ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

MARCH, 1981

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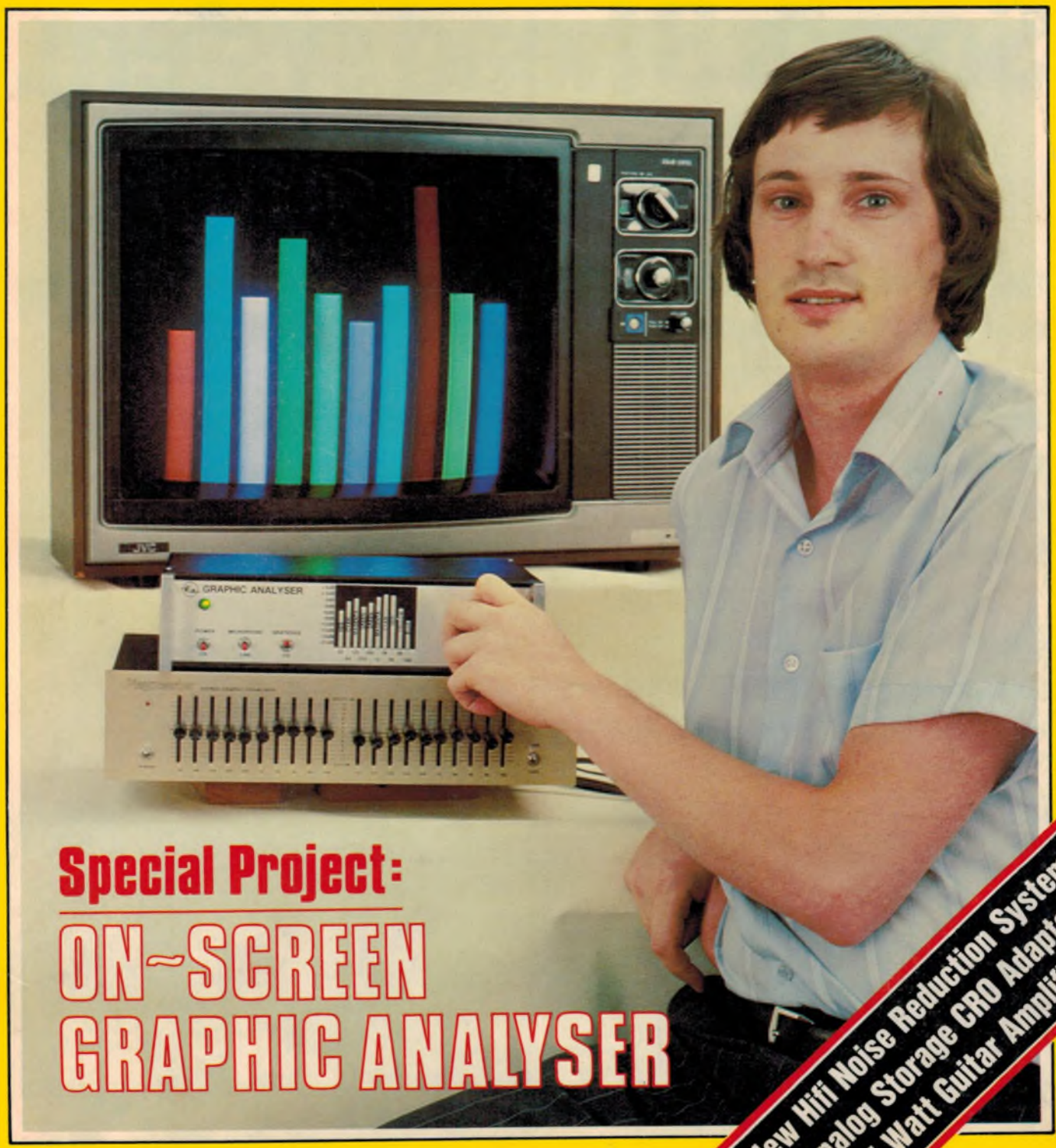

Special Project:

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Analog Storage CRO Adapter
25 Watt Guitar Amplifier

It's a better system, at a better price, and it's Sony. In Sony's new TC-K81 three head cassette tape deck, each head has its own individual casing and suspension system.

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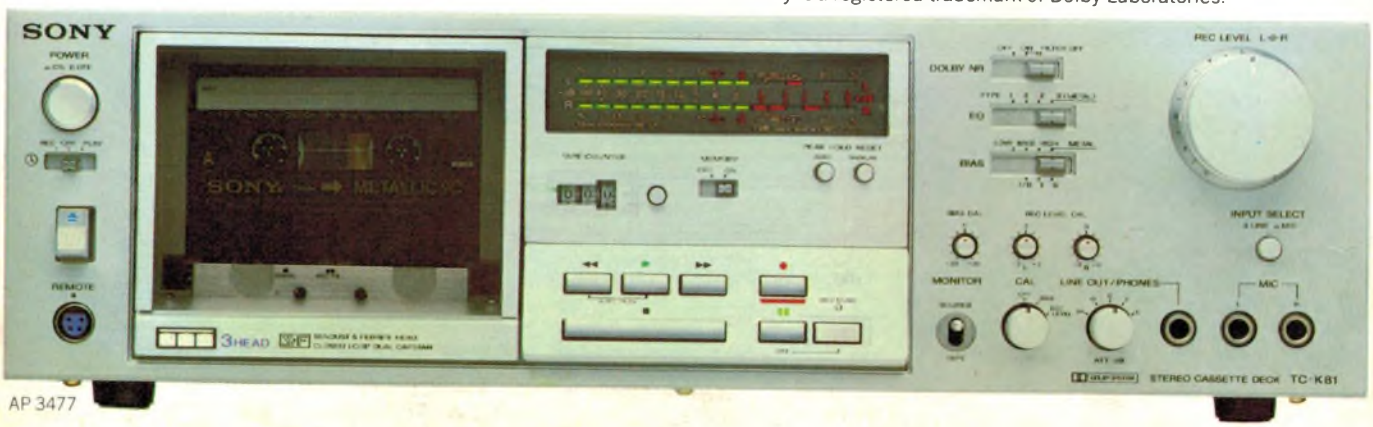

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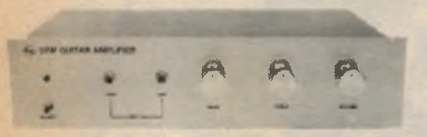
ELECTRONICS AUSTRALIA

Volume 43, No. 3
March, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

Guitar amplifier



With 27 watts RMS output power, this new guitar amplifier is ideal for the home guitarist. Find out how to build it on p56.

Christened "Le Gong", this has to be the simplest door chime ever described in "Electronics Australia". See page 72 for the details.

Our **Storage CRO Adapter** *now includes additional circuitry to enable analog signals of up to 100kHz to be stored and displayed. Details p74.*

On the cover

Staff member Ron de Jong demonstrates his latest project – an On-Screen Graphic Analyser. You can use the Analyser to check your room acoustics and to provide a dynamic colour display of program content (see p42). Photograph by Bob Donaldson.

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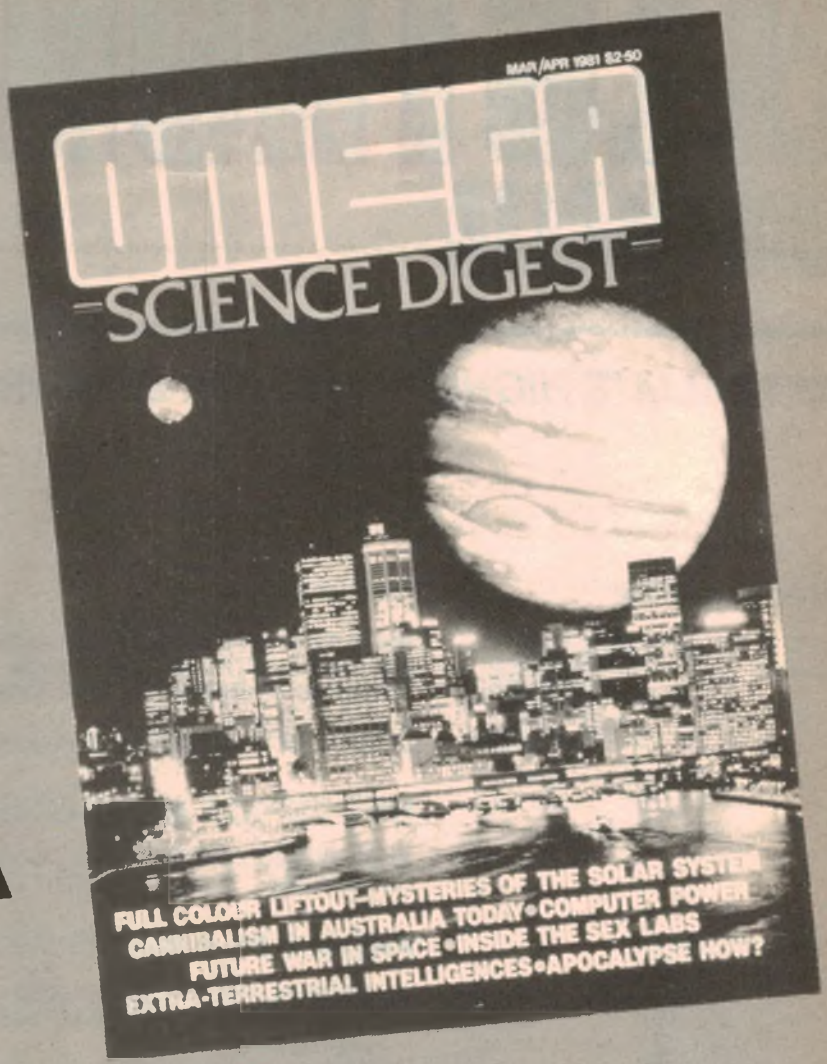

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Editorial Viewpoint

A new "Wireless Telegraphy" Act?

In 1905, the Parliament of the day debated and passed the Wireless Telegraphy Act, establishing control over what was then a completely new branch of technology. It seems likely that few, if any, of the members had any real notion of what lay ahead for "wireless". For the most part, the Act mirrored what had already been worked out in Britain, under the watchful eye of the British Post Office.

Since then, wireless has expanded its horizons at an incredible rate and the authorities have progressively had to generate new rules and regulations in an effort to keep the whole thing under control. Inevitably, serious – even ludicrous – anomalies have developed between the demands and practice of modern radio communication and what was considered appropriate in 1905.

For example, no one in Australia is supposed to operate a radio receiver without first having obtained the relevant licence to do so. Yet no provision now exists for licensing the very receivers that most people use – those intended to receive broadcast radio and television programs.

General coverage receivers have posed a further problem. By their very nature, they are able to receive all manner of transmissions but, traditionally, the authorities have come to accept them as "broadcast" receivers, provided they include a broadcast band. They never have been licenceable in the strict terms of the Act.

Again, the Wireless Telegraphy Act of 1905 makes it an offence to reveal the contents of a wireless message, or even to reveal the existence of such a message. That would make things difficult for our regular contributors, Pierce Healy and Arthur Cushen, who have been writing about wireless messages for years. In fact, to fine everyone who has ever offended against this particular provision would provide a most effective way to wipe out the national debt!

In the face of these – and other – basic legislative anomalies, it was encouraging to receive a letter from Mr Ross Ramsay, First Assistant Secretary, Radio Frequency Management Division of the Department of Communications. He states that the Department is now working positively towards legislation to replace the old WT Act of 1905.

If they keep at it, it may be possible to repay an ancient debt: to provide a model on which British legislators could up-date their own time-tattered Act!

Neville Williams

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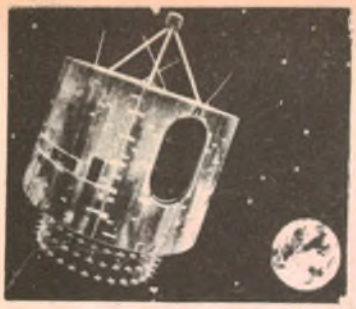

News Highlights

Key role for electronics in Cadillac engine

Recently released by General Motors is a new vehicle that attempts to provide small car economy without eliminating the size and prestige of the traditional US "big car".

The company's latest six litre V-8-engined Cadillac is claimed to be the first production car with a "modulated displacement engine" – that is, it can operate on eight, six or four cylinders according to driving needs. Operation of this "cylinder switching" as well as a digital fuel injection system is controlled by a central microcomputer about the size of a text book.

This follows an announcement late last year that from now on, "virtually all GM petrol driven cars built in the US will be fitted with a small digital computer." As a result, the company was already claiming to have become the largest manufacturer of computers in the world in unit production terms – some 20,000 per day from two plants of Delco, a GM subsidiary.

The closing down or opening up of cylinders two at a time means that the car can have a capacity of 6000, 4500 or 3000cc – the processor automatically makes the adjustments to suit driving requirements in terms of power output. It is claimed that the change from one mode to another is so smooth that the car's occupants are unaware of it.

Changes are accomplished by solenoid-operated valve selector mechanisms controlled by the microcomputer and in accordance with a program that takes other operating parameters into account. When the mechanism operates both induction and exhaust valves close to shut down the appropriate cylinders.

According to General Motors, by varying the displacement in this way significant reductions are achieved in the internal work the engine has to do. Engine friction becomes relatively smaller; the basic work to drive the car remains the same whether it is in the eight, six or four cylinder mode, but the internal losses in the engine are reduced by changing the displacement to match the load.

Whether or not this cylinder switching takes place is in the hands of the central microcomputer and is the result of continuous total monitoring of the situation by the computer.

For example, a basic task is to regulate precisely the air fuel mixture entering the engine to give optimum fuel economy, improved engine performance and much better control of exhaust emission.

The processor receives data from appropriate sensors about cooling system temperature, crankshaft revolutions, throttle position, manifold pressure and the amount of oxygen in the exhaust gases.

It analyses all this in milliseconds and then, according to its program, sends out digital pulse instructions to engine and drive train components. Messages sent to the carburettor for example, give rise to fuel adjustments at up to 10 times each second. Other functions controlled include engine idle speed and the operation of automatic transmission.

GM says that to allow the driver to take full advantage of the system, the Cadillacs with the new V8-6-4 engine have a digital MPG read-out on the dashboard which displays on demand the instantaneous and average fuel consumption; also shown are the anticipated fuel range based on average consumption so far and the fuel left in the tank, and the number of active cylinders in use at any particular time.

Major changes loom for vehicle electrics

Major changes in vehicle electrics are taking place not just on the face of the dashboard – where for example, liquid crystal and fluorescent gas displays will soon begin to appear, controlled by a microprocessor – but behind it as well where the complicated copper wire "spaghetti" has given way to printed circuit boards and, more recently, to flexible circuits.

Recently, Lucas in conjunction with Leyland Vehicles announced what it called the "intelligent bus." Three wires go round the bus to connect everything up with the exception of safety-critical functions: one for power, one for digital transmission and one for timing pulses.

Associated with each device on the vehicle such as headlamp or windscreen wiper is a small receiver and, at the dashboard, a central transmitter which sends messages according to the switches used by the driver. Each of the receivers can recognise only the messages intended for it by a system of digital codes (aided by the timing pulse wire).

In general, these "multiplexing" systems can assume one of two forms. In the "polling" variety a central computer looks at each outstation in turn, either applying or extracting data from it. Such systems have been used quite widely in remote control systems but they have the drawback that failure of the central processor invalidates the whole system and it is difficult to add new outstations without altering the software.

An interesting system developed at Salford University, called Salpex, is of the other, decentralised variety and uses only one power line and one signal bus. The approach is general enough for any input to communicate to any one of a number of outputs. There is no central weak link of a central processor and faster operation is claimed. On such a system it is possible to "hang" a pair of units anywhere round the "ring" to give communication between the two points without disturbing the rest of the operation. However, local software is needed at each station.

— Financial Times.

New batteries

Postage stamp size batteries may soon be in common use if development at Hitachi reaches the commercially viable stage. The Japanese company has succeeded in synthesising a solid lithium electrolyte for use in solid state batteries.

At present, Hitachi has produced extra-thin batteries 0.7 × 20mm diameter, which have shown feasibility in practical applications. The maximum output current is 5mA.

It is claimed that an electronic watch fitted with one of these batteries would operate for more than 10,000 hours.

RADIO FOR THE PRINT HANDICAPPED

The main control desk at radio station 3RPH. The station is in need of volunteer technical help (see story).

It has been estimated that at least 3% of the community either have difficulty or are completely unable to read standard printed material. This 3% is made up of blind people and other people who have varying degrees of visual impairment, including many elderly folk, quadraplegics and many others.

Over the years attempts have been made to overcome these difficulties, but these attempts have only been partly successful.

In recent years a lot of material has become available on tape and this method of reading is popular for books and some magazines but is not suitable for the reading of daily news, as the tapes are at least a few days old by the time the reader receives them. And while the electronic media do broadcast regular news services, many news items are only dealt with very briefly whilst others are not touched on at all.

In America, and some other countries, special radio stations have been set up especially for the broadcasting of daily news and this method of conveying up-to-the-minute information, seems to be very successful indeed. The idea is to present a wide range of newspaper articles and to deal with each item in its entirety.

There are now moves in Australia to start similar stations in most of the capital cities and in some other areas. In Melbourne, the preparation of 3RPH (Radio for the Print Handicapped) is well under way. A licence has been granted, the transmitter is all but completed and work at the studio is well advanced.

As far as possible, preparation of the studio has been carried out by blind and print handicapped people. However, there is still work that needs to be carried out and this can only be done by people with technical capabilities. Volunteer help is needed for installation work and for the maintenance of station equipment.

Licences have also been granted for stations in Sydney, Hobart and Brisbane.

FOOTNOTE: If any reader can help station 3RPH, either by maintenance or studio installation work, they should contact Mr Gordon Merry of the Association for the Blind on 598 8555 ext 273 (PO Box 123, Brighton Beach, 3186).

Britain/US to develop electric vehicle battery

Speed-up of the development of a new type of battery that could double the range of present day electric vehicles is likely to result from an Anglo-US research agreement announced recently in London.

Under the deal, the British Chloride Silent Power Company will join forces with the General Electric Company of USA on the final stages of developing a commercial sodium sulphur battery. Both companies have for some years been carrying out extensive development programs on this type of battery now widely accepted as having the most promising high performance for both transport and industrial applications.

Already some $40 million has been spent on the two programs, with Chloride concentrating on a battery for road vehicles and GE on one that can be used to store off-peak electricity.

The sodium sulphur battery cell is normally constructed in tubular form. When the cell is fully discharged all the sodium and sulphur is converted to sodium sulphide. When the cell is recharged the whole process is reversed.

In its commercial form, the new battery will be sealed for life and will store about four times the energy of a lead-acid battery of the same weight. It will be capable of giving an electric vehicle a range of some 200 kilometres on a single charge.

Dick Smith Marketing Manager in new business venture

One of the men responsible for the growth of the highly successful Dick Smith Electronics wholesale and retail operation, marketing manager Gary Johnston, has left the company.

Gary Johnston

At a recent press conference, Mr Johnston (31) announced that he had purchased a 70% interest in John Carr and Company Pty Ltd (popularly known as Jaycar) and would assume the position of Managing Director in early March. He said that he believed he "needed a new challenge" and this meant running his own business.

Mr Johnston is very enthusiastic about his new venture and is determined to inject new life into a company which he says has been rather weak in the marketing department. "Jaycar has an absolutely amazing range of electronic kits and components. The only problem is that the average enthusiast has not been made aware of these products", he explains.

According to Mr Johnston, the company will adopt a more aggressive marketing stance to bring products and kits to the notice of electronic enthusiasts. In addition, the range of kits to be marketed would be greatly expanded.

Other problems such as very few products on display at the Sussex St (Sydney) store and no Bankcard credit facilities have already been eliminated. Mr Johnstone claims that it is now as easy to buy from Jaycar as it is from other electronics retailers.

Jaycar is located at 380 Sussex St, Sydney (Ph 264 6688).

60-plus TV channels

A digital video switching system located on the top of the home TV set to allow selection of programs may become available in the US by the end of the decade. Present cable TV systems provide 60 channels for home entertainment, but with a telephone type pushbutton keypad the viewer could choose, by means of fibre optic cables, from hundreds of selections!

NEWS HIGHLIGHTS

Teletext — alive & well in Britain

At a recent special meeting of the Sydney Division of the Institution of Radio and Electronics Engineers (IREE) Aust, two guest speakers – one from Britain and one from the USA – discussed viewdata systems; Teletext, CEEFAX, Oracle, Prestel, Line 21, etc.

Mr Colin McIntyre, Chief Editor, CEEFAX, BBC, London, described the development of CEEFAX by the BBC's engineering department from an original concept to provide captions – on demand only – for the hard of hearing.

Mr McIntyre quoted some interesting figures to indicate the growing popularity of the CEEFAX system in Britain. At the end of 1979 there were some 40,000 sets in operation and at the time of the discussion (October 1980) it was around 100,000. Surveys and projects suggest that by 1981 it should be 250,000.

Mr McIntyre summed up his comments with the statement, "CEEFAX is alive and well and thriving in Britain".

The guest from the USA was Dr Malcolm Norwood, Chief, Captions and Telecommunications Division, Department of Health, Education and Welfare, Washington.

Dr Norwood spoke of the Line 21 system, as it is known in the USA. This is in use by three of the four major networks but, for the present, solely for subtitling for the hard of hearing.

Since the actual captioning is a major cost factor, Dr Norwood emphasised the need for technical compatibility between different TV systems, in order to minimise these costs. The Line 21 system is already compatible with the TV systems in Canada, Japan and Mexico, and the technical barriers between it and PAL and SECAM appear to be minimal.

Electronics invades the humble bicycle!

At first glance, a microprocessor for a bicycle may seem to be on a par with an electronic wheelbarrow. But the makers, Micronic Computer Systems, of Walton-on-Thames, London, are deadly serious. According to the London Financial Times (21/11/80) the device was to be launched by Halfords in time for last Christmas.

Called Cycomp, the handlebar mounted unit incorporates a microprocessor chip driving an eight digit display. Its main function is as a speedometer, but the unit will also tell the cyclist the maximum speed that has been reached, the average speed maintained, the distance travelled and the time taken on a journey.

All the information can be displayed in either miles or kilometres, and the unit can be operated as a stopwatch on or off the cycle.

The handlebar bracket contains a tiny plug and socket so that the main unit can be removed from the cycle. The unit operates by means of electro-magnetic transmitter/receivers mounted on the fork and on two front wheel spokes, so wheel speed is measured without friction. The unit can be adjusted for virtually any international wheel size.

Halfords reckon that the unit will find a ready market among cycling commuters who can use it to plan the quickest and shortest route on any journey.

Business Brief:

- OTC's fast growing international facsimile service, called "Overseasfax", has been further expanded to link with one of Australia's major trading partners, the United Kingdom. Countries to which Overseasfax is now available include: the US, Japan, Canada, Hong Kong, Taiwan, France, New Zealand, West Germany, Singapore, Papua New Guinea, South Africa, Switzerland, Belgium, Sweden, Spain, Greece and the Netherlands.

- **Dick Smith Electronics** has opened a store at 145 Parramatta Rd, Auburn (Telephone 648 0558) to serve the western suburbs of Sydney. The store is managed by Ilidio Teixeira, formerly manager of Dick's Parramatta store, and will be open seven days a week.

- **Philips Electronic Components & Materials** and **Sycom,** the Australian marketing division of Systems Reliability (Aust) Pty Ltd, have signed a distribution agreement. Under the agreement, Sycom will actively merchandise throughout Australia a Philips/Signetics/Dialight/Airpax product range that includes semiconductors, capacitors, hifi loudspeakers and kits, and electromechanical devices.

Troposcatter communications link

Equipment from Amalgamated Wireless (Australasia) Limited is being used in a troposcatter communications link between two remote islands and the Australian mainland in Western Australia.

Koolan Island and Cockatoo Island, in Yampi Sound, in the north-west of Western Australia, are 135km from the nearest communications centre at Darby.

The Dampier Mining Company is mining high grade iron ore on the two islands.

AWA have supplied troposcatter communication equipment from their RL 900 radio link series. The installation provides up to 24 voice communication channels, connected to the Telecom Australia network on the mainland via a radio spur route. These channels provide bearers for telex services in addition to separate channel access to Koolan and Cockatoo Islands.

Prestel: costs are coming down

The Plessey Company, one of Britain's leading electronics companies, has developed a unique terminal which combines the features of an advanced telephone and a Prestel/Viewdata access terminal. It has been designed to provide voice and data communication for businessmen, with the first production models becoming available this year.

The low-cost unit fits compactly on to an office desk and is not much larger than a conventional telephone. Already considerable interest has been shown in the product since it will open up the Prestel service for business use. At present only expensive television monitors can be used to link into the service.

New Intelsat satellites

With the first of its Intelsat V satellites only just launched, the Intelsat organisation has already decided to purchase three advanced Intelsat V-A satellites. The new satellites will enable Intelsat to cope with the increasing world demand for satellite communications, which is doubling every three to four years.

The Intelsat V-A satellites will be similar to the V models, but will incorporate modifications that will increase reliability and boost their communications carrying capacity by 25% – from 12,000 to about 15,000 simultaneous telephone calls, plus two television programs. The new satellites will be in addition to the nine satellites planned in the Intelsat V series, all of which should be in orbit by the end of 1982.

Launchings for the Intelsat V-A series will commence in 1984.

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Growing use of UHF translators

More and more Australians will need to know about the UHF (Ultra High Frequency) band if they want to obtain good television reception in future years. This is because the Commonwealth Government is increasingly authorising the use of the UHF band for television services.

At present of course, most television is transmitted in the VHF (Very High Frequency) band, but this is becoming increasingly crowded with pressures from FM radio services as well as television services.

By opening up the UHF band for television translators and main stations, the government will be able to provide television to areas which have not had them formerly because of the lack of available VHF frequencies.

At present, UHF translators provide television services to the Adelaide foothills and some areas in Western Australia. New UHF translators are also planned for parts of the Sydney metropolitan region, Northern Tasmania, and the Gold Coast in Queensland.

The first main service in the UHF band is the new multi-cultural television service operated by the Special Broadcasting Service (SBS). This began in Sydney and Melbourne in late October, 1980, and initially is "simulcasting" – that is, broadcasting the same progam in both the UHF band, on Channel 28, and in the VHF band, on Channel 0. Eventually, this service will be available in UHF only.

Many readers will be aware that when the multi-cultural service began operating a number of reception problems were reported in Sydney in particular. Because of its many sandstone ridges, Sydney has many pockets of poor reception for all kinds of television. The translators now being established to direct television signals into these areas will operate in the UHF band.

Two groups of UHF translators are already scheduled for Sydney, and one group should be in operation from the top of the Hyatt Kingsgate Hotel in Kings Cross when this article goes to press. These translators will re-transmit all of the Sydney commercial TV channels in the UHF band. Translators for the ABC and the Special Broadcasting Service will follow later in 1981.

The UHF service from Kings Cross should bring clear television reception to: Edgecliff, Darlinghurst, Surrey Hills, Redfern, Darlington, Chippendale, East Sydney, Wooloomooloo, Kings Cross, parts of Potts Point, Rushcutters Bay, Double Bay, Kirribilli, Milson's Point and parts of Elizabeth Bay, Darling Point, Paddington, Sydney (city), North Sydney, Waverton, Neutral Bay, Cremorne, Cremorne Point and Clifton Gardens.

Another group of translators is proposed for North Head, but provision of this service depends on suitable arrangements being made to overcome environmental problems. The North Head translators would service: Allambie Heights, North Manly, Manly, Manly Vale, Queenscliffe, Fairlight, Balmoral and parts of Harbord, Balgowlah, Clontarf, Clifton Gardens, Elizabeth Bay, Darling Point, Double Bay and Bellevue Hill.

The other UHF translator stations planned for the coming year include national and commercial translator stations due to open in Kelcy Tier, East Devonport, Tasmania in mid 1981. They will serve East Devonport, Quoiba, Spreyton, Ambleside and Latrobe.

Most people will need to make some adjustments to their sets in order to receive television in the UHF band. Viewers also need to realise that finding the tuning position for the UHF channel may be more difficult than finding a VHF channel.

Some of the changes needed to sets to enable UHF transmissions to be received include:

- in most cases external aerials designed to receive UHF signals will be required;
- in sets not fully equipped to receive UHF, an internal UHF tuner will be required;
- where sets have been designed to receive the VHF band only, a down converter will be needed;
- systems which distribute television signals in flats and apartment blocks may require modifications or special converters.

Viewers will need to adjust the UHF tuner on their set in the vicinity of the UHF tuning position listed for the TV stations. They may find however, that best reception does not occur precisely on the number listed.

You should check with the manufacturer of your set, or a qualified television service person, if you have any doubts about whether the set will tune to UHF channels.

If you are buying a new set, check with the State Broadcasting Engineer of the Communications Department in your State to see if a UHF translator is planned in your district. If so it would be advisable to obtain a set with a UHF capacity. The phone numbers are: NSW (02) 439 7725; Vic & Tas (03) 266 921; Qld (07) 371 2277; SA & NT (08) 51 2877; WA (09) 325 7448.

A leaflet outlining the Government's plans for television in the UHF band is available from the Department.

R. B. Lansdown,
Secretary, Dept. of Communications.

NEWS

Prestel International goes commercial

After a successful trial period in several countries, Prestel International – the world-embracing information system developed by the British Post Office which enables users to interrogate computerised data by means of a simple terminal – is to be established on a commercial basis.

The service will be offered from July initially to customers in the United Kingdom, United States, Australia, the Netherlands, Sweden, Switzerland, Federal Germany and Hong Kong. Most of these countries took part in the extensive trials.

It will be offered at first to selected potential users in investment, shipping, the computer industry, insurance, market research and commodities. About 300 subscribers have so far joined the system.

Prestel International is an offshoot of Prestel UK – the information is not interchangeable between the two systems because of publication laws – and is aimed specifically at businessmen, giving information on such subjects as stock market prices, exchange rates, commodity prices, economic indicators for the major countries, business news, travel and entertainment.

The information is up-dated regularly.

The service is available in three different forms: international information for any user; in private closed-user groups used mainly by multinational companies for inter-branch communication; and in syndicated closed-user groups for circulating information to specific areas of business or commerce.

PARTS FOR NEW KITS

If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue or call in to your nearest Dick Smith store.

EA GUITAR AMPLIFIER (See EA March)
PCB only ... Cat. H-8389 $7.90
All other parts including case are available ex stock

CRO SWITCH (See EA February)
Complete kit ... Cat. K-3517 $59.50
PCB Only ... Cat. H-8392 $3.75

SYSTEM 80 RS 232 INTERFACE (see EA February)
PCB only ... Cat. H-8391 $2.25
All other components in this kit are normal stock lines.

GUITAR FUZZ BOX (See EA February)
PCB only ... Cat. H-8390 $2.15
All other components in this kit are normal stock lines.

MINI SPOT 455kHz GENERATOR (See EA February)
PCB only ... Cat. H-8389 $1.75
Other components in this kit are normal stock lines.

AUTODIM (See EA Jan)
PCB ... Cat H-8388 $3.50
All other parts are normal stock lines

ETI MOSFET AMPLIFIER MODULE (See ETI January)
PCB ... Cat H-8633 $9.95
Power Mosfets (low cost medium power types as above) ... Cat Z-1815 $15.00 pr

SELECTALOT (See EA December)
PCB ... Cat H-8384 $2.95
All other components are normal stock lines

AC MILLIVOLTMETER
PCB ... Cat H-8385 $2.25
All other components are normal stock lines

SYSTEM 80/TRS80 INTERFACE (See EA Nov)
PCB ... Cat H-8383 $1.90
All other components are normal stock lines.

PLEASE NOTE: ABOVE PROJECTS AND PRICES ARE SUPPLIED FROM MAGAZINE'S ESTIMATES ONLY.

Weller Soldering Station

This is a transformer powered station with a low voltage, temperature controlled pencil. Max tip temperature is closed loop controlled – protecting temperature sensitive components while the grounded tip protects voltage & current sensitive components. It's a must for the serious constructor.

- *Silicone rubber non-burn cord
- *Removable plug

Cat. T-1000

$62.50

Listen to aircraft

How often have you wondered what is said between aircraft and the control tower? With this radio you can receive both the aircraft bands (VHF) plus the normal AM broadcast bands. It's high sensitivity and portability make this radio a truly versatile unit at low low price.

AM: 530-1600kHz, AIR: 108-174MHz
Cat. D-2836

$24.50

Your guide to a fortune

WANT TO KNOW ABOUT PROSPECTING?

This book tells you about everything you need to know. Like where to go, what to look for, what to do when you get there ... it's up-to-date & it's authoritative.

Cat. B-4525

$1.95

Gem & Treasure Year Book

Keeps you up-to-date with the world of fossicking & prospecting. Read about the latest gold find areas & you can even have a chance to win a trip or a metal detector! 125 pages of colour photographs, technical information & leisure guides. A must for the serious treasure seeker.

Cat. B-4536

$2.50

CB IS ALIVE & WELL!

Super Jaguar AM/SSB Mobile CB

You'll make plenty of friends & when that emergency arises, you'll be able to help too! 18 channels with LED readout & easy to use controls. (licence required to operate this unit)

Cat. D-1710

$219

Operate as a Base Station!

Use your mobile CB as a base station! This 13.8V regulated power supply delivers all the power you need with a 4 amp peak rating!

Cat. M-9545

WAS $39.50

$29.50

ANTENNAS: For the car

This flexible helical antenna is excellent for mobile use. Easy SWR adjust & comes complete with cable & plug. Cat. D-4076

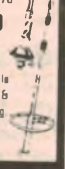
$24.50

For the home

Get your signal out with this incredible Swamper II base antenna. Easy to erect & SWR. Complete with 15m of cable & plug.

Cat. D-4428

$69.00



BONZA BULK BUY BARGAINS BEWDY

ALMOST 50% OFF! Fantastic SLIDE POT

As used in the Playmaster Graphic Equaliser kit. This slide control is ideal for the hobbyist, experimenter & budding kit builder. 50K linear. Cat. R-1980

Normally 90c each
THIS MONTH ONLY **50¢** (10 or more 45c each!)

WATCH THIS SPACE

AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! N.B. Specials are strictly while store stocks last.
Don't miss out!

LAST MONTH:

SCREW ASSORTMENT PACK H-1600
Normally $3.90; reduced to $1.90

SAVING $2.00!

A MUST FOR EVERY KIT BUILDER . . .

Do you suffer from burnt fingers when soldering PCB's? Your troubles are over with this unique soldering station from Dick Smith. Not only does it hold the PCB firmly and securely at any angle you want your roll of solder and soldering iron are also within easy reach. It's mounted on a heavy cast base so it won't tip up leaving you both hands free to concentrate on the assembly job.

Once you've used it you'll wonder how you ever soldered PCB's without it!

Cat T-5700

$19.50

SUPPRESSION!

Here's the way to eliminate annoying static, whine & other noises from your car radio, hi-fi or CB radio.

COAX ALTERNATOR SUPPRESSOR
Gets rid of that whine. Heavy duty.
Cat. A-7928 **$4.95**

INLINE DISTRIBUTOR SUPPRESSOR
Connects anywhere in coil. Easy to mount.
Cat. A-7904 **50¢**

GENERATOR NOISE SUPPRESSOR
Heavy duty. Easy mounting with only a screwdriver.
Cat. A-7902 **65¢**

ALTERNATOR NOISE SUPPRESSOR
Has 3 leads. Greatly reduces alternator whine.
Cat. A-7924 **$2.50**

DELUXE ALTERNATOR SUPPRESSOR
High density ferrite core. Excellent results.
Cat. A-7926 **$9.50**

A GOOD CASE FOR BUILDING PROJECTS

Superbly made folded aluminium cases in a variety of sizes; fitted with rubber feet and have ventilation slots. Look really great!

SIZE	CAT	1-9	10 up
102 x 58 x 83	Cat H-2741	$2.75	$2.55
150 x 81 x 103	Cat H-2742	$4.35	$3.95
150 x 76 x 143	Cat H-2743	$3.90	WAS $4.90
184 x 70 x 180	Cat H-2744	$5.45	$5.00

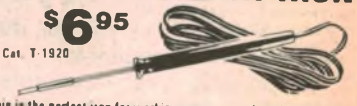
Economy calculator WITH LCD READOUT!

A bargain for pocket or purse. Batteries last for ages, auto switch off.
Cat D-3015
WITH MEMORY!

$9.95

The famous MINI IRON

$6.95
Cat. T-1920



This is the perfect iron for working on computer boards or any other detailed area. Comes with spare copper tip and heats up in seconds! The voltage is low so it is safer to work in those "delicate areas". Connect up to car cigarette lighter plug (Cat. P-1875 @ 70c) and you can repair things in the car!

TRANSFORMER TO SUIT: Cat. M-2155 multitap $4.90

SPARE TIPS:
Conical Cat. T-1921 $1.50 Wedge Cat. T-1922 $1.50

Builder's mate

Hey builders, carpenters etc. Trace hidden wires with this metal detector. It will save you a lot of time and perhaps a nasty shock!

Cat. X-1060

$9.95

Easy Conversion Car adaptor

This high power car converter plugs into your car cigarette lighter socket. It allows transistor radios, cassette units, portable record players etc. to operate from the 12V car battery. Complete with 4-way plug & battery snap connector. 8V-7.5V-9V @ 800mA

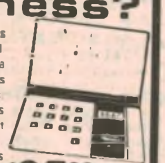
Cat. M-9584

$9.95

Learning to play Chess?

Improve your skills with this Chess Master learning aid. You can soon play like a professional! Solve problems in the least number of moves. Play alone or with others and experience the different tactics and checkmates etc. Complete with 7 booklets each containing 50 moves – that's 350 moves to play!

$35.00 Cat. X-1257



The project to test all projects!

LCD PANEL METER KIT

This economical, yet high quality accurate device is ideal for the hobbyist or amateur etc. Its large LCD display make it easy to read while its low power consumption saves on batteries. Comes complete with comprehensive data & instructions. Full scale reading is 200mV & conversion is easy for 2V & greater. Being a kit you can expand its uses for what you require!

Cat. K-3450

$42.50 3½ DIGIT DISPLAY!

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforseen circumstances might hold up goods so that advertised lines are not in the stores by the time the advert appears. Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray.

What we are trying to say is that if you're about to drive across town to pick up a particular line at a Dick Smith Store, why not give the store a ring first (addresses and phone numbers below) ... just in case! Thanks.

Dick Smith and Staff

NOW OPEN in SPRINGVALE

Yes you lucky Victorians, you've got a new store! It's the first store we've built from the ground up, so we want you to have the very best. There's everything for the electronics enthusiast, hobbyist, amateur, CB'er, computer operator, hi-fi buff etc etc. We're now open at the corner of Springvale & Dandenong Roads (Telephone: 547 0522). If you can't make it to Springvale, drop into one of our other stores or resellers, addresses below.

115V PROBLEMS?

A very common request is for a transformer to operate 115V equipment from 240V mains. Here it is rated up to 80VA (suits most audio & entertainment appliances). Fully approved, ready to plug in.

Cat. M-1156

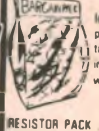
$42.50

DICK'S ZIPPYS ARE BEST!

Dick Smith zippy boxes are unique, they're the ones with slotted sides allowing for easy mounting of PCB's etc. Insist on them!

SIZE	Cat No.	1-9	10 up
150x90x50	H-2751	$2.50	$2.00
196x113x60	H-2752	$3.75	$3.00
130x68x41	H-2753	$1.85	$1.60
85x54x28	H-2755	$1.50	$1.20

PACK IT IN



Ideal for the hobbyist and professional. Each pack contains top quality components in various ranges you save when buying in bulk!

RESISTOR PACK	R-7010	$4.90
CERAMIC PACK	R-7050	$3.00
GREENCAP PACK	R-7040	$6.50
ELECTROLYTIC PACK	R-7030	$5.00

MAJOR DICK SMITH RE-SELLERS:

Listed below are re-sellers who stock a large proportion of our range. However, we cannot guarantee that they will have any or all of the items, or at the same prices, as those advertised on these pages.

ATHERTON, QLD: Tableland Radio Service
2 Jack Street. Phone 912 017

BENDIGO, Vic: Sumner Electronics
95 Mitchell Street. Phone 431 877

BLACKHEATH, NSW: Goodwin Electronics
123 Station Street. Phone 878 379

BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street. Phone 6897

CAIRNS, QLD: Thompson Instrument Services
78–81 McLeod Street. Phone 512 404

COFFS HARBOUR, NSW: Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave. Phone 525 684

DARWIN, NT: Kent Electronics
42 Stuart Highway. Phone 814 749

DUBBO, NSW: Selekta Sound
31 Talbragar Street. 826 875

EAST MAITLAND, NSW: East Maitland Electronics
Cnr Laws & High Streets. 337 327

FAIRY MEADOW, NSW: Trilogy Wholesale Elect.
40 Princes Hwy. Phone 831 219

GERALDTON, WA: KB Electronics & Marine
381 Main Terrace. Phone 212 176

GOSFORD, NSW: Tamarrow's Electronics & Hi Fi
68 William Street. Phone 247 246

HOBART, TAS: Aero Electronics
123a Bathurst Street. Phone 348 232

KINGSTON, TAS: Kingston Electronics & Records
Channel Court. Phone 296 802

LAUNCESTON, TAS: Advanced Electronics
5a The Quadrant. Phone 317 075

LISMORE, NSW: Decro Electric
Magellan St & Bruxner Hwy. Phone 214 137

MACKAY, QLD: Stevens Electronics
42 Victoria Street. Phone 511 723

MARYBOROUGH, QLD: Keller Electronics
218 Adelaide Street. Phone 214 559

MORUYA, NSW: Coastal Electronics
43 Vulcan Street. Phone 742 545

MT GAMBIER, SA: Hutchesson's Communications
5 Elizabeth Street. Phone 256 404

MUSWELLBROOK, NSW: Silicon Chip Electronics
Suite 3, 98 Bridge Street. Phone 43 1096

NAMBOUR, QLD: Nambour Electronic Shop
Shop 4, Lowan House, Ann St. Phone 411 604

NEWCASTLE, NSW: Elektron 2000
181 Wharf Road. Phone 262 644

ORANGE, NSW: M&W Electronics
48 McNamara Street. Phone 626 491

ROCKHAMPTON, QLD: Purely Electronics
15 East Street. Phone 21 058

SOUTHPORT, QLD: Amateur's Paradise
121 Nerang Street. Phone 322 844

TAMWORTH, NSW: Sound Components
78 Brisbane Street. Phone 661 363

TOOWOOMBA, QLD: Hunts Electronics
18 Neil Street. Phone 326 944

TOWNSVILLE, Qld: Tropical TV
49 Fulham Rd, Vincent Village. Phone 791 421

TRARALGON, VIC: Power 'N Sound
147 Argyle Street. Phone 743 638

WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street.

