk-based system include a 70-key typewriter keyboard and a 12-key numeric pad, 4MHz Z80A processor with 64K of RAM, parallel printer port and an 80 column by 24 line screen display. Main memory can be expanded to 128K bytes, and the new TRSDOS 6.0 has a "memory disk" feature which creates a fast simulated disk drive in unused RAM.

Prices start at $1799 for a 16K model, with the dual disk 64K machine at $3299.

Also newly released, the model 12 is intended for business applications requiring more extensive disk storage. The Model 12 features a Z-80A microprocessor, direct memory access and interrupt driven operation for faster through-put. 80K of RAM is standard, with one or two 20cm disk drives, each providing 1.25MB of storage (unformatted).

Also newly announced were the adoption by Tandy of Datapoint's "Arcnet" computer local area networking scheme, an agreement with Digital Research to allow Tandy to distribute the latest CP/M Plus version 3.0 and the release of Microsoft's "Xenix" operating system for the Model 16 computer.

As Tandy repeatedly insist, it is a retailer, and in the computer business to make money. The company professes to be unconcerned about latest survey results which give Tandy an 8% share of the microcomputer market, down from 25% a few years ago. With 14 different computer models, covering the full range of the marketplace and mostly produced "in house", Tandy Corporation is in a very good position to continue making money.

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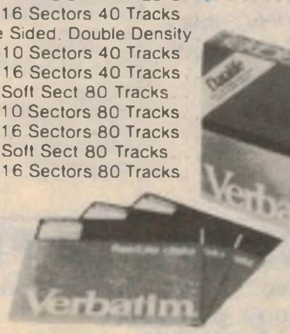

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More graphics for the Super 80

El Graphix of Victoria has added a new product to its range of a character generator add-ons for the Super-80 computer.

The El Graphix Kit 4 consists of two EPROMs, one to replace whatever character generator chip is currently in use and the other to replace the EPROM containing the Super-80 monitor. In addition to 255 ASCII and graphics characters, nine new monitor commands are provided to enable full use of the new graphics capabilities of the Super-80.

Kit 4 supports lower case ASCII characters with a choice of keyboard formats. When the Super-80 is first switched on the keyboard produces uppercase characters as usual. Pressing the SHIFT key however gives access to lowercase characters. Alternatively pressing SHIFT and LOCK simultaneously will put the keyboard into lowercase mode, with uppercase characters produced with the SHIFT key as on a typewriter.

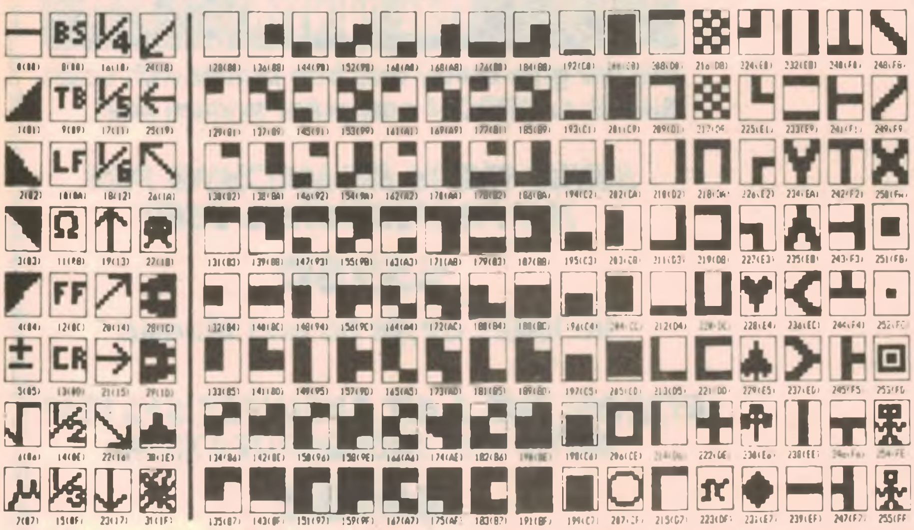
In addition to upper and lowercase characters the "Chunky graphics" of the El Graphix Kit 2 are provided along with most of the Kit 1 graphics set and new symbols for bar graphics, fractions, Greek letters and some "Invaders" type figures. The chunky graphics use the same ASCII codes as those of the TRS-80 Model 1 and the System-80.

The new Monitor software should also be a major selling point of the kit. Two printer drivers are provided in the EPROM, one for a Centronics parallel printer and the other for an RS232C serial printer.

Also included in the new Monitor are nine new monitor commands to allow easy selection of 300, 600, or 1200 baud cassette operation, VDU display paging and interfaces to Basic. New commands allow plotting of lines and points by calling built-in machine language routines from Basic program, and there are also screen shift, wipe and fill routine which enable the screen to be scrolled left or right or even diagonally.

Earlier El Graphix character generators can also be upgraded with the new kit at a cost of $25.00, while the full kit for a previously unmodified machine costs $55.00. For further information contact El Graphix, PO Box 278, Croydon, Vic. 3136. Phone (03) 725 9842 (after 7 pm).

El Graphix Kit 4 Graphics Characters
With corresponding ASCII code in Decimal and (Hex)



Texas Instruments "Professional Computer"

Texas Instruments Australia Ltd has introduced its "Professional Computer", marking the company's entry into the personal business computer marketplace.

Features of the system include high resolution colour graphics, a detachable, low-profile keyboard and a wide range of software from TI and independent suppliers.

The basic system, expected to sell for around $4,200, consists of a monochrome display, keyboard, system unit with 8088 processor and 128K of RAM and a built-in floppy disk drive providing 320K of storage space. Memory can be expanded to 256K on board and space is provided for mounting an additional floppy disk drive or a 5 or 10MB Winchester disk in the system unit.

The standard display is a 30cm monochrome monitor with an 80 character by 25 line format and bit-mapped graphics resolution of 720 x 300 pixels. A colour display controller and 37cm monitor is optionally available, offering the same screen format and resolution.

An outstanding feature of the new system is the incorporation of artificial intelligence techniques to allow "natural language" processing. Users can access the system by combining common English words and phrases from a menu into sentences which instruct the computer. Also included is a voice management system which combines speech processing, voice recognition and telephone management into a single integrated unit installed inside the computer. This system provides functions such as voice "store and forward", automatic telephone dialling and answering and recognition of an 'unlimited" number of spoken words.

Using a 32-bit signal processing microcomputer chip, the voice response system allows the computer to recognise and respond to spoken commands while running applications programs such as spreadsheet calculators.

Form TI's initial publicity it appears that an extensive range of software will be available for the "Professional" system. Four operating systems are supported; MS-DOS, CP/M-86, Concurrent CP/M-86 and the UCSD p-system. Third party software will be available from Ashton-Tate (database management), Digital Research, Lifeboat, Micropro (word processing), Peachtree (accounting systems), Microsoft (programming languages), Sorcim (SuperCalc) and VisiCorp (VisiCalc and related "Visi" series products).

With the addition of a Z80 "Softcard" manufactured by the Xedex Corporation the system will also be able to run CP/M. and the huge range of programs available for this operating system.

For further information contact Texas Instruments Australia Pty Ltd, PO Box 106 North Ryde, NSW, 2113.

Club news

- Chip-8 users are still catered for by the Chip-8 Users Group. Members of the group use a variety of systems based on the 6800 and RCA 1802 processors and running the Chip-8 language, including the RCA VIP, Dream 6800 and the 660 computer system. Advice and software is also available for users of the new 1802-based COMX 35 system. A newsletter is also planned to commence publication from this month.

For further details contact Frank Rees, 27 King St, Boort, Vic.

- A club for Super-80 users has been formed in Sydney. For details contact the Sydney Super-80 Users Group, c/- Harry Port, 84 Wild St, Maroubra, NSW, 2035.

Information centre

PLAYMASTER TUNERS: I write in the interest of those who may be considering building the Playmaster Wideband AM tuner described in December 1982 and later issues of EA.

I live in Cairns where there are three local commercial radio stations and the ABC. Even in the daytime interference in the form of monkey chatter can be a problem when wideband equipment such as the Playmaster wideband AM tuner is used in the wide position. The interference is caused by low power repeaters operating in proximity with high power stations on adjacent channels.

Unfortunately, stereo AM must remain the poor relation to FM since, due to the lack of band space, use of wideband equipment cannot be made. So in my opinion the Playmaster AM/FM stereo tuner is the best investment, only I wish "Electronics Australia" would consider providing the unit with 9kHz readout on AM (confusion arises with the old readout). (M.L., Earlville, Qld).

● Your comments are apt. In many rural areas it would only be possible to use the Playmaster wideband AM tuner in the narrow mode (rural readers please note). Even so, the quality of reproduction in the narrow mode is still quieter and cleaner than is obtainable from our Playmaster AM/FM tuner when it is in the AM mode.

Unfortunately, since the AY-3-8112 frequency counter chip used in the tuner is only suitable for 10kHz AM station separation, it would require a completely new counter board to provide 9kHz readout. We have no plans for such a revision at present.