WINDSOR, NSW: Hawkesbury Electronic Centre
111 George Street. Phone 773 411

WODONGA, VIC: A & M Electronics
78a High Street. Phone 244 588

WHYALLA NORRIE, SA: Mellor Enterprises
Shop 2, Forsythe Street. Phone 454 764

WOULD YOU LIKE TO BE A DICK SMITH RE-SELLER?

How would you like to join the hundreds of successful Dick Smith re-sellers spread right across Australia?

If you're interested, why not give our wholesale division a call – Sydney (02) 888 3200, 9AM – 5.30PM weekdays.

It could be the start of something big ...

COMING NEXT MONTH...the new DICK SMITH 1981 CATALOGUE

Packed with more products, more information and over 30 pages of data! A RECORD 136 PAGES!!! FREE in the April issue of EA & ETI!

PHONE IT! Speaker Phone

This phone has the latest in push button technology – but that's not all! It has a re-call button that remembers the last number dialled as well as a mute switch that allows you to hear the caller without him hearing you. You can place the speakerphone on a table or desk and talk – hands free!

NOTE: Current regulations do not permit this phone to be used as a replacement of the normal Telecom phone

Cat. X-1177

$99.00

12 VOLT CAR CLOCK

Enhance the appearance of your car's dash and add SSS to its value! Features alarm, automatic brightness and a large, easy to see digital readout. Easy to install. Complete with all mounting hardware and instructions. Suit cars, planes, trucks, boats etc. Cat X-1047

$24.50

NEW INTERCOM TERMINAL BOX

This 12-8 station system can be wired with a minimum of fuss. Use with any intercoms including the Myphone systems & communicate with ease. Cat. F-1321 (not illustrated) **$59.00**

MYPHONE TC-PR REMOTE UNIT

Use in conjunction with master units TC-3 & TC-5M. Incorporates a privacy switch to prevent unauthorised listening by the master.

Cat F-1201 **$13.50**

MYPHONE TC-3 MASTER

Use in conjunction with the TC-PR remote units to make a system where the master & any remote unit can communicate but where remotes cannot communicate with other.

Cat F-1230 **$35.00**

MYPHONE TC-5M STATION MASTER

Use with up to 4 other TC-5M's giving a max. of 5 'all master' units. Distance between units can be up to 1000 feet. Also incorporates a privacy switch & the called unit can answer hands free. Can be intermixed with TC-PR remote units too.

Cat. F-1240 **$45.00**

CABLE & MORE CABLE!

Connecting an intercom? Check out our huge range of cable for the hi-fi buff, CB/Amateur operator, experimenter etc etc. Here are just a few:

MINI FLEX SPK CABLE

2 Conductor. Trace marked for polarisation.
Cat W-2010 07¢/m (100m 15¢/m)

TELEPHONE CABLE

4 conductor
Cat. W-2120 45¢/m (100m 35¢/m)
12 conductor
Cat. W-2140 75¢/m (100m 80¢/m)

RAINBOW CABLE

12 conductor 12 colour coded strands.
Cat. W-2045 85¢/m (100m 70¢/m)

SHIELDED AUDIO CABLE

Single conductor
Cat. W-2030 30¢/m (100m 25¢/m)
Twin conductor
Cat. W-2034 50¢/m (100m 30¢/m)

TRACE IT! AND SAVE $10.00! WAS $49.50

Can't afford one of those big radar detectors? Then Here's the answer! The Dick Tracer MKII is almost as good as those 'big guns' but you can save SSS over them. The Dick Tracer has more components than the MKI model & can be recharged (via cigarette lighter plug). Leaves no messy wires around. Keeps you away from the boys in blue!

$39.50 Cat. A-8500

ADAPT IT! WAS $9.50!

Throw away those old batteries and save a bit on the side too! This battery eliminator will adapt your radio/cassette recorder/calculator etc to the 240 mains – easy! Also has a 4-way connector to suit most types of electrical equipment. Cat. M-9525

$6.90

MAKING ANTENNAS?

EGG INSULATORS

Tough nylon egg insulators for many antenna applications. Unbreakable & durable.
SMALL: Cat. D-5300 **85¢**
LARGE: Cat. D-5302 **$1.45**

ANTENNA BALUN KIT

Contains ferrite ring, enamelled copper wire and winding details for 1:1, to 1:9 ratio. Input power 2kW PEP and frequency range of 3-30MHz!
Cat. D-5350 **$9.90**

MOUNT IT!

$9.50 Cat. D-4520

This handy roof rack has a mount for a CB or HAM antenna etc. So don't reduce the re-sale value of your car by drilling unnecessary holes. Buy another and carry a surfboard!

SEAL IT! Silastic Adhesive/Sealant $3.95

This general purpose one part silicon rubber adheres to metals, glass, paint, ceramics, most plastics & wood. Ideal for mending leaks in windscreens, fish tanks, roof tiles etc. Cat. N-1225

RECORD IT

Apply directly to any phone or intercom (via suction pad) and feed into your amplifier or tape recorder. Easy to use. Cat. C-7300 **$1.50**

NEW DIGITAL MULTIMETER

Here is the ultimate in accuracy. This LCD multimeter is perfect for the servicemen, technician etc. Provides 20 ranges with an accuracy of ± 0.8%!!! You'll be surprised at the savings over other competitive meters that don't live up to this one!

DCV: 200mA, 2, 20, 200, 800.
ACV: 200V, 1000V.
DCmA: 200uA, 2mA, 20, 200.
RESISTANCE: 2k, 20k, 200k, 2000k, 200 ohm
HI/LOW OHM RANGE
OVERLOAD PROTECTION
Requires 9V battery.

Cat. Q-1450 **$75.00**

COMING SOON... THE ALL NEW YAESU FT-720RUH 2M TRANSCEIVER

Cat. D-2890

This is the rig for todays 2 metre operator. You can scan the frequencies up & down at the touch of your finger & you can even program it to stop on a busy channel. As many as 5 memory channels can be programmed for instant return. The LED meter gives an easy & accurate reading of power & signal at a glance. Its compact size makes it ideal for the car of the '80s.

$450.00

APOLLO Handheld

This 5 watt 8 channel transceiver is ideal for campers, fishermen or on the boat. Delivers plenty of power but does not exhaust the batteries. Makes it ideal for that unexpected emergency that can happen at any time. Features a squelch control, battery, TX/RX meter, ext mic & antenna jack plus MUCH MORE. One channel is fitted with the marine emergency channel (27.880MHz). So be prepared next time you venture the great outdoors.

Cat. D-1122

$120

LED TACHO KIT

Get the best from your car's engine. As with a conventional tacho, it displays the engine speed in an analogue form – but with an illuminated row of LEDS! It indicates at a glance what your engine is doing, without having to mentally interpret a numerical display as with a conventional tacho. YOU DON'T TAKE YOUR EYES OFF THE ROAD! Use with 12V positive or negative earthed systems. Only 3 connections are required and it is easy to build. Complete with instructions.

Cat. K-3240 **$24.50**

HI SIDE XTALS FOR 27MHz TRANSCEIVERS

Eliminate 'image' interference on marine frequencies from CB radios & paging units etc. RECEIVE XTALS NEEDED ONLY.

D-6123	27.88	28.335	ONLY
D-6124	27.89	28.345	$5.00
D-6125	27.90	28.335	EACH!
D-6126	27.91	28.365	

Yes, we've got the crystals for the new 27MHz marine channels receive, transmit pairs plug straight in.

27.880 (Cat D-6088)
27.940 (Cat D-6094)
27.96 (Cat D-6096)

$5.00 pr.

Handyman's MULTIMETER

OUR BIGGEST SELLER

This is the meter anyone can use. Gives all the accurate readings needed for that important job. Provides 20 ranges PLUS a dB scale. Comes complete with batteries, test leads and instructions.

DCV: 0.1, 0.5, 2.5, 10, 50, 250, 1000V.
ACV: 2.5, 10, 50, 250, 1000V.
DCA: 0.05, 2.5, 25, 500mA
RESISTANCE: 5k, 50k, 500k, 5M ohms

Cat. Q-1024 **$29.50**

WE'VE GONE METRIC!

Soon, you'll be able to buy our new range of metric pots, knobs, and rotary switches. Prices will even be less so you'll be able to purchase with remarkable savings (especially with bulk prices). If you require imperial knobs, pots, or rotary switches, we will still be stocking them for a while for your convenience.

CHECK OUR NEW 1981 CATALOGUE FOR DETAILS – COMING NEXT MONTH!

Hey shoppers, secretaries, businessmen... Take down all your notes on this MICRO CASSETTE UNIT

This handy little unit will accept micro cassettes that are so small, no one will notice! Makes it ideal for conferences, secretaries etc. Just slip it into your pocket on your travels. Also has two speeds, so you can double the time of a 30 minute cassette to one hour!

Cat. A-4040 **$47.50**

MICRO CASSETTES TO SUIT:
15 minutes per side
Cat. C-3360 $2.95

3 CH RADIO CONTROL UNDER $100!

Ideal for planes, boats, cars etc etc. 3 channels, comes with servos, battery case, etc.

- digital proportional control
- each channel has 'offset'
- Xtal controlled (changeable xtal).

$99 Cat X-1230

COMPUTER CASSETTE

Do you ever get those annoying drop-outs affecting your program? These tapes will eliminate the problem. Leaderless for hassle-free recording. 6 mins a side.

$1.95 Cat. X-3500

QUALITY PRICE VALUE!

That's what you look for in a cassette tape. You can't have value without high quality, or a bargain price. Most often, you have to settle for one or the other. Dick Smith cassettes

C60	low noise	$1.50	C-3350	$1.00
C90	low noise	$2.00	C-3352	$1.20
C90	Extended dynamic range	$2.75	C-3354	$1.90

10 OR MORE:

The Dick Smith SUPER CRO AT A SUPER PRICE!

Want a quality CRO at a budget price? We've sold hundreds of this quality 6.5MHz CRO – ideal for hobbyists or the service bench. Cat Q-1280

OUTPERFORMS CRO'S COSTING MUCH MORE!

$199

DICK SMITH ELECTRONICS

NSW	145 Parramatta Rd	AUBURN	648 0558
	613 Princes Hwy	BLAKEHURST	546 7744
	818 George St	BROADWAY	211 3777
	531 Pittwater Rd	BROOKVALE	93 0441
	147 Hume Hwy	CHULLORA	642 8922
	162 Pacific Hwy	GORE HILL	439 5311
	30 Grose Street	PARRAMATTA	683 1133
	125 York Street	SYDNEY	290 3377
	263 Keira Street	WOLLONGONG	28 3800
ACT	96 Gladstone St	FYSHWICK	80 4944
QLD	166 Logan Road	BURANDA	391 6233
	824 Gympie Rd	CHERMSIDE	59 6255
SA	60 Wright Street	ADELAIDE	212 1962
VIC	399 Lonsdale St	MELBOURNE	67 9834
	656 Bridge Road	RICHMOND	428 1614
	Dandenong Rd	SPRINGVALE	547 0522
WA	414 William St	PERTH	328 6944

DICK SMITH MAIL ORDER CENTRE:

PO Box 321, North Ryde NSW 2113. Phone (02) 888 3200

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What price the Breeder Reactor?

While Australians have argued over the desirability of uranium mining, the debate has been largely invalidated by events overseas. In Europe, Japan and the USA, the necessity for nuclear power is well accepted. The question now facing the US is whether or not to follow the European lead and build breeder reactors!

by EDWARD EDELSON

The three 8-metre high black domes that I saw as we drove up to the undistinguished F. W. Hake warehouse on President's Island in Memphis didn't seem especialy dramatic. Nor did the half-dozen or so tarpaulin-covered tanks that loomed inside the shadowy building, for all their massive presence.

But for knowing eyes, the drama was there – the drama of the tough decisions that must be made as mankind tries to find a way out of the global energy crisis. Standing in the warehouse, I was looking at some visible evidence of the questions that must be answered as the experts try to determine whether the world should follow a nuclear path to energy abundance.

The $16 million worth of equipment in the warehouse and the $22 million in components at the CBI nuclear plant at the other end of the island are part of a whopping half billion dollars in hardware already fabricated or under construction for a new kind of nuclear reactor, the Clinch River Breeder Reactor. But it is one that the Carter administration had vowed would never be built.

Supporters of the Clinch River project are openly dismayed by the administration's stand. They see the Clinch River breeder as the prototype of a new generation of reactors that will provide an almost limitless supply of electricity. "Building this is saying that we want more electricity, rather than doing without," I was told by William F. Rolf, general manager of the Clinch River plant. "That's what I think the country wants."

But opponents say that breeder reactors, in general – and Clinch River, in particular – are the wrong way to go, for any number of reasons. "I don't think the breeder pays on the basis of nuclear proliferation, safety, or economics," said Thomas B. Cochran of the Natural Resources Defense Council. "It has all the problems of general fission reactors and some of its own."

Conservation is not the answer

The debate between the supporters and opponents of the breeder reflects gnawing anxieties over the world's energy future. The supply of nonrenewable fossil fuels – oil, gas, coal – is steadily dwindling. Conservation can stem the haemorrhage, but only for so long. Thus there is an increasing clamour for a gradual transition to renewable-resource methods, such as biomass, solar energy, and eventually nuclear fusion.

But uranium – the radioactive substance that fuels existing nuclear reactors – is also being depleted. The whole point of the breeder is to turn uranium into a renewable resource by "breeding" more fuel – in the form of plutonium – than it consumes, thereby providing us with reactor-generated electricity for centuries. Without the breeder, nuclear energy could pass from the world scene as fast as oil promises to do. A report from the Government Accounting Office last year stated the issue baldly: "Breeders are the essential ingredient of making nuclear fission a longterm energy source. A decision not to develop breeders implies the phasing out of nuclear fission. . ."

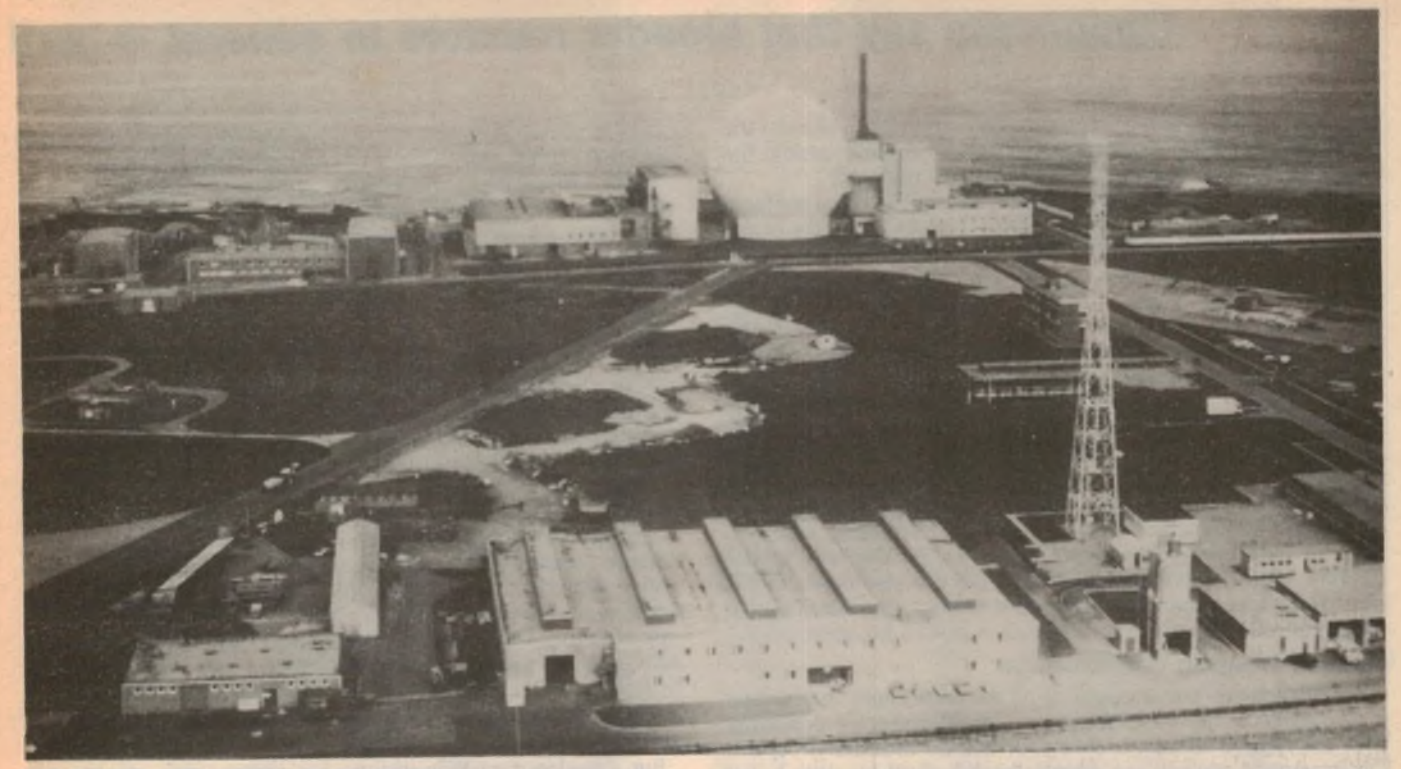
Do we really then need the breeder? Its opponents say no. The major objection is pinned to the very thing that makes the breeder so attractive to its supporters: A breeder makes plutonium. And plutonium, unlike the commonly found form of uranium, can easily be made into nuclear weapons, either by maverick governments or by determined terrorist groups. The prospect of the unhindered spread of nuclear weapons – the proliferation issue – is what prompted President Carter in April 1977 to halt construction of the Clinch River plant, to suspend reprocessing of spent fuel from conventional reactors (which also yields plutonium), and to urge other nations to follow his lead.

And, say the breeder's opponents, there are other objections. They say that the breeder's complex technology makes it basically unsafe; that on purely economic grounds it is unsound; that because we have enough uranium to bridge the gap between fission and fusion (or other energy sources) it is unnecessary; and finally, that even if it turns out we will need the breeder, we won't have to make that decision for another five years or so.

The perplexed citizen trying to sort out these conflicting claims must understand, first of all, the differences between the breeder and a conventional fission reactor.

Today's nuclear industry is based entirely on uranium-235, which makes up just 0.7% of mined uranium. The other 99.3% is U-238, which is not usable as nuclear fuel. That natural supply can be stretched somewhat, because today's reactors do produce some plutonium and uranium that can be used as fuel. But the current reactors (sometimes called "converters" to distinguish them from breeders) produce only six atoms of fuel for every 10 they use. Build enough reactors, and

> "Building this is saying we want more electricity, rather than doing without. That's what I think the country wants"



Britain's 250MW Prototype Fast (breeder) Reactor began generating electricity at Dounreay in northern Scotland in 1974.

eventually all the natural fuel will be gone – unless mankind does something to replenish the supply.

That fact was recognised at the very beginning of the atomic age, when physicists started down what some of them thought would be a smooth, unbroken road to a breeder-reactor economy. The Manhattan Project included a reactor called Clementine, which incorporated some basic features of current breeder reactors.

The basic principle of all reactors is the same. Each has a core made up of hundreds of fuel rods. A fuel rod in one of today's commercial reactors consists mostly of U-238, with about 3% U-235, all wrapped in a protective jacket made of an alloy called Zircaloy. The U-235 atoms fission, or split spontaneously. When a U-235 atom fissions, it gives off several neutrons. Those neutrons can hit other U-235 atoms, causing them to fission and to emit more neutrons, which strike more U-235 atoms – the celebrated "chain reaction." Some of the neutrons hit U-238 atoms, turning them into plutonium atoms that are fissionable and thus are usable as fuel.

Light-water slowdown

Current nuclear reactors keep all the neutrons within the core by slowing them down. The neutrons are slowed by a "moderator" – which turns out to be plain water. The water not only slows the neutrons but also carries the heat from the core to a steam generator, which produces electricity. Thus, current reactors are called "light-water reactors" (a name deriving from the finicky scientific desire to distinguish ordinary water from the "heavy water" that contains the unusual hydrogen isotope called deuterium).

By contrast, Clementine used fast neutrons, meaning that nothing was done to slow the neutrons emitted by fissioning atoms. Some of the fast neutrons could stream out of the core. If the core were surrounded by a thick blanket of U-238, many of the atoms in the blanket would be transformed into plutonium. If the core and the blanket are properly designed, the reactor breeds more nuclear fuel than it consumes, making it an efficient and desirable source of energy.

As early as 1963, a commercial breeder reactor was operating in the United States – the Enrico Fermi plant, built by Detroit Edison. But the first signs of trouble with the American breeder program soon appeared. A zirconium plate – added, ironically, as part of an extra safety system – came loose and blocked the flow of coolant to the nuclear core. Part of the core melted, and the plant had to be shut down for long and expensive repairs. The Fermi plant eventually went into full operation, but it was closed down permanently at the end of 1971, in large part because of financial problems caused by the accident.

The Fermi incident was just one symptom of what have turned out to be chronic difficulties with the American breeder program, which has steadily lost the clear lead it once had over the rest of the world. The United States now stands solidy in fourth place in the development of the breeder reactor.

> "I don't think the breeder pays on the basis of nuclear proliferation, safety, or economics. It has all the problems of general fission reactors and some of its own"

The French are clearly first, having laid out a breeder program with relentless Gallic logic. An experimental reactor named Rhapsodie, which produced 20 megawatts of heat, went into operation in 1967; its heat output was doubled by design improvements in 1971. The Phenix reactor, with a capacity of 250 megawatts of electricity, went into operation in 1973. The French are now building Super Phenix, with a design capacity of 1200 megawatts of electricity and an on-line target date of 1982. And this year, Electricite de France, the state-owned authority, said that it will order two 1500 megawatt breeder reactors, to be put into operation by 1985.

The British and the Soviets are not far behind the French. The British have been running their 250 megawatt Prototype Fast Reactor at Dounreay in Scotland since 1974. They have plans for a 1300 megawatt commercial demonstration reactor whose construction would start by 1985, with an on-line target date of the early-to-mid-1990s. A Soviet 350 megawatt

breeder has been operating since 1973 at Shevchenko on the Caspian Sea, and a 600 megawatt breeder at Beloyarsk in the Ural Mountains went into operation early this year.

Obviously, the view from Europe is drastically different from that of the US government. C. Pierre Zaleski, a leader of the French nuclear effort, said he could understand why the US is holding back on the breeder. "It's clear that you are less vulnerable to an energy shortage in the immediate future," Zaleski told me. "Only 20% of your energy is imported. We import 77% of our total energy. For us, the breeder reactor comes down to a question of survival."

John Gaunt, a nuclear expert at the British embassy in Washington, DC, told me that even with North Sea oil finds, the breeder reactor seems essential for his nation. The oil will run out eventually, Gaunt said, and the obvious alternative is the plutonium that Britain is already extracting from the fuel elements of its Magnox nuclear reactors. "We have about 10 tons of extracted plutonium," he said. "By the end of the century, we will have about 40 tons. We will also have 20,000 tons of depleted uranium. That is the energy equivalent of five times the oil in the North Sea. That is not to be sneezed at."

Fear of weapon construction

But it is exactly the thought of all the plutonium that would be available if the world turns to a breeder-reactor economy that has helped to cast a chill over the US breeder program. Disarmament experts are especially disturbed by their belief that plutonium from a breeder reactor could be used to construct nuclear weapons with remarkable ease.

Studies done for the US Arms Control and Disarmament Agency show that light-water reactors are rather proliferation-resistant. A country that wants to extract weapons-grade material from used fuel rods has to go out of its way to build a complex and expensive fuel-reprocessing plant. Such a plant is not really necessary for operating a light-water reactor, so construction would be a clear signal to the world that a nation was on the path to nuclear weapons. By contrast, fuel reprocessing is an essential part of a breeder-reactor economy. The whole point of the breeder reactor is to extract plutonium from used fuel rods. That plutonium can be turned into weapons-grade material in a matter of days – and a single breeder core yields enough plutonium for hundreds of bombs.

Energy-hungry European nations have not bought the US government's anti-proliferation arguments. But in October 1977, everyone agreed to a broad-based study. The International Nuclear Fuel Cycle Evaluation (INFCE), which had eight working groups, eventually included 66 nations, and handed down a voluminous bundle of findings early last year.

One of the major points of the INFCE report supported something that breeder opponents have been saying for years: There is no technical fix for the proliferation problem. A number of schemes had been proposed to make weapon construction more difficult. One is the CIVEX fuel-processing plan, which would leave a large proportion of the lethal radioactive byproducts of fission in the processed uranium. Radiation would be so deadly that no one who came near the fuel could survive long enough to build a bomb. Another proposal is to switch to a fuel cycle based on uranium-233, another fissionable isotope, and thorium on the grounds that much less plutonium would be produced. INFCE's experts concluded that none of the schemes would work. The only way to handle the weapons-proliferation problem, the experts said, is by political agreements – for example, by requiring storage of all plutonium under international supervision.

The proliferation problem does not appear to worry European nuclear leaders. The genie is already out of the bottle, Zaleskie told me: Nuclear fuel is being reprocessed to yield plutonium, hundreds of nuclear weapons are in place, and the addition of breeder reactors will not make much of a difference. British Prime Minister Margaret Thatcher summed up one prevalent point of view about plutonium when she said that "the safest thing is to burn it in a fast reactor."

European nuclear experts also say that the safety of breeder reactors is not a major issue. Opponents disagree, and say that there are several serious weak points in breeder safety.

One is the use of highly enriched fuel in the core of a breeder reactor. There is a good deal of plutonium in the breeder core, and some studies say that if a meltdown began, parts of the core could have enough fissionable material for a minor explosion – "minor" by nuclear standards, that is. There are worries about whether such an explosion could break through the reactor's containment vessels. (Such an explosion cannot occur in a light-water reactor, because its fuel is not highly enriched. It can melt, but it can't blow up.)

There's also the problem posed by the coolant used in breeder reactors. Every program is concentrating on LMFBR's – Liquid Metal Fast Breeder Reactors. The liquid metal is sodium, which transfers heat given off by the core to the water, which becomes steam that turns an electric generator. Sodium is used because it can store a large amount of heat per unit volume and liquefies at relatively low temperatures. It also reacts violently with both water and air. The Soviet breeder at Shevchenko had a major fire in 1973 when a sodium line burst, and critics say that sodium fires are a constant threat for any breeder.

But Zaleskie says that sodium has some safety advantages over light water as a coolant. The biggest advantage is that

> "If I were in France, I'd be working as hard on a breeder reactor as I could. They don't have oil, they don't have natural gas, they don't have uranium, and they don't have coal"

sodium in a breeder is not kept under the high pressure that is needed for water in a light-water reactor. The big problem at the Three Mile Island reactor, for example, was that pressurised water came roaring out of the reactor, exposing the core and allowing a dangerous buildup of heat. In a similar situation, sodium in a breeder will just lie there, carrying away heat as it should, Zaleskie said. Gaunt adds that the British have run a number of tests in which they stopped pumping sodium through a breeder. Heat built up so slowly that the reactor would have been safe for months, compared to the few minutes' margin of safety in a light-water-reactor accident, he said.

As for the possibility of an explosion, breeder proponents say that one simply calculates the maximum possible explosion and builds a containment vessel strong enough to sustain it – a strategy that is greeted with predictable skepticism by breeder opponents.

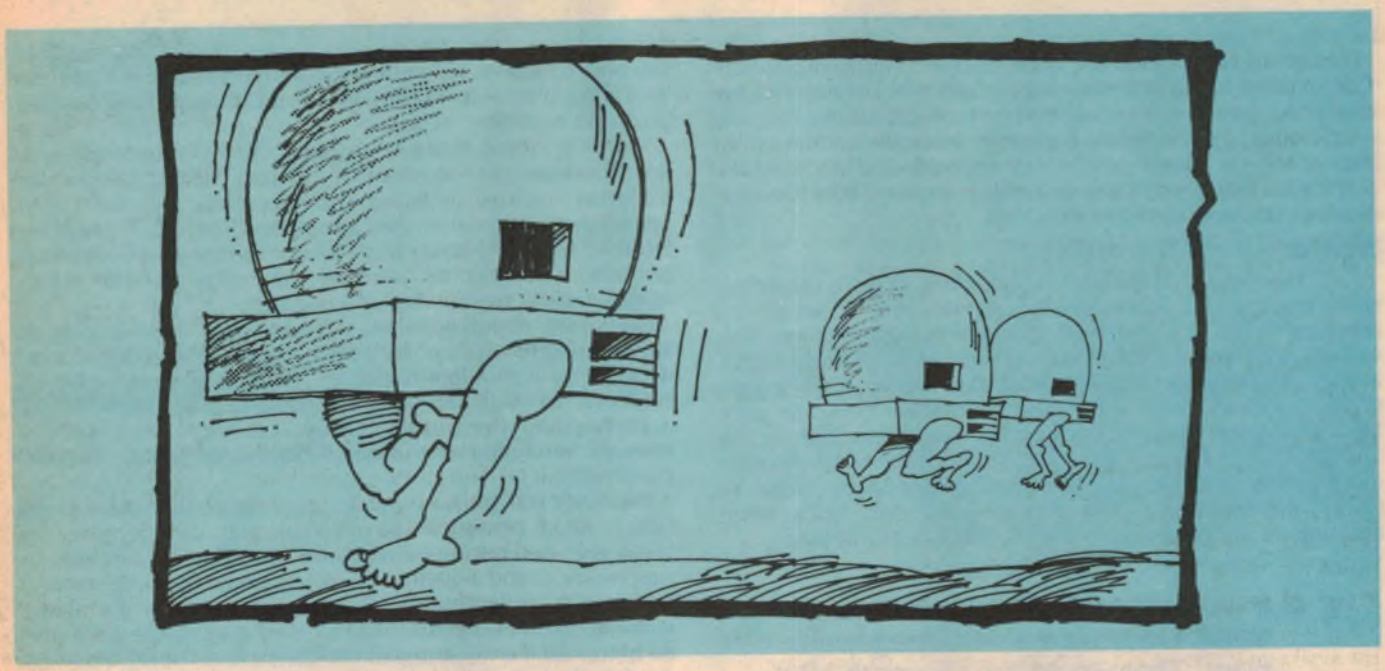
Different in America

One intriguing thought behind these arguments is that the European situation might be so different from ours that their reasoning has to be different. "If I were in France, I'd be working as hard on a breeder reactor as I could," said Marvin Moss, associate director of energy research for the US Department of Energy. "They don't have oil, they don't have natural gas, they don't have uranium, and they don't have coal."

It's different here – different enough so that several studies have concluded that we can delay a decision about going ahead with a breeder for at least five years and perhaps much longer. Those studies are, of course, challenged by breeder proponents.

One important element in the breeder decision is the fact

Clinch River, in particular — are the wrong way to go



that the US will be using much less nuclear energy in the foreseeable future than was predicted when the breeder program began. In 1972, the Atomic Energy Commission forecast that there would be 1200 gigawatts of nuclear electricity on line in the US by the year 2000. (A gigawatt is 1000 megawatts). Last year, Secretary of Energy Charles Duncan told a congressional committee that "nuclear capacity in the United States appears likely to increase from current levels of about 50 gigawatts to 150-200 gigawatts by 2000."

Some exult over that decline, as a sign that Americans are at least learning to conserve energy. Others agonise over it, as a sign of American technological deterioration. But given the long lead time for building new nuclear plants – about 12 years in the current regulatory climate – most experts accept those numbers and move on to calculate when we might need the breeder because we would be running out of uranium.

A standard 1000 megawatt nuclear plant of current design will use about 4300 tonnes of uranium for a 30-year life-time. Therefore, 200 gigawatts of nuclear power on line in the year 2000 would require roughly one million tonnes of uranium. The official estimate by the National Uranium Resource Evaluation group is that 4.1 million tonnes of uranium will be available in the United States if the price is $110 per kilogram of uranium. (The current price is $88 a kilogram.)

But there is enormous uncertainty in that estimate since it includes much uranium that has not yet been discovered but is assumed to be there. Looking at the same geological data, the massive study of the Committee on Nuclear and Alternative Energy Systems (CONAES) estimated the supply to be 2.4 million tonnes.

Comparing the economic elements

And the economics of the breeder reactor must also be part of the equation. Even if we make a total commitment to the breeder, it would not make sense to start building commercial breeder reactors until they are economically competitive with light-water reactors. Fuel costs are only one part of the economic equation. Capital costs – the price of building the breeder – must also be considered in determining economic feasibility.

Breeder capital costs will be higher than light-water reactor costs; the question is how much higher. The current generation of demonstration breeders cost at least twice as much as off-the-shelf light-water reactors. Breeder experts say that commercialised products will cost only about 40% more, and that much of that difference will be recouped by fuel reprocessing.

No way, says breeder opponent Thomas Cochran. "To get down to 40% more capital costs, they have to do a lot of arm-waving and talking about learning curves and mass production," Cochran said. "Those are the same kinds of arguments they made in the early 1970s for the light-water reactors. They said the costs would go down as they moved along the learning curve. In fact, they went way up."

The argument that fuel reprocessing will save money is greeted with the same scepticism by doubters. In a report for the Arms Control and Disarmament Agency, Brian Chow of Pan Heuristics quotes German figures showing that costs of a proposed reprocessing plant there more than quadrupled. Current US estimates for fuel-reprocessing costs "should be considered unrealistically low," Chow said.

Opponents also claim that fuel-reprocessing technology is a tough beast to tame. The only plant ever to operate in the United States, at West Valley, NY, was open for only six years. It closed in 1972 for a modernisation program that initially was estimated to cost $15 million. Safety requirements added by federal nuclear officals raised that estimate to $600 million, so prohibitively high that the plant was abandoned by the corporation that operated it. The legacy of West Valley includes 600,000 gallons of high level radioactive waste whose disposal could cost more than one billion dollars.

The new French reprocessing plant at Cap de la Hague, near Cherbourg, had a potentially major incident last April 16, when it lost all electric power for an hour. Experts said that serious trouble was avoided only because the plant was not yet in production.

The need for such expensive and possibly dangerous fuel reprocessing can be put off for years by technological fixes that stretch the current supply of uranium, some experts say. One technique is to change the composition of light-water-reactor fuel rods to get more "burnup" – more energy out of the same amount of uranium.

New fuel rods already in advanced testing give 15% more energy than fuel elements now in use. The life-time of today's fuel rods is limited by cracking that is caused by an interaction between the uranium and the Zircaloy cladding. Designers of the fuel rods now being tested are trying to eliminate the cracks either by adding a copper or zirconium lining or by coating the uranium with graphite. If the fuel rods last longer, more of the uranium will be burned up, and more energy will

be extracted from each fuel rod.

Further down the road are changes that could give another 15% increase in light-water-reactor efficiency. One change would be the addition of some heavy water to the reactor, which would also switch to a thorium-uranium-233 fuel cycle. Such changes, which could be incorporated in reactors coming on line toward the end of the century, could reduce uranium demand by more than 50%.

Squeezing out the atoms

The Department of Energy is also looking at ways of getting more uranium-235 atoms out of uranium ore. There are 70 atoms of U-235 in every 1000 atoms of natural uranium. The current enrichment method extracts about 50 of those U-235 atoms. It combines uranium with fluorine to form a gas, uranium hexafluoride. The gas molecules then are sent through porous barriers. Because the gas atoms with U-235 are lighter than those with U-238, more of them get through the barriers, and the gas becomes progressively richer in U-235. Unfortunately, the process not only uses large amounts of energy but also leaves much U-235 behind.

> "If we proceed with Clinch River, by 1988 we'll have a 350-megawatt plant. That would be 15 years after the French and the Soviets had the same thing. We must leapfrog if we want to maintain our position"

Several experimental enrichment methods use laser light to separate out U-235 with greater efficiency and less energy. The two uranium isotopes cannot be separated by ordinary chemical methods because their chemical behaviour is identical. But they absorb slightly different wavelengths of light. If just the right wavelength of laser light is used, only the U-235 atoms will absorb the energy from the laser beam. That absorbed energy allows the efficient separation of the U-235 atoms from the U-238 atoms. Such advanced technology could get 15 of the 20 currently wasted U-235 atoms separated out, increasing the effective supply of uranium.

The Department of Energy cranked all those numbers into a model in 1979 and came out with numbers that sounded like bad news for supporters of an all-out program to commercialise breeders.

"The range for the year in which a commercial breeder would be needed was from 2005 to greater than 2050, and the majority of the numbers were at the higher end," said Marvin Moss. "We felt that the year 2020 was a prudent estimate to select. To commercialize the breeder in 2020, we would have to make a decision on a demonstration breeder probably by 1985.

The DOE report brought a predictably acid response from the Government Accounting Office, which works for Congress – predictable because Congress and the Carter administration were at odds about the Clinch River program. For the past few years, Clinch River has been kept alive only because Congress has restored the funds that the Carter administration has cut out of its budget.

GAO said that the Energy Department's assumptions on such variables as the breeder's capital cost "range from doubtful to highly questionable. The direction of this bias is such as to lean toward conclusions that support the administration's previously stated position – that there is enough time for the United States to delay breeder development."

The GAO report came out strongly for continuation of the Clinch River project – a proposal that can generate an argument even from some who describe themselves as supporters of the breeder-reactor concept. Their argument is not that the Clinch River design is obsolete, as the Carter administration contended. Rather, they say that the US would be better off if it leapfrogged the Clinch River phase and went on directly to build a much larger demonstration breeder.

"If we proceed with Clinch River, by 1988 we'll have a 350 megawatt plant," said Robert Staker of the Energy Department. "That would be 15 years after the French and the Soviets had the same thing. We have to do leapfrogging if we want to maintain our position."

As it happens, that is exactly the administration position. It proposes to drop Clinch River but to proceed with conceptual studies of a 1000 megawatt breeder that could go on line early in the 1990s. A detail design for such a plant will be completed next year, according to DOE's Staker.

One way or the other, the US must decide about the breeder during this decade. "There is room for conservation in the United States, because your per-capita energy consumption is two and half times that of France," said Zaleski. "But in four or five years, your energy savings will taper off. Then you will be in the same position as we are. You must go back to energy growth for growth of your economy. The minimum risk for society is to have the nuclear option available. To have the nuclear option, you must have the breeder reactor."

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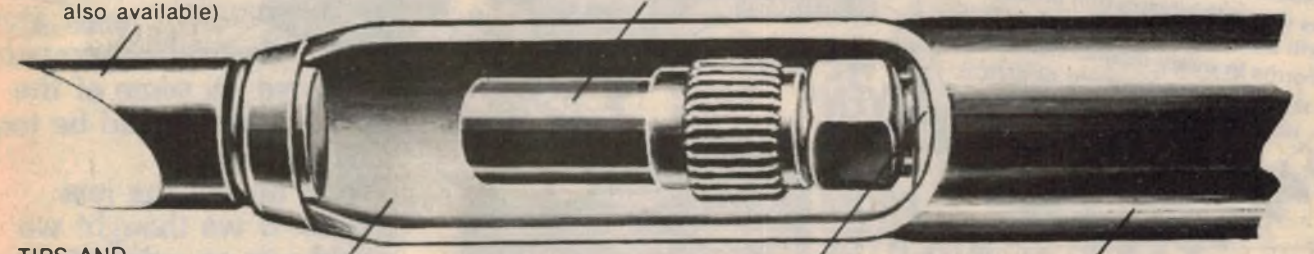

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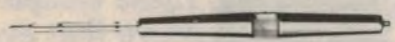

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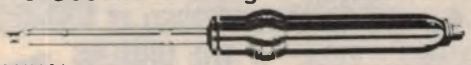

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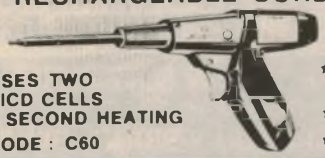

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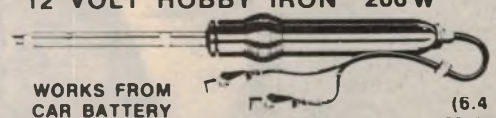

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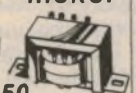

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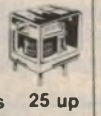

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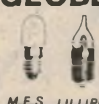

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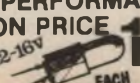

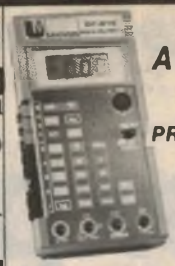

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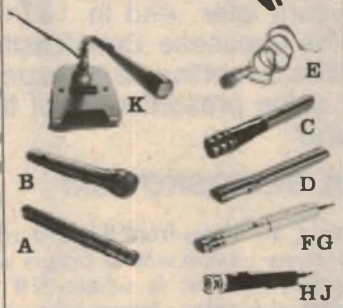

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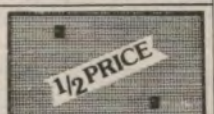

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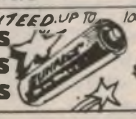

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Solving urban TV reception problems

Japan experiments with SHF television

Following an international agreement made in 1959 allocating portion of the Super High Frequency (SHF) band for future broadcasting use, experiments in SHF broadcasting commenced in West Germany some six years later. And in 1971 the Technical Research Laboratories of the Japanese Broadcasting Corporation (NHK) began their own studies by setting up an experimental station operating at 12GHz. What is the present state of the art and how might it affect our own future?

by PAUL DE NOSKOWSKI

In many large cities of the world a multiplicity of highrise buildings have been erected over the past half-century. These, together with the topographical difficulties which occur in many cities such as Sydney, can create tremendous problems for TV reception.