HIFI AM TUNER: I have recently completed building a high performance AM tuner as described in December 1982. For several reasons, I have not been able to set it up for correct operation without having first modified the circuit. I am wondering if anyone else has had similar problems.

Firstly, the local oscillator would not cover 975 to 2085kHz. Second, the local radio station tunes in at 1036 not 1026kHz. Third, the frequency response seems to roll off too early and fourth, clipping distortion was noticed on the narrow position.

Now to the circuit amendments suggested by a local radio technician who has also built one and suffered the same problems. First, a 120Ω now ties the fixed plates of the gang to L2 to dampen the resonance.

Second, 82kΩ resistors are wired into the positions occupied by R1 to R4 to dampen the coils L6 and L7. Thirdly, the top coupling capacitors were reduced to 22pF. Fourthly, the 4066 switch is bypassed so that the narrow position is not used. Also a 10kΩ resistor was placed at the inverting input of the CA3100 instead of 3.3kΩ.

The last two modifications were to eliminate the distortion caused by the 4066 switch IC and to increase the peak of L8 by loading it less. Needless to say, all these patch ups do not quite kick it into shape and as far as I can see they should not be necessary at all. My other Playmaster equipment works quite nicely stock standard.

Having explained the troubles, and we are both sure that the kits have been correctly assembled and set up according to the instructions, would you be able to pass on any information you have concerning the problem. (R.V., West Mackay, Qld).

● The local oscillator should easily cover the 975 to 2085kHz range provided that the 3-30pF trimmer across the oscillator capacitor gang is not set to a high capacitance during the initial stages of alignment. Try realignment with the trimmer set to low capacitance when setting the oscillator range. If still unsatisfactory, change the slug in the oscillator coil, since it may be of the incorrect grade.

Distortion in the narrow position also

EPROM programmer trap:

EPROM PROGRAMMER: Recently I built up the Free Standing EPROM Programmer from the article in January 1982 (by John Clarke). All parts supplied by Rod Irving to original design.

My problem is that the unit "blows up" the chips and I am writing to seek your help before I consign the lot into the can.

Out of the first batch of six 2716 chips only three programmed properly and of the second batch of eight only one was successful, ie four out of 14, but I am not game enough to try more or to try to reprogram one that did work.

I have watched through the window of the 2716 and when I switch S3-program ready (+25V) on, a fireworks display inside the chip burns everything out. This occurs not only at the memory location being programmed but at all locations. All outputs of the 2716 go low and the chip cannot be erased.

I have carefully measured all voltages around the circuit and at the socket of the 2716 and all are correct. I have examined pin 21 using a CRO to see if any transients/spikes were present when S3 was turned on but it is clean.

I read an article in a recent magazine about static charges on the window which can cause damage to the EPROM and have wondered about that aspect, also if the chips I am using are second quality (purchased through Rod Irving) and may not successfully be programmed in this unit, or if too long an erasure might cause the problem — because I always erase the chips when I get them irrespective of whether they need it or not. (R.I. Jindalee, Qld).

● Firstly, there are two different 2716 EPROMS available. Those supplied by all manufacturers other than Texas Instruments are suitable for programming in the EPROM programmer. The Texas Instrument version of the 2716 is the 2516. Note that the Texas Instrument 2716 EPROM will provide the "fireworks" display on the EPROM programmer. Note that it is actually a 2708.

Apart from this point, provided the voltages, addresses, data and programming pulse length are correct, then no damage to the EPROM should occur. Check that the programming pulse is low until the program switch is pressed and is between 45 to 55ms long. Also check the voltages as described on page 46 to see if these are correct. Check also that the 25V line is stable and not oscillating. If so, then the decoupling capacitors at the input and output of the regulator may be faulty and need replacing.

50 & 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

September 1933

"The Wireless Engineer" (England) for July 1933, interested us chiefly on account of the clear article on the new 2A7 pentagrid converter. It seems strange that one usually has to go to an English magazine to get a clear explanation of any of the new American advances. Otherwise the articles are far too deep to interest the average radio enthusiast, such as "The Magnetoionic Theory" and "The Optimum Decrement of Tuned Circuits for the Reception of Telephony". Good stuff, of course, but very deep.

☆ ☆ ☆

Transmission quality: The real test of a station's transmission and of the tonal qualities of a receiver is in the reaction to them of a person with a discriminating musical taste. Such a person does not insist that the only piano worth listening to is an expensive grand or the only violin a Stradivarius. An ordinary piano or violin made by competent craftsmen is quite good enough for everyone but "poseurs". The ordinary radio set as manufactured by numerous factories in Sydney today, employing diode detection (55, 2B7 or 56 valve), with power output, an ordinary speaker costing a few pounds and not £15, as suggested by Mr Schultz, fitted into a cabinet with good acoustical properties, will give reproduction that is satisfying even to the most critical and musical of listeners; that is, provided the transmissions are such that the receiver is given a chance to prove its worth.