On the VHF band used for normal television broadcasting, the direct signal suffers attenuation although it does tend to bend around obstacles. But this signal is often coupled with strong reflections (delayed in time due to the extra distance covered) from other buildings or land formations. It is these delayed reflections which result in the ghost imges often seen on TV receivers.

Where large areas of a city are affected by such problems, attempts have been made to improve reception by installing UHF translators on suitable sites. Only recently UHF translators were installed in Kings Cross, Sydney (see December 1980 issue), with the possibility of additional installations elsewhere in the not too distant future.

But even with these UHF services functioning, several small pockets of population (such as Pyrmont, The Spit etc) will still be inadequately serviced. This is due to man-made structures or natural terrain conspiring to shield the areas from the UHF transmissions in the same way as occurs with VHF signals.

This is where SHF transmission can offer hope for much improved reception. Imagine a network of SHF translators strategically located on tall structures with each beaming its signal onto an area almost directly beneath it. With transmission being intended for reception only at short distances, low transmitter power (less than one watt) is all that is required – and low power minimises interference problems in other areas.

It would thus appear that SHF translators could be built and installed for a relatively low outlay. But practical difficulties arise. Operating frequency stability, carrier level and modulation depth of the SHF transmitter must be comparable with that of its high-powered VHF counterpart; and the SHF receiving adapters must also offer stability comparable to that of the consumer's conventional TV set. In addition the SHF receiver should be suitable for domestic use, easy to operate and available at a reasonable price.

At this point we should, perhaps, look at the development of the SHF system in Japan. A paper by Toyoo Tanaka of the Japanese Broadcasting Corporation (NHK) published in a recent issue of the Japanese Journal of Electronic Engineering (JEE) provides information on their own studies and progress over the last decade. Much of the data in the following sections has been obtained from this article.

Development and practical application in Japan

Commencing in 1971 with an experimental station operating in the 12GHz band, the Technical Research Laboratories of the Japan Broadcasting Corporation (NHK) have been studying SHF band propagation characteristics. Some four years later they supplemented the above station with a mobile station to investigate the complexities of transmission and interference in city and suburban areas.

As was already well known – and indeed put to practical use for several decades in the operation of radar systems – it was confirmed that SHF signals do travel in straight lines with no bending and negligible diffraction. Thus reception is virtually impossible if the line-of-sight between receiving and transmitting antennae is obstructed by either natural or man-made obstacles.

Therefore, high-power transmission in the SHF band to achieve a large service area would be unsatisfactory; best utilisation of the band is for a relatively small service area for which coverage can be achieved with very little power.

Whilst the SHF waves are reflected from objects, they suffer fairly high attenuation in the process. These attenuated signals usually reach the SHF receiving antenna – which has a narrow acceptance angle – from a direction where its sensitivity is low so that

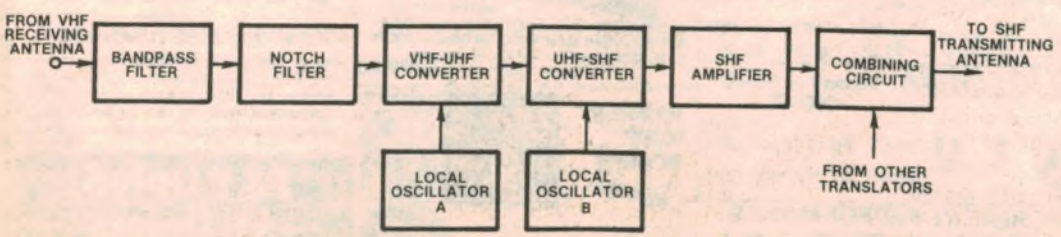

FIG. 2: SHF TRANSLATOR/TRANSMITTER

LEFT: Basic scheme for a VHF/SHF translator. Note that frequency conversion is carried out in two stages.

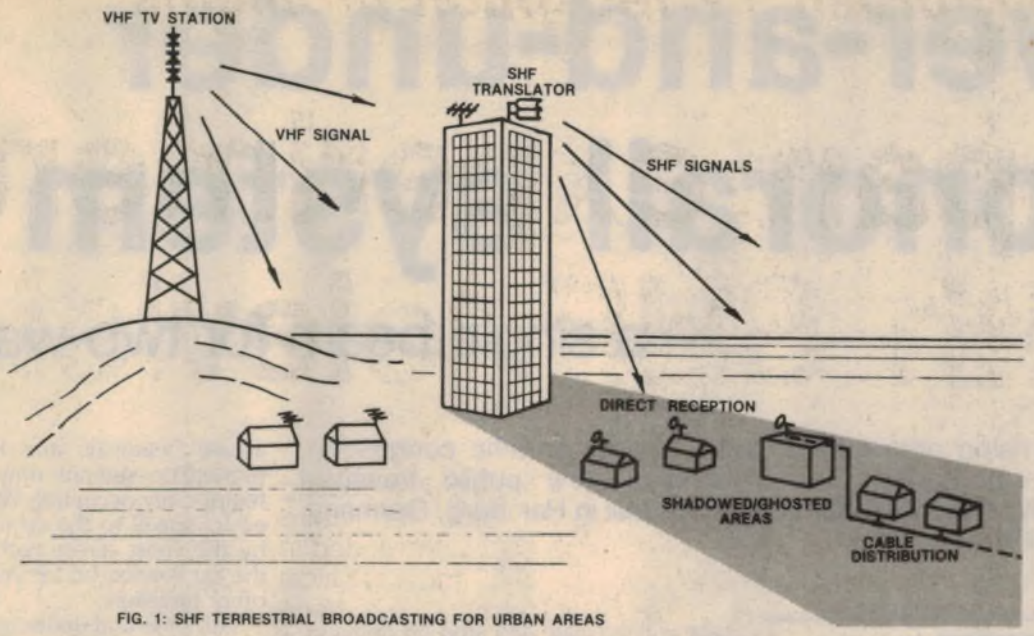

FIG. 1: SHF TERRESTRIAL BROADCASTING FOR URBAN AREAS

"ghosting" was found to be almost non-existent on SHF TV.

Following these studies, it was decided to commence a regular service in a part of the north eastern area of Tokyo where severe ghosting problems exist. The translators were commissioned in 1979, the system catering for two channels of NHK together with five channels of the commercial stations.

Translators

The translator basically consists of a VHF tuner whose output is converted in frequency to the SHF band, thence amplified to the power level desired. Referring to Fig. 2 it will be seen that the output of the VHF tuner is taken to a bandpass filter which ensures that any signal frequencies outside the desired passband are removed.

The frequency conversion is carried out in two stages, the first conversion being to UHF after mixing with local oscillator A, thence to the SHF band with the aid of the second local oscillator, B.

This SHF signal is then amplified to the required level (300 milliwatts at sync peak), with a gallium arsenide FET – specially developed for the SHF band – being used as the output amplifier in the translator. Apparently the GaAs FET is a very linear device which minimizes the dangers of cross modulation, even with the video and audio carriers being simultaneously amplified.

Exactly the same method of modulation as that used for VHF and UHF transmissions (vestigial sideband amplitude modulation) is applied to the SHF carrier.

Four transmitting antennae are used for the Tokyo SHF service, with the outputs of six of the translators being connected in pairs by means of combining networks, before being applied to the appropriate antennae.

SHF reception

Since the same modulation system is used for the SHF TV transmissions it is possible to use a normal domestic TV set for reception provided that an adapter (to convert the signal frequencies) be inserted between the SHF antenna and the receiver.

As the field strength of SHF transmissions in the service area is in the region of -70dBW per square metre, an antenna with a 40cm diameter parabolic reflector provides adequate signal strength to the adapter.

It is customary to use waveguides as the interconnecting medium when dealing with frequencies much above 1GHz, as conventional coaxial cable becomes too "lossy" at these frequencies. Since the installation of waveguides is far more complex and difficult than the simpler technique of handling flexible cable, it makes good sense to locate the adapter right behind the antenna – and then use flexible cable for interconnection to the TV set.

Typical SHF/UHF receiving adapter and 40cm parabolic dish antenna.

The Japanese have opted for this approach. A water-proofed outdoor unit is mounted behind the parabolic reflector and contains a local oscillator operating at a frequency of 11.430GHz. This signal is beat against the incoming 12GHz signals to provide signals in the range of 660-770 MHz (the UHF TV band). A broadband IF amplifier raises the level of these signals to approx. 85dBuV (with 75Ω termination), and they are then fed via coaxial cable to the UHF input of the TV set.

Power for the outdoor unit is supplied from a mains-operated indoor unit. Cost of the complete SHF-UHF receiving adapter (indoor and outdoor units) is around $200 on the Japanese home market.

Future developments

An extension of the SHF principle is the possibility of radiating signals from geostationary satellites. Studies have shown that if an SHF transmitter with an output power of approximately 100 watts is installed on a satellite located some 35,000 kilometres above ground, a coverage of several thousand square kilometres can be obtained. The receiving antenna could be of simple parabolic form with a diameter of approximately one metre, oriented to the appropriate position of the satellite in the sky.

Experiments thus far indicate that SHF signals from Japan's broadcasting satellite are received all over the country at good signal strength. Experiments with teletext signals, still-picture broadcasting, and high-definition TV are also proceeding.

Over-and-under monorail system

— a single beam for two-way taxis

Faced with rising petrol prices and increasing traffic congestion, researchers in Europe are developing new public transport schemes. This new monorail system, on trial in Hamburg, Germany, is one new idea.

By DAVID SCOTT

MUNICH; WEST GERMANY

Starting this year, the people of Hamburg will be able to peer down on the city from a Cabintaxi, a personalised urban conveyor with a difference. It has small electric cars moving in both directions, but on a single elevated track. Cars run both above and below the slim, lofty beam. This unique mass-transit system was designed here by Messerschmidt-Bolkow-Blohm, Germany's leader in aerospace and a high-technology innovator in other fields.

There's already a demonstration setup working in Hagen, in the Ruhr area, and by mid-1981 the Hamburg line will be installed by Mannesmann Demag, MBBs construction partner in the project. This will be a 1.6km loop with three overhead stations linking a commuter rail station with a nearby business district. Nine 12-passenger driverless cabs will circulate and stop on demand, with all movement computer-controlled. The initial installation is intended to test public acceptance and to prove feasibility.

Now, let's take a ride. From the main rail station I take an escalator to the Cabintaxi level, drop a coin into a ticket-vending machine, and punch out my destination by number on a keyboard. A magnetically encoded ticket and my change drop out, and my departure platform appears on an indicator panel.

At the platform I drop the ticket into a reader that flashes my demand to the central computer. This assigns the next free car to my destination, which is displayed on the car's side for identification. I step in and press a button to close the door. That starts the journey. If one or two other people are going to the same place, we share the cab.

The computer now takes over completely. It regulates our speed, senses the position of any car ahead to maintain a safe headway, and holds us at intermediate stations only if the track is temporarily occupied. We're programmed for travel to the selected destination by the most direct path. Upon arrival, the car is released for immediate use by other travellers.

"Our over-and-under guideway is a big space-saver and cost-cutter", MBBs Gert von Lieres told me. "A two-level guideway can fit into narrow streets that couldn't accommodate parallel rails, and there's less clutter in the streets from support columns. Construction is simplified and thus relatively cheap".

It's also a quiet system; the cars glide at about 35km/hr on rubber-tyred wheels. And it shouldn't be affected by weather; the base, suspension, and guidance tracks are fully enclosed within the beam. "This protects them from snow and ice", von Lieres said, "while the lateral rollers eliminate any risk of derailment. They allow tight corners – a turn radius as small as 30 metres – meaning greater versatility in urban routing".

Electric drive is from individual on-board linear-induction motors. Power and flat reaction rails at both levels are completely shielded, so there are no weather or safety problems. Since trac-

(continued on p142)

Twelve-passenger cars are of similar modular construction, but have different lengths and layouts. Modules can be built to carry from 3 to 12 passengers.

Single elevated station at Hagen demonstration track serves Cabintaxis on both levels for travel in either direction. Diverging tracks at this junction have no points; all switching is done on the cars themselves.

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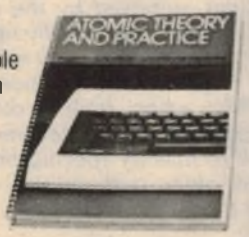

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Free with every ATOM, is a computer manual. The first section explains and teaches you BASIC, the language that most personal computers and the ATOM operate in. The instructions are simple and learning quickly becomes a pleasure. You'll soon be writing you own programs. The second section is a reference manual giving a full description of the ATOM's facilities and how to use them. Both sections are fully illustrated with example programs.

The standard ATOM includes:

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SOFTWARE
★ 32-bit arithmetic (±2,000,000,000) ★ High speed execution ★ 43 standard/ extended BASIC commands ★ Variable length strings (up to 256 characters) ★ String manipulation functions ★ 27 × 32 bit integer variables ★ 27 additional arrays ★ Random number function ★ PUT and GET byte ★ WAIT command for timing ★ ★ DO-UNTIL construction ★ Logical operators (AND, OR, EX-OR) ★ Link to machine — code routines ★ PLOT commands, DRAW and MOVE ★

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CMC6

FORUM

Conducted by Neville Williams

Oh for a really good old-fashioned multimeter

So you have scraped and saved to buy yourself a brand new digital multimeter, combining fantastic accuracy with a strange inability to make up its mind about the umpteenth decimal figure. Alas, says a correspondent, you may have opted for an instrument less suited to a lot of bench work than the faithful old analog meter which you discarded.

Receipt of the letter triggered argument and discussion within our own staff and contributors, who include people brought up on analog, born to digital, and others in between.

I personally remember the days when it was a privilege to own any meter at all – even one of those primitive little moving iron meters that rejoiced under the brand name of Readrite. Whether they ever did is open to some debate!

Much to be preferred were the Jewell moving coil voltmeters salvaged from discarded deluxe battery operated receivers. They were better meters than the Readrites but still too insensitive to be of much use for general circuit testing.

The only real multimeters we saw in those days were the Westons, Ferrantis, etc, supplied by our employers for specific production tasks. They were cherished but often bashed, in the absence of diode protection . . . or diodes for that matter!

The appearance, later, of Australian-made movements – opened the way for enthusiasts to build or buy their own multimeters. They may have lacked the ultimate refinement of imported instruments like the AVO, but we were glad to have them, nevertheless.

After the war, the Japanese got into the act with multimeters that were smaller, cheaper and more accurate than anything we had been accustomed to – with diode protection as almost a standard fitment.

It was the era of the multimeter. Anyone aspiring to take up servicing, or set up a test bench, or get involved in electronic hobbying, bought tools, a soldering iron – and a meter. Other equipment followed on, as and when possible.

I still feel regimentally undressed without a multimeter to hand, even if it's only a twenty or thirty-dollar instrument.

But no such sensitivity affects the younger members of our staff. On numerous occasions, I have gone into our workshop wanting to verify some detail, to be faced with an array of oscilloscopes, generators, analysers and digital whatnots – but not a multimeter in sight.

It's like a doctor without a stethescope. Or a dental surgery without a gently gurgling spittoon!

Which remark brings us to the letter to hand from Michael Sheriff of The Colour Box, 457 Sydney Rd, Balgowlah, NSW. He, and his organisation, are primarily involved in servicing colour TV receivers and his remarks flow from this context, rather than from a general lab situation.

Dear Sir,

I would like to lament publicly the demise of the conventional professional-level analog multimeter, which is being supplanted by digital versions.

Speaking as a TV technician, I feel that the digital meter does not adequately replace the analog type. To be sure, it offers digital readout, greater accuracy and very high input impedance but, in the majority of cases, these qualities are just not required.

Most circuits, if well designed, will operate correctly over a range of voltages, imposed by the tolerances of components. Who really needs to know that a 1000-ohm resistor is 999.9? Or that the base-emitter junction voltage is 0.596V, when 0.6V would be close enough? How many technicians need to work to military specifications?

The older style meters have certain very tangible advantages:

- *With voltages which are unstable or swinging at very low frequencies, analog meters can display the fluctuation directly, which is particularly helpful when faced with intermittent faults. Digital readouts in these circumstances are much less meaningful.*
- *Analog meters, with their lower impedance are less likely to produce misleading readings due to the influence of capacitive paths.*
- *Analog meters are much more practical when it comes to measuring leakage paths in a servicing situation.*

In expanding on this last point, I have in mind particularly instruments with a sensitivity of 100,000 ohms/V and which provide a ×100k ohms range using a high voltage battery, typically 22.5V (9V is not enough). I refer to the old Hioki/Peak AS1000, Simpson meters and others. (The AVO-8 is not really quite in this class).

Measuring the collector/emitter reverse leakage of transistors and diodes

WHO OWNS WHAT?

A reader appeared to be somewhat disturbed by a reference in the Dick Smith sales brochure distributed in our January issue.

In a competition open to DSE store customers a clause read: "Anyone may enter this competition with the exception of employees (and their immediate families) of Dick Smith Wholesale Pty Ltd and associated companies, Sungravure Pty Ltd, and Modern Magazines (Holdings) Pty Ltd."

Whatever the ambiguities of punctuation, let us assure the concerned reader that:

- "Electronics Australia" is owned by Sungravure Pty Ltd which, in turn, is a wholly owned subsidiary of the Fairfax group.
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cannot really be accomplished with digital or even FET meters, as so little current flows through the test path. In consequence, many faulty semiconductors will be read as okay when, in fact, they will leak in actual service.

The 22.5V battery and 100kΩ range in a good analog meter means that the test situation is more typical of circuit conditions.

Two disadvantages of analog meters are that it is difficult to measure very low resistance (eg 0.75 ohm) and that, with usage contact resistance (fuses, etc) can rise to the extent that it is no longer possible to zero them on the lowest resistance range.

FET meters are a nuisance in that you have to calibrate them every time you switch them on and they can be so easily ruined by voltage spikes.

Unfortunately, it seems no longer possible to obtain the kind of analog meters I require, particularly having six good resistance ranges – ohms times 1, 10, 100, 1000, 10,000 and 100,000. Also a true polarity switch so that you do not have to swap the leads over when checking diodes, &c.

If anyone knows of a good one, please let me know and I will be only too happy to buy it. Up to now our company meters, which are taut band types, have been repaired but they are getting beyond this stage and we need two replacements a year.

Yours faithfully,
Michael F. Sheriff.

As I observed earlier, receipt of this letter triggered a certain amount of argument at staff level. Some of it centred around the built-in bias that individuals may have for and against the two methods of visual display – analog and digital. It led to a discussion of preferences for the respective methods when reading everyday things like watches, clocks and auto speedometers.

READING METERS, ETC

One line of argument is that we have on file a mental image of a watch or clock face, and we also store similar images of our car speedometer, ammeter, or any other instrument to which we frequently refer. It needs only a very quick glance to refresh that image and to note the position of the pointer(s) at any one instant. The brain may interpret the significance of the indication without resource to figures, at all.

The battery may be charging or discharging; we may be above or below the speed limit; or the clock may be very close to knock-off time! In short, as often as not, we may be reacting to an optical pattern rather than reading and interpreting actual figures.

Someone who has grown up with ordinary analog multimeters may react in this same way, particularly with a familiar instrument. They may even react to the acceleration of the pointer and conclude that the HT or mains voltage is present and normal, before even the pointer comes to rest!

And, as our correspondent points out, if the voltage is fluctuating or wavering in a cyclic fashion, the pointer can show it up very clearly.

But the digital display is not like that. It has no obvious "ballistic" or positional characteristics and you may have to wait for it to settle down before reading the figures. You may have to discard the unnecessary decimal places to arrive at the significant quantity, and apply further interpretation if the reading is not stable for any reason. In short, you have to stop and think about what you see.

I have heard this same argument applied to aircraft situations, where a pilot has to keep track of many instrument readouts. He can survey a whole array of conventional instrument faces, looking for a possible anomaly, but could he do likewise with rows of figures?

BASIC COMPLAINT

However, while all this is interesting enough at a general level, it is not at the heart of Michael Sheriff's complaint. It may contain some element of analog/digital bias but it seemingly has more to do with the overall characteristics of the instruments currently available to servicemen.

Seemingly, his complaint boils down to this. Prior to the digital era, instrument manufacturers produced a wide variety of multimeters. Their up-market models had a generous number of ranges and this fact, together with all the other inherent characteristics of a good analog multimeter, added up to an instrument which Mr Sheriff found well suited to his needs as a TV service technician.

But then electronic multimeters and, later, digital multimeters began to gain acceptance and a shake-out in models became evident. Emphasis shifted to the production of simpler and cheaper versions and up-market models became rather thin on the ground.

Manufacturers apparently assumed that, above a certain figure, customers would prefer their latest all-talking, all-singing digital model!

Not so, says Michael Sheriff.

What's more, he claims to have discussed the matter with quite a few other service technicians and noted exactly the same reaction.

What about top of the line models sold by Tandy, Dick Smith and various other suppliers?

For one reason or other, they don't quite meet the need of professional servicemen, says our correspondent. In fact, direct correspondence with a manufacturer like Sanwa has failed to produce an answer.

Well, I'm not a serviceman and I don't really know, but I wonder . . .

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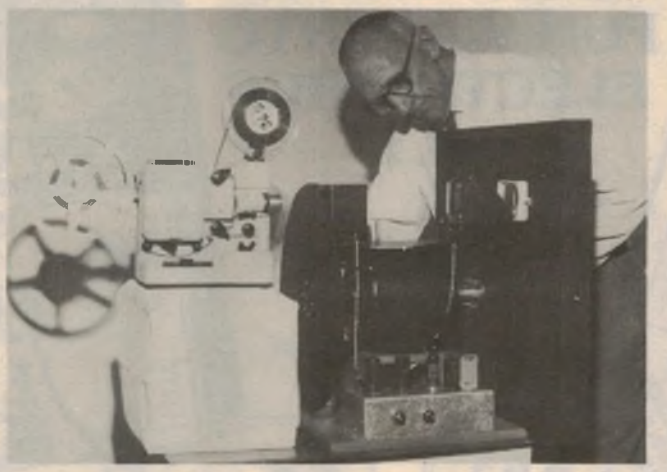
First Australian TV Broadcast . . . Jan 10, 1929



In "Forum" for January (p.29) we quoted from a copy of a members journal published by the Waverley Radio Club in Sydney. It credited the first ever TV transmission in Australia to two Club members in 1933. We had overlooked something!

A reader reminded us that we had carried two articles on previous occasions (Dec '69 and July '72) describing a "Radiovision" transmission from Melbourne station 3UZ on January 10, 1929. It was followed shortly afterwards by a similar transmission from 3DB.

Pictured above is the late Gil Miles with a replica of the televisor which he built in 1929. On the left is a strip of the cartoon film used and, below, a replica of the first page from a shortlived publication "Radiovision". The company responsible for the enterprise, Television and Radio Laboratories Pty Ltd, abandoned radiovision in the following year.

RADIOVISION

An Australian Journal devoted to Television and Allied Subjects

PUBLISHED MONTHLY BY TELEVISION AND RADIO LABORATORIES PTY. LTD.

VOL. 1 No. 1

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Television is the most recent development of radio throughout the world, and it is with a view to assisting its rapid development in Australia that this journal is being published. At the outset, its scope will be, to a large extent, educational, but as the art develops it is intended to deal with all phases of television and picture broadcasting, both from scientific and popular standpoints. The various journals and magazines dealing with broadcasting will, in time, include television, but its possibilities are so enormous and its development so rapid that the publishers consider that a journal dealing exclusively with the subject is fully warranted, and although, at the outset, no very ambitious scheme of production is being attempted, it is confidently anticipated that within a few months the journal will have achieved a standing, both by reason of its contents and of its production, that will place it in the front rank of Australian sectionalised literature.

THE EDITOR.

September, 1928.

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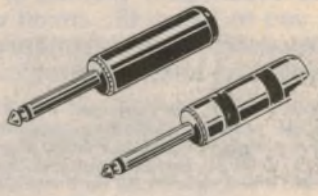

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Noise reduction systems battle it out — Dolby's new bid to retain supremacy

The success of digitally-mastered analog discs, and the impending release of fully digital discs has put the cat among the cassette pigeons! Deck manufacturers are looking harder than ever at noise reduction systems and dynamic range in an effort to keep up with the elusive platter.

by NEVILLE WILLIAMS

Tape noise reduction systems have been around for many years. In particular, the Dolby-B method is commonly credited with having helped the compact cassette to win initial recognition as a modestly-priced hifi medium.

Since then, continuing improvements in tape formulation and in head design have opened the dynamic window still further, such that the performance of top-end cassettes and decks is now quite impressive.

Even so, cassettes are hard put to it to keep up with the best present-day phono equipment and are in danger of being completely outclassed by the up-and-coming video style discs, whether optical or capacitive. While most hifi manufacturers have a foot firmly in both camps, they certainly do not want to see the highly profitable cassette market slump.

Having, in the last couple of years, directed a lot of effort towards achieving greater headroom for peak level signals, the obvious move, now, is somehow to push the noise floor substantially downwards — presumably by the use of more effective automatic noise reduction systems. This would allow cassettes to compete with the whisper-quiet of the best pressings, and also to lower the average recording level by a few dB. Hopefully, distortion would come down with it.

In this context, the time-honoured Dolby-B system has taken a beating — verbal, at least. It operates mainly in the region above 1kHz and improves the effective signal/noise ratio by about 10dB. While it has proved a fairly "safe" system, in the face of misuse, the 10dB improvement is too modest to meet the emerging requirement.

So, while most deck manufacturers have retained Dolby-B to meet an established demand, a strong trend has been evident to develop and exploit other options which offer a higher noise reduction factor. These include dbx (TEAC), Hicom (Telefunken), Hicom II (Nakamichi), Super-D (Sanyo), Adres (Toshiba), plus other systems by Philips, Matsushita and Sony.

While the many systems undoubtedly have their good points, the very multiplicity of names and ideas must reduce the chances of many — or any — of them being universally accepted. If I had to back any one of them, it would be dbx, as explained in some detail in our December '80 issue, page 32.

Until, recently, I would not have expressed this opinion, because the idea of compressing the entire dynamics of a performance by 2:1, and of subsequently expanding them by the same amount, seemed extreme and unnecessary; too likely to be attended by excessive distortion.

But modern microcircuit technology has removed most of the hassle from the electronics, while a 2:1 compression/expansion ratio no longer seems extreme in the face of digital recording systems which have an input/output S/N ratio of about 96dB.

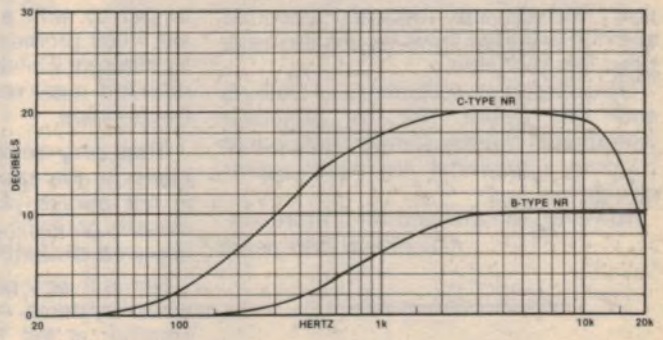
Moreover, dbx has the dual advantage that it operates over the entire audio band and for all amplitude levels. The system therefore does not need to be set up to "track" in terms of level on to or off the tape. A dbx-encoded tape or phono disc should be playable through any dbx decoder/amplifier system, without further ado.

It would seem that Matsushita, the manufacturers of Technics brand hifi, have now come round to this point of view. With a large share of the Japanese cassette market to safeguard, they have reportedly reached the conclusion that it is too difficult to rationalise or embrace all the fiercely competitive NR systems being promoted by other manufacturers.

In consequence, Matsushita have just announced two decks for the Japanese domestic market which are fitted with Dolby-B to meet the traditional demand, and with dbx for those who wish to ex-

Dolby-C noise reduction

This curve shows the frequency range over which the Dolby-B and Dolby-C systems operate.



In the Dolby-C system a "high level" stage processes signals at about the usual Dolby-B level, while very low level signals are further processed in a second stage.

ploit dynamic range to the full. They thus join TEAC in marketing dbx-equipped decks but, characteristically, they look like going in "boots and all".

They are saying that dbx surpasses all other systems in the quest for dynamic range and that, combined with top-end deck and tape technology, they can now talk in terms of 110dB of dynamic range at 1kHz – thereby surpassing the claimed figures for digital technology!

They also appear to have fitted phono jacks to the decks so that they can process the output from cartridges playing dbx-encoded discs; these are becoming more numerous on the Japanese and US markets. Thus, the owner of one of the new Technics decks can not only make and play dbx encoded cassettes, but he/she can also use the deck in straight decoder mode to play encoded discs.

This is particularly significant because the price of the complete Technics decks, in the range $US350-550, is comparable to the cost, to date, of separate add-on dbx adapters.

Where does all this leave Dolby? Is the rug being pulled out from beneath them?

It seems not. Their answer is the Dolby-C system.

At a press conference in November, Dolby's Ian Hardcastle explained the Company's emerging philosophy.

In the first instance, he said, they had settled for the Dolby-B system because it seemed adequate for user needs at the time. They had resisted going to a higher figure than seemed necessary, because every extra decibel increase the danger of audible side effects – mistracking, breathing, and of course noise modulation. The disparity between encoded and non-encoded tapes would also have been less tolerable.

The subsequent acceptance of Dolby-B and the desire not to prejudice widespread industry standardisation had become a powerful argument against change.

However, the demand for a more am-

(Continued next page)

Sanyo "Ultra-Mini" car radio/cassette

Sanyo's model FT 360M is a car radio and cassette player expressly designed to fit today's smaller vehicles. Yet, for its small size, it features auto reverse, fast forward and rewind, Dolby NR and loudness facilities. Stereo is available on cassette and FM radio, with a rated power of 7.5W per channel. RRP is $340.50. [G. Boucher, Sanyo Aust Pty Ltd, 225 Miller St, North Sydney. Tel: (02) 436 1122.]

Sennheiser's "microport" serves the hard-of-hearing

By bridging the gap between classroom blackboard and classroom desk, low-frequency transmitters and receivers can greatly alleviate the problems of students who suffer with impaired hearing.

To a person with normal hearing, listening to a speaker across a large or reverberant room is a fairly common and not-too-traumatic experience. Almost unconsciously, the listener mentally "processes" the information supplied by his/her two ears, rejects the unwanted room echoes and the extraneous noise, and concentrates on the basic sound information.

However, if the listener blocks one ear with a finger, thereby defeating their binaural ability, it becomes much more difficult to make out what is being said. In particular, ambient noise and echoes created by the high-energy and low-frequency vowels can no longer be rejected and therefore mask many of the consonant sounds on which the clarity of speech depends.

This problem is faced all the time by a person with impaired hearing, who tries to get by with a conventional hearing aid. Their problem may be made worse by inherent limitations of the unit and by reduced aural response to the higher frequencies.

Their only certain relief is by moving closer to the speaker — an option that is not always practical, particularly in classes containing a number of hearing impaired students.

Nor is it very practical to rely on fully wired systems — a microphone and amplifier at the teaching position and leads to selected desks. Apart from the wiring being vulnerable, teachers and students alike lack freedom of movement.

Sennheiser's solution to this problem is by the use of their "Microport" system, which can easily bridge the space between teacher and student with low power, high frequency radio waves.

The teacher wears a small lightweight transmitter strung around his neck. A microphone attached to the top of the transmitter is typically positioned about 20cm from his lips and therefore picks up his voice clearly, with very little masking from room noise and echoes.

The voice signal is frequency modulated on to an RF carrier, with the

modulation level being controlled automatically after initial pre-setting. For the German market, the Microport transmitter normally operates on 36.7, 37.1 or 37.9MHz but it can be supplied on frequencies approved for use in Australia.

Students wear receivers which are very similar in appearance to the transmitter. In normal use, their output is fed into an induction loop around the neck, which creates an audio inductive field adjacent to the student's head. This can be sensed by inductive pickup via his existing hearing aid, to which he has normally become accustomed.

However, a number of other options are available, depending on the type of hearing aid being used, and Sennheiser have complemented these with various attachments.

Transmitters and receivers alike can be operated from 9V "transistor" batteries, giving from eight to 10 hours of service.

In the longer term, nickel cadium rechargeable batteries are likely to be more economical and, as part of the Microport system, Sennheiser have developed a special automatic battery charger. After use the units are plugged bodily into the charger, which is styled rather like a table stand. The cells can typically be recharged 500 to 1000 times.

Sennheiser are represented in Australia by R. H. Cunningham Pty Ltd, of 146 Roden St, West Melbourne, 3003. They point out that, while the Microport system is finding wide use by people with impaired hearing, it also has no less a potential in normal wireless microphone applications. For example, the Microport system has found frequent application for on-the-spot interviews featured on German television.

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bitious system had now asserted itself, prompted largely by the availability of — and competition from — sources having a wider dynamic range.

Carefully controlled listening tests suggested that a new target should be set at 20dB noise reduction. It became apparent that the existing Dolby-B system could not be stretched this far, although the engineers could see good reason why the new system should be as compatible as possible with the old.

A Dolby-B tape played on "Dolby-C" and vice versa should lead to no greater disparity than between Dolby-B and normal. Simple switching should allow the new system to revert to Dolby-B, leading to the assumption that they should employ a similar design philosophy and similar electronics.

What emerged from this thinking was a system which virtually comprises two Dolby-B style processors in tandem, as illustrated by the accompanying block diagram.

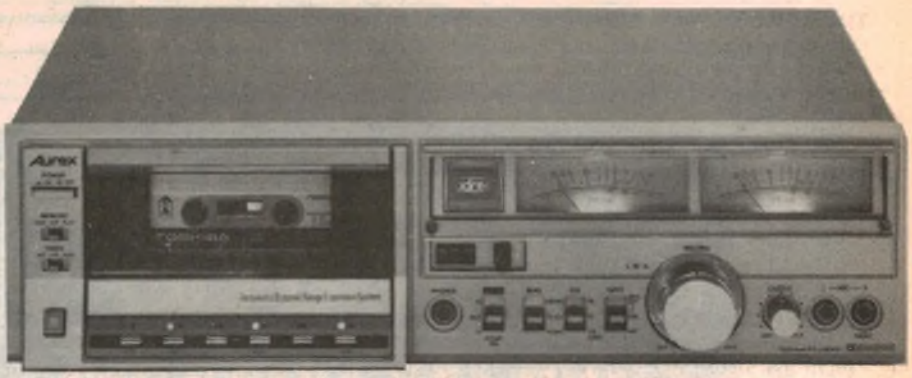
A program to be encoded for recording first encounters a so-called "High Level" processor. High amplitude signals pass through unmodified but those which fall below the traditional Dolby-B reference level are selectively boosted. But that is only half the story.

Very small amplitude signal segments, emerging from the high level processor, undergo further processing (selective boosting) in a second or "Low Level" stage, before passing to the recording system.

During replay, decoding circuits reverse the encoding process. High amplitude signals pass through unchanged; signals below the traditional Dolby-B reference are progressively attenuated and, with them, a proportion of the poorly masked tape noise; very low amplitude signals, within the operating range of the low level processor, are further attenuated, along with some of the virtually unmasked noise residue.

As a further departure from past practice, Dolby have extended downwards the frequency band over which the system operates. Whereas Dolby-B functioned mainly above 1000Hz, Dolby-C reaches down to about one-quarter that figure. (See curves).

The block diagram also shows "spectral skewing" and "anti-saturation" networks which apply a certain amount of passive pre-emphasis and de-emphasis to signals



Toshiba's PC-X60AD stereo cassette deck features both the Dolby-B noise reduction system and their own ADRES (Automatic Dynamic Range Expansion System). They claim that, with metal tape, a signal/noise ratio of better than 80dB is obtainable with the latter system, and a dynamic range of up to 100dB measured at 1kHz. [Toshiba Aust Pty Ltd, 16 Mars Rd, Lane Cove 2066. Phone (02) 482 2055.]

CBS introduces yet another NR system . . .

While we were in the very act of preparing this article, a circular to hand from M. R. Acoustics of Annerley, Qld, drew to our attention yet another system of noise reduction and dynamic range expansion. Described as the CAX (Compatible Audio Expansion) system, it is reportedly being promoted to American disc manufacturers by CBS.

While the development work has been done mainly by the CBS Technology Centre, the circular was initiated by Audionics of Oregan, who have been named as one of a number of licensees to produce and distribute CAX hardware.

Dated December '80, the circular claims that the first CAX encoded records would be released by American Columbia (CBS) in February '81 and that all new CBS releases would be encoded by June. Prime quality recordings in the existing inventory would be re-cut and re-released progressively after that.

Other manufacturers are likely to follow suit, says Audionics, those interested including RCA, Capitol (EMI), Warner and Vanguard. CBS deliberately refrained from exhibiting the system at the Las Vegas CES, in the hope that they could gain industry accord before the public became involved.

It would appear that the CAX system is similar in concept to dbx, in that it applies automatic dynamic compression to recordings, which is linear and non frequency conscious. However, whereas dbx uses a standard 2:1 compression, CAX settles for a smaller ratio. CBS claims that the compression is such that the recordings can be reproduced acceptably on normal amplifier equipment — hence the description "compatible".

But, if processed through a CAX decoder, the original dynamic range is restored, lifting typical figures for dynamic range and S/N ratio from the '60s to the '80s. This falls short of what is possible with dbx but it may well meet user requirements, particularly when reinforced by modern techniques at the mastering stage. And, of course, dbx demands the use of a playback decoder and a separate inventory of dbx encoded discs — factors which have significantly inhibited its acceptance.

In some ways, the proposal to adopt CAX might be considered as automating the arbitrary manual dynamic compression which is commonly used to squeeze the dynamics of live performances into that of normal recording and reproducing systems. The penalty of simply playing back an electronically compressed recording may therefore not be all that great, but the benefits of doing so through a proper decoder could be considerable.

According to another report, the cost of a CAX playback decoder may be fairly modest. And, of course, the user would have the option of using it with those existing recordings or radio broadcasts which stand to benefit from modest expansion.

What about CAX and cassettes? Basically, it would appear that CAX could be used as readily with cassettes as with discs. The vital difference is that, of necessity, the cassette scene is already a battleground for competing noise reduction systems. CAX would be just one more contender in the fray. If CAX is to assert itself, it will have to do so in the area of conventional analog discs. Cassettes might come into line, later.

A pro doesn't wrestle on stage.

We've all seen the artist who seems to spend half his time on stage wrestling with the mike stand adjustment. It doesn't look good. And it doesn't make for a good performance, either.

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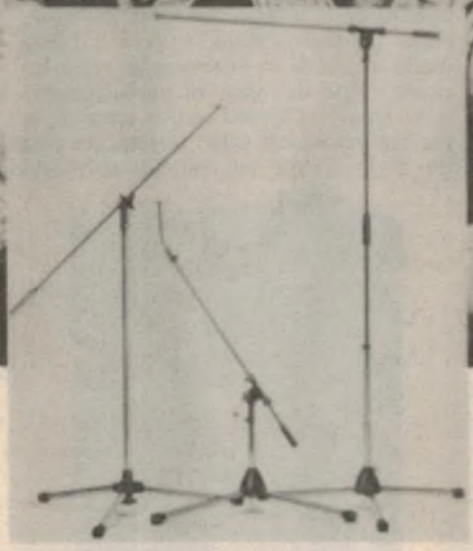

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New from Tandy is this MPA-80 general purpose public address amplifier, designed for use in churches, public halls and auditoria, lecture rooms and professional music situations. Power output is 80W RMS. Input facilities will typically handle up to four mics, two magnetic phono decks, cassette deck or tuner, and a frequency analyser. Mics can be of low or high impedance, with either XLR connectors or jack plugs. The unit comes complete with 12-page manual and retails for $269.95. Details from any Tandy outlet.

passing through the overall system. They serve to make it more tolerant of other than perfect record/replay conditions.

Dolby-C is credited with achieving an additional 10dB of noise reduction, thereby meeting the Company's target of 20dB. Moreover, the extra circuitry can readily be disabled or modified, so that the system can be made panel-switchable from Dolby-B to Dolby-C.

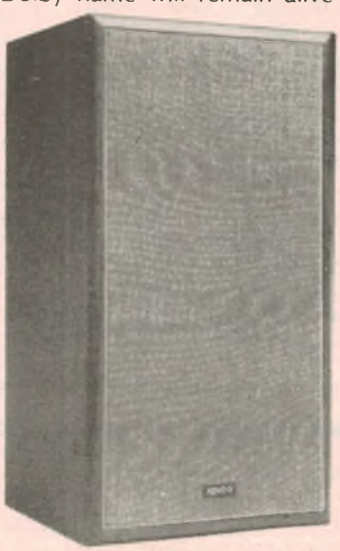
Like the Dolby "HX" system of headroom extension (October '80 issue, page 32), the Dolby-C system is being made available to licensees at no extra charge. And the array of manufacturers who have expressed active interest in the system would seem to indicate that the Dolby name will remain alive and well for yet another audio era.

Whether it does so at the expense of dbx, or co-exists with it, remains to be seen. Indeed, one can well imagine that it is one of the answers that Matsushita have been seeking diligently from their corporate crystal ball.

As for Dolby themselves, they are optimistic that a composite chip will emerge which will make Dolby-C/B available at only a modest margin above the present cost of Dolby-B. It will become the natural choice, they hope, for all up-market decks.

Availability of Dolby-C, and the option of lowering the overall recording level, should reduce the need for HX or headroom extension.

But, because HX is an automatic record-only function, Dolby see it as a desirable inclusion in down-market decks, to protect the user against the worst effects of persistently recording at too high a level.



A new range of Advent loudspeakers is now available in Australia. Advent's well known acoustic suspension woofer is retained but new upper range drivers offer improved performance and precise stereo imaging. [Details from Chadwick Audio Furnishings Pty Ltd, 89 Carnarvon St, Silverwater, NSW. Phone (02) 647 1103.]

IN BRIEF . . .

CONCEPT AUDIO PTY LTD have announced the release of two new compact loudspeaker systems, the KLH-160 and KLH-150, produced by the KLH Research and Development Corporation. The KLH-160 is a two-way acoustic suspension (sealed) system, with a nominal power rating to 50W, while the KLH-150 is a three-way reflex (vented) system rated to 75W. Both use a 200mm woofer (or woofer/mid-range) with a polypropylene cone which offers a high degree of stiffness, combined with very low mass. The tweeter is a 25mm soft-dome type. Finish is in a birch-grain vinyl with removeable black grille. For further details: Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale, NSW 2100. Phone (02) 938 3700.

PIONEER ELECTRONICS AUST PTY LTD are making a definite effort to assist potential hifi buyers who cannot afford

B&O's new Beocenter 7000 uses microcomputer control system

With an in-built microcomputer to control tuner, amplifier, phono and cassette deck, and an infra-red system to extend that control to the listening position, the Bang & Olufsen Beocentre 7000 represents the ultimate in user convenience. Programming facilities and a timer permit unattended operation, as well. Power is 2 x 40W RMS, with provision for two pairs of loudspeakers. B&O are particularly proud of the cassette deck, which is metal compatible, with a Sendust R/P head and a twin-gap erase head, plus automatic de-magnetisation. Dolby-B is provided, and automatic bias selection, plus attractive tape handling facilities. [Details from the GRD Group Pty Ltd, 698 Burke Rd, Camberwell, Vic. Phone (03) 82 1256.]

some of the exotic systems which are currently on the market. Their "Formula" series systems are built around receivers or integrated amplifiers with a power output in the range 16-20W per channel, which is adequate for domestic purposes, assuming the use of sensitive loudspeakers. A cabinet is standard equipment. Where the budget will stretch further, Pioneer offer the Avante systems, which have power levels in the range 30-65W per channel. Taking into consideration the optional cassette deck, the two systems bracket the range from $469 to $1599. [Pioneer Electronics Aust Pty Ltd, 178-184 Boundary Rd, Braeside Vic 3195. Phone (03) 90 9011].

THE VCR WAR in Japan is hotting up, with the emphasis shifting towards lower cost machines. Matsushita caught the spotlight recently with a new six-hour deck with a good range of features, the NV-3300, which sells for Y168,000 or about $A700. But Sharp, Sanyo and Mitsubishi come in below that again, with models ranging down to about Y140,000 or $A583. These are all NTSC machines, of course, but they emphasise a trend. In the meantime, Sony has released its HG (High Grade) video tape to compete with VHS tapes already marketed by TFK, Maxwell and Fuji. Sony say that they are now producing 2.4 million Beta tapes per month.

RCA's SELECTAVISION video disc system, to date focussed firmly on the US market, has begun its outward move. An agreement with Gaumont will bring the system to France and to French speaking areas in Africa. Gaumont, the world's oldest film maker, dominates the French market and holds one of the largest stocks of historic newsreels. Another agreement with Beta/Taurus in West Germany will open the way into a vast libray of films in that country.

PERSONAL CASSETTE PLAYERS like the Toshiba KT-S2 featured last month could easily be dismissed as a minor fad, limited in their appeal to those who want to lie around or walk around wearing a pair of stereo headphones. They also invite the further criticism that the user pays for his/her stereo music in the form of new batteries every few hours. But, according to a recent issue of JEI magazine, personal stereo cassette players are "taking off" in terms of user reaction.

In various forms, they are available also from Sony, Sanyo, Hitechsound, Aiwa and Maeden, to mention just a few.

RCA'S SELECTAVISION is at the starting barrier, ready to run. "Video Review" magazine is planning to review a CED player but, in the meantime, says that the picture quality is excellent. It also observes that RCA's price (below $US500) has forced Pioneer to announce a lower cost optical player with fewer features than their current $749 model. Toshiba, which will market VHD in Japan, has signed with RCA for CED in USA. Another major Japanese manufacturer is likely to follow suit. As well, the giant Radio Shack (Tandy) chain has signed with RCA and that will add 4000 stores plus 2000 associated outlets to the CED sales force.

SONY IN JAPAN have announced the "Profeel" system for the videophiles. Their aim is to provide a range of high quality video components (as distinct from integrated TV receivers) which can be assembled into high quality video systems, or combined with audio components to produce an audio-visual grouping. If your video recorder contains a top quality TV tuner, why pay for a second one unnecessarily? And why pay for an inferior amplifier and loudspeakers if you have a prestige hifi system available?

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Marantz St-8 FM/AM Tuner

Marantz has recently introduced a prestige range of equipment with the title "Esotec". Marantz Esotec equipment is aimed at the very top of the hifi market and has very high performance ratings. Here we review one item from that range, the St-8 FM/AM tuner with in-built oscilloscope, which acts as a comprehensive tuning aid.

Conforming with current trends in presentation, the Marantz St-8 is a relatively large unit measuring 416 × 146 × 302mm (W × H × D) with a mass of 9kg. However, whilst the interior layout is neat with a minimum of overcrowding, there is certainly no vacant space as can sometimes occur with units which are constructed on a bigger-is-better basis.

Maintaining the usual Marantz quality finish on all visible surfaces, the front panel and knobs have a satin gold anodised finish, whilst the top and side covers are colour-keyed in a light brown hammertone. A very legible straight-line dial measuring some 250mm long makes for easy station selection, but in no way dominates the appearance of the front panel.

Previously seen on other Marantz equipment, the "Gyro-Touch" tuning control is essentially a large thumbwheel mounted for horizontal operation. It provides a flywheel type action for large changes in dial position, yet acts as a precise tuning knob when tuning to a particular station. Selection of the quartz-lock AFC is interlocked with the Gyro-Touch tuning control such that AFC is disabled whilst tuning, but is immediately enabled when one's hand is removed from the knob.

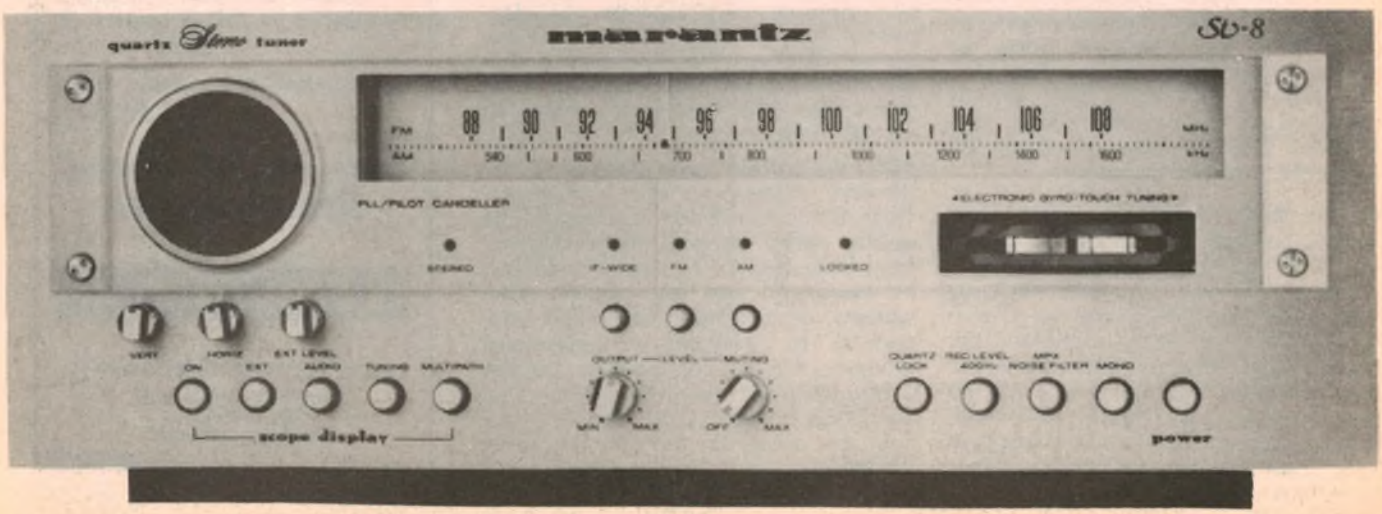
Also seen previously on Marantz equipment is a 50mm diameter oscilloscope in place of the usual signal strength meters or LEDs. Scope screen and controls are neatly grouped together on the left side of the front panel. Pushbutton selectors enable it to display signal strength for station tuning (AM or FM), "multipath" in which the ideal display is a straight horizontal trace with no tendency to deteriorate into a bent, snake-like line. Such a display would most likely be due to incorrect antenna orientation (picking up time-delayed reflected signals); thus the multipath display is a most useful tool for obtaining optimum antenna orientation.

The "audio" display mode is set up so that left channel signals produce vertical (Y) deflections, whilst right channel signals give horizontal (X) deflections. Monophonic reception produces straight line deflections angled 45° clockwise to the Y-axis. Stereophonic signals give similar deflections to mono, except that the line becomes a broad ellipse sometimes approaching a full circle. Out-of-phase stereo tilts the ellipse 90° such that it is oriented 45° anti-clockwise to the Y-axis. Marantz have also seen fit to provide facilities for accepting external audio signals – eg preamplifier and tape recorder outputs etc – for display on the 'scope.

Grouped to centre and right of the front panel are the controls and indicators for the tuner itself. These consist of LEDs for indicating the mode selected: FM or AM, quartz locked tuning, IF channel bandwidth, and stereo (presence of pilot tone in the received signal). Pushbutton controls include FM or AM, 400Hz tone, IF bandwidth, quartz lock, stereo/mono function and MPX noise filter, together with rotary controls for muting threshold and audio output (applicable to one stereo output pair only).

Installed on the rear panel are four phono sockets which provide two independent stereo output pairs, one pair giving a fixed output level – approx 600mV for 100% modulation – the other variable to a maximum of some 1250mV for the same modulation depth. The internal output impedance is approximately 1000 ohms on each output. Provision of separate output pairs make it possible to, say, connect the variable output stereo pair to the amplifier system (and match the level to other input sources), whilst the other "fixed" output pair could feed a tape or cassette recorder directly.

In common with only a few other tuners, the St-8 has an internal 400Hz oscillator which may be switched in to provide a steady tone for the purpose of presetting the level controls on a recorder – prior to commencing recording. The level of the tone corresponds to 40% FM modulation depth, which is some 8dB below peak modulation (100%). This is a well-chosen level since it



Zenith gets it all together with the new Z-89 three in one desk top computer.

The All-In-One Computer brings to the ***design and business office*** all the power and built-in peripherals needed for most computer tasks—all in one compact, desk-top cabinet.

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C.P.U. The popular Z80 microprocessor gives you abundant computer power. Features include 48k of user random access memory (RAM), and two serial I/O ports complete with standard RS-232 for connection to printers or mainframes via modems.

V.D.U. All terminal functions are controlled by a separate Z-80 microprocessor for significantly increased throughput. It never shares processor power with the computer as do most desk top computers. A crisp, clear video image reduces eye strain and an excellent keyboard layout and touch make data entry fast and easy.

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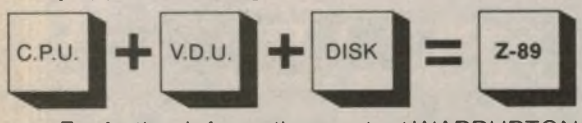
Software. HDOS operating systems software includes BASIC interpreter, 2-pass absolute assembler and a powerful text editor. The popular CP/M™ 2.2 operating system runs on the **Z-89** allowing the system to be programmed in microsoft BASIC, FORTRAN, COBOL and others. Many application programmes available.



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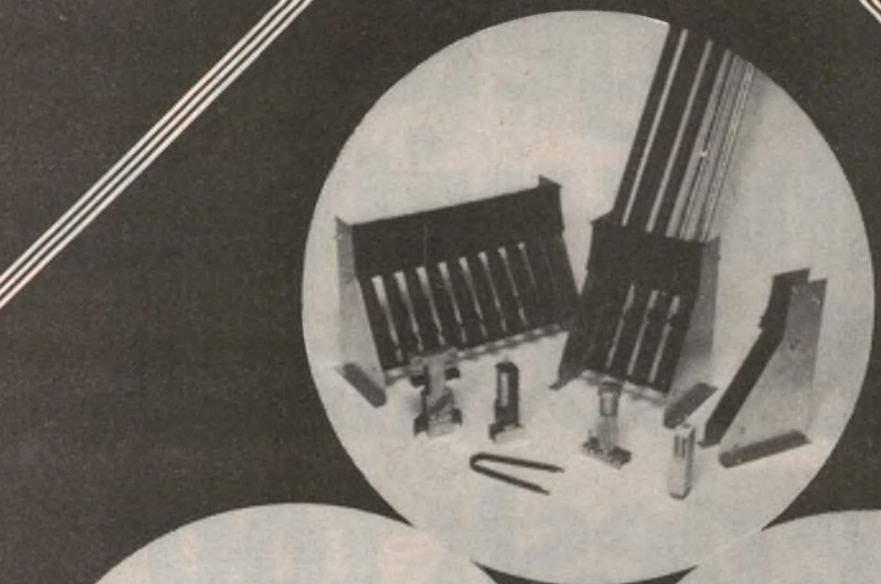

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I.C. Dispensers

MARANTZ St-8 FM-AM TUNER

corresponds to zero (0) meter level calibration on the average domestic recorder. With a recorder with true peak-reading meters, it should be adjusted so that its meters indicate approx – 8dB on their scales.

Circuitry of the St-8 is naturally state-of-the-art, having such features as a dual-gate Mosfet front-end and phase linear IF channel incorporating both ceramic and SAW (surface acoustic wave) filters with selectable bandwidth. The AFC is a quartz lock system whilst a phase locked loop employing negative feedback techniques is used in the demodulator section. An ingenious pilot tone cancelling circuit which automatically cancels any 19kHz residual, minimises the possibility of these signals being present at the demodulator output.

In addition, the demodulator circuit is equipped with an automatic stereo-mono switcher, as is usual practice, such that if the RF input falls below the strength required for quality stereo reception, the circuit automatically changes to monophonic, thus ensuring a high signal-to-noise ratio (and vice versa).

The particular St-8 submitted for review was not fitted with an approved Australian three-core mains cable.

However we have been assured by Marantz (Australia) that our sample St-8 was a pilot unit and that subsequent units intended for retail sale will comply with Australian wiring standards. A similar comment applies to the high frequency de-emphasis network which was 75μs instead of the 50μs Australian standard. Once again Marantz assure us that all St-8s released for sale will conform to the 50μs characteristic.

Thus the frequency response was down some 3dB at 10kHz and 3½db at 15kHz. But it should be noted that the St-8 easily met Marantz' specifications (+0.2,–1dB from 30 to 15000Hz) when the signal generator's pre-emphasis was altered to 75μs. Presumably the "Australian" 50μs versions will perform equally well.

Referring to the accompanying graph it will be seen that channel separation is better than any figures we have previously recorded for FM tuners. Note that the MPX noise filter is essentially a mid/high frequency "blend" of the left and right channel signals. Whilst it may initially appear that the reponse of the active channel is degraded by the action of the MPX filter, it should be realised that any signal energy taken from the active channel is transfered to the inactive channel (and vice versa).

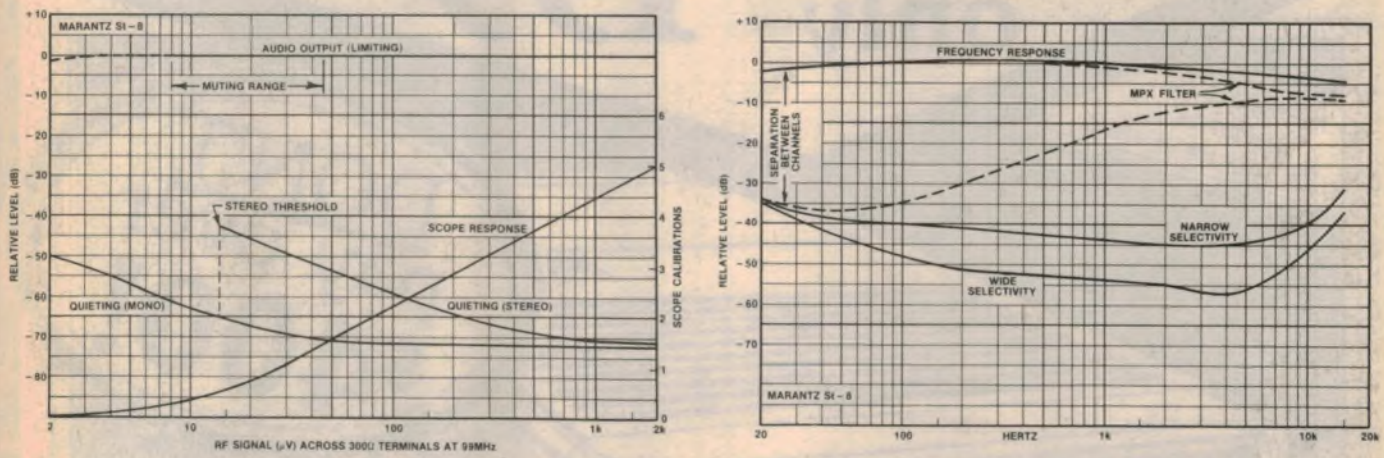
Whilst we were unable to duplicate the quoted distortion figures, the results we obtained were superior to any tuner we have previously tested. All figures were taken with the quartz lock "on" as this represents the listener's usual mode of operation. With mono selected we achieved 0.07%, 0.1% and 0.18% at 100Hz, 1kHz and 6kHz respectively with the selectivity set to WIDE. Changing to NARROW bandwidth we obtained reading of 0.11%, 0.15% and 0.34%, figures at least as good as if not better than any tuner previously tested.

In stereo mode we measured distortion of 0.12/0.15% at 100Hz, 0.13/0.15% at 1kHz and 0.28/0.47% at 6kHz for WIDE/NARROW bandwidths respectively. Previous comments – on excellent performance – still apply.

Referring to the Quieting curves it will be seen that at low to medium RF input levels these are the best results we have yet recorded. While our measurements of ultimate quieting at high RF input levels do not quite meet Marantz' specification, it is possible that the ultimate signal-to-noise figure was better than the test results indicate. At the same time as the measurements were being taken we were listening to the noise – or rather, the lack of noise – and it seemed as if the audible noise was decreasing (with further increase of RF input level) even though the actual meter reading had reached its lower plateau. Perhaps the quieting performance of the St-8 exceeds that of our test equipment?

We were unable to measure the residual 19kHz and 38kHz signals, as their level was too low to accurately measure. Obviously Marantz' pilot tone cancelling circuit – in which out-of-phase signals cancel the 19kHz residual – was doing its duty.

The response to signal strength as indicated on the 'scope is the most linear we have ever recorded. As can be seen initial deflection is achieved for inputs as low as 2 or 3μV, and that above about 20μV input the deflection characteristic is essentially logarithmic. Beyond the upper limits of the graph, increase in input level up to 30mV (the maximum obtainable from our signal generator) results in further deflection of the trace on the scope, ie no saturation of the indicator circuitry.



These graphs depict Quieting, Frequency response and Separation between channels for the Marantz St-8 tuner.

Again, in common with other FM tuners, the AM section is the poor relation. Simple circuitry with high selectivity results in very narrow bandwidth, and thus a severely attenuated high frequency response. As a matter of interest at the same time as we were putting the St-8 through its paces, we happened to have a ten-year old FM/AM Receiver on the same bench, and we were surpised to find that its AM tuner – although itself very poor – actually had a wider bandwidth than the Marantz. As we have said before, apart from extra cost there is no reason why the AM section of an FM tuner should not be comparable in performance with high quality AM – only tuners such as we have reviewed in recent years.

However, as an FM tuner the performance of the Marantz St-8 is excellent, and it makes a significant step forward in all aspects of its specifications.

Recommended retail price of the St-8 is $699 including sales tax. Further information can be obtained from high fidelity retailers or from the distributors, Marantz (Australia) Pty Ltd, 32 Cross St, Brookvale, NSW, 2100.

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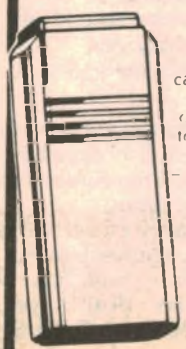

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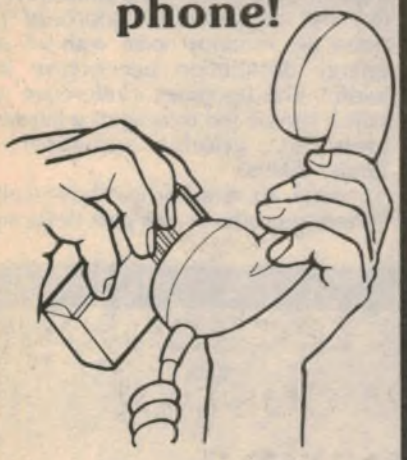
Remote control of your machine from any other phone!



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The telephone answering unit simply plugs into the power and connects to your telephone (Telecom install a socket at a nominal charge). We even supply instructions on how you can easily install it yourself in seconds where Telecom regulations do not apply.

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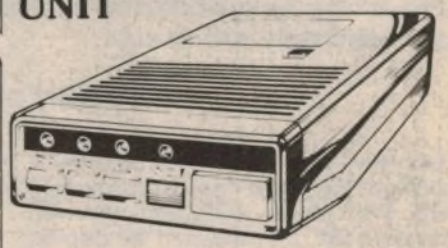

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DICK SMITH ELECTRONICS

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SPECIAL FEATURE PROJECT

On-screen Graphic Anal

At the rate at which electronic technology is moving it is seldom that we can claim a world-first but this time we can. To our knowledge, this is the first time that a design for a graphic analyser with full-colour television display has been published in any magazine. But while it may be a world-first exclusive, it is delightfully simple to use and reasonably low in cost.

by RON DE JONG

Our new graphic analyser provides a six-colour bar graph display on any standard PAL colour television receiver. There are ten vertical bars in the display, corresponding to the ten octave bands of most stereo graphic equalisers. These octave bands are centred on the following frequencies: 32Hz, 64Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz.

The ten-bar display gives a dramatic presentation of the frequency response of your hifi system or the total response of the system plus room. Thus, not only does our new Graphic Analyser enable you to use your Graphic Equaliser to best effect, it ultimately gives you the best sound quality your system can deliver. As a bonus, the Graphic Analyser can function as a dynamic ten-band display of program signals.

As yet, there is no commercial equivalent to our new Graphic Analyser on the consumer hifi market but there are similar although very expensive instruments in use in recording studios. When you think about it, there really should be quite a few commercial equivalents to our Graphic Analyser – a graphic equaliser without an analyser is virtually useless.

Even so, all graphic equalisers are touted as being essential to "equalise" a high fidelity system so that loudspeaker and room induced "peaks" and "troughs" are smoothed out, if not eliminated entirely. In practice, even with the best instrumentation, it is not possible to eliminate these peaks and troughs with a simple ten band equaliser, although it is possible to effect a great improvement.

The problem is that, with ten knobs per channel to adjust, even a person with the most educated ears will rapidly become confused. Part of the problem is that the knobs interact with each other to some extent, so that an adjustment to one band produces a smaller but significant change in adjacent bands.

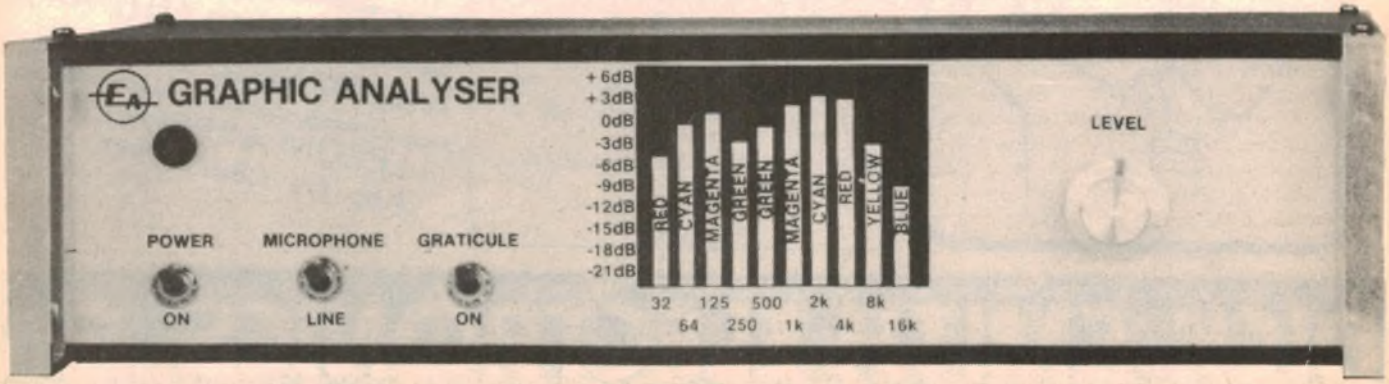
When this is understood, it is easy to see that trying to use an equaliser without some sort of complementary measuring instrument is a futile waste of time.

Yet almost every graphic equaliser buyer is left blissfully unaware of this simple fact – until he/she faces the problem in his or her living room. After that, most users merely fiddle with their equalisers – using them as glorified tone controls – if they bother to use them at all.

This is really a waste of money because, when teamed with a graphic analyser such as the one decribed here (preferably), a graphic equaliser can really make very worthwhile improvements to the sound quality of any good quality system. In fact, the potential improvements are often far greater than could be obtained by substantially upgrading other parts of the system.

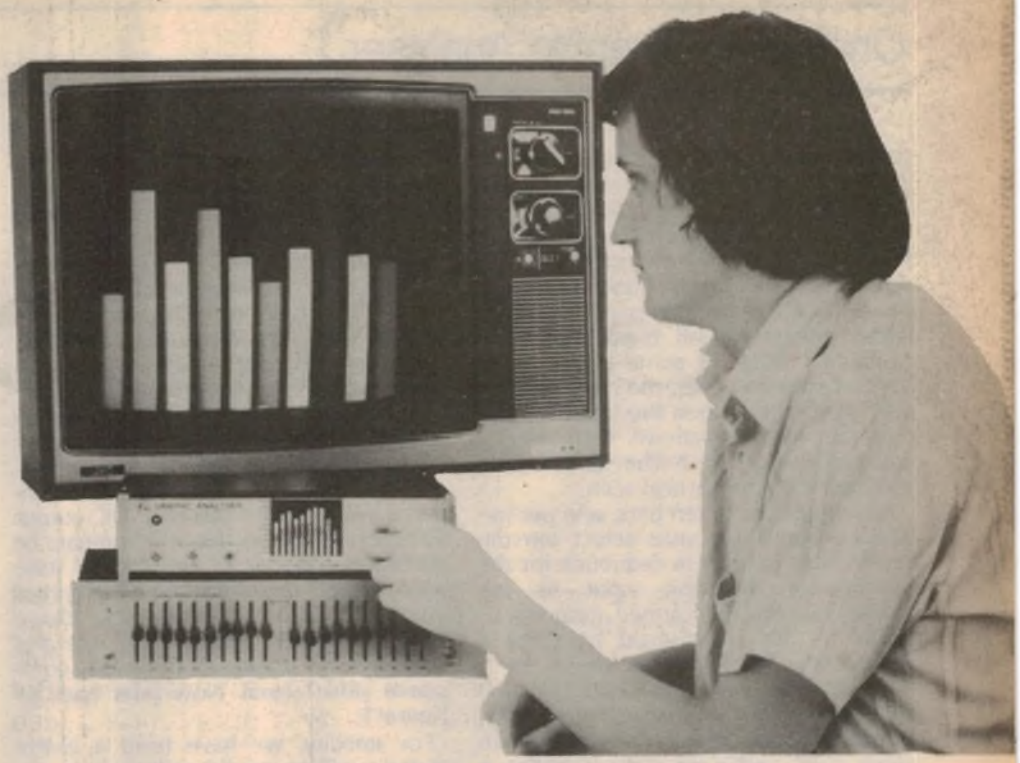
How does our Graphic Analyser render a graphic equaliser into a panacea for hifi ills? First, it has an inbuilt source of "pink" noise (ie, random noise with an equal energy distribution per octave bandwidth). This becomes a reference signal which can be fed through the hifi system amplifier, graphic equaliser and loudspeakers.

Second, to monitor just how well the system reproduces this pink noise signal,



The front panel features a schematic of the TV display so that you can match each colour bar with its octave band.

yser



Our new graphic equaliser gives a dynamic colour bar-graph display of your hifi response on an ordinary colour TV set.

the Analyser provides a preamplifier for a high quality electret microphone. The monitored signal from the microphone is fed to ten octave band filters covering the whole audio range and the response in each of these octave bands is displayed in colour on your TV screen, as shown on the cover of this magazine.

At a glance, the user can see which bands are a trifle high or low and thus adjust the appropriate equaliser slider control. Nudge one control up and the adjacent bands shift up too? No problem. Just make the necessary slight adjustments while watching the TV display.

Ultimately, the quality of your equalisation will depend on the quality of the electret microphone you use. But the quality of typical electret microphones is far above that of most, if not all, loudspeaker systems. Further information on equalising rooms and loudspeakers was published in our February 1978 issue, in an article entitled "Locating Peaks and Troughs with an Equalisation Analyser". Photostat copies of this article are available from our Information service for $3.

So our Analyser makes the job of equalising loudspeakers and room response a relatively simple task.

It enables you to do the job with your eyes rather than "groping about in the dark with your ears"!

And having performed such major improvement to your system, in smoothing out the major peaks and troughs in your loudspeakers and in the room itself, our Graphic Analyser can add a further exciting dimension to your hifi enjoyment. It becomes a dramatic video display of program signals. You can observe the bass rhythm, the harmonic content of the body of the music and the dynamics – all in colour.

Think of it as a sophisticated Music-to-Video converter, easier on the eyes than our ever popular Musicolour but providing a far more dramatic and interesting display. And just think how it could impress your family and friends! In fact, we feel sure that at least some readers will build this project for this reason alone – without even having a graphic equaliser.

The Graphic Analyser is housed in a readily available case with aluminium front and rear panels and Black Marviplate top, base and side panels. Case dimensions are 305 × 76 × 228mm (W × H × D).

Six colours are used to present the bars, with some repeated to make up the ten bars. As a means of displaying the amplitude of each octave band, a fine white graticule is electronically superimposed on the TV pattern, giving horizontal traces at 3dB intervals.

In total, a dynamic range of 27dB may be displayed on a colour television screen. If desired, the graticule may be switched off.

There are few controls on the front panel – just three switches and a control knob. The first switch is for Power and is accompanied by a LED indicator. The second switch is a Microphone/Line Selector. You simply select the Microphone position for equalisation procedures or the Line position for dynamic program display. The third switch disables the graticule, as mentioned above.

The control knob is used to vary the sensitivity of the microphone or line preamplifier, for best display on the video screen.

Also featured on the front panel is a schematic form of the TV display, which enables you to identify which colour bar corresponds to which octave band.

On the rear panel is a 6.5mm jack socket for the microphone and a four-way RCA phono socket panel. This accommodates the VHF modulator output set to Australian channel one. As well, there is the pink noise output which is fed to the amplifier and a Line input which is supplied from one of the "Tape Rec" outputs on the amplifier (or via a Graphic Equaliser). Finally, to compensate for what would otherwise be a loss of one of the "Tape Rec" outputs, the Line input is fed out via the adjacent phono socket.

HOW IT WORKS

A "composite" video signal consists of a stream of horizontal and vertical sync pulses (with appropriate timing) plus the signal which actually modulates the brightness of the beam scanning the TV tube. In a bar graph display such as this, the TV tube gun (or guns) is turned on and off as the beam scans across the screen, dependant on whether the beam is traversing across a vertical bar or the space in between the bars.

To simplify our discussion, lets assume that we only have a single bar the entire width of the screen. We then want all of the screen above a certain height to be black and the screen below that height to be white, where the height is related to the amplitude of some input signal. This is accomplished by taking the video signal from the output of a comparator with its inverting input connected to the DC input amplitude signal and the non-inverting input connected to a ramp signal.

The ramp starts out at some set voltage at the beginning of the vertical scan, and

decays linearly to zero at the end of the scan. In effect, the ramp voltage is proportional to the vertical position of the current horizontal line being scanned. Hence at the start of a vertical scan the ramp voltage will be greater than the DC input voltage to the comparator and the signal generated will blank out these horizontal lines. At some point in the vertical scan however, the ramp voltage will become less then the input voltage and the video signal will turn the TV trace on and generate white lines for the remainder of the vertical scan.

Now to generate ten bars, one per frequency band, we must select ten different filter outputs in sequence for the comparator inverting input as the horizontal lines are scanned. Referring to Figure 1, this is achieved by using a 10-to-1 line demultiplexer driven by a 4-bit binary counter which counts from 0 to 15 during each line scan. Hence each horizontal scan line is divided into 16 "time slots", and in ten of the time slots a different filter output is passed to the comparator.

We should point out that we have not actually used a linear ramp as the comparator reference since in most audio applications the display must be logarithmic, not linear. There are two ways of doing this: either to add a logarithmic converter to the output of each filter rectifier and use a linear ramp, or as we have done, simply generate an inverse logarithmic ramp. What this boils down to is the old familiar exponential decay, which is easily achieved by just initially charging a capacitor up and then letting it discharge slowly via a resistor.

Figure 2 explains the process further. An exponential ramp voltage is compared with each of the filter DC output voltages in turn, so that the comparator generates a signal to turn the TV tube gun on or off, dependant on whether it is scanning across a bar or not. These signals are mixed with the horizontal and vertical sync pulses to form the composite video signal. Now refer back to Figure 1.

For stability, we have used a 2MHz crystal oscillator to drive the whole circuit. The 2MHz clock is divided by eight to drive the 4-bit counter controlling the multiplexer. The horizontal sync pulse is also decoded from this counter. Additionally, the counter output is divided by 26 to give one line every 26 lines and this serves as our 3dB graticule.

Further division by 12 results in the vertical sync and blanking pulses.

Colour is generated by a single chip, designated the TEA1002. This Philips device provides digital input for red, green, blue, sync and blanking, and generates a composite video signal ready to be applied to the video stages of a TV or to a VHF modulator.

The three colour inputs of the chip plus a colour "invert" input are connected to the outputs of the 4-bit counter, just as the multiplexer is. Hence each bar will be assigned a different colour given by a combination of the three primary colours, red, green and blue.

CIRCUIT DETAILS

Looking at the circuit in detail now the 2MHz clock is a simple "pi" type oscillator using one 4049 CMOS inverter. The output is squared up using another inverter and then divided by eight by one half of a 4520 dual 4-bit counter package. The other half of the package, IC14b, is the 4-bit counter shown in block diagram Figure 1.

Since there is no such beast as a 10-to-1 demultiplexer, as shown in our block diagram, we have actually used two 4051 8-to-1 analog multiplexers, IC8 and IC9.

The two multiplexers are connected together as a 10-to-1 multiplexer by tying the three address lines together and connecting them to the three lower outputs of the counter, Q1 to Q3. The Q4 output of the counter goes to the inhibit pin of one multiplexer, IC8, and an inverted version goes to the other multiplexer IC9. Since only one multiplexer can be enabled at a time and one of its eight inputs is selected this results in a total of 16 possible inputs.

Since we have but ten inputs we have connected these in such a way that the ten resultant bars will be approximately centred on the TV display.

Horizontal sync is obtained by decoding the outputs of the counter IC14b using IC5b, a 3-input NOR gate, IC1b and IC1c, which are NAND gates, and IC6e, an inverter. The three inputs of the NOR gate IC5b are connected to the three outputs Q2, Q3 and Q4 on the counter IC14b so the output of the gate will be a brief high pulse at the 000 count. This makes the pulse 1/8 of the line scan period of 64us, or 8us. This signal is our horizontal blanking pulse and it occurs at the beginning of each line scan.

The 8us blanking pulse is further decoded by IC1c and IC1b which NAND the blanking pulse with counter output Q1 and Q1 inverted to generate brief

SPECIFICATIONS

DISPLAY:
Ten vertical bars displayed on a TV screen. Height of each bar is logarithmically related to amplitude in corresponding frequency band.

CENTRE FREQUENCIES:
32, 64, 125, 250, 500, 1k, 2k, 4k, 8k, 16kHz.

ELECTRONIC GRATICULE:
Ten horizontal lines nominally −21dB to +6dB in 3dB steps. Can be switched off.

RESPONSE TIME:
.03s attack time (see text); 0.3s decay time.

LINE SENSITIVITY:
50mV RMS for +6dB indication

MICROPHONE SENSITIVITY:
100μV for +6dB indication

INPUT IMPEDANCE:
20kΩ for microphone, 30kΩ for line

PINK NOISE:
150mV RMS

TV OUTPUT:
75 ohm VHF channel 0 or 1 (see text)

COLOURS:
From left to right; red, cyan, magenta, green, green, magenta, cyan, red, yellow, blue.

low pulses in the second and first half of the blanking period respectively. The first pulse (from IC1b) is a 4us horizontal sync pulse and the second (from IC1c) is the colour burst gating signal required by the TEA1002.

Output Q4 of the counter, which is at the line frequency, is inverted by IC5c and divided by two by flipflop IC13a to generate the PAL flipflop signal which is alternately high and low on successive lines. This signal is required by the TEA1002 colour generator because in the PAL system, or "phase alternate line" system, the phase of the colour burst and one of the chrominance signals is inverted on alternate lines.

(Some readers may figure that we could have generated this signal without using flipflop IC13a simply by connecting the clock input of IC14b to the Q4 rather than Q3 output of the previous counter, IC14a. Then we could take our four binary outputs from Q4 of IC14a, Q1 of IC14b and so on, with Q4 as our flipflop signal. In fact this would work but the advantage of taking the four outputs from one synchronous counter is that, since the outputs are synchronous, no timing glitches are generated and a much "cleaner" TV display results.)

The flipflop signal from IC13a is also divided by 13 by IC12b which is one half of another 4520 dual 4-bit synchronous counter. Together with the division by two provided by the flipflop, this gives a division of 26. This is the 3dB graticule; ie one line every 26 lines.

Counters of course do not normally divide by 13 but IC12b will when combined with gates IC3a,b,c and IC4d. When the counter reaches the desired count (ie, 13) all three inputs of IC3b go high and its output goes low, setting the RS flip-flop (IC3a,c). This resets the counter back to zero via the reset input, pin 15, and the whole cycle repeats itself again.

Note that we have not simply inverted the output of IC3b to reset the counter directly, though this might at first seem the way to do it. This method is unreliable because the length of the reset pulse would be determined by the propagation delays of the counter and gates, which in some cases could be too short to reliably reset all the internal registers of the counter.

In our circuit, the counter is advanced on the positive edge of the clock signal and the RS flipflop is then set when the desired count is reached. The flipflop remains latched even though the counter is reset and the signal from IC3b disappears. Half a clock cycle later, the clock signal will go low and this resets the flipflop, via pin 8 of IC3a, so the reset pulse length is half a clock cycle. So while our method is slightly more complex it results in more reliable operation.

As it turns out, there is another bonus; because the reset signal will be high for half a clock cycle, ie exactly one line, every 26 lines – it is exactly what we need to generate the 3dB graticule.

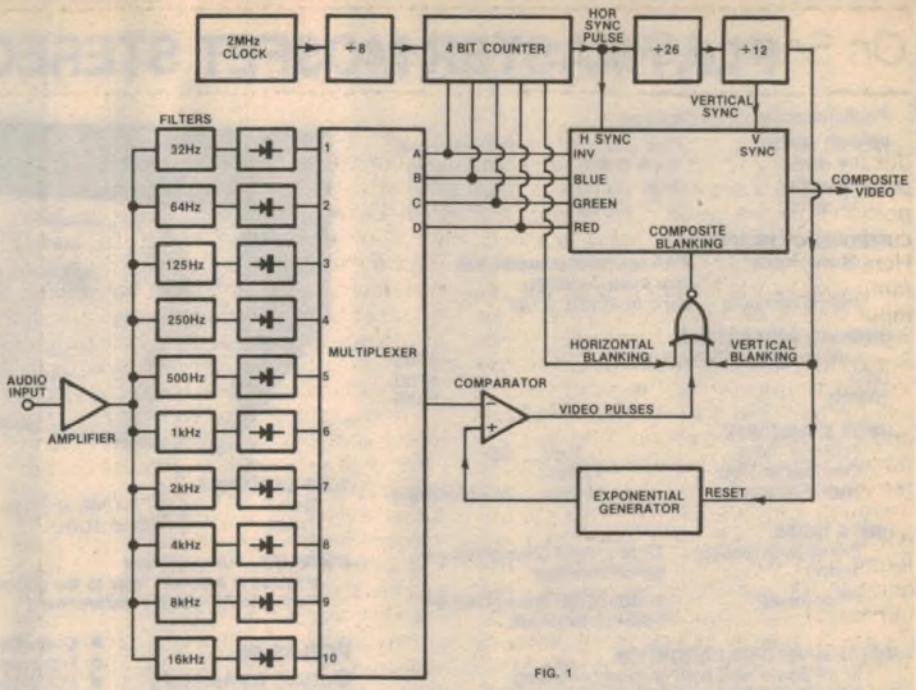


Fig. 1: basic scheme for the On-Screen Graphic Analyser.