☆ ☆ ☆

Autodyne vagaries: The whimsical operation of some autodyne valves can soon break the heart of even the most enthusiastic home-builder; in fact, several factory technicians have suffered nervous breakdowns after spending a few weeks trying to find out why two identical (apparently) sets fail to give the same performance. One will operate to perfection, whilst the other will stop oscillating and go quite dead over the lower (or maybe the upper) end of the dial. Cure after cure has been discovered by enterprising engineers, but we can say very definitely that we have not yet encountered any scheme which can be depended upon as a panacea for all cases.

☆ ☆ ☆

Technical progress: To the Australian student of radio technique the reports on the Olympia show are, to put it mildly, disappointing. Most of the innovations detailed as "new" have been standard practice with Australian set manufacturers for years, or at any rate months. The ability of the four-five type of autodyne superhet has only now been appreciated by English manufacturers, although this type of set has been boosted by "Wireless Weekly" for at least two seasons, and has enjoyed great popularity here.

RADIO TELEVISION AND HOBBIES

September 1958

Police radio: Something new is being added to the belt of the cop on the beat — a miniature radio station to keep him in constant touch with headquarters.

The foot patrolman long has been on his own between telephone call boxes. Reaching a fixed point of communication can be a time-consuming operation in an emergency, drawing the policeman away from the scene of action.

Now radio engineers have come up with a compact solution in the form of a small receiver and accompanying transmitter which the crime fighter straps to his belt beside his service revolver and other tools of his trade.

The RCA Personalphone has aroused the interest of public safety officials including the police department of New York City.

One of the problems facing New York's "finest" has been patrolling the city's sprawling park system, all 34,000 acres of it.

☆ ☆ ☆

Sterilised rockets: Some scientists have advocated sterilising the United States moon rocket scheduled for launching on August 15 or 16.

They want this done to prevent earth bacteria reaching the moon and contaminating it.

They want future scientists who will make the space journey to find the moon exactly as it is now and so avoid "scientific confusion".

The US Air Force will aim the moon reconnaisance rocket in a bid to have luna gravity swing the rocket around behind the moon.

The plan is for the rocket to return to earth in a giant figure eight.

The small loop of the eight would be around the moon and the large loop around the earth.

But the rocket could orbit around the moon or hit the moon and contaminate it with earth bacteria.

☆ ☆ ☆

Multiplex stereo: Although the gramophone record industry has standardised on the 45/45 stereo system, there are several others which may some day receive further attention, although for the moment their extra complexity has put them to one side. One of these is the Minter system, which uses a 25kc FM carrier to transmit the difference signal and a standard lateral cut for the sum signal. It is therefore largely compatible with monaural discs.

Modern high-fidelity recordings are the product of many manhours of research, tempered by years of practical experience. It seems logical to the authors to utilise the vast experience accumulated with lateral disc recordings in coping with the problems presented by stereo disc recording, and avoid recourse to any stereo system requiring the development of complex cutting heads and playback pick-ups. A basic objective is to make a stereo disc capable of being played monaurally on any monaural phonograph in good working order without sacrifice in performance or damage to the disc. The introduction of such a record would present no inconvenience to those not having stereo equipment, while permitting subsequent inexpensive conversion to a stereo system.

SEE PAGE 21 FOR THE JAYCAR ADDRESSES AND PHONE NUMBERS

points to incorrect alignment with this stage. In particular, the ceramic filter may be of frequency necessitating readjusting the IF to a higher or lower frequency. This is fully detailed in the article.

We do not recommend connecting damping resistors across the RF and IF coils. The sharp cut-off of the filters is rendered ineffective with damping resistors, which will increase noise and interference from neighbouring stations. Correct frequency response will be obtained with a properly aligned tuner set to the transmitter frequency of the tuned radio station.

The 4066 switch used to select the narrow/wide positions will not in itself introduce distortion since the inherent distortion of this device is well below the overall distortion of the tuner. Increasing the 3.3kΩ resistor at the inverting input of the CA3100 is also not recommended. We found that at radio frequencies the CA3100 provides least distortion with a gain of minus one and with these low value resistors. The loading of L8 with the 3.3kΩ resistors does not appreciably dampen this coil. The 3.3kΩ resistor also provides correct loading for the ceramic filter which gives distortion with other loads such as 10kΩ.