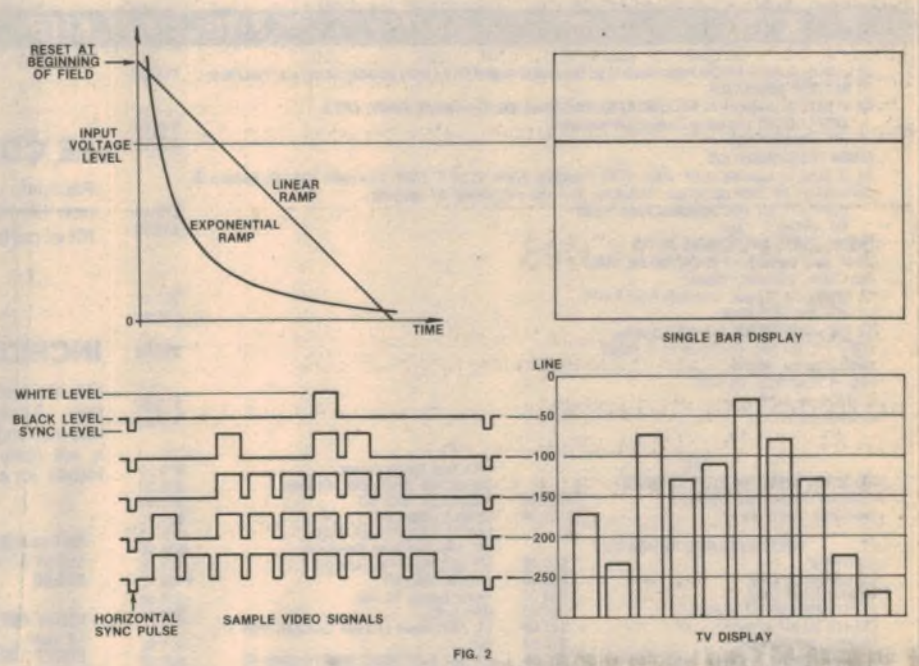


Fig. 2: sample video signals and the resultant TV display.

Referring again to the block diagram, the reset signal is now divided by 12 to obtain the vertical sync and blanking pulses. This is accomplished by IC12a which is similar in operation to the previous counter. In this case though the correct count is detected by IC2d and the RS flipflop is made up of IC2a and IC2b, all NAND gates. Since the clock signal to this stage is low for one line every 26 lines, the output of this divider will be a pulse which is low for 25 lines and high for the remaining 287 lines in the 312 line field. This becomes the vertical blanking interval.

Vertical sync pulses are derived from the blanking pulses by "NAND-ing" with the output of IC4d. Since the output of IC4d is high during eight lines of each 26-line period, the sync pulse will be eight lines long or 512us, and it will occur at the beginning of each vertical blanking interval.

As our block diagram Figure 1 indicates, the vertical blanking pulse is used to reset the exponential ramp generator. This is a simple circuit consisting of a 0.1μF capacitor and a 47kΩ discharge resistor plus an analog switch, IC7b, which is turned on by the blanking pulse at the beginning of each field, charging up the capacitor to +5V. After the blanking interval, IC7b is turned off and the capacitor discharges via the

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CHANNEL SEPARATION
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INPUT SENSITIVITY

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High level inputs	190mV	36k (minimum)

HUM & NOISE
Phono (with respect 10mV) — 73dB (75dB) unweighted with typical cartridge
Other inputs — 80dB (82dB) unweighted with inputs open circuit

TOTAL HARMONIC DISTORTION
At full power with both channels operating from 25 to 20kHz: less than 0.2%
Typically less than 0.05% at normal listening levels

TONE CONTROLS

Bass	+12, −13dB at 50Hz
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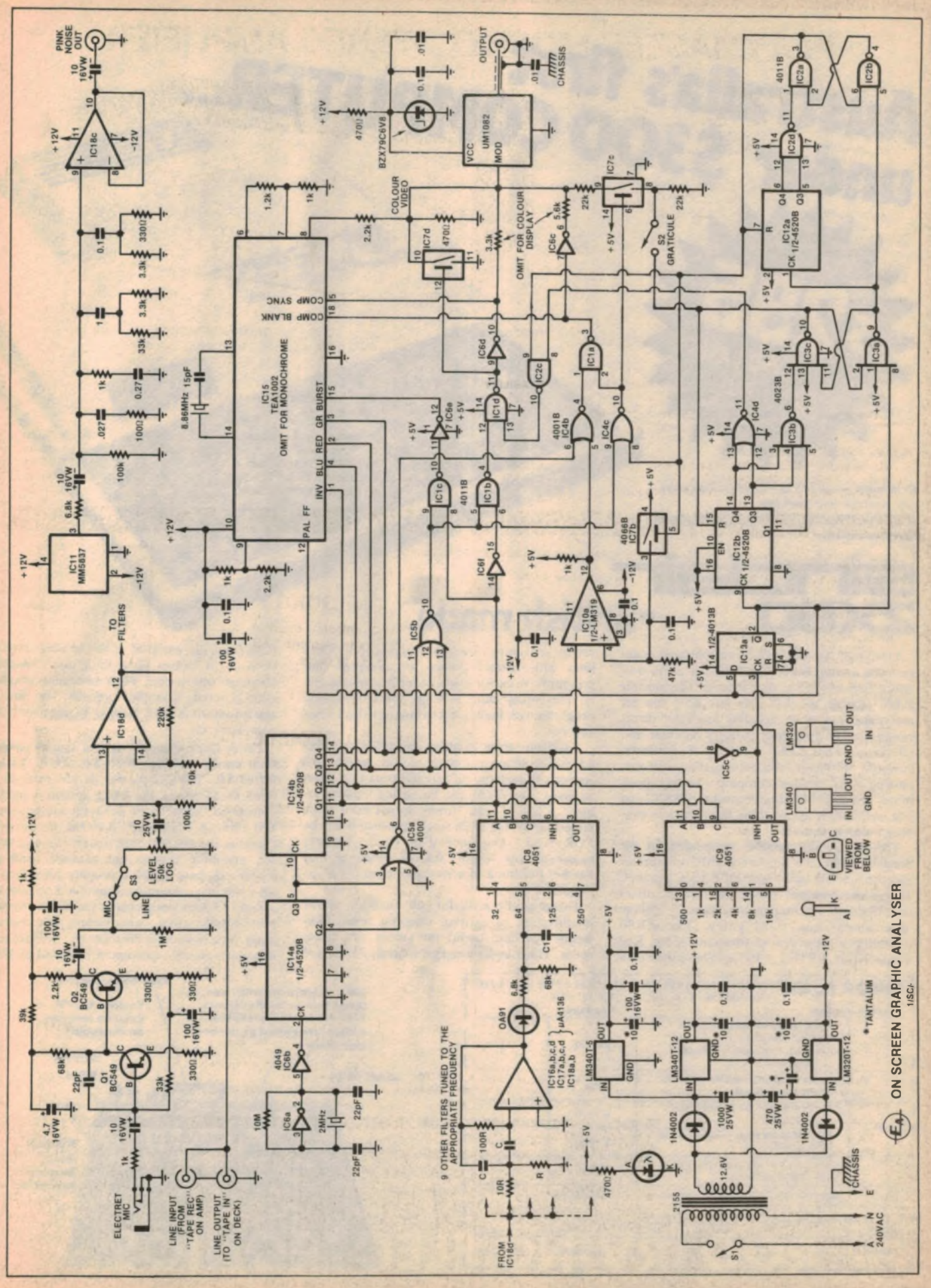
ON SCREEN GRAPHIC ANALYSER
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PINK NOISE OUT
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CHASSIS
COLOUR VIDEO
OMIT FOR COLOUR DISPLAY
S2 GRATICULE
IC15 TEA1002 OMIT FOR MONOCHROME
COMP BLANK
COMP SYNC
INV BLU RED GR BURST
PAL FF
8.86MHz 15pF
IC11 MM5837
TO FILTERS
LEVEL 50k LOG.
MIC
LINE
S3
ELECTRET MIC
LINE INPUT (FROM "TAPE REC" ON AMP)
LINE OUTPUT (TO "TAPE IN" ON DECK)
9 OTHER FILTERS TUNED TO THE APPROPRIATE FREQUENCY
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IC16a,b,c,d IC17a,b,c,d IC18a,b
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OA91
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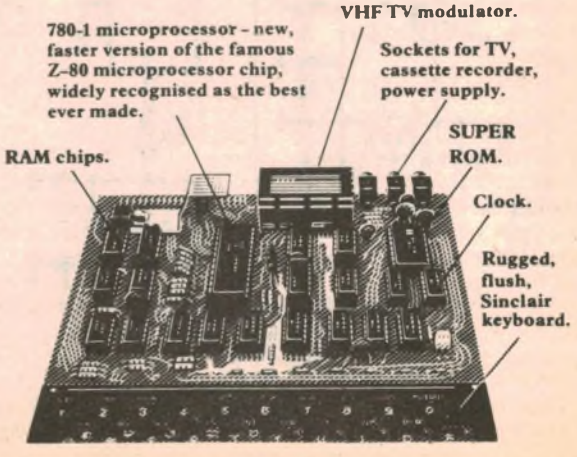


47kΩ resistor, producing the exponential waveform.

The vertical blanking pulse also passes to IC4c where it is "ORed" with the horizontal blanking pulse from IC5b, generating a composite blanking signal. One function of the composite blanking is to switch off the 3dB graticule lines from IC3c. This is done with another analog switch, IC7c, which passes the graticule signal via a 22kΩ resistor to a simple video mixer where it is combined with the video from the colour chip. During blanking, however, this is inhibited to prevent the sync signal levels from being upset.

The blanking signal is also mixed with the video signal from IC4b by a two input NAND gate IC1a. Output from IC1a goes to the composite blanking input of the TEA1002 colour chip; thus when either the video or blanking signal is low, the video is turned off. Actually this is just a convenient way of applying the video signal; we could have, for example, just applied the blanking signal alone and used the video to turn off the red, green and blue inputs to the chip – but this would have been at the cost of another quad NAND or NOR package.

Looking at the video signal now, this is generated by IC10a, an LM319 fast comparator. Response time of the comparator for an "input overdrive" of 20mV is 100ns, which is fast but not fast enough to avoid smearing of the bars. This is totally overcome in our circuit by blanking out the first quarter of the bar using a two input NOR gate, IC5a, to decode the relevant state of the counter IC14a. An additional benefit of this is that the space between bars clearly separates them, making the display easier to read and more attractive.

There is not a lot more we can say about the TEA1002 without going into the theory of colour television but apart from the signals we have already discussed, all we have to add is an 8.86MHz crystal (twice the colour burst frequency), a resistive divider on pin 9 to set the DC bias level of the video output, and another divider on pins 6 and 7 in lieu of a delay line.

Video output from the TEA1002 chip is 3V peak to peak with a DC bias of about 3V, ie the bottom of the sync tips are at 3V. For proper operation of the VHF modulator however the sync level should be .1V, the black level .6V and the peak white level .9V. To match these signals the output of the TEA1002 is passed through a voltage divider comprised of a 2.2kΩ and 470Ω resistor and the video is additionally pulled down to ground during a sync pulse by analog switch IC7d.

Final composite video from the colour chip is fed to a UM1082 VHF modulator which is a commercially built unit set to Australian channel 0 or channel one. This unit has a 75Ω output suitable for direct connection to the antenna input of a colour TV. Power for the modulator is obtained from a simple regulated supply comprised of a 470Ω resistor and a BZX79/C6V8 zener diode, plus bypass capacitors.

Returning now to the ten octave filters mentioned earlier, the basic circuit of each filter can be seen in the circuit diagram. For space reasons we have only shown one filter with components labelled R, C, 10R, 100R and C1. We have listed the component values in a separate table.

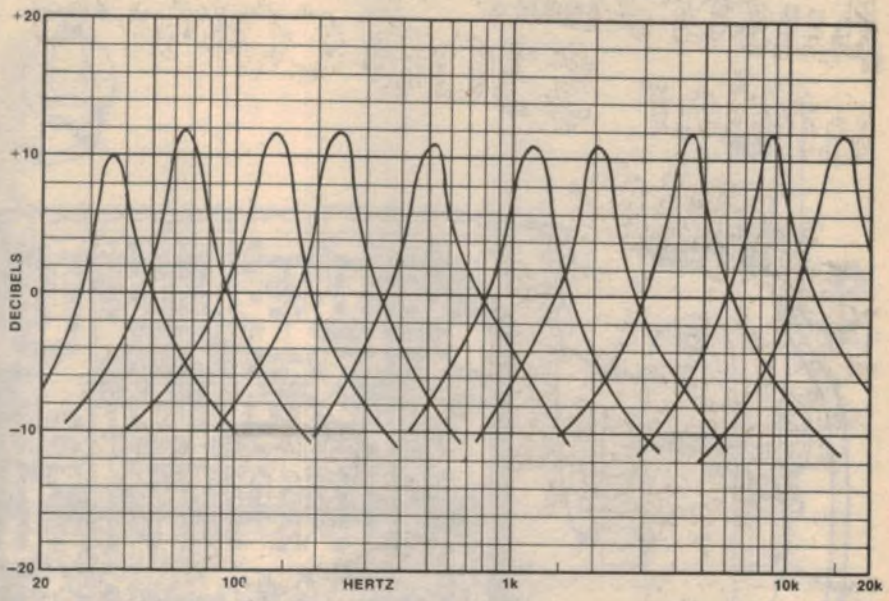
The op amp used in the filters is a 4136 quad op amp. Hence only 3 packages are required for the 10 filters with two op amps remaining: One is used as an input amplifier and the other in the pink noise circuit. The circuit we have used for the filters is a standard multiple feedback design with a "Q" of 5.

Each filter is followed by a simple half-wave rectifier consisting of an OA91 germanium diode and a filter capacitor, C1. The reason we have used a germanium rather than a silicon diode is that the smaller diode voltage drop gives a larger dynamic range.

A 6.8kΩ resistor is included in series with each diode to clearly define the "attack" time of each display and also to prevent the op amp from being overloaded by the large filter capacitor C1.

The attack time is 0.03s for all frequency bands except the first three where large values of C1 have been used to reduce filter ripple and smooth the display response to the large cyclical signal peaks in the pink noise source. Decay times for the rectifier outputs are set by the 68kΩ resistor across C1 and so will be about 10 times longer than the attack times.

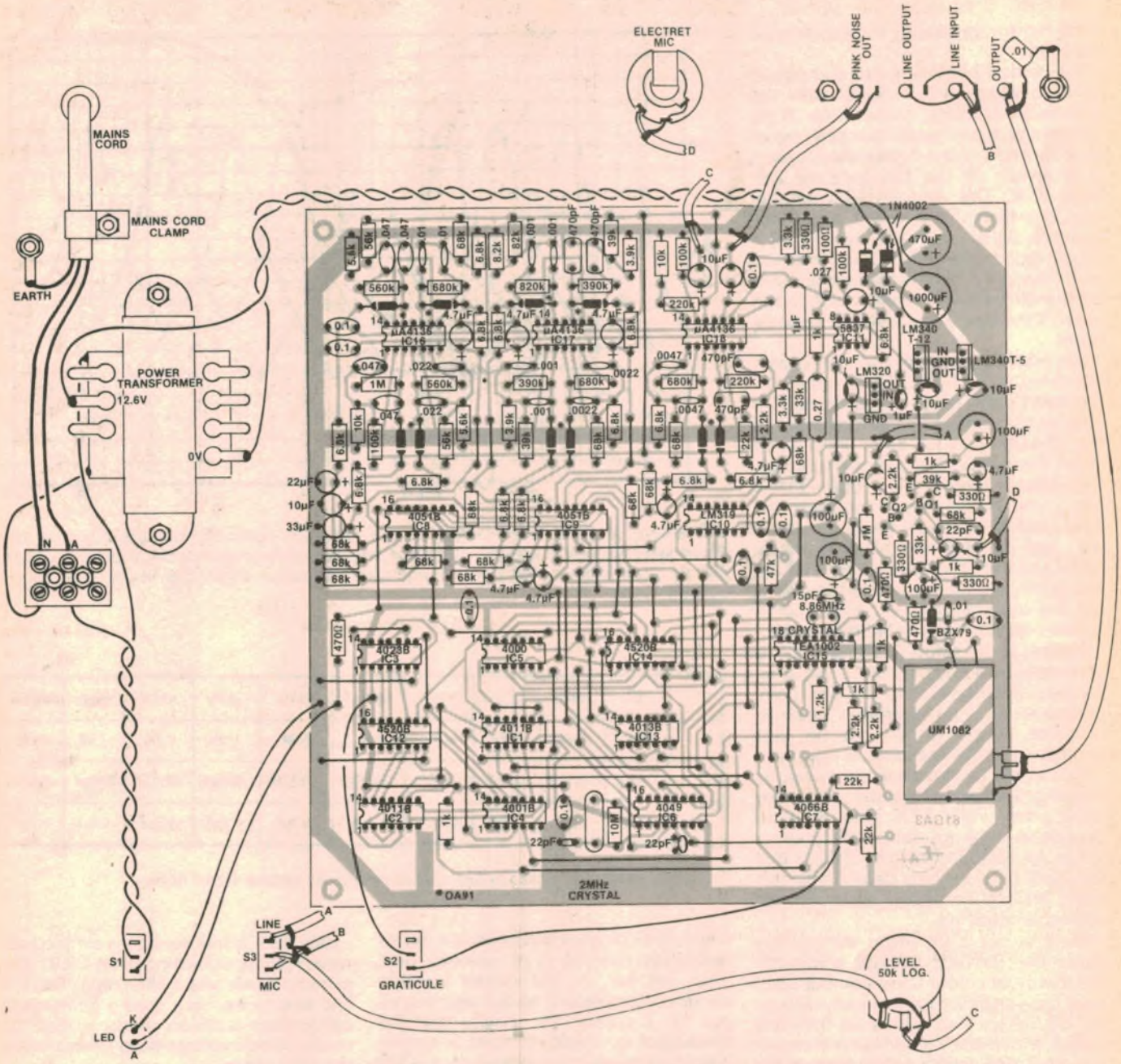
The pink noise circuit uses an MM5837 IC which generates a PBRS or pseudo



The shape of these filter curves in the Analyser complements the filters in the Playmaster Graphic Equaliser. Note that because of the shape of the filters any adjustment to one slider control on the equaliser will cause some shift in adjacent bands as well.

F	32Hz	64Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16kHz
R	10k	5.6k	5.6k	6.8k	6.8k	6.8k	8.2k	3.9k	3.9k	2.2k
C	.047μF	.047μF	.022μF	.01μF	.0047μF	.0022μF	.001μF	.001μF	470pF	470pF
C1	33μF	22μF	10μF	4.7μF	4.7μF	4.7μF	4.7μF	4.7μF	4.7μF	4.7μF

This table gives the component values of the 10 octave-band filters.



Observe the usual precautions when soldering in the CMOS ICs. The TEA1002 gets hot during normal operation.

random bit sequence which is applied to a 3dB per octave filter to produce pink noise. This pink noise signal then passes to a 4136 op amp configured as a voltage follower. Output voltage is around 50mV RMS which makes it suitable for direct connection to any of the high level inputs of an amplifier, such as AUX or TUNER.

The microphone preamplifier consists of two transistors Q1 and Q2 and offers an input impedance of greater than 20kΩ, minimum gain of 420 and an output impedance of about 2kΩ.

Signals from either the microphone or line inputs pass to the level control which is a 50kΩ potentiometer and thence to a non inverting op amp IC18d which drives all the filters.

Finally the power supply consists of a 12V transformer driving two half-wave rectifiers to produce plus and minus 17V. This is passed to three, three-terminal regulators to generate the required +12, −12 and +5V supplies.

CONSTRUCTION

Construction of the unit is simplified since all the components are mounted on a single printed circuit board, coded 81GA3 and measuring 200 x 200mm. The first step in construction should be to install the links on the board, using the PC overlay shown with this article as a guide. There are about 50 links all up, which is quite a lot but then it is considerably cheaper than a double sided board. Capacitors and resistors etc, can be mounted next but pay particular attention to the orientation of diodes and electrolytics.

ICs are mounted last; since most of these devices, including the TEA1002, are either MOS or CMOS devices the usual precautions should be taken against

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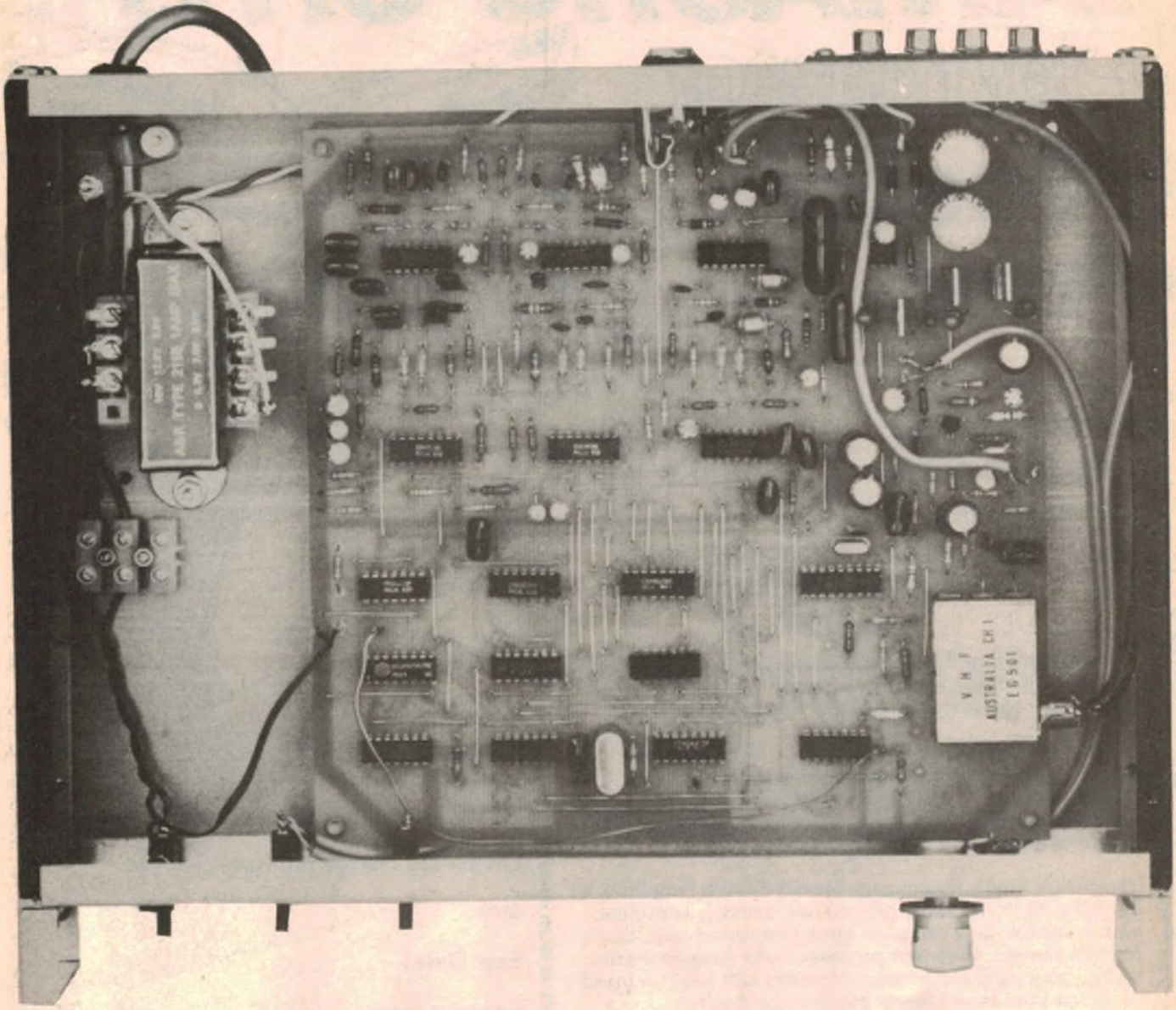

This internal view of our prototype emphasises the simplicity of construction. Keep mains wiring neat and tidy.

damage from static electricity. Use a soldering iron earthed to the PCB common rail and solder the supply pins first (pins 1 and 14 or 16).

While we fully expect that stocks of the TEA1002 colour modulator will be available when this issue "hits the street" there could be unforeseen delays in delivery. Hence we have provided an optional monochrome capability which does not require the TEA1002 or its associated components and merely involves inserting the 3.3kΩ and 5.6kΩ resistors indicated on the circuit diagram. Of course these should be omitted if the colour chip is being used.

We housed our Graphic Analyser in a Horwood case measuring 228 × 76 × 305mm (D × H × W). The case is of all metal construction which is essential for proper shielding. It is not necessary to use this particular case. One alternative would be to use a Playmaster 40/40 amplifier chassis.

Scotchcal front panels can be obtained from Radio Despatch Service, 869 George St, Sydney or Rod Irving Electronics, PO Box 135, Northcote, Vic 3070.

The rear panel contains the microphone jack socket and a four-way RCA socket panel. The basic position of these sockets can be seen in photographs of the unit. The only point to note here is that the circuit is not directly earthed to the chassis, hence the microphone socket must be insulated. This can be done by making insulating washers and a bush from sheet plastic, but a much easier approach is to simply use a large rubber grommet.

We mounted our PC board with the front edge about 8mm from the front panel using 9mm Richco plastic board supports. Note that, in this position, the board sits beneath the front panel graticule switch so it will be necessary to remove this switch to insert the board.

Wiring between the board and the

We estimate that the current cost of parts for this project is about

$95

including sales tax, but not the colour TV or electret microphone.

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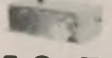

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DPX: Requires Sorcerer's Development Pac. For serious Z80 program development. $32.95
Forth: Now Sorcerer owners can enjoy the speed and convenience of this fascinating language. $54.95

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Action Bowling: Simulating the real thing for one or two players. Skill can be set. $21.95
Touchdown: Play against computer team or a friend. Results depend on skill & luck. $15.95
Salvo: The object is to sink Sorcerer's fleet before he sinks yours. $10.95
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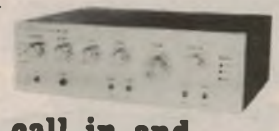

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We have connectors to DIN specifications and other standards and they all carry the Utilux guarantee to meet your rigid standards.

Take our Mass Termination System for instance, which has the following features:

- Memory U-shaped element cuts through insulation only, leaving the wire intact
- Visual inspection confirms proper connection
- Testing without disconnection for your convenience (probe fits through top of connector)
- Floating element assures a better contact every time

So your production costs are contained.

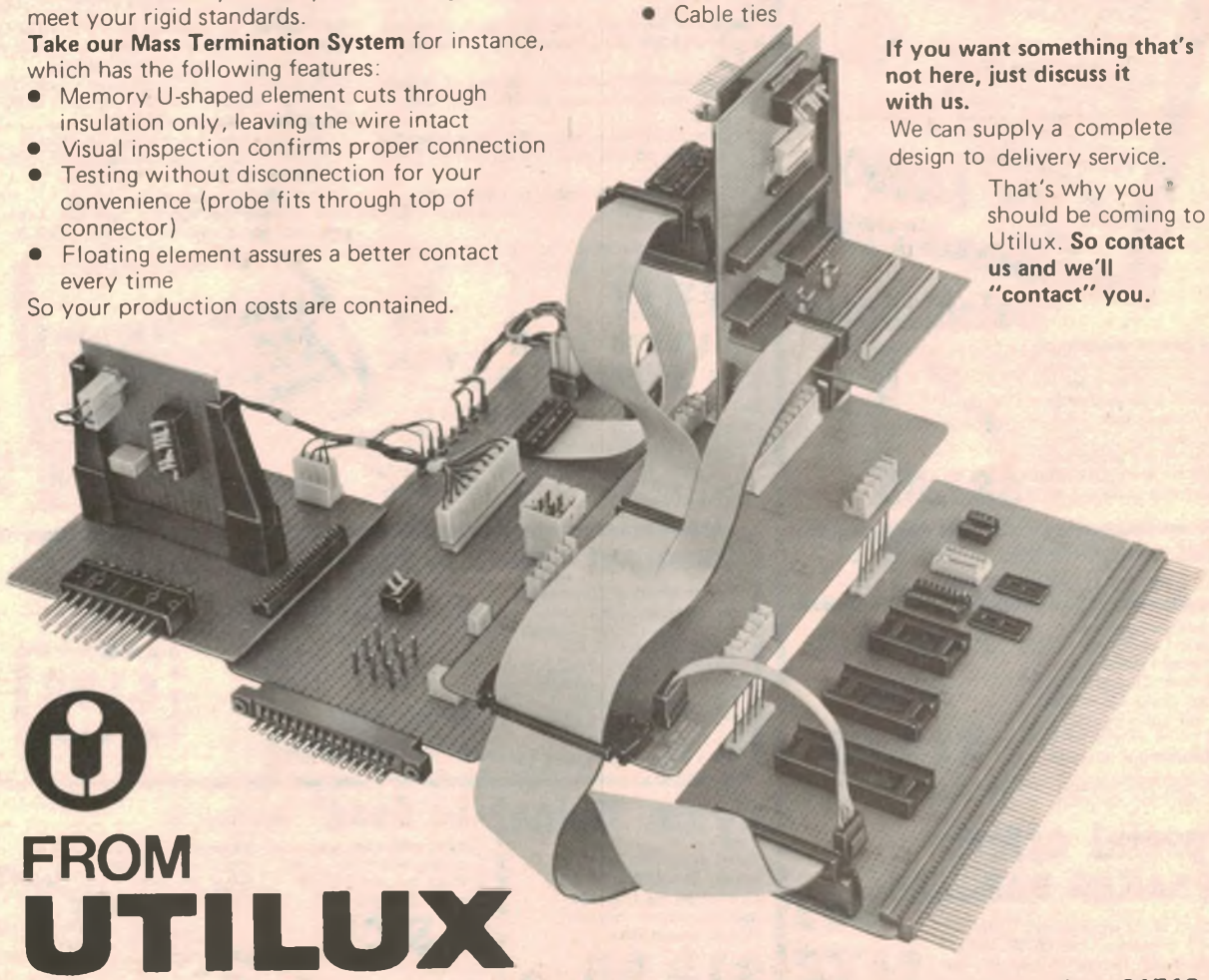
Here is a list of items we can supply ex stock:

- Discreet wiring connectors
- Ribbon cable wiring and connectors
- I.C. sockets
- Wire wrap jumper blocks
- Wire wrap pins
- Plugs and sockets
- Edge connectors
- Binary option selection switches
- Transistor sockets
- KK Interconnect systems
- Flat flexible cable connector
- Cable ties

If you want something that's not here, just discuss it with us.

We can supply a complete design to delivery service.

That's why you should be coming to Utilux. **So contact us and we'll "contact" you.**



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Agents in all states

PARTS LIST FOR THE GRAPHIC ANALYSER

1 Horwood instrument case, 228 × 76 × 305mm (D × H × W)
1 12V transformer, Arlec 2155, DSE2155, Alltronics 2155 etc
1 PC board, coded 81GA3, 200mm × 200mm
1 UM1082 TV modulator
3 SPDT miniature toggle switches
1 50k log rotary potentiometer
1 4-way RCA panel socket
1 6.5mm shorting type panel socket
1 LED bezel
1 3-way mains terminal strip
1 mains cable and plug
1 metre of audio shielded cable
1 metre of colour TV coax cable
4 9mm Richco plastic board supports
1 2MHz crystal
1 8.867238MHz crystal
26 SWG tinned copper wire (for links), PC stakes, solder lug, nuts and screws

SEMICONDUCTORS

1 TEA1002 (PE1X) colour encoder (colour option)
3 µA4136 quad op amps
2 4051B 8-channel analog multiplexers
1 LM319 dual comparator
1 4000 dual 3-input NOR gate plus inverter
2 4520B dual 4-bit synchronous counters
2 4011B quad two input NAND gates
1 4001B quad NOR gate
1 4049 hex inverter buffer
1 4013 dual D flipflop
1 4023 triple 3-input NAND gate
1 4066B quad analog switch
1 MM5837 noise generator
1 LM340T-5 three-terminal regulator
1 LM340T-12 " " "
1 LM320T-12 " " "
2 BC549 transistors
2 1N4002 power diodes
10 OA91 germanium diodes
1 BZX79/C6V8 zener diode

CAPACITORS

1 1000µF/25VW PC electrolytic
1 470µF/25VW PC electrolytic
4 100µF/16VW PC electrolytic
1 33µF/16VW " "
1 22µF/16VW " "
6 10µF/16VW " "
3 10µF/16VW tantalum
8 4.7µF/16VW PC electrolytics
1 1µF/25VW tantalum
1 1µF metallised polyester (greencap)
1 0.27µF greencap
9 0.1µF greencap
4 .047µF greencap
1 .027µF greencap
2 .022µF greencap
4 .01 greencap
2 .0047µF greencap
2 .0022µF greencap
4 .001µF greencap
4 470pF polystyrene
3 22pF polystyrene
1 15pF polystyrene

RESISTORS (all ¼W 5%)

1 × 10MΩ, 2 × 1MΩ, 1 × 820kΩ, 3 × 680kΩ, 2 × 560kΩ, 2 × 390kΩ, 2 × 220kΩ, 3 × 100kΩ, 1 × 82kΩ, 14 × 68kΩ, 2 × 56kΩ, 1 × 47kΩ, 3 × 39kΩ, 2 × 33kΩ, 3 × 22kΩ, 2 × 10kΩ, 1 × 8.2kΩ, 14 × 6.8kΩ, 3 × 5.6kΩ, 2 × 3.9kΩ, 3 × 3.3kΩ, 4 × 2.2kΩ, 1 × 1.2kΩ, 6 × 1kΩ, 3 × 470Ω, 4 × 330Ω, 1 × 100Ω

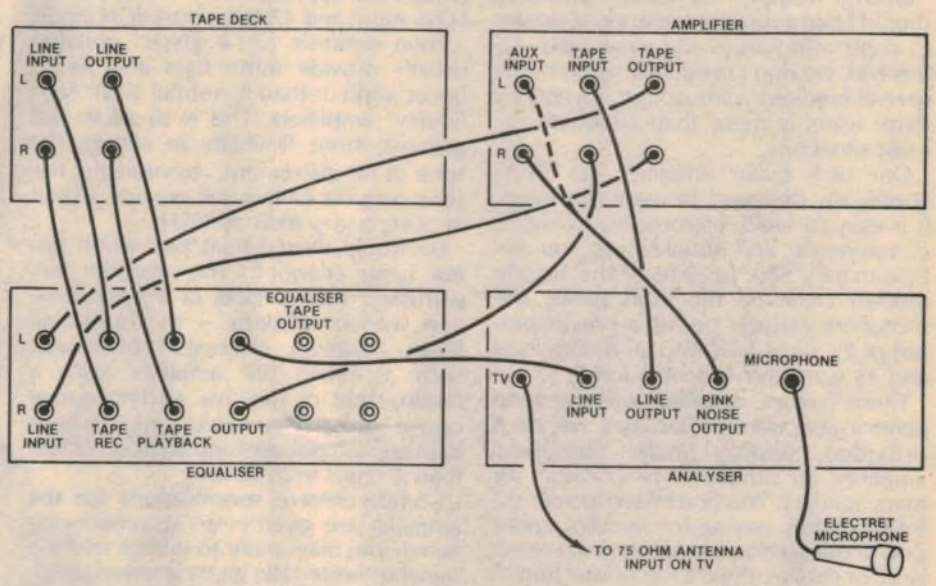
NOTE: Where specified, the "B" suffix on a CMOS IC part number indicates that only a buffered device should be used.

controls and sockets can now begin. We recommend that PC stakes be used to simplify wiring. Other points to note are that audio shielded cable must be used for connections to the line input and microphone input on the back panel as well as the wiring to the level control and microphone line switch. Seventy-five ohm TV coax cable must be used for the connection between the UM1082 modulator output and the back panel. An RCA plug is used to make the connection to the modulator output and the earth connection should be directly connected to the lid of the modulator with a soldered wire link.

You should now be in a position to turn the unit on, but first make another detailed check of the orientation of the ICs, diodes, resistors, electrolytics and the three terminal regulators; this is very important. If you are satisfied that the unit is wired correctly switch on and make a check of the supply voltages, if these are wrong switch off immediately and re-check the circuit.

If all is well connect the VHF output to the input of your TV. Note again that 75 ohm coax cable must be used for this purpose and one end should be terminated in an RCA plug and the other with a Belling Lee line plug. If the TV set is an old B/W set without provision for a line input socket then a 75 ohm to 300 ohm balun can be used.

Connect the pink noise output of the analyser to the AUX or TUNER inputs of the amplifier and the line input of the analyser to the "TAPE REC" or "PREAMP OUT" sockets of the amplifier. Switching the MIC/LINE socket on the analyser to line, you should be able to display the frequency spectrum of the music program selected. If pink noise is selected the resulting display should be quite flat, at least within better than ±1dB. Now an electret microphone can be connected and equalisation started.



This diagram shows how to connect the Analyser into a hifi system which involves a stereo amplifier or receiver, a tape or cassette deck and a graphic equaliser. Assuming that the amplifier has only one set of "tape monitor" connections, connect the equaliser to these and connect the tape deck to the tape monitor outputs on the equaliser. The pink noise output from the analyser is connected to the left or right channel Auxiliary input of the amplifier, dependent on which channel is being analysed at the time.

Guitar Amplifier for practice sessions

27W output plus tone controls & tremolo

Compact in size, with 27 watts RMS continuous output capability, this new guitar amplifier is designed for practice work and for use in small halls. The unit is fully solid-state and features tone controls, a tremolo facility, and high and low level inputs.

by JOHN CLARKE

While expensive guitar amplifiers with ratings of several hundred watts are necessary for professional musicians, there are many guitarists who do not need this kind of power output. Instead, the main requirement appears to be for a relatively compact amplifier suitable for use in the home and for practice work.

Ideally, though, a guitar amplifier should have a sufficient reserve of power to cope with parties and small halls. To this end, we don't need an amplifier with several hundred watts output. Twenty to thirty watts is more than adequate for most situations.

Our new guitar amplifier has been specifically designed to meet this need. It is easy to build, uses readily available components, and should cost you approximately $80. In spite of the slightly modest claim on the front panel, the prototype actually boasts a power output of 27 watts RMS into an 8 ohm load and 35 watts into a 4 ohm load.

These factors, coupled with the tone control and tremolo facilities we have provided, should make the new amplifier an attractive proposition for many readers. You don't have to spend a lot of money paying for features and a power output that you don't really need. And, of course, there's the satisfaction of having built it yourself.

Many of the parts used, including the power transformer and the chassis, are common to those used in the Playmaster Twin Twenty-Five stereo amplifier. This has been partly responsible for keeping the cost down. But the completed unit still looks impressive. As with all our recent amplifiers, we have provided a professional-looking front panel with an anodised scratch-grain finish.

Let's take a closer look at some of the circuit facilities.

As can be seen from the accompanying photograph, two jack sockets are provided on the front panel to accept the guitar input. Input sensitivity is 20mV or 100mV for full power, depending upon which input is selected. The less sensitive (HIGH) input should be used for bass guitars or guitars which have a higher than usual signal output. This prevents overloading of the preamplifier stage. Input impedance is approximately 100kΩ for the LOW input and 47kΩ for the HIGH input.

Tone controls for a guitar amplifier usually provide more bass and treble boost and cut than is normal with "high fidelity" amplifiers. This is to allow the guitarist more flexibility in setting the tone of his instrument. Accordingly, the tone controls on this unit provide ±18dB at 50Hz and ±20dB at 10kHz.

Electronic short circuit protection has not been provided. The amplifier will withstand short-circuits of a brief duration without damage – the fuses will blow. However prolonged overloads, such as using the amplifier with a loudspeaker of too low an impedance could possibly cause permanent damage. Do not use loudspeakers of less than 4 ohms impedance.

Comprehensive specifications for the amplifier are given in an accompanying panel. The main point to note is that the signal to noise ratio given is unweighted, which means that it refers to wideband noise. A weighted figure would result in a much higher signal to noise ratio. Certainly, all specification figures are in line with current performance standards.

THE CIRCUIT

Refer now to the circuit diagram. It can be divided into four basic sections: a power supply, an input preamplifier and tone control stage, the tremolo circuit, and a power amplifier.

NPN transistors Q1 and Q2 make up the direct coupled preamplifier circuit which has a voltage gain of approximately 22 times. This is set by the ratio of the 33kΩ resistor to the 1.5kΩ resistor. Bias for the input transistor is derived from the junction of the 330Ω and 270Ω resistors. Notice that there are two DC feedback networks in the circuit: the bias network and via the 33kΩ resistor to the emitter of the input transistor.