As far as the remaining problems are concerned, they are all related to incorrect alignment. The fact that your local station tunes in at 10kHz to one side of the correct frequency indicates considerable double humping with the IF amplifiers and misalignment with the RF stages. Try realigning the tuner following the procedure exactly as described in the alignment article.

GUITAR AMPLIFIERS: Many thanks to all at EA for the excellent magazine. Can you please help with a couple of questions about guitar amplifiers?

Firstly, I have heard of musicians being electrocuted by electric guitars. How could this be possible — surely all mains-powered amps have a fuse in the power line; and would it require an actual shorting of the power supply to the output to cause the guitar to go live, or could this occur through component breakdown in the actual amplifying circuit? Are these stories just old muso's tales, and if not, how can I make sure I don't get my fingers burnt?

Secondly: what is an "effects loop" exactly? Is it merely an output from the preamp and an input to the main power amp for routing of the signal through effects, or is there more to it than this? (S.S., St Peters, NSW).

● Musicians certainly have been electrocuted in the past. Often this has been because they have deliberately broken the mains earth connection to the amplifier to solve hum loop problems. Subsequently, a component in the power supply may have failed, causing the chassis to be energised at the full 240VAC. There is a warning here to anybody who would tamper with amplifier earth connections. DON'T DO IT.

Your interpretation of "effects loop" is essentially correct. It is rather like the "tape monitor" loop on a typical stereo amplifier.

DIGITAL STYLUS TIMER: I intend to build the Digital Stylus Timer featured in the October 1980 issue and would appreciate help on two points:
1. Am I able to connect instead, a four digit display and switch it alternately from stylus time to real time?
2. The unit will need to function occasionally in North America. What circuit modifications will be necessary to accommodate a 60Hz supply? (K.P., Morningside, Qld).

● It would be impractical to have a 4-digit readout to indicate real time and stylus time because a large number of connections would have to be switched.

The unit can be adapted to a 60Hz supply by changing the connections to IC4 from IC3 so that IC4 counts to 21,600. IC4 should decode the Q5, Q6, Q10, Q12 and Q14 outputs of IC4, ie, pins 1, 3, 4, 5 and 14.

BLOOD PRESSURE: Having read with interest the article on the portable heart rate monitor published on page 62 of the July 1983 issue of EA, and which I will have built by the time this letter reaches you, made me wonder if you had any plans to publish an article on a unit to measure blood pressure.

As I have had cardiac trouble for some time now (and lack the design knowhow) I was very interested in an instrument in a survival unit which was used on me when I was being transported to hospital by ambulance when I had my last heart attack.

The instrument appeared to be approximately the size of a medium sized pocket calculator with two separate digital readouts, a sensor and a pressure band for the arm.

Pressure was applied to the band until the systolic pressure reading was indicated on one of the readouts and when the pressure was released the diastolic pressure reading was indicated on the other readout.

As these readings can be held for an indefinite period and performed without the use of a stethoscope, I feel it would be a worthwhile project considering the number of people nowadays with cardiac troubles.

As exercise is needed to assist in recovery, and, in my case consists of a considerable amount of walking, as no doubt in many other cases also, I feel it would be a very useful instrument to be used in conjunction with the heart rate monitor and would give a fairly accurate assessment of one's capabilities when exercising. (C.T. Sale, Vic).

● Thanks for your interesting and informative suggestion of a blood pressure monitor. We will have to do some research into this area before we can make a decision on whether it is suitable as a project.

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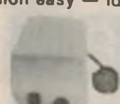

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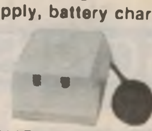

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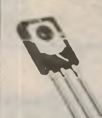

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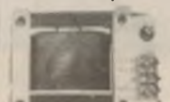

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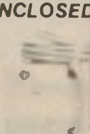

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Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

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EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

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Dick Smith Electronics,
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Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
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Telephone 745 3077.

117 York Street,
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Jaycar Pty Ltd,
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Sydney 2000.
Telephone 264 6688.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
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Northcote, 3070.
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Kalextronics,
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Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
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Sunbury Printed Circuits,
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Sunbury 3429.
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P.C.B. ETCH TANK: Commercial and hobbyist types. See advertisement on page 47. Kalex (03) 458 2976.

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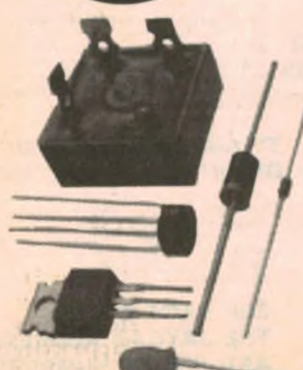

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