A 100pF capacitor shunting the 33kΩ resistor increases the negative feedback at high frequencies and thus rolls off the response above the audible range to assure low RF sensitivity. Similarly, a 100pF capacitor between the base and collector of Q3 lowers the cutoff frequency of this transistor.

In addition to rolling off the response at high frequencies, there is an RF attenuation network in the input circuit consisting of a series of 10kΩ resistor and shunt 100pF capacitor.

Following the preamplifier stage is an active tone control stage using NPN transistor Q3. This stage has a gain of unity with the tone controls set for a flat response.

The output from the tone control stage is fed to the volume control and thence to the tremolo control stage consisting of transistors Q4 and Q5. Q4 is a com-

mon emitter amplifier stage with gain control provided by varying the emitter degeneration via the N-channel FET Q6.

Under normal operation, the gate of the FET is held at ground potential with the normal tremolo switch. This provides a low drain-source resistance which shunts the 1.2kΩ emitter resistor. With the lower emitter degeneration, the gain of this stage is at maximum.

When the normal-tremolo switch is open, the gate of the FET is driven by sine wave oscillator Q5. The varying voltage at the gate gives a corresponding variation in the drain-source resistance of Q6 and so varies the gain of Q4. Consequently the amplified guitar signal is modulated by the varying gain of this stage.

The actual amount of modulation or "tremolo" is adjustable by means of the intensity control.

The tremolo oscillator is essentially a voltage amplifier with a phase shifting network connected between the output and the input. At one particular frequency, the phase shift produced by this network will be exactly 180°, which allows continuous oscillation to occur provided the gain is adequate. By making one of the resistors in the phase shift network adjustable in value, the oscillation frequency may be varied. This allows adjustment of the vibrato speed.

ohms. This ensures that the voltage excursions at the collectors of Q7 and Q8 are always similar.

Signal output from the differential input stage is taken from the collector of Q7 and amplified by common emitter stage Q11. Local negative feedback in this stage is in the form of emitter degeneration provided by the 39Ω resistor. The no-signal current through Q11 is set by constant current source Q10 which also uses D1 and D2 as its voltage reference.

Q16, a Vbe multiplier, sets the quiescent current in the output transistors. This configuration is very stable and will keep this quiescent current within a close tolerance.

The output stages operate essentially as Darlington emitter followers with slightly less than unity voltage gain but considerble current gain.

Q12 and Q14 combine to form a conventional Darlington emitter follower while Q13 and Q15 form a compound transistor also operating as an emitter follower. Diode D3 provides the same overall Vbe drop as the Q12/Q14 Darlington and thus helps to make the output stage more symmetrical. The .022uF capacitor across D3 compensates for the load capacitance in the collector circuit of Q13 due to the Miller capacitance of the base-collector junction of Q15. The

PERFORMANCE

POWER OUTPUT
4 ohms: 35W at .13% distortion
8 ohms: 27W at .13% distortion

FREQUENCY RESPONSE
20Hz to 20kHz: ±1.5dB

INPUT SENSITIVITY
LOW at 1kHz: 20mV
HIGH at 1kHz: 100mV
Overload at 1kHz: 130mV and 600mV

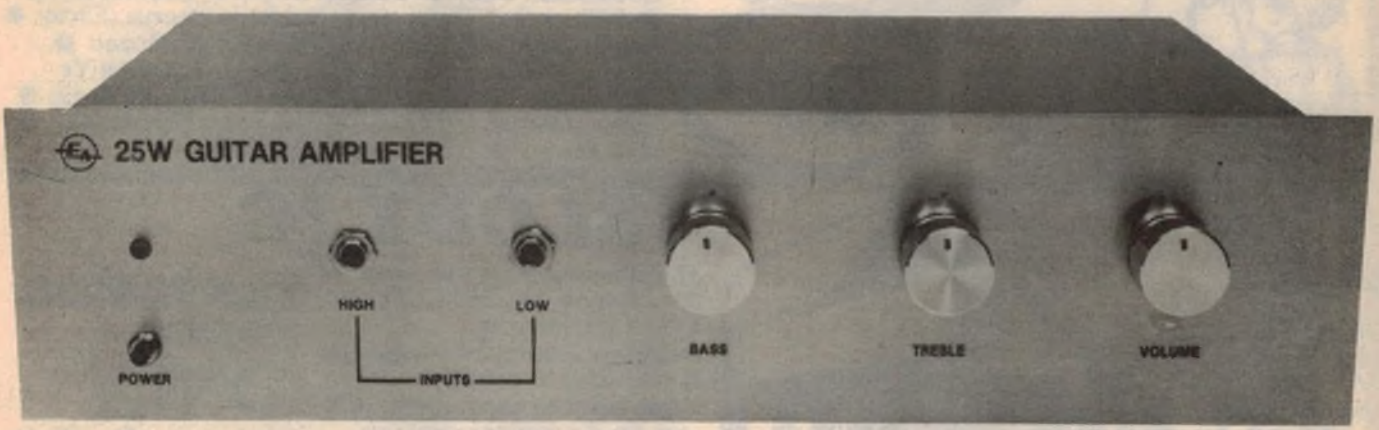
SIGNAL-TO-NOISE RATIO
59dB with respect to 10W

HARMONIC DISTORTION
Typically less than 0.07% at normal listening levels (see graph)

TONE CONTROLS
Bass
see graph
Treble

DAMPING FACTOR
at 1kHz: 75
at 30Hz: 50

STABILITY
unconditional



The prototype was housed in a Playmaster Twin-25 chassis, with the tremolo switch on the rear panel.

The power amplifier is the same as that used for the Playmaster Twin Twenty-Five stereo amplifier published in April, 1976. This uses rugged, yet inexpensive, 2N3055 power transistors connected in a quasi-complementary output stage. Direct coupling is used throughout the amplifier and only one electrolytic capacitor is employed.

Q7 and Q8 form a differential pair which enables the amplifier quiescent output voltage to be set close to 0V and thus eliminate output capacitors. Current through the differential pair is set by the constant current source Q9 which uses D1 and D2 as its voltage reference. To ensure that the differential input stage remains balanced, Q8 has a collector resistor of the same value as Q7; ie 680

capacitor thus gives another small improvement in output stage symmetry.

Voltage gain in the amplifier is set by the ratio of the 22kΩ and 1kΩ resistors in the base of Q8. Low frequency response is set by the 22μF feedback capacitor.

An RLC network connects the load to the amplifier, to ensure amplifier stability with highly reactive loads. The network is highly effective and renders the amplifier unconditionally stable. As a bonus, the network prevents radio interference picked up by long loudspeaker leads from being fed back to the amplifier input via the feedback network.

CONSTRUCTION

We built our guitar amplifier into a Playmaster Twin Twenty-Five case, measuring 370 x 77 x 245mm (W x H x D). This case is readily available from Dick Smith Electronics stores, but is by no means the only case suitable for the amplifier. The Horwood cases are a viable alternative, and feature carrying handles on the front panel.

Note, however, that the front panel artwork would have to be altered for cases other than the Playmaster Twin Twenty-Five chassis.

The majority of components are mounted on a printed circuit board (PCB) coded 80ga12 and measuring 160 x 154mm. Assembly can begin with the PCB. Follow the overlay diagram carefully when mounting components as mistakes can lead to disaster. Start by

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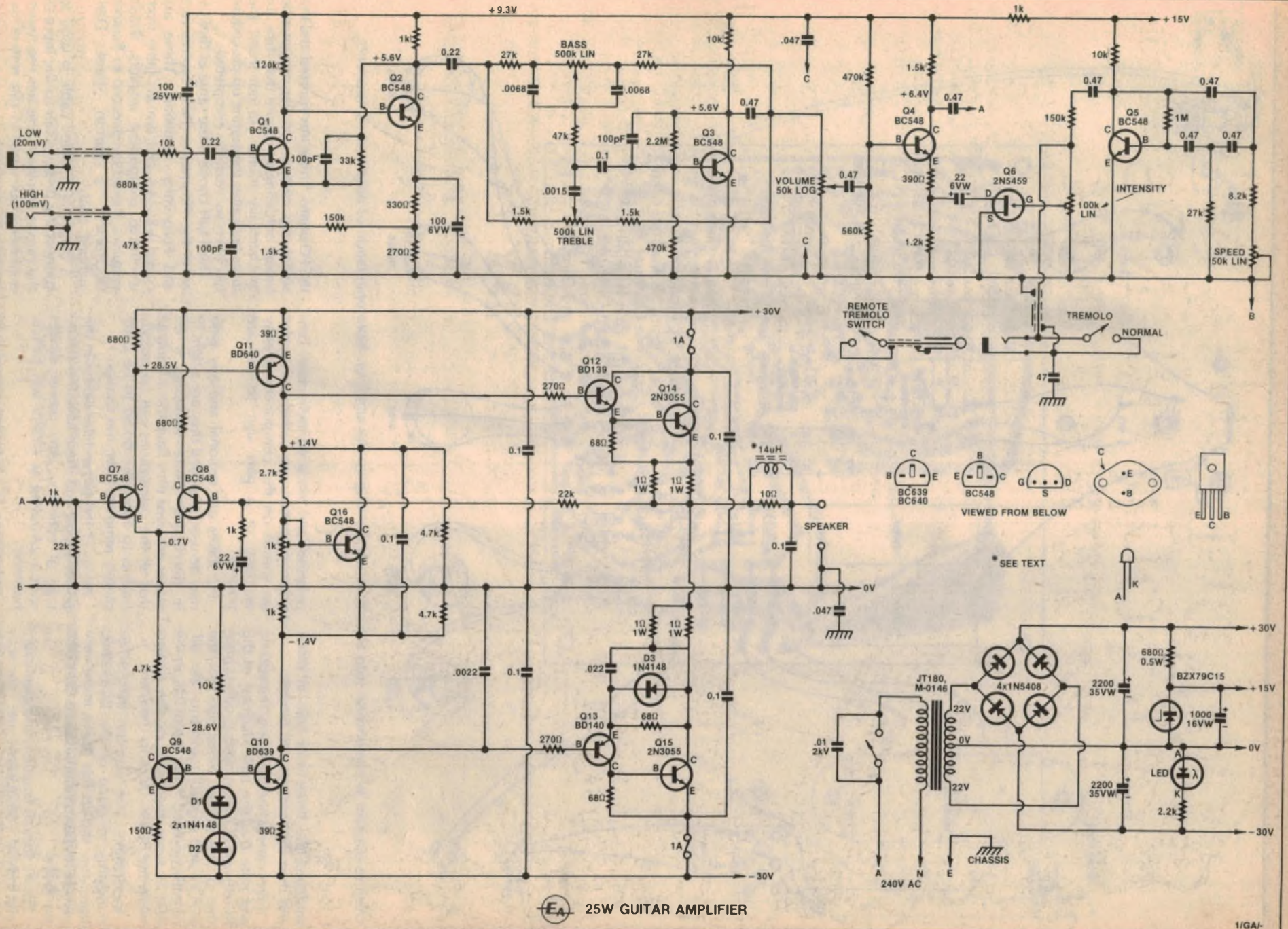

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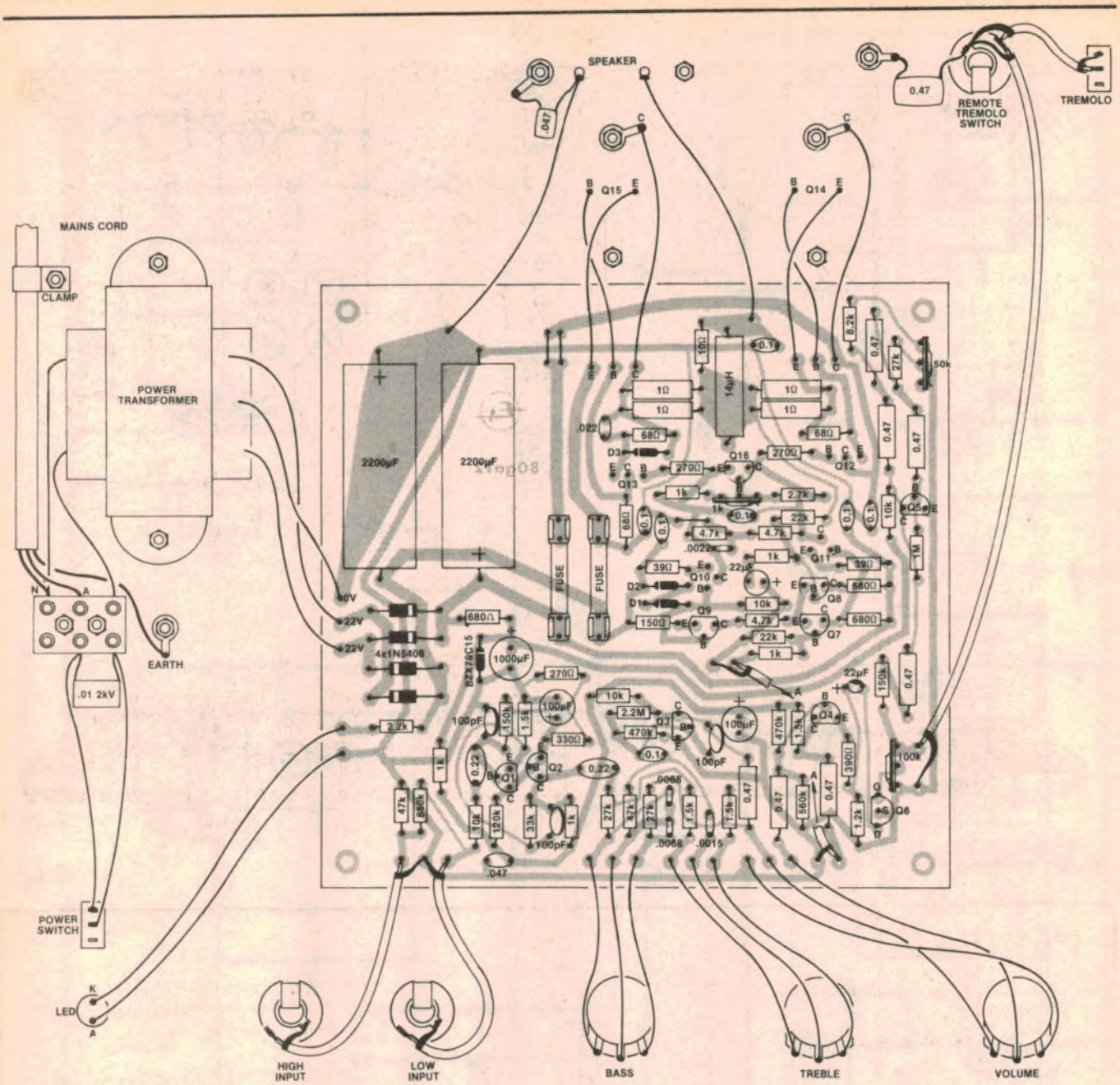


Use this diagram in conjunction with the circuit when wiring up the amplifier. Note orientation of polarised components.

soldering the three wire links in place and then the resistors and diodes.

Take care when inserting transistors, and note that the base diagram of the BC639 and BC640 transistors differs from that of the BC548. Note also that the BD139 and BD140 transistors are differently oriented – the metal flat on the BD139 faces the front of the chassis while the BD140 faces to the rear.

Incidentally, you can use BD139/140 transistors in place of the BC639/640 transistors should this prove more convenient. In fact, this is what we did in the prototype.

Ensure that all tantalum and aluminium electrolytic capacitors are correctly oriented, otherwise they will be reverse polarised and rendered ineffective. Tantalum capacitors are coded with a dot (as shown on the component overlay diagram) or a plus sign to indicate polarity.

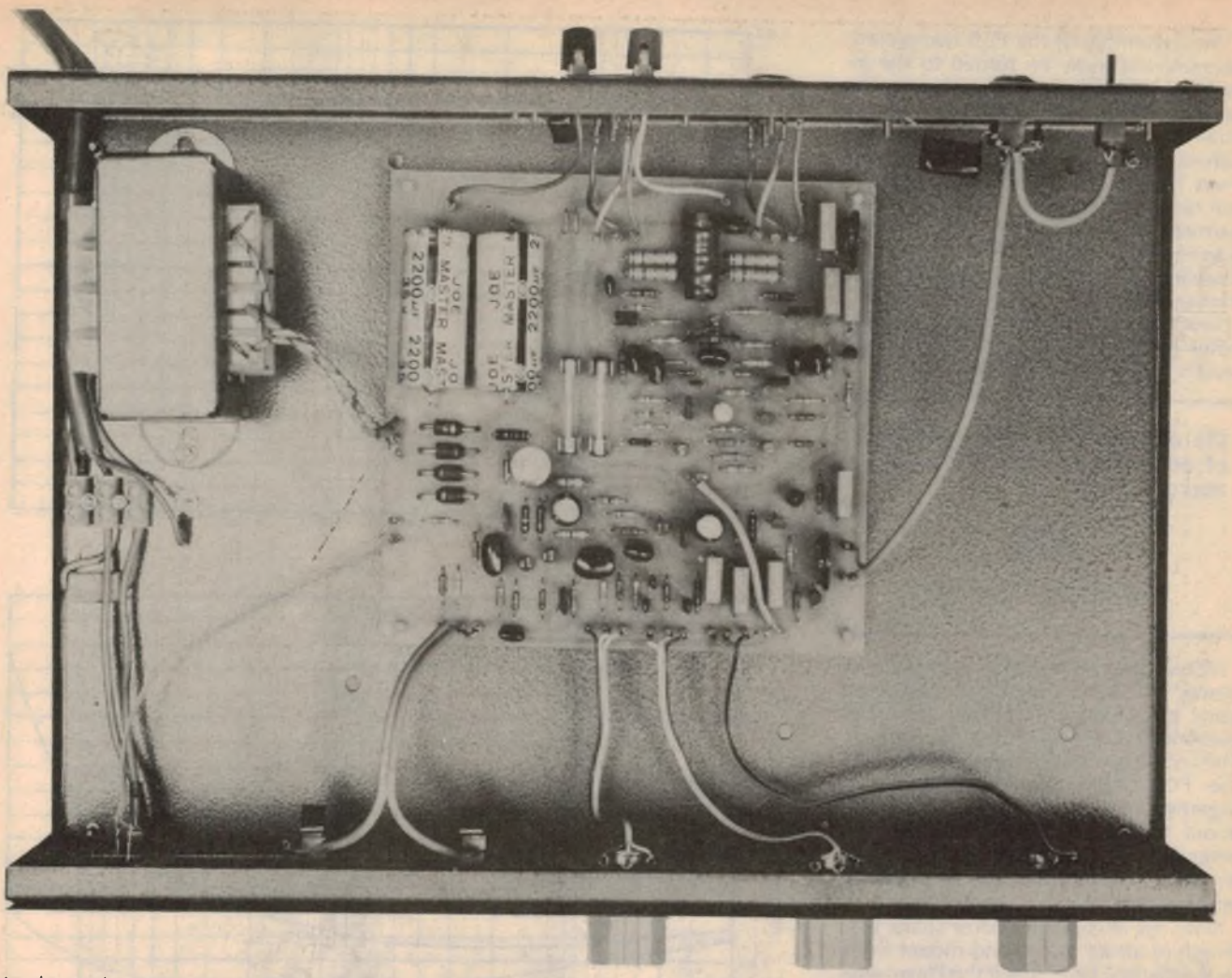
PC stakes are optional and any type may be used provided they are a tight fit in the board before soldering. If PC stakes are used they have the advantage that all the connections can be quickly broken to allow the board to be completely removed from the chassis.

We used 1N5408 rectifier diodes in the power supply and these have the advantage of economy. Any power diodes with a 2A rating at 100PIV will suffice, however.

Four Swann FC1 fuseclips are used on the PC board. These are inserted and the solder tags crimped on the copper side before soldering to ensure that they are mechanically sound. Do not insert the fuses until after the setting up procedure has been successfully completed.

The 14µH choke is the same as that used in the Playmaster Twin Twenty-Five and Forty-Forty amplifiers. These are coded VPC14A and are available from electronic component retailers. Trade enquiries should be directed to Paradio Electronics, 7a Burton Street, Darlinghurst, NSW.

A length of shielded cable is used to connect the preamplifier to the input of the power amplifier. This ties the power amplifier input earth to the rest of the board earth network.



This photo shows the internal layout of the amplifier. Keep all mains wiring neat and tidy.

PARTS LIST

1 PC board code 80ga12, 160 x 154mm
1 metal case, 370 x 77 x 245mm, Playmaster Twin-25 case or equivalent
1 transformer, 44V CT 1.25 amps, M-0146 or Jones JT.180
1 front panel to suit case
1 14μH choke, type VPC14A
2 SPDT miniature toggle switches
3 6.5mm panel sockets
1 two-way speaker terminal
3 knobs to suit panel
1 3-way mains terminal block
1 mains cord and plug
1 grommet and cord clamp to suit mains cord
4 rubber feet
4 Richo CBS-6N PC board supports
2 1A 3AG fuses
4 fuse clips, Swann FC1
5 solder lugs
2 sets of mounting hardware for TO-3 power transistors; ie mica washers, insulating bushes plus screws and nuts
1 red LED

SEMICONDUCTORS
2 2N3055 NPN power transistors
1 BD139 NPN transistor
1 BD140 PNP transistor
9 BC548 NPN transistors
1 BC639 NPNtransistor
1 BC640 PNP transistor
1 2N5459 N-channel FET
3 1N4148 signal diodes
4 1N5408 3A rectifier diodes
1 BZX79C15 15V/400mW zener diode

CAPACITORS
2 2200μF/35VW pigtail electrolytic
1 1000μF/16VW PC electrolytic
1 100μF/25VW PC electrolytic
1 100μF/6VW PC electrolytic
2 22μF/6VW PC electrolytic
8 0.47μF metallised polyester (greencap)
2 0.22μF metallised polyester
7 0.1μF metallised polyester
2 .047μF metallised polyester
1 .022μF metallised polyester
1 0.01μF/2kV ceramic or 250VAC polycarbonate
2 .0068μF metallised polyester
1 .0022μF metallised polyester
1 .0015μF metallised polyester
3 100pF ceramic

RESISTORS (¼W, 5% unless noted)
1 x 2.2MΩ, 1 x 1MΩ, 1 x 680kΩ, 1 x 560kΩ, 2 x 470kΩ, 2 x 150kΩ, 1 x 120kΩ, 2 x 47kΩ, 1 x 33kΩ, 3 x 27kΩ, 2 x 22kΩ, 4 x 10kΩ, 1 x 8.2kΩ, 3 x 4.7kΩ, 1 x 2.7kΩ, 1 x 2.2kΩ, 4 x 1.5kΩ, 1 x 1.2kΩ, 5 x 1kΩ, 2 x 680Ω, 1 x 680Ω ½W, 1 x 390Ω, 1 x 330Ω, 3 x 270Ω, 1 x 150Ω, 3 x 68Ω, 2 x 39Ω, 1 x 10Ω, 4 x 1Ω 1W, 1 x 100kΩ trimpot, 1 x 50kΩ trimpot, 1 x 1kΩ trimpot, 2 x 500kΩ lin potentiometers, 1 x 50kΩ log potentiometer.

MISCELLANEOUS
Screws, nuts, shielded cable, hook-up wire, mains rated wire, PC stakes, solder.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used provided they are physically compatible.

With assembly of the PCB completed, attention can now be turned to the installation of hardware in the chassis. The accompanying wiring diagrams shows how the various components are positioned. If you are using a Playmaster Twin Twenty-Five chassis, existing holes can be used to mount virtually all components, including the power transformer, front panel controls, loudspeaker connector and output transistors.

You will have to drill new mounting holes for the PCB and for the tremolo switch and socket, however.

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

$79

This includes sales tax.

Mount the transformer so that it is spaced off the chassis by at least 3mm using brass nuts or washers. This is to prevent hum induction into the chassis. The secondary leads should be closest to the PCB. Twist the secondary leads together and cut them to a length of about 10cm. Similarly, twist the primary wires together and cut to a suitable length for termination at the insulated terminal block.

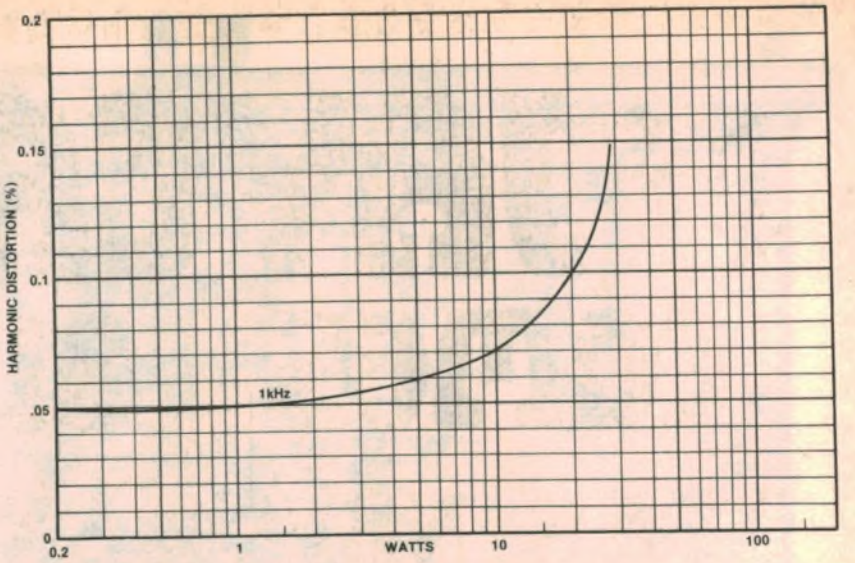
Now cut all potentiometer shafts to a length of about 12mm and mount these to the chassis. Note that if the Playmaster Twin Twenty-Five case is used, the hole for the treble control will need to be filed so that the control can be lined up with the bass and volume controls. Install the switches and sockets but leave the escutcheon plate off at this stage to avoid scratching.

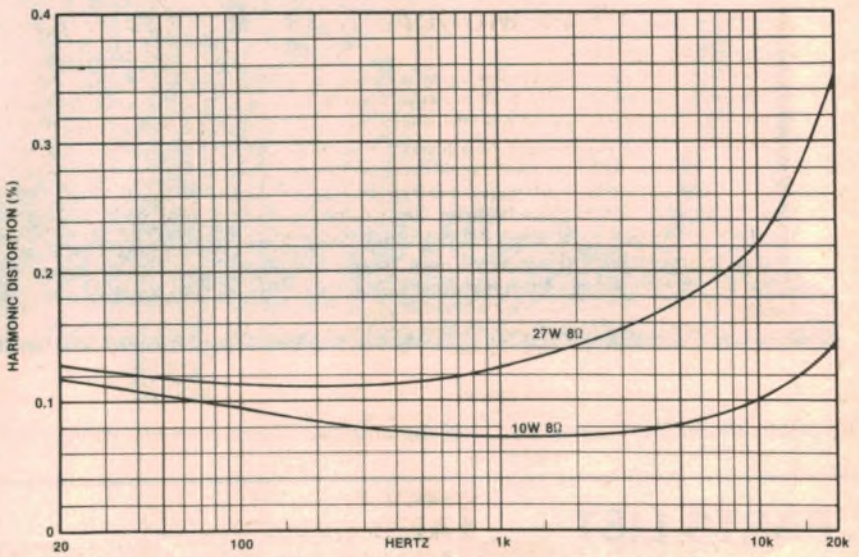
The remote tremolo switch socket mounted at the rear of the chassis needs to be insulated from the case to prevent earth loops. We insulated it with a rubber grommet, but insulating tape wrapped around the shaft would serve equally as well.

The loudspeaker terminals we used are spring-loaded and are more convenient than the cheaper screw terminals.

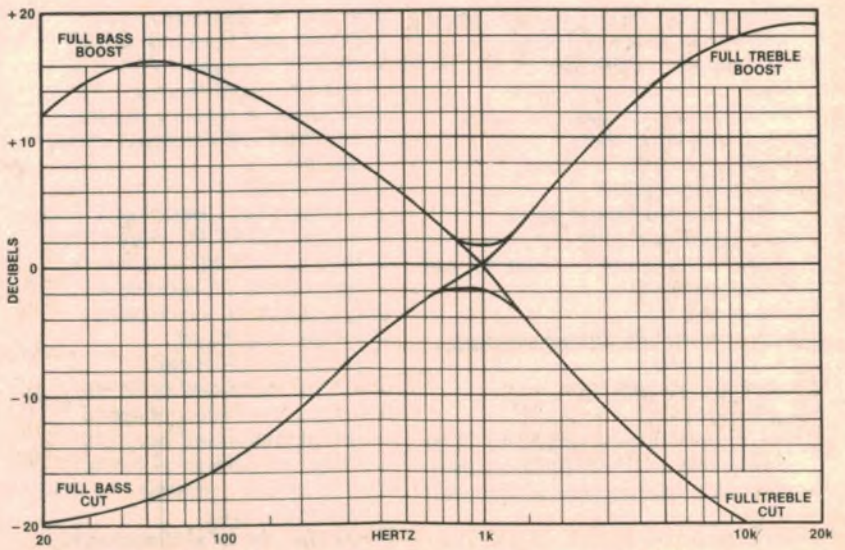
Before mounting the output transistors, ensure that the contact area is completely smooth and free of burrs and swarf. If the case is painted, scrape away the paint at the transistor contact area. Smear this contact area, both sides of the mica washers and the base of the transistors with heatsink compound. The mica washers are necessary, along with insulating bushes, to isolate each transistor from chassis. Attach a solder lug to one of the retaining screws of each transistor.

After mounting the transistors, check the electrical insulation between the chassis and the transistor cases with an ohmmeter. Any short to chassis must be





Above are two graphs showing the distortion performance of the amplifier. Harmonic distortion is typically less than .07% at normal listening levels.



This graph plots the tone control characteristics.

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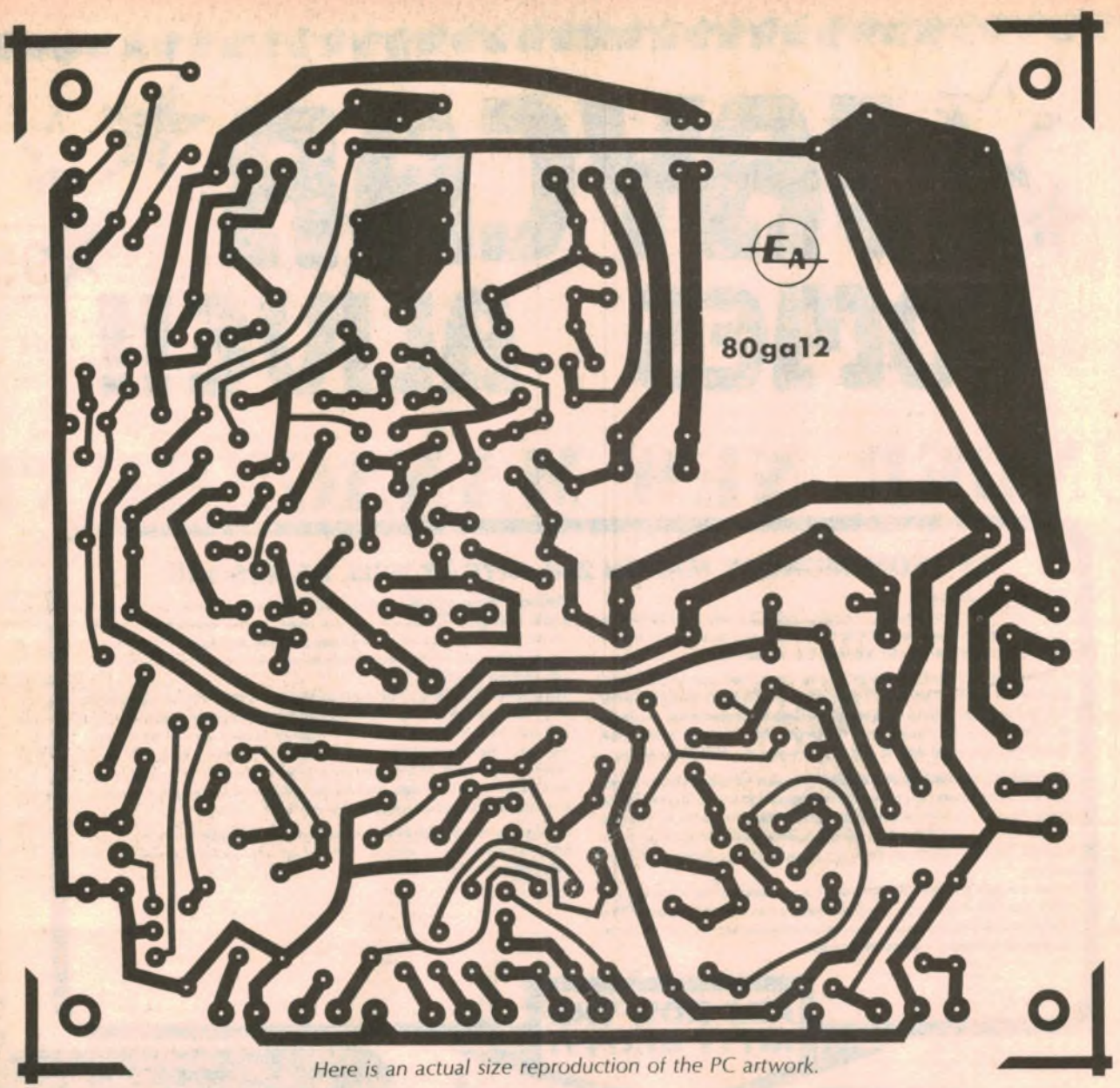

Here is an actual size reproduction of the PC artwork.

repaired at this stage. Either the mica washer has punched through or the transistor has been mounted incorrectly.

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

The mains switch has a 0.1μF/2kV ceramic or 250VAC polycarbonate capacitor wired across it at the insulated terminal block. Use insulating sleeving on the capacitor leads. As well, before soldering the wires to the mains switch, slip some insulating sleeving over the wires and after soldering, push the sleeving over the terminals of the switch. The spare terminal, if a double throw switch is used, should also be insulated.

The PC board can now be dropped into place in the chassis and mounted using Richco plastic supports. Make all connections from the PC board to the chassis components exactly as indicated in the chassis wiring diagram. We used ribbon cable for the volume, tone controls and LED indicator, but shielded cable must be used for the input wiring and the wiring to the normal-remote switch and remote tremolo switch socket.

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

Solder 100Ω1W resistors across each fuse holder. Now, looking from the front of the chassis, rotate the 1kΩ trimpot fully clockwise. The volume control should be set to minimum. Do not connect any loads to the amplifier at this stage.

Apply power and check voltages in the power amplifier. There should be less than 1 volt DC across each 100Ω test resistor and less than plus or minus 100mV DC at the amplifier output. If these checks prove okay, the quiescent current can be set. Rotate the 1kΩ trimpot to obtain 2 volts DC across one of the 100Ω resistors. This corresponds to a quiescent current of 20mA.

As a final test, check all the voltages shown on the circuit diagram. If these are all within 10 per cent of specification then the 100Ω resistors can be removed and the fuses installed. Connect a loudspeaker to the amplifier, apply power and the project is ready for use.

One final comment. If a remote tremolo switch is used, make sure that the switch lead to the amplifier is run in shielded cable. The switch can be a heavy duty momentary push-on type mounted in a box suitable for foot operation.

For those who expect to use the tremolo feature regularly, potentiometers can be used instead of trimpots for the speed and intensity controls. These can be mounted on the rear of the chassis and wired with ribbon cable. The speed control potentiometer can be logarithmic type for improved control, while a linear type should be retained for the intensity control.

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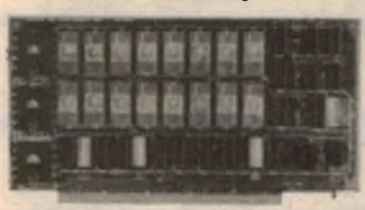

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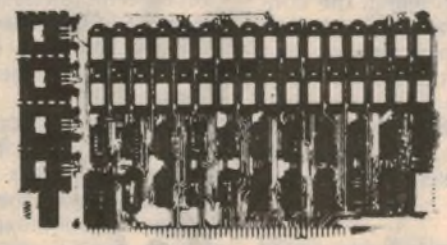

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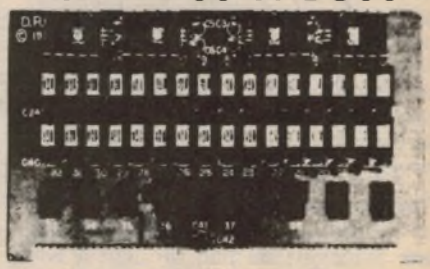

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The Serviceman

A little LED that almost "led" me astray!

After some of the rather way-out stories I have presented in recent months, I'm afraid that this month's story may seem a little ordinary. The truth is that weird faults don't happen all the time — for which I am duly thankful — and so I have had to pick the most interesting case from a period of quite routine work. There is also a reader's story that must set some kind of record.

Nevertheless, this story does have its points. For one thing, it emphasises just how helpless a serviceman can be when faced with an unfamiliar set, without the benefit of a service manual or circuit diagram. And for another, it demonstrates how a feature of the set, supposedly designed to help the serviceman, not only failed to do this but proved actually misleading.

The set was a German Blaupunkt colour TV set which belonged to the local bank manager. He had brought it with him when he moved into the area a couple of years ago, and I had erected a new antenna for him and generally helped with the installation.

Apart from that, and a couple of very minor faults, I had had very little to do with it. And, since he was my only customer with this make of set, I had put off getting the appropriate service manual; something which was to prove a trifle embarrassing.

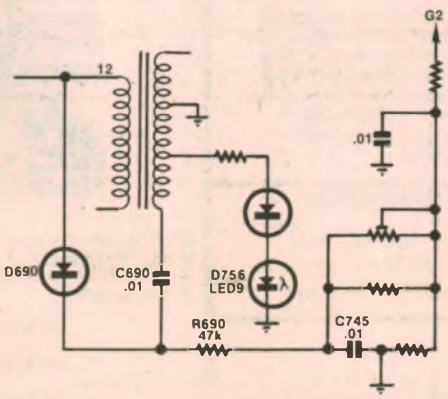
A feature of this model set is a built-in fault finding system, designed to monitor various critical voltages and, therefore, provide a quick indication as to which section of the set should be checked. The system consists of nine LEDs (light emitting diodes) fed from the various voltage rails and which will all light when the set is functioning normally. Failure to light indicates that the particular section should be checked.

Five of the LEDs are in the mains unit, and the remaining four on the sweep unit board. No. 1 LED monitors the power supply; No. 2, the 250V rail; No. 3, the 33V rail; No. 4 the 15V rail; and No. 5, the 5.5V rail. On the sweep unit board, No. 6 monitors the vertical deflection voltage across the deflection coils; No. 7, a line pulse on the flyback thyristor; No. 8, a switched voltage across the scanning module; and No. 9, the flyback pulse across the horizontal deflection coils.

I have no doubt that, within the constraint imposed by a reasonable number of LEDs, the design engineers had chosen the most appropriate points to monitor, at the same time conceding that not all faults could be expected to create a fault indication. And, as we shall see, it very nearly worked in this case – but not quite.

The customer's complaint was sound but no picture and, he added, the screen was completely black; ie, no raster. Being conscious that I had no service manual, but being vaguely aware of the LED monitors, I was hoping that the fault would be either self evident, or at least hinted at by one of the LEDs.

Alas, I was disappointed on both counts; there were no obviously faulty components and all the LEDs were glowing brightly. So much for the in-built fault finder. The first clue was provided by turning up the brightness, contrast, and colour controls to maximum, which produced a very faint picture.



Two breakdowns in sequence first produced the appropriate fault indication on LED 9, then created a second condition by which the fault indication was cancelled.

This prompted me to start checking voltages on the picture tube. First I checked the three cathodes and, even without the benefit of the circuit, I felt sure something was wrong here. The voltages were around 45 to 50, whereas I would have expected about 150V. (My estimate was subsequently shown to be almost spot on.)

An even more obvious fault concerned the grid 2 of the picture tube. I expected to find something between 500 and 700V here but, in fact, there was no G2 voltage at all!

At this point I reluctantly decided that I would have to give it away until I could get my hands on a circuit. It was one thing to establish that there was no G2 voltage, but something else again to try to trace the G2 circuit through a complicated network of boards and cables.

While I didn't imagine that I would have any real difficulty in obtaining a service manual, I was worried about the time it was likely to take, remembering that the customer was going to be without his set until I did. (And remembering, also, that he was the bank manager and that there was the rather touchy subject of my overdraft to be discussed in the near future!)

Then I remembered something else. One of my colleagues owed me a favour and there was a good chance that he had such a manual. A quick phone call confirmed both ideas; he had a manual and was quite happy to repay the favour. As a result, I was back on the job within a few hours.

With the circuit to guide me, the G2 supply became obvious. A pulse of around 680V was picked off the line output transformer primary (pin 12), rectified by a diode (D690), filtered by a .01uF capacitor (C690), and fed to the three G2s via a 47kΩ resistor (R690). (All three grids were tied together). The voltage was shown as 760. (According to LED 9, which monitors this part of the set, there was no fault at this time.)

Physically, the arrangement was a little more complex. There was a main board which accommodated the line output transformer and associated deflection circuit, plus a number of sub-boards

mounted on it. One of these, called the scanning module, carried the aforementioned diode, .01 capacitor, and 47kΩ resistor.

Unfortunately, the manner in which the sub-board is mounted on the main board makes it difficult, and in some cases impossible, to measure voltages on the sub-board when it is mounted on the main board. As a result, I was forced to adopt a routine of checking individual components while the board was unplugged.

The most likely suspect was the diode and a quick check with the meter confirmed my suspicion; it was open circuit. So I replaced the diode, plugged the board back in and, with high hopes, switched on. But it wasn't going to be that easy; the first thing I noted was that LED 9 had now gone out, indicating that we now had a fault! We did too – there was still no G2 voltage.

My next suspect was the .01 capacitor, C690, although I was aware that there were at least two more capacitors on the G2 line, one on the main board and one on the picture tube board. At this stage I decided to make LED 9 justify its existence. I lifted the 47kΩ resistor, R690, put the sub-board back in, and switched on again. When LED 9 still refused to light I knew it could only be C690, because all the rest of the line was disconnected.

BACK TO NORMAL

I fitted a new capacitor, re-fitted the 47kΩ, and tried again. And this time everything came good. The picture came up bright and clear, and all the voltages slipped into place well within tolerance.

With the fault found and fixed, the sequence of events before I arrived, and the reason for the seemingly contradictory behaviour of the LED, became clear. The initial failure would have been the breakdown of C690 and, at that moment, LED 9 would have correctly indicated a fault condition, due to the excessive loading on the line output transformer.

Subsequently, and before the set was switched off, the diode D690 failed due to the heavy overload. This removed the excessive load from the line output transformer, which went back to delivering normal voltages, and LED 9 promptly came to life and declared that there was no longer a fault.

Had I taken this indication more seriously I could well have been led up the garden path. As it was, I had enough troubles due to a lack of service data – which was my own fault – lack of experience on this model – which was simply unfortunate – and the difficulty of working on some of the boards while they are in position – for which I can only blame the manufacturer.

But that's the luck of the game and even if I did take a little longer than I should have to find the fault, the customer was duly impressed and, I

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hope, will still be in a happy frame of mind when my overdraft comes up for discussion!

On a different note, I have a very interesting story from a reader describing how he tracked down an intermittent fault in his TV set – after 18 years! (That ought to make the Guinness Book of Records.)

The reader is Mr P. D. of Wombat, NSW. (No, I'm not kidding, there is such a place.) Mr P.D. is only a hobbyist, not a professional serviceman, but I must commend him on his methodical approach to the problem. Here is the story as he tells it.

My TV set uses the Stromberg-Carlson 4A002 chassis and still performs well. The only valves replaced in 18 years are the 6ES8 and 6BL8 in the tuner and the 6DX8s in the audio and video amplifiers. Also, several paper capacitors in critical positions have been replaced with modern plastic types.

"We've tried just about everything else. What about putting the tube in upside down?"

The intermittent problem has been with the set since new. At irregular intervals there would be a plop in the speaker, followed by frame buzz in the sound and horizontal streaks in the picture, varying in sympathy with the sound.

The first few times it corrected itself after a few minutes. Subsequently it was discovered that it could be "fixed" by retarding the contrast control to minimum. With a plop the sound would come good and the contrast control could be returned to its original position.

I need hardly add that this fault always occurred at the most inappropriate times, when it was just not practical to investigate the problem on the spot. And, since it was easily "fixed", this was the procedure adopted.

And, just as typically, I could never make the fault occur when I was able to work on the chassis. So I tried to simulate the fault by disconnecting various components around the video amplifier, on the assumption that it was due to some component going open circuit intermittently. Unfortunately, nothing I did ever created the fault.

I will digress here to describe another fault which had been with the set from the beginning, since it provided a clue to the intermittent fault. This fault was non-linearity in the vertical scan and, no matter what I did, I could not achieve the linearity claimed in the service manual.

The cause was eventually traced to the vertical output stage and, more specifically, to the plate supply decoupling capacitor (60μF) and the cathode bypass capacitor (200μF), both being in the same can. Disconnecting the cathode bypass and substituting a separate capacitor cured the problem.

MEMORY DAWNS!

I thought no more about it at the time but, recently, I came across some notes I had made about the exercise at the time and the light suddenly dawned. Looking at the circuit confirmed that the screens of the video amplifier and the audio amplifier were both bypassed by 8uF electrolytics and, yes, they were both in the same can.

To prove my theory I disconnected the positive terminals of both electros and substituted two separate 8μFs. Disconnecting the audio one increased the hum slightly, while disconnecting the video one made no apparent difference. But disconnecting both negative ends from the chassis, with them still connected together, produced the fault symptoms exactly.

So it appears that the fault was an intermittent open circuit between the common negative electro terminals and the can, with the connection between these terminals intact. Thus the screens of the two valves were not only robbed of their bypasses, but were effectively connected together via the two electros in series, back to back. In a way, it would be a three-in-one fault.

OPEN TO SUSPICION

Well, that's Mr P.D.'s story, and a most interesting one too. Significantly, it is not the first time that multiple electro assemblies have exhibited faulty negative terminals and I suspect that they were never very reliable. On the other hand, I have never heard of a failure causing a common coupling path in this manner, though it may well have happened but not been recognised.

More importantly, I think, the story is a reminder that endeavouring to simulate an intermittent fault is still one of the most valuable tricks we have to either find the fault, or to confirm that it has, in fact, been found.

So thank you, Mr P.D. I imagine that life in the seething metropolis of Wombat has now returned to normal.

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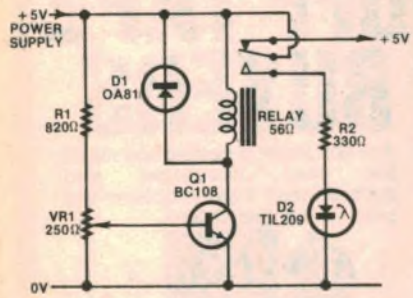
CIRCUIT & DESIGN IDEAS

We invite readers to submit circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. Sources of material must be acknowledged and will be paid for if used. As these items have not necessarily been tested in our laboratory, responsibility cannot be accepted.

TTL Over-Voltage Protection



This idea is intended to protect TTL devices from excessive power supply voltage which can possibly cause costly damage. The unit is inserted between the output of the supply and the (TTL) load.

Referring to the circuit it will be seen that VR1 and R1 are connected across the input to form a voltage divider, which applies a potential to the base of Q1 such that with a nominal 5-volt supply Q1 is just biased off. Preset VR1 is adjusted so that if the supply voltage exceeds (say) 5½ volts, Q1 switches on.

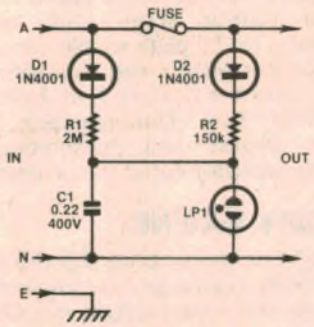
The relay is then actuated with its changeover contact set interrupting the supply to the load, and simultaneously energising the LED which provides visual indication of the fault.

(From "Practical Electronics", January, 1981.)

Fuse Failure Indicator

This design is intended for use with 240VAC mains distribution boards. With an intact fuse the neon lamp glows steadily to indicate that the circuit is "alive". Should the fuse fail, an immediate change to a "flashing" display occurs, simplifying indentification of the blown fuse.

Referring to the circuit diagram, it will be seen that under normal conditions current is supplied to the neon lamp via D1 & R1 in parallel with D2 & R2. Diodes D1 and D2 operate as half-wave rectifiers on the positive half-cycles of the AC mains. R2, lower in value than R1, is



chosen so that the neon will glow continuously with an intact fuse.

When the fuse blows, the circuit to the neon is solely via D1 and R1. C1, R1 and the neon combine to form a simple relaxation oscillator. As the potential across C1 reaches the striking voltage of the neon, the lamp will light and C1 will discharge to a value where the lamp extinguishes. This whole cycle repeats itself and will continue – hence the "flashing" – until such time as the fuse is replaced.

(From "Practical Electronics", January, 1981.)

5V Logic Tester with Audio Buzzer

This device indicates a zero or one depending upon the logic level, and '?' if the voltage level is not within the logic thresholds. Additionally, it gives an audible indication of the logic level so as to minimise visual observations.

Referring to the circuit it will be seen that the device is designed around a 7400 quad two-input TTL NAND gate. In the absence of input signal both Q1 and Q2 are cut-off, and thus both inputs of gate IC1c are "high". Therefore IC1c's output is low, allowing current to flow through the green "0" LED.

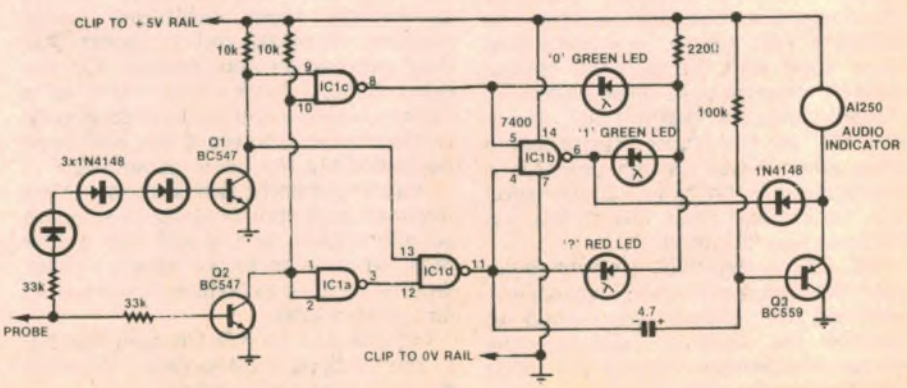
Gate IC1a's output is also low, thus gate IC1d's inputs are simultaneously low and high. This results in its output being high, holding the red "?" LED dark. The same situation applies to the inputs of IC1b and thus its output is also high, holding the green "1" LED off. Similarly, the audio alarm – connected to IC1b's output via the 1N4148 diode – is not energised at this time.

This state of affairs is maintained with up to 0.8V input. However, when the input lies between 0.8V and 2V, Q2 conducts (with Q1 remaining cut-off because of the three series connected 1N4148 diodes in its base circuit) pulling both inputs of IC1a and one input of IC1c low. IC1c's output goes high, extinguishing the green "0" LED; whilst IC1a's output goes low, causing IC1d's output to also go low.

The red "?" LED is therefore on, whilst Q3 momentarily turns on (until the 4.7μF capacitor charges) energising the audio alarm for a short period.

When the input rises above 2V (a TTL "1") Q1 conducts, sending the outputs of IC1a and IC1c high. Thus IC1d's output goes high (extinguishing the red "?" LED), sending IC1b's output low. This turns the green "1" LED on, whilst the diode connected between IC1b's output and the alarm completes the circuit for producing a continuous audible alarm.

(D. Williams, Instrument Technics, Doncaster, Victoria.)



The audio indicator in this circuit can be a Sonalert or similar oscillator-driven piezoelectric device.

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by GERALD COHN

Twas early summer. After lunch. An air of somnolence had descended upon the Technical Editor as he sadly contemplated what might have been. He might have had a bigger office. He might have been a politician. Or he might have skipped lunch altogether . . .

Then Peter Ketley, NSW Sales Manager for Siemens Electronic Products arrived. Duly ushered in, he plonked a small box on the said Technical Editor's desk and, with flourish, pressed a button thereon. All of a sudden three rich, vibrant tones blared forth in dazzling succession from a grille on the small box. What glorious sound, such tintinnabulation! (Well anyway, it sounded pretty good and loud.)

The Technical Editor picked himself off the floor. He was impressed.

Le Gong had struck. Or at least that was the name we immediately coined for this highly effective door-chime which uses just one 8-pin IC, the Siemens SAB 0600 and a few other parts.

No more need you put up with one of those complicated microprocessor-based door chimes with their inane ditties. This single-chip circuit does it all unknowingly, without need of memory. It is hardwired without being hard to wire.

At the time of writing only preliminary data is available on the SAB 0600 chip. It is sufficient to enable presentation of the circuit being described here without any really detailed explanation of the internal works of the chip.

The IC may be divided into six sections, with the first two being power supply and triggering. The power supply section provides internal supply regulation for the chip functions while the triggering section recognises that the door button has been pushed, connecting pin 1 of the chip to the positive supply. This initialises the digital tone generation section which is driven by the clock oscillator.

A resistor and capacitor network connected to pins 6 and 7 of the chip sets the oscillator frequency and thereby sets the pitch and duration of the three tones which are harmonically related. The three tones are fed to a summing node network which has an external integrating capacitor at pin 8. From there, the tone signals are fed to the internal audio amplifier which drives the loudspeaker via a 100μF capacitor and series adjustable resistor which sets the loudness level.

In the quiescent state, before the button is pressed, the current drain of the circuit is typically less than one microamp. This rises dramatically, to about 80 milliamps, when the tones are sounded. The tone sequence typically lasts about three or four seconds. This is adjustable, along with the pitch of the three tones, by the 22kΩ trimpot.

In keeping with the simplicity of the circuit, the construction is just as simple. All components with the exception of the loudspeaker and the battery are mounted on a printed circuit board

We estimate that the cost of parts for this project is approximately

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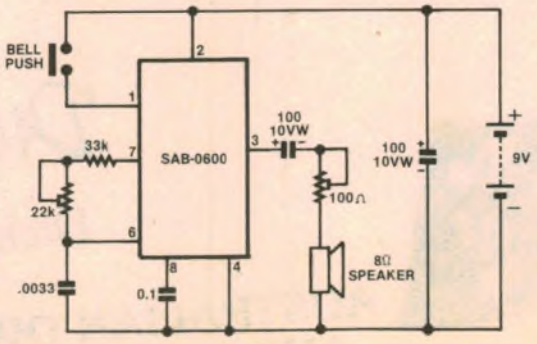

A Siemens SAB-0600 IC forms the heart of the circuit. The RC network connected to pins 6 & 7 sets the pitch and duration of the three tones.

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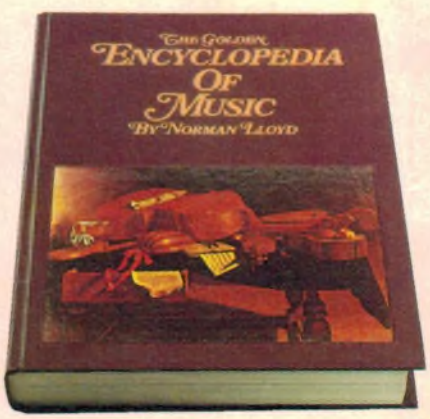

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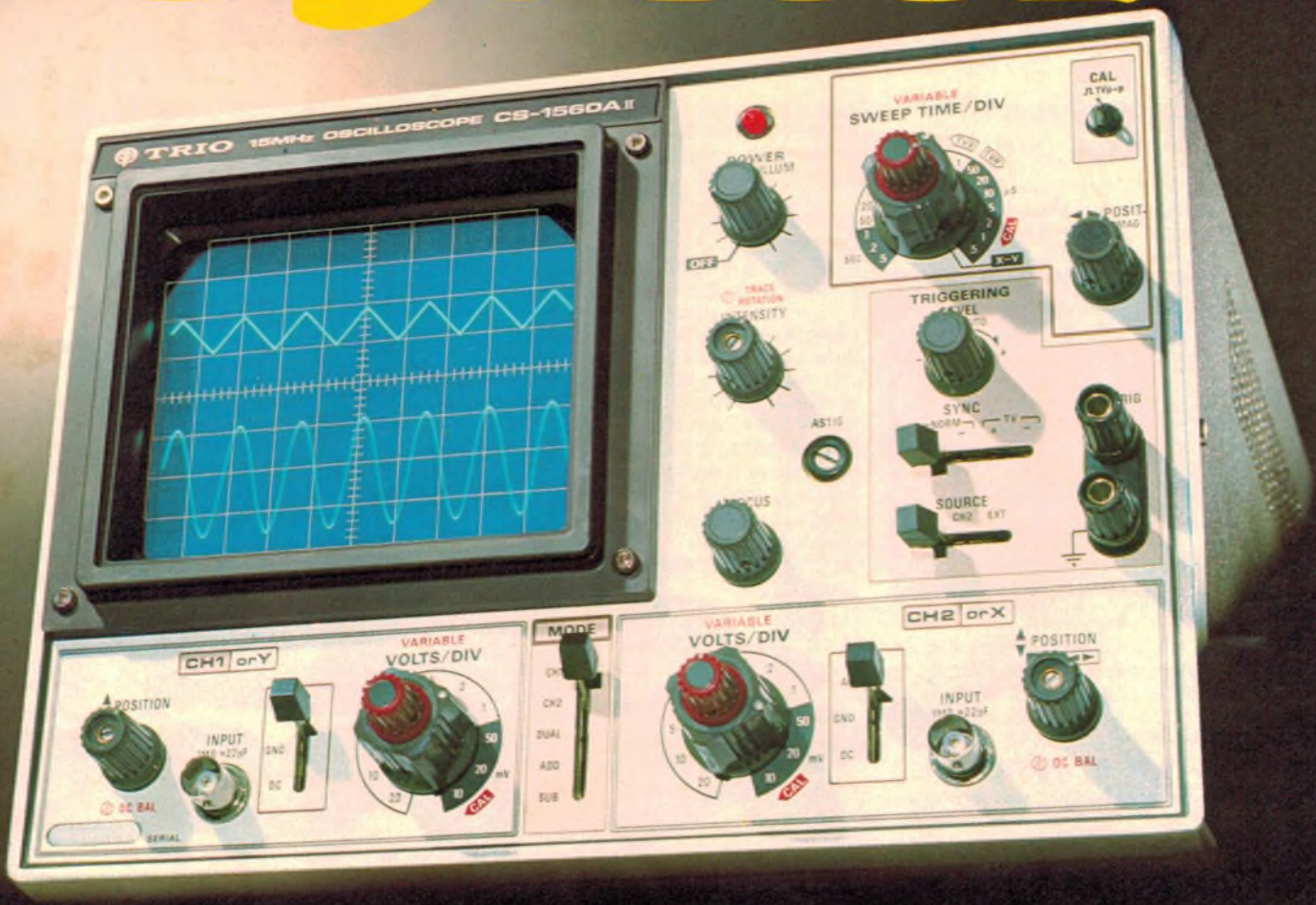
6555.283

TRIO

15MHz



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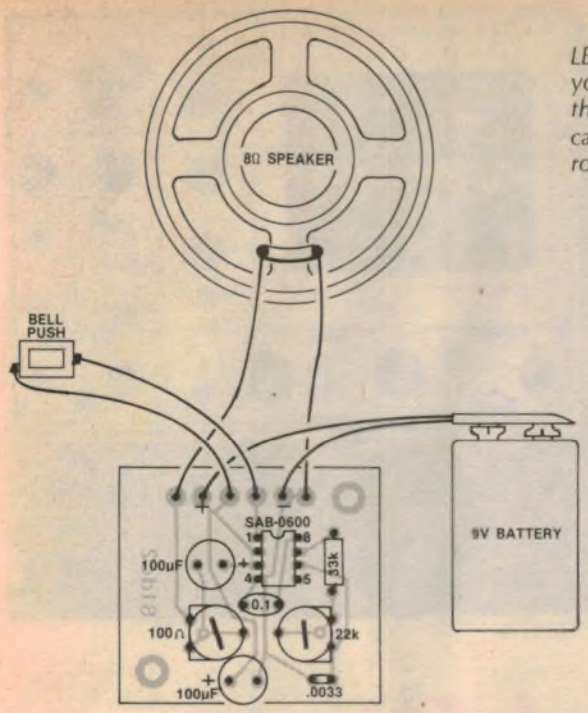
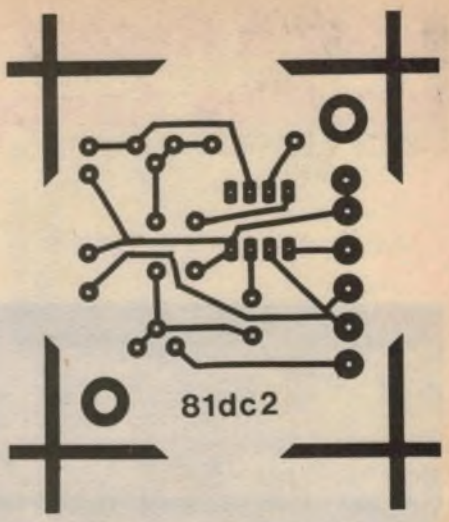


LEFT: make sure that you insert the IC and the 100µF electrolytic capacitors the right way round.



RIGHT: here is the actual size artwork for the PCB.

measuring 50 × 44mm which is coded 81dc2. The overlay diagram shows the placement of the components on the board. Start the assembly by first soldering all the passive components to the board, leaving the IC until last. Next solder the six wires to the board, two for the loudspeaker, two for the battery and the final two for the pushbutton. The wires for the battery are those from the battery clip.

When the above has been completed (we know that you are dying to try it out) you should go over it again just to make sure that all the components and associated wiring are as per the diagram. When this has been done, press the pushbutton and you should get a three-tone chime. You can now adjust the pitch and the volume with the two trimpots on the board. The only thing to do now is to place the PCB into a suitable case.

We mounted the prototype into one of the popular "jiffy" boxes, measuring 159 × 96 × 51mm. The aluminium cover was drilled to provide a sound grille for the loudspeaker. The loudspeaker is glued to the aluminium using some "Araldite" or similar epoxy adhesive.

Three holes are required in the plastic case; two in the bottom of the case towards one corner (see photograph) to hold the PCB in place, and a third for the pushbutton connector. The battery is held in place using some double sided tape, but a small bracket fashioned from tinplate will do just as well.

The way in which the pushbutton is connected to the rest of the circuit depends upon presonal preference. If the installation is to be permanent then the wire could be connected directly to the PCB, or else a plug and socket can be used. We chose the latter method for the prototype as this offered the greatest flexibility, but as we said, it is a matter of preference.

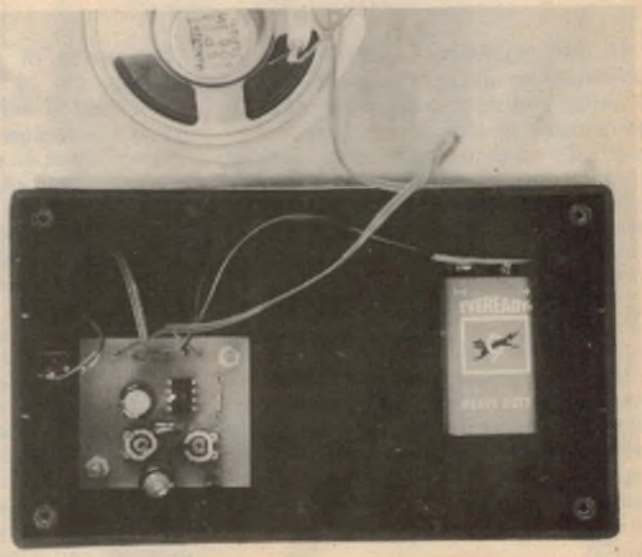
If the chime is to be activated regularly, then we recommend the use of a bigger battery. You will remember from earlier discussion that the drain on the battery is quite substantial when the chimes are sounding, but drops to almost nothing in the quiescent state.

For normal domestic use, the Eveready type 216 battery will probably be adequate and should give service life approaching the normal "shelf" life. In other words, we would expect the battery to last about 12 months or so. For frequent use, as in a doctor's practice or commercial establishment, a much bigger battery or plugpack DC supply would be a must.

But whatever the application, we are sure you will agree with us that this is a most effetive door chime. Why not put one together this weekend?

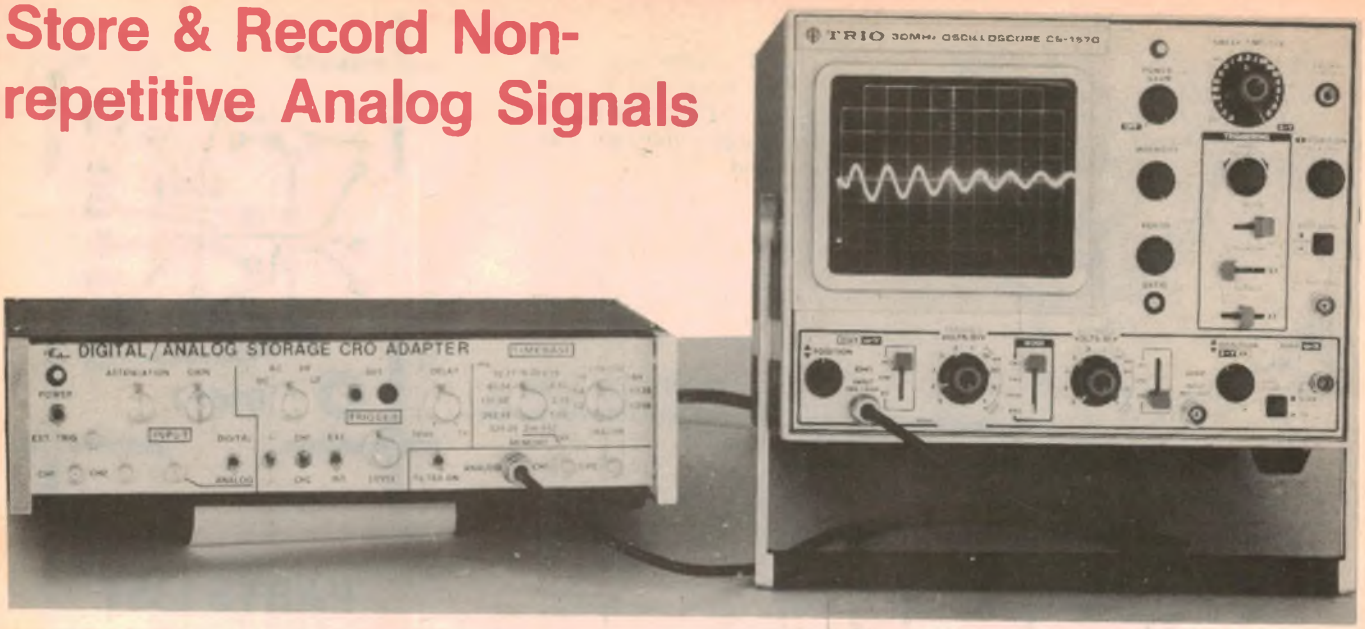
PARTS LIST

1 printed circuit board 50 × 44m (81dc2)
1 SAB 0600 integrated circuit
2 × 100µF/10VW aluminium electrolytics
1 × 0.1µF metallised polyester (greencap)
1 × 10033µF greencap
1 × 33kΩ resistor
1 × 22kΩ miniature trimpot
1 × 100Ω miniature trimpot
1 × 8Ω miniature loudspeaker
1 × No. 216 9-volt battery and clip to suit
1 plastic utility case 159 × 96 × 51mm
1 3.5mm jack socket (optional, see text)
1 3.5mm jack plug (optional, see text)
Screws, nuts, hookup wire, glue etc.



Inside Le Gong. The circuit may be powered by a small 9V battery or from a DC plugpack supply.

Store & Record Non-repetitive Analog Signals



Analog/Digital Storage CRO Adapter

Here we describe additional circuitry to the Digital Storage CRO Adapter, of the November 1980 issue, which enables analog signals of up to 100kHz to be stored. The conversion allows the unit to operate in either Analog or Digital storage format. The extra controls and Printed Circuit Board required are designed to be easily accommodated within the existing case. Also featured is a revised PC board for the November Digital Storage CRO Adapter.

by JOHN CLARKE

In the November 1980 issue, we presented an article on a Digital Storage Adapter and in this we mentioned the advantages of digital storage over the methods used in conventional storage oscilloscopes. The device was capable of storing digital signals, with two channels available. The first channel had tracer or marker pulses to enable the period of the waveform to be measured.

Similarly the Digital/Analog Storage CRO Adapter in displaying of analog signals on an oscilloscope, incorporates a tracer, however, only one channel is available. The majority of the circuitry from the Digital Storage CRO Adapter is utilised with the extra circuitry to produce a complete circuit for analog signal storage. Reversion to the digital storage mode is achieved at the flick of a switch.

Processing of the analog signal for storage in a digital memory is implemented with 8-bit Analog-to-Digital (A-D) conversion techniques. Here the analog signal is converted to a binary representation of discrete analog levels. With 8-bits there are two to the power eight or 256 discrete levels to represent the analog voltage levels. For example 00000000 represents a zero voltage level, 10000000, half full scale, and 11111111, full scale.

To retrieve the stored digital signal, Digital to Analog (D-A) conversion reverses the process. The most common D-A method being to use an R/2R weighted ladder network. This is easy to implement in either discrete or IC form. The IC package has refinements over the R/2R ladder network, having current switches and a reference amplifier. The IC has the extra advantage of lower capacitance and consequently a faster settling time over a discrete R/2R ladder.

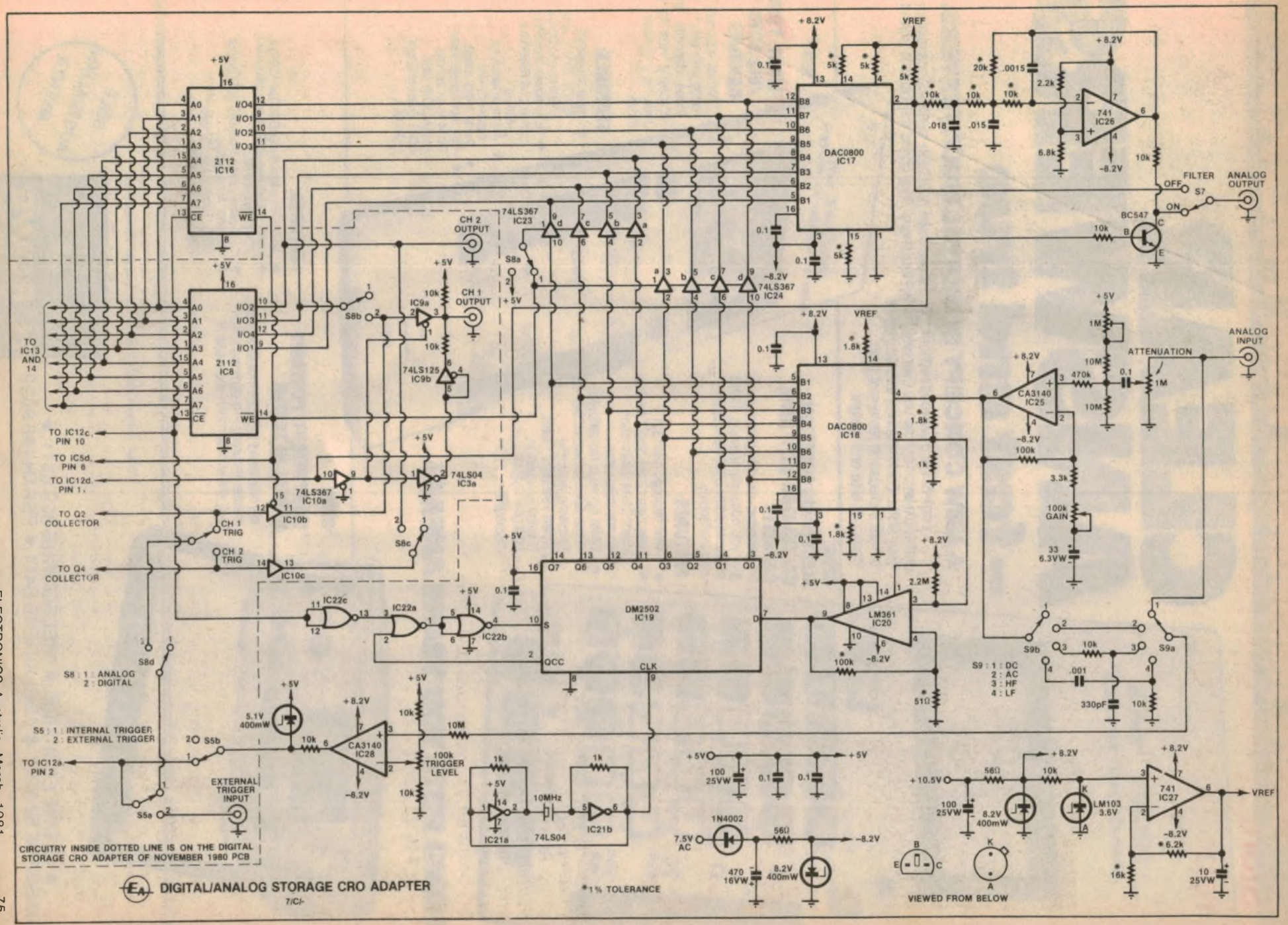
There are several ways in which A-D conversion can be done and usually involve a comparator which compares the incoming signal with the analog signal derived from an A-D and D-A converter operation.

The error signal resulting from this comparison informs the A-D converter of what steps need to be taken to reduce the error.

In the case of an "up counter A-D converter", the counter starts at zero and counts up in binary until the comparator changes state and stops the counter. This method can be slow since the maximum time to reach the correct conversion could be 256 counts for an 8-bit converter. Consequently continuous "up/down counters" are used in preference to the up counter since gradually changing signals (a sine wave) will need only a small up or down count correction to the bit pattern. However, in adverse conditions such as converting a square wave, the maximum count of 256 is still required.

A much faster method which converts in almost as many clock cycles as the

At right is the complete circuit diagram of the Analog Storage section.


DIGITAL/ANALOG STORAGE CRO ADAPTER
7/CI-
*1% TOLERANCE
VIEWED FROM BELOW
CIRCUITRY INSIDE DOTTED LINE IS ON THE DIGITAL STORAGE CRO ADAPTER OF NOVEMBER 1980 PCB
S8 : 1 : ANALOG 2 : DIGITAL
S5 : 1 : INTERNAL TRIGGER 2 : EXTERNAL TRIGGER
S9 : 1 : DC 2 : AC 3 : HF 4 : LF
DAC0800 IC17
DAC0800 IC18
DM2502 IC19
2112 IC16
2112 IC8
CA3140 IC25
CA3140 IC28
LM361 IC20
741 IC26
741 IC27
74LS367 IC23
74LS367 IC24
74LS367 IC10a
74LS04 IC3a
74LS125 IC9b
LM103 3.6V
1N4002
BC547
CH 1 OUTPUT
CH 2 OUTPUT
ANALOG INPUT
ANALOG OUTPUT
ATTENUATION
FILTER
EXTERNAL TRIGGER INPUT
100k TRIGGER LEVEL
100k GAIN
10MHz
74LS04
TO IC13 AND 14
TO IC12c, PIN 10
TO IC5d, PIN 6
TO IC12d, PIN 1
TO Q2 COLLECTOR
TO Q4 COLLECTOR
TO IC12a PIN 2
CH 1 TRIG
CH 2 TRIG
+5V
+8.2V
-8.2V
VREF

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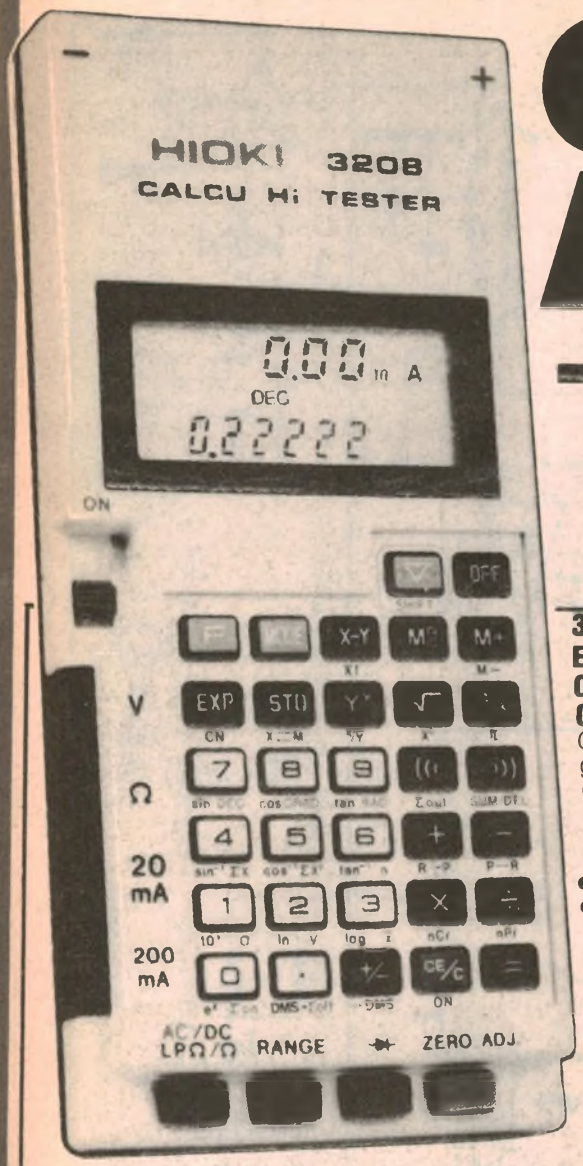

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- Operation of the SHIFT button enters DMM information into the calculator.
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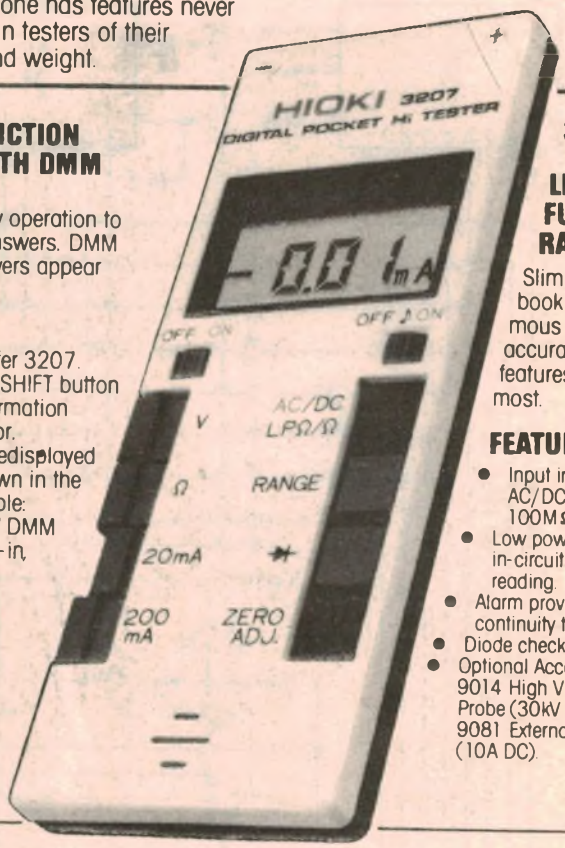

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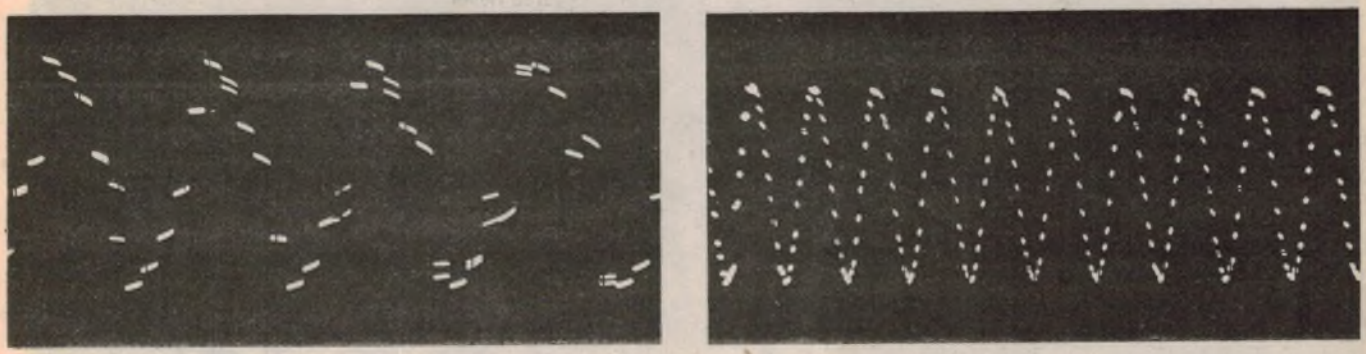
number of bits, is with the Successive Approximation Register or SAR. This method involves some clever logic and begins conversion by setting high, the most signifigant bit (bit 8) and the rest of the bits low. This is the mid-way voltage point (2.5 volts for a 5 volt converter).

If the input signal is higher than the A-D, D-A conversion, then the comparator signals the SAR to keep the most significant bit (bit 8) high and to then continue the conversion. However, if the signal is lower than the A-D, D-A conversion, then the comparator signals the SAR to bring the most significant bit low again and continue the conversion. So already the SAR has determined whether the incoming signal is higher or lower than the midway voltage in only one clock cycle. The next step is to set the next significant bit (bit 7) high and to test for a higher or lower voltage than the A-D, D-A conversion.

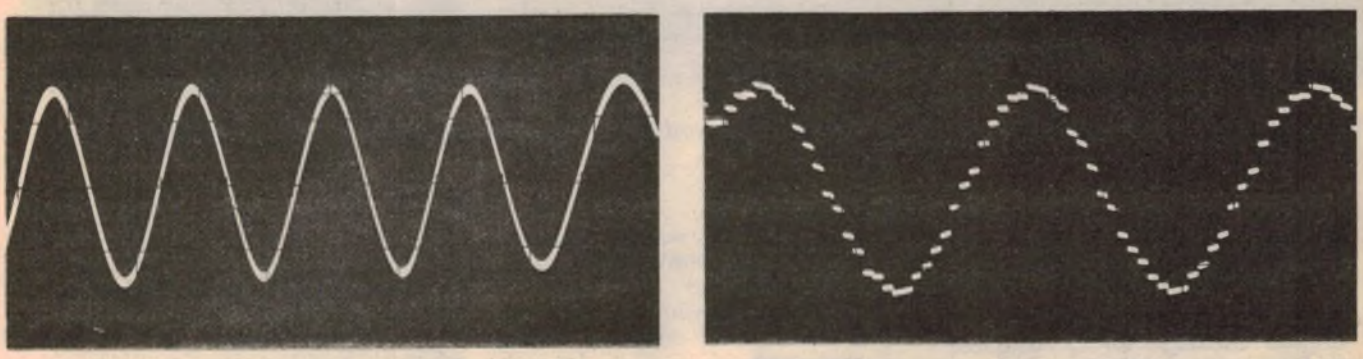
The SAR continues with this successive approximation comparison until the last bit (bit 1) is compared. As can be seen, the digital conversion takes only eight cycles plus the setting up time of the SAR.

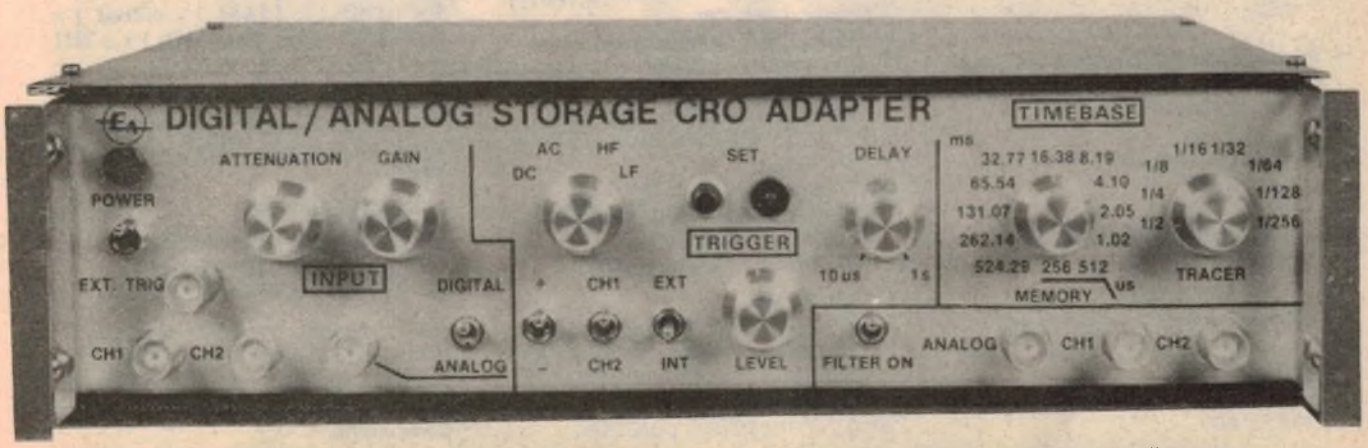
Generally, during digital conversion of an analog signal, the sampled signal should remain within ± a Least Significant Bit, LSB, to avoid errors in conversion. For a 0-5V, 8-bit converter, the incoming signal needs to remain within 5/256=19.5mV during the conversion time. With a 0.9us conversion time (which is the conversion time of our A-D converter) this represents a maximum incoming signal slew rate of 21.7mV/us, corresponding to 1kHz for a triangular waveform and about 700Hz for a sine wave.

As can be expected, at higher slew rates (higher frequencies) the resolution of the A-D conversion becomes less. For example, 7-bit resolution occurs with a triangular 2kHz waveform, and 4-bit resolution at 16kHz. To get around this problem a Sample and Hold, S and H, circuit is generally used which holds the

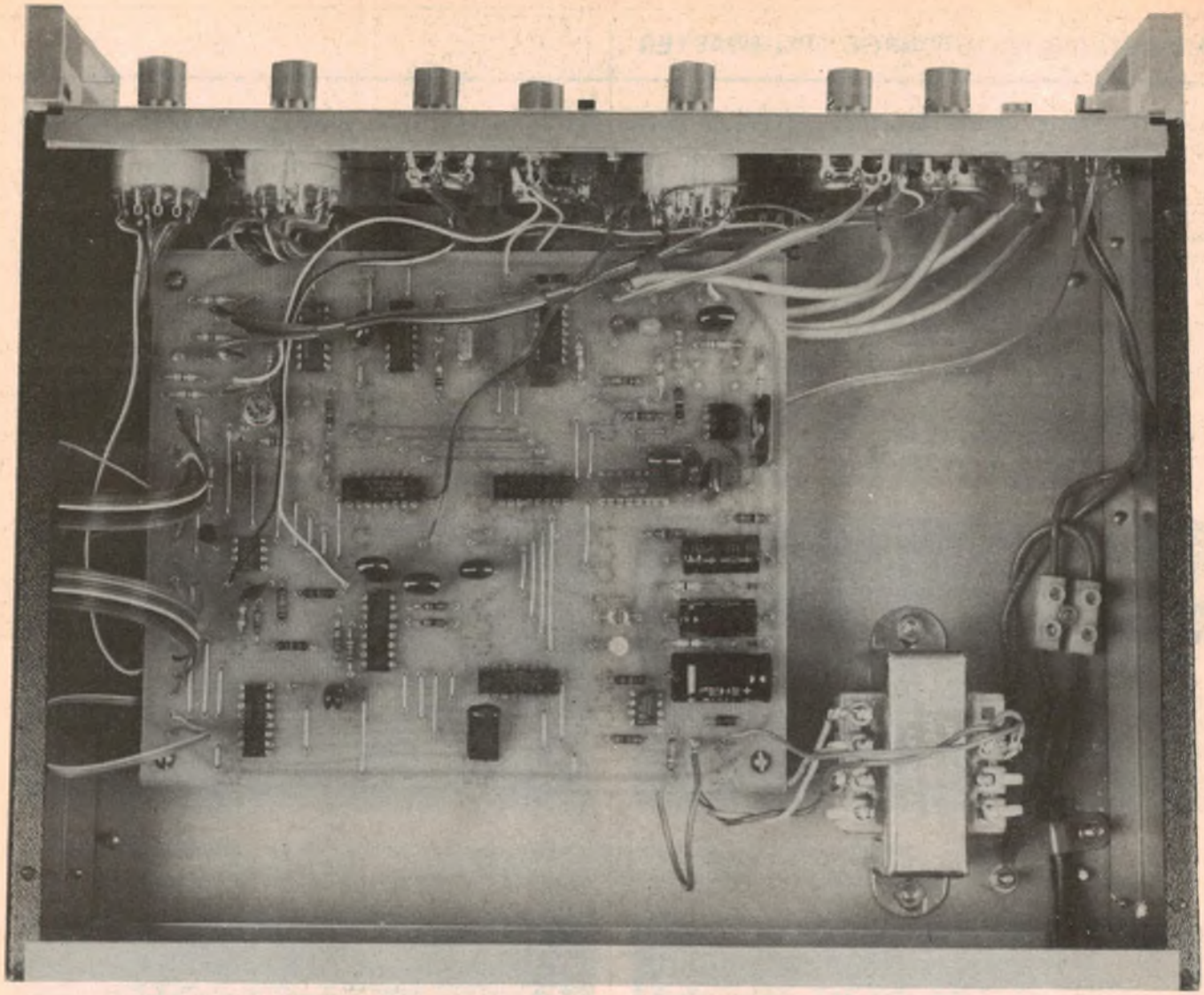


The above photograph shows a 100kHz sinewave, captured in memory and displayed without low pass filtering. Below left is the same waveform after filtering. At top right is a 20kHz and below right a 1kHz sinewave, both unfiltered.





Complicated to behold, the Adapter is relatively straightforward to use and much cheaper than a Storage Oscilloscope.



Not visible in this photograph is the Digital Storage PC board which is stacked below the Analog PC board.

PARTS LIST:

NB: These parts are in addition to those listed for the Digital Storage CRO Adapter in November 1980.

1 Printed Circuit Board 141 × 174mm coded 81dc3a.
1 Scotchcal panel
4 knobs
2 BNC panel sockets
1 DPDT switch
1 4PDT switch
1 2-pole, 4 position rotary switch
1 10MHz crystal

SEMICONDUCTORS
1 1N4002 100PIV rectifier diode
1 5.1 volt 400mW zener diode, 1N751 etc
2 8.2 volt 400mW zener diodes, 1N756 etc
1 LM103 3.6 volt voltage reference or 3.6 volt 400mW zener diode 1N747 (See text)
1 BC547 NPN transistor
2 DAC0800 8-bit digital to analog converters
1 DM2502 8-bit successive approximation register
1 LM361 high speed comparator
2 CA3140 FET input operational amplifiers
2 741 operational amplifiers
1 2112 256 × 4 static RAM, 450ns access time

LOW POWER SCHOTTKY TTL
1 74LS02 quad two input NOR gates
1 74LS04 hex inverter
2 74LS367, Tri-state hex buffers

CAPACITORS
1 470uF/16VW pigtail electrolytic
2 100uF/25VW pigtail electrolytic
1 33uF/6.3VW tantalum electrolytic
1 10uF/25VW PC electrolytic
10 0.1uF metallised polyester
1 .018uF metallised polyester
1 .015uF metallised polyester
1 .0015umetallised polyester
1 .001uF metallised polyester
1 330pF disc ceramic

RESISTORS (¼W, 5%)
3 × 10MΩ, 1 × 2.2MΩ, 1 × 470kΩ, 1 × 100kΩ, 8 x 10kΩ, 1 x 6.8kΩ, 1 x 3.3kΩ, 1 x 2.2kΩ, 3 x 1kΩ, 2 x 56Ω.

RESISTOR (¼W, 1%)
1 × 100kΩ, 1 × 20kΩ, 1 × 16kΩ, 3 × 10kΩ, 1 x 6.2kΩ, 4 x 5kΩ, 3 x 1.8kΩ, 1 x 51Ω.

POTENTIOMETERS
1 × 1MΩ large vertical trimpot
1 x 1MΩ linear potentiometer
2 x 100kΩ linear potentiometer

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatable.

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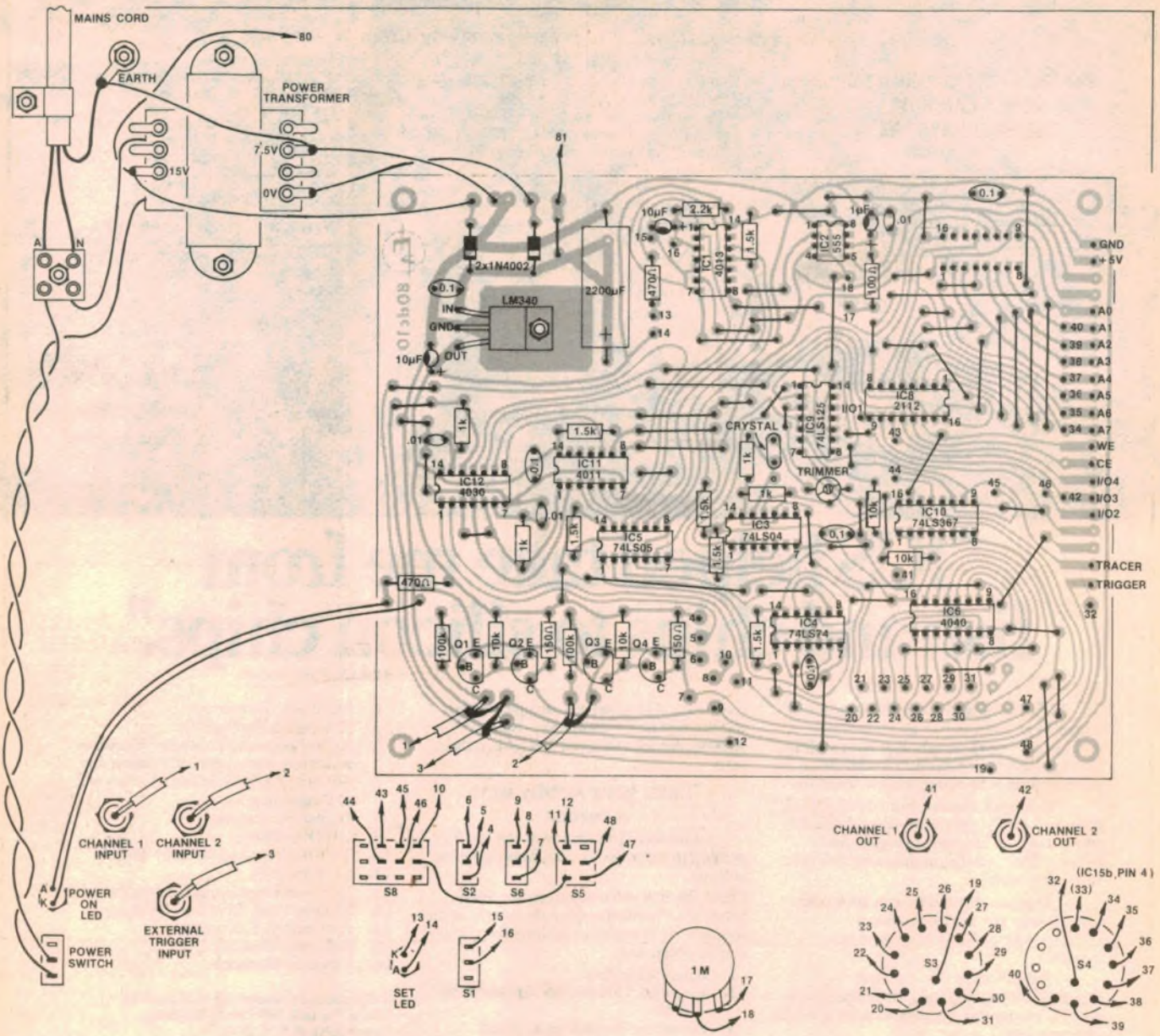

This diagram shows the connections and changes necessary to the original PC board published in November 1980 for wiring to the Analog PC board. The Veroboard additions published in January 1981 should be added to this.

analog signal steady during the conversion time. This method is only relevant, however, if the S and H acquisition time is faster than the conversion time of the A-D converter. No common S and H circuits are faster than the 0.9us of our A-D converter.

A problem associated with the stored A-D conversion of a signal and replayed D-A signal, as is with any sampling methods, is that if the sampling frequency is not at least twice the sampled analog signal, strange results can occur. For example, with a 100kHz signal sampled into memory at 50kHz (½ the sampled frequency) the replayed signal will appear as a 25kHz signal. A solution to this is to provide a very sharp cut-off filter at the input to the D-A converter, to prevent higher frequency signals entering the converter. This will need to have various cut-off frequencies depending upon the sampling rate. Due to the large number of filters required, we did not provide for this "Anti-Aliasing" feature.

Refer now to the circuit, the description of which should be read in conjunction with the Digital Storage CRO Adapter circuit description in the November 1980 issue. We used an 8-bit SAR and two D-A converters in IC form. The D-A converter, IC18, in conjunction with the SAR, IC19 and the high speed comparator, IC20, form the A-D converter. With a clock provided by a 10MHz crystal and two inverters, IC21a and IC21b, the A-D conversion time is nine clock cycles or 0.9us.

The 8-bit memory to store the A-D conversion is comprised of both the 4-bit memories of IC16 and IC8, the latter being located on the Digital Storage CRO Adapter PC board. The memory is loaded with data from the SAR via Tri-state buffers, IC23 and IC24. At the beginning of storing a signal in memory, the memory address counter is at zero count. During the loading of each memory location, the SAR is stopped by gate IC22a when memory ICs are enabled and the SAR conversion complete signal is true.

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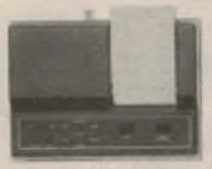

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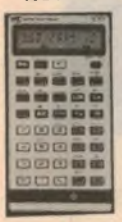

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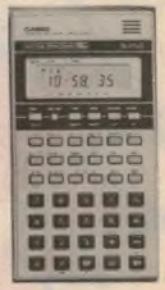

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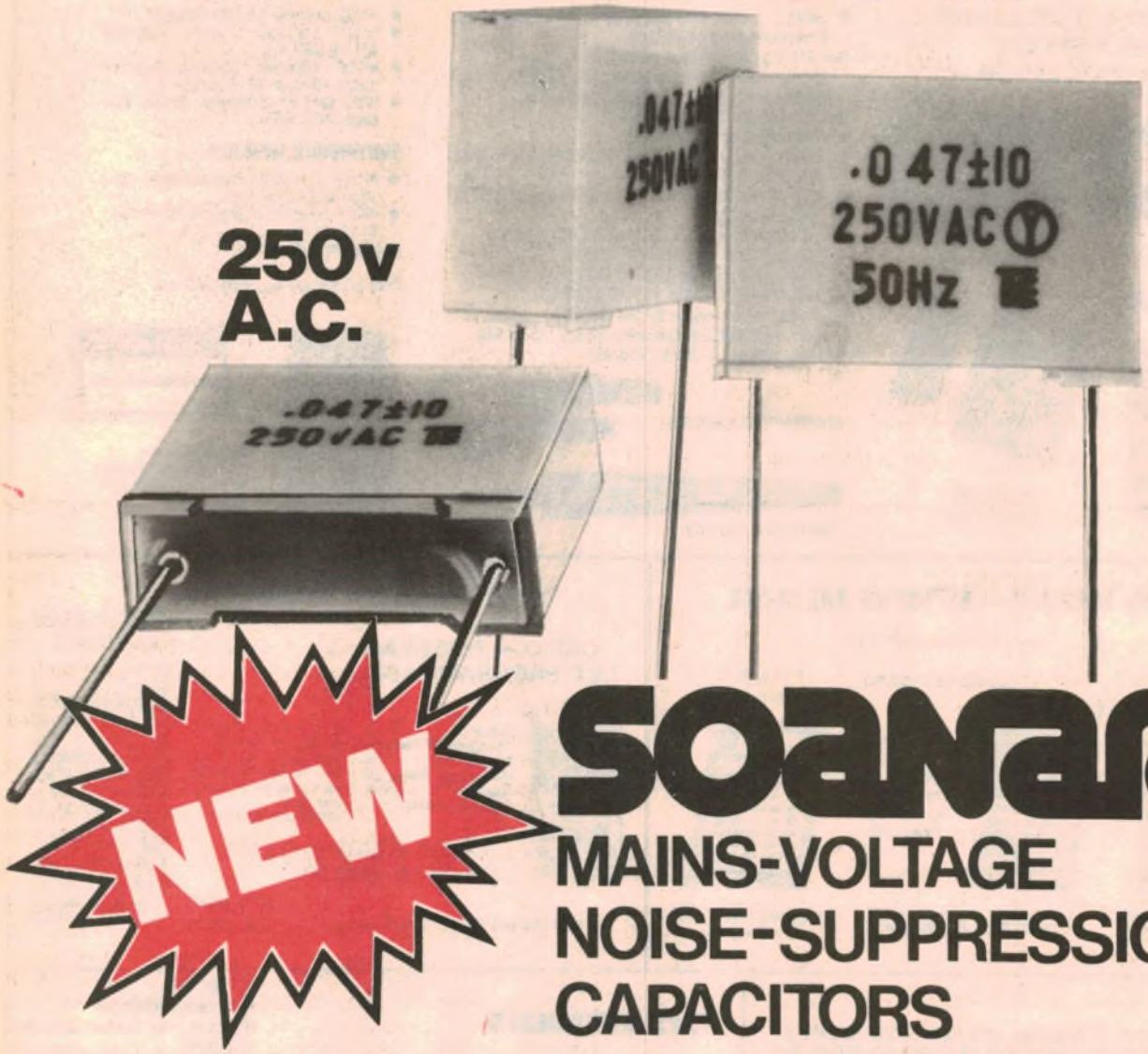

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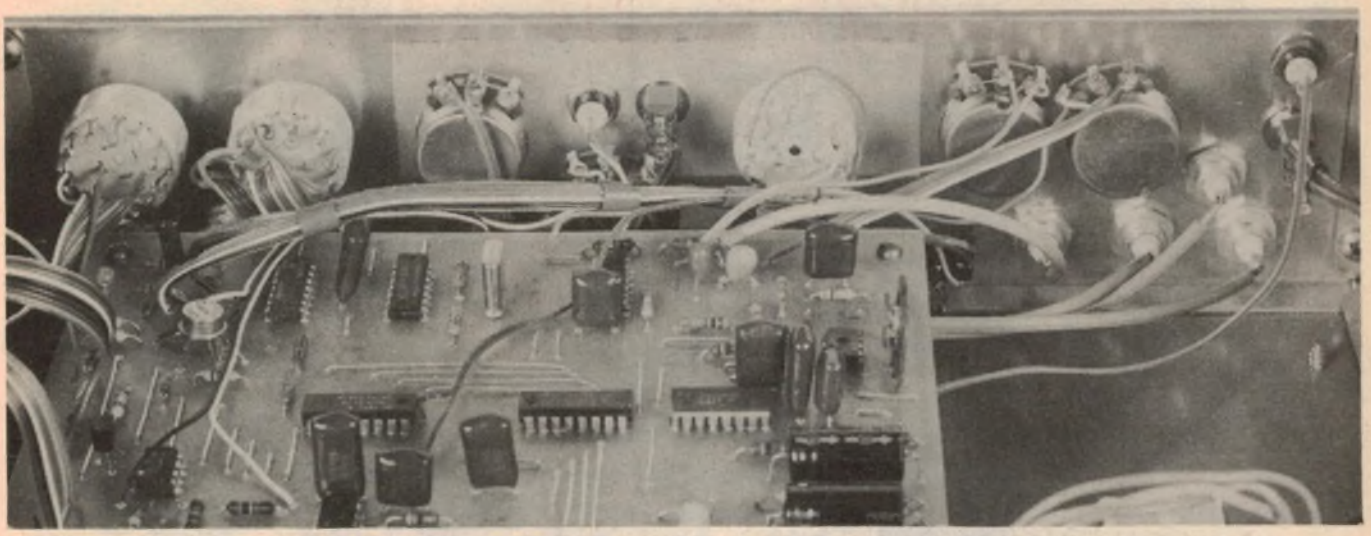


This photo shows details of the front panel wiring.

SPECIFICATIONS

INPUT/OUTPUT: — one channel with 2kHz low pass filter and tracer

SENSITIVITY: — 160mVp-p for 0-5 volt conversion (up to 20kHz only, see text)

INPUT IMPEDANCE: — 1 Megohm

TRIGGERING: — Positive and negative edge triggering. AC/DC/HF rej/LF rej

TRIGGERING LEVEL: — adjustable from 4.5 volts to 0.5 volts

MINIMUM RESOLVABLE FREQUENCY: — 1.9Hz for a timebase setting of 524.29ms

MAXIMUM RESOLVABLE FREQUENCY: 8-bit resolution; 700Hz sine wave; 1kHz triangular wave; 7-bit resolution; 1.4kHz sine wave; 2kHz triangular wave; 2-bit resolution; 42.8kHz sine wave; 64kHz triangular wave

NOTE: These specifications refer to the Analog storage mode only.

converts to the new digital code representing the incoming analog signal at that point in time. When loading is complete, signalled by the ripple carry of IC14, the 256 × 8-bit locations are filled and the Tri-state buffers go into their Tri-State or high impedance state.

After the digitally represented signal has been stored in memory, the memory is in the read state and with the D-A with the address counter continuously and sequentially cycling through the addresses of the memory, a repeating waveform is presented at the output of the D-A converter.

It should be noted that the SAR and the memory address counter for the memory operate on different clocks. The memory address counter clock operates from the oscillator located on the Digital Storage CRO Adapter PC board and has a maximum clock rate to the memory address counters IC13 and IC14, of 2MHZ. The clock for the SAR will therefore allow for complete A-D conversion between successive memory locations provided the memory address counter clock is not set to greater than 1MHz.

The analog output from the D-A converter, IC17, is switchable to a filter with S7. The filter is a third-order low-pass and has a cut-off frequency of about 2kHz. By adjusting the memory timebase of the stored waveform, an optimal setting will be found for filtering. Since this timebase is adjusted after storage, a tracer is provided to enable the measurement of the waveform period. The tracer pulses generated from IC12d are taken to the base of the BC547 at the output of the filter. Consequently the filtered output signal is brought to ground on every tracer pulse.

Note that the operational amplifier, IC26, at the heart of the filter, is biased higher than the ground point with the 2.2kΩ and 6.8kΩ at pin 3 to keep the output signal well above ground making the tracer more distinctive.

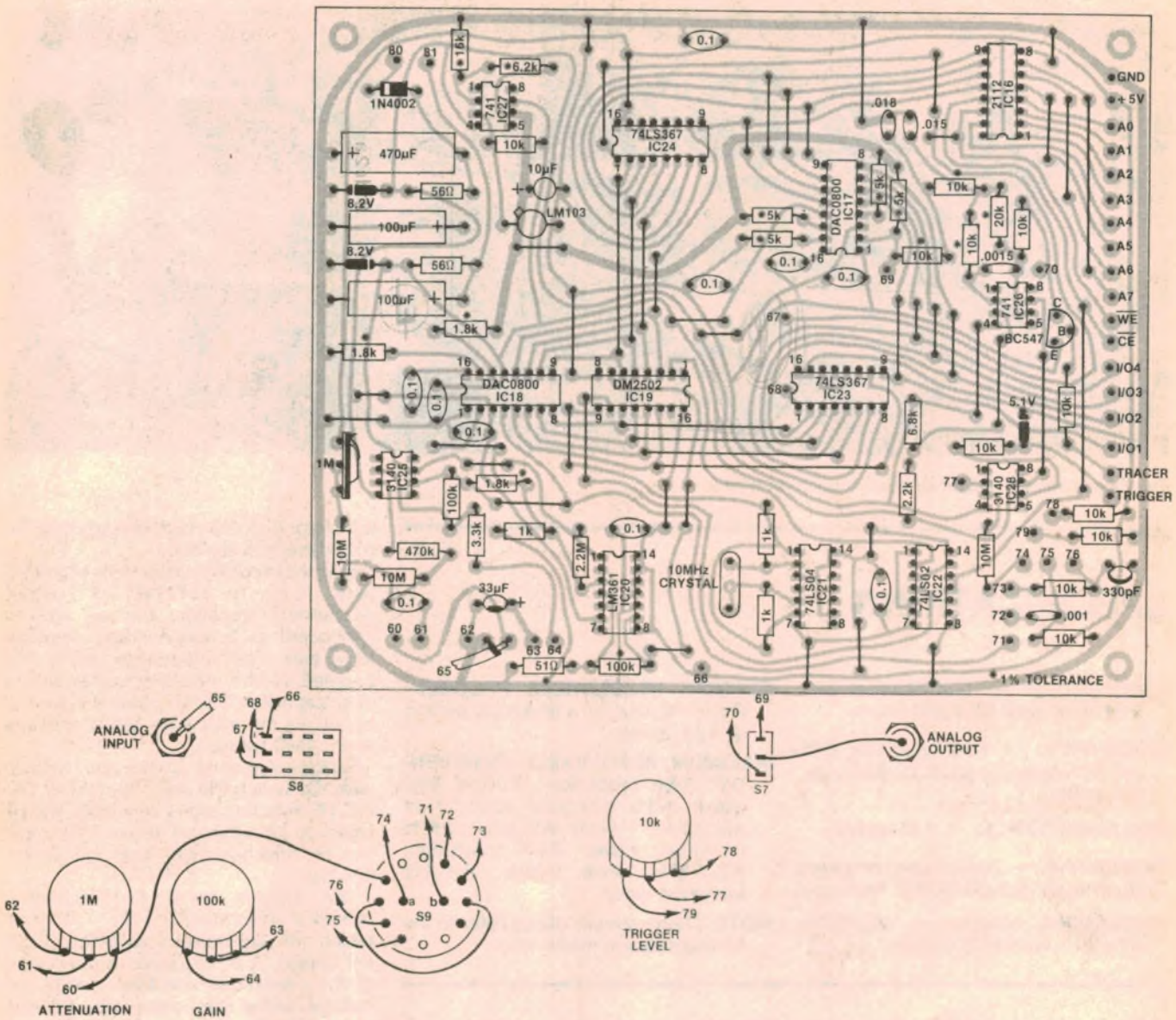
Input to the A-D converter is provided with IC25, a CA3140 FET input operational amplifier. This op amp is connected as a non-inverting amplifier for a high input impedance and is AC-coupled to the incoming signal with a 0.1uf capacitor. The amplifier is biased to about −1.5V with two 10MΩ resistors and a 1MΩ trimpot.

Various triggering modes are available with the switch S9a and S9b: that of DC, AC, HF rejection and LF rejection. The HF rejection filter cuts off above 50kHz and the LF rejection filter cuts off below 1.5kHz.

The trigger level potentiometer provides adjustment for the voltage at which the operational amplifier, IC28, will trigger. A zener diode at the output of the operational amplifier clamps the voltage swing from zero volts to +5.6 volts, suitable for the trigger input of IC12a.

The power supply for this analog storage circuit is derived from the digital storage PCB. The +10.5 volts is filtered with a 100uF capacitor and regulated with an 8.2 volt zener diode. This +8.2 volts supplies the positive voltage for the operational amplifiers, comparator and D-A converters. The +8.2 volts is further regulated with a 3.6 volt zener (LM103) and buffered with an operational amplifier, IC27. This provides a 5 volt reference for the D-A converters.

The LM103 reference diode is a two-terminal IC device similar to a zener diode. The breakdown characteristic is very sharp and the dynamic impedance very low. If this diode is unavailable, a standard 3.6 volt zener diode can be used with little detrimental effect to the circuit performance, in which case a 270Ω resistor will need to replace the 10kΩ dropping resistor.



This diagram shows the connections and component layout of the Analog conversion PC board.

The 5 volt supply from the digital storage PCB is filtered with a 100uF capacitor and several 0.1uF capacitors. The negative voltage for the operational amplifiers, comparator and D-A converters is obtained by half-wave rectifying the AC voltage directly from the transformer. This is regulated with a zener diode, to give −8.2 volts.

As can be seen in the circuit diagram, switching is organised to allow for digital or analog signal storage. The switches in question are S8 and S5. S5 was used in the Digital Storage Adapter to enable internal or external triggering, but in this case an extra pole is used to allow internal and external triggering for both the digital and analog inputs. S8d allows internal triggering for either analog or digital inputs.

Switches S8b and S8c disconnect the output memory data lines of IC8 from the Tri-state buffers IC10b and IC10c when in the analog storage mode and S8a keeps the Tri-state buffers of IC24 in Tri-state when in the digital storage mode. This prevents conflicts between the Tri-state buffers when in the digital or analog modes.

As mentioned previously, the circuitry for the Analog storage facility is contained within the Digital Storage CRO Adapter case, as featured in November 1980. New front panel artwork has been produced to provide for the extra controls. The Analog storage circuit is accommodated on a PC board coded 81dc3a measuring 141 × 174mm. This is the same size as the Digital Storage PC board and is stacked on it.

As mentioned in the addendum to the Digital Storage CRO Adapter in the January issue, a revised PC board pattern has been produced, coded 81dc3b and measuring 141 × 174mm.

If this new PC board is used, then the following applies. Solder all the components to the PC board in a similar manner to that described in the November issue. Note the wiring changes to the switch, S4, from the original PC board overlay.

An overlay and wiring diagram have been provided for the analog circuitry PC board, 81dc3a, and two overlay diagrams for the Digital Storage CRO Adapter: one for wiring the original 80dc10 PC board of the November issue to the 81dc3a PC board and the other for wiring the revised 81dc3b PC board. Another overlay features the 81dc3b PC

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board for when the analog PC board, 81dc3a, is not required.

Note that when the Digital PC board of either 80dc10 or 81dc3b is used in conjunction with the Analog PC board 81dc3a, an extra link near the regulator bringing out the 10.5 volts and the replacement of three links with switches, differentiates them from the overlay diagrams when the Analog PC board, 81dc3a, is not required.

Start construction by placing the links on the PC board and soldering them in place. Use the overlay to help you in construction.

Next the diodes and resistors can be soldered into place, followed by the ICs. Note the orientation of the ICs on the overlay before soldering in place since errors can be disastrous. Finally the capacitors, transistor, trimpot and crystal can be soldered in place.

Assuming the Digital Storage CRO Adapter has already been built as described in the November issue, the front panel Scotchcal artwork should be removed from the front panel after removing all the switches, input sockets, potentiometer and LED bezels. The new Digital/Analog Storage CRO Adapter Scotchcal artwork can now be placed on the front panel and the holes drilled using the artwork as a guide.

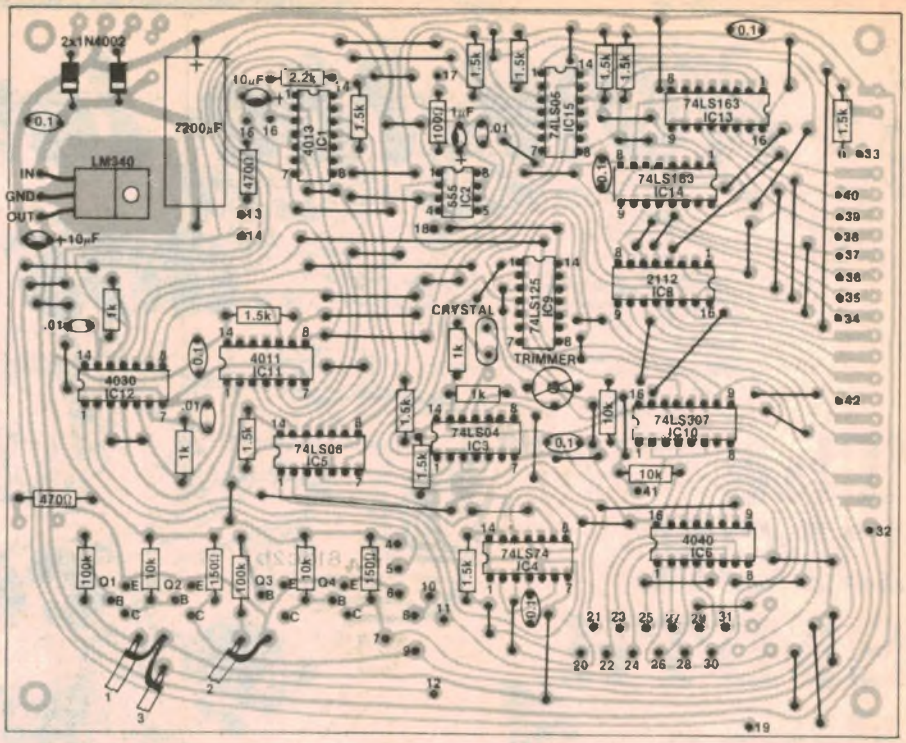
The input sockets, switches, potentiometers and LED bezels can now be secured to the front panel. Note that the single pole switch used for the internal/external triggering selection, S5, is replaced with a double pole type. The orginal switch can be used in the filter on/off position S7.

We used 13mm long tapped brass standoffs to support the lower PC board, containing the digital storage circuitry and untapped 18mm long brass standoffs between the lower and upper PC board containing the analog circuitry. This method of PC board support allows the lower spacers to be secured to the base of the case with short screws and the upper PC board held with longer screws extending down from the upper PC board through the untapped spacers to the lower tapped spacers.

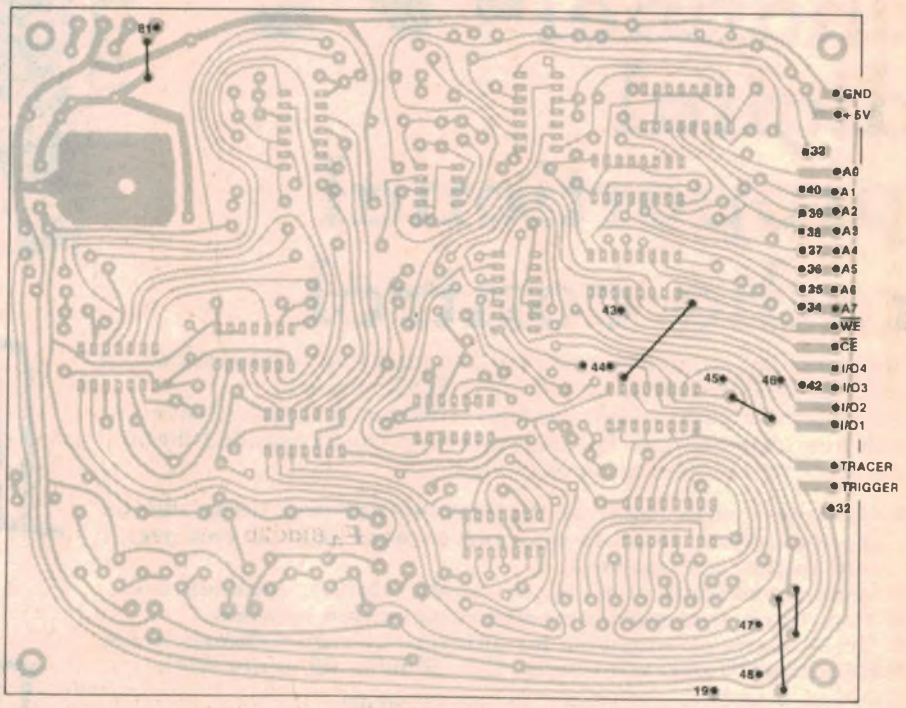
We estimate that the cost of parts for this project is approximately

$80

This is additional to the parts for the Digital Storage CRO Adapter described in November 1980.



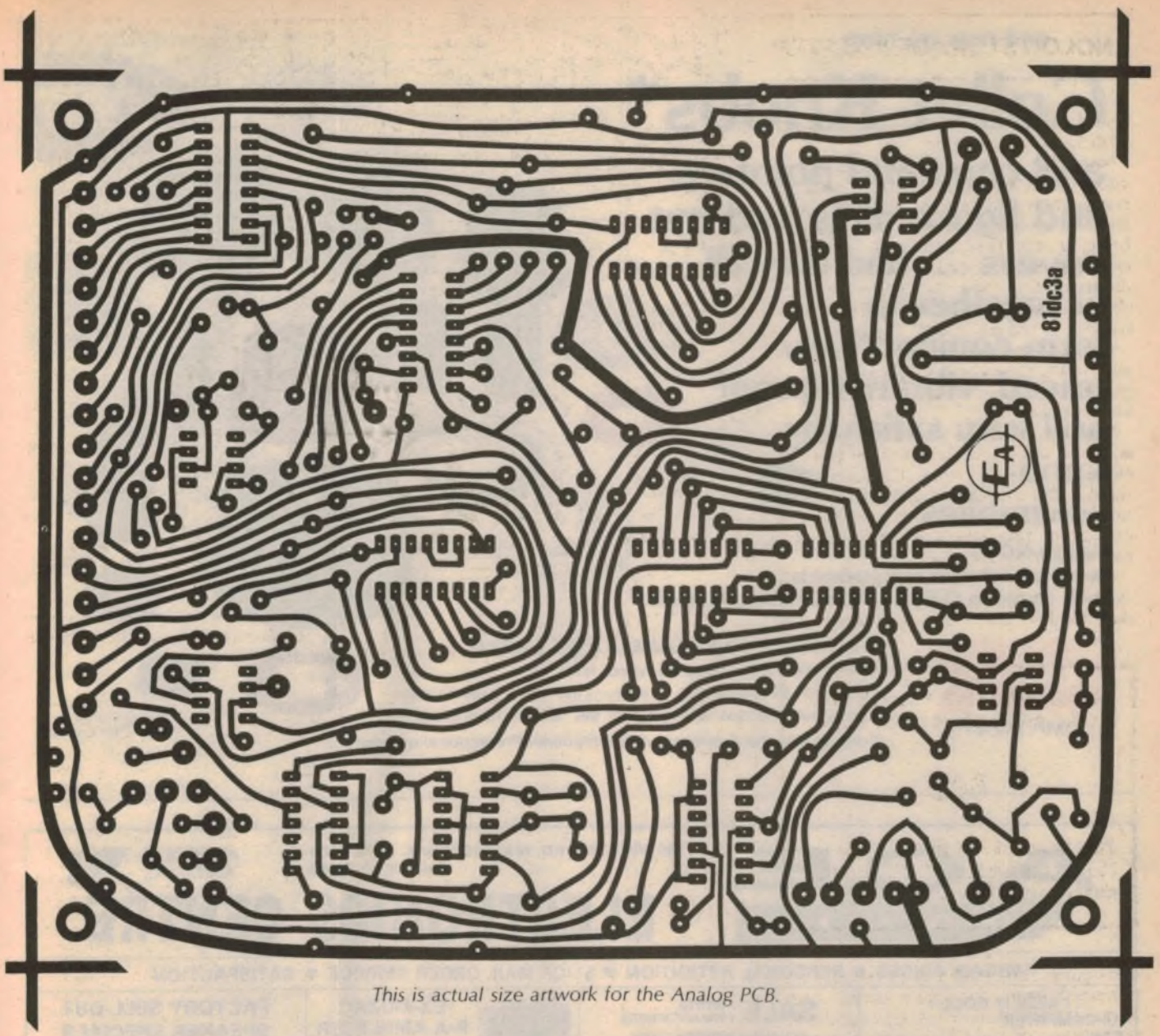
This diagram shows the component layout for the modified digital storage PCB, encompassing the modifications published in the January 1981 issue.



This diagram shows the mods necessary to the PCB above to connect it to the analog PCB. Refer also to the diagram on page 80.

Wiring of the PC boards should be accomplished by wiring the lower digital PC board first. All the relevant wires to the controls on the front panel can be run with consideration for the fact that another PC board is being stacked on top. In other words leave enough slack in the wiring. The interboard wiring such as GND, +5V, the address lines A0 to A7. WE, CE, and the data lines I/01 to I/04 plus the tracer and trigger interconnections can be soldered to the lower PC board with ribbon cable in preparation for wiring these to the upper PC board.

With the lower PC board wiring complete, the interconnecting wiring can be connected to the upper Analog PC board, 81dc3a. The wiring to the controls can also be made at this stage.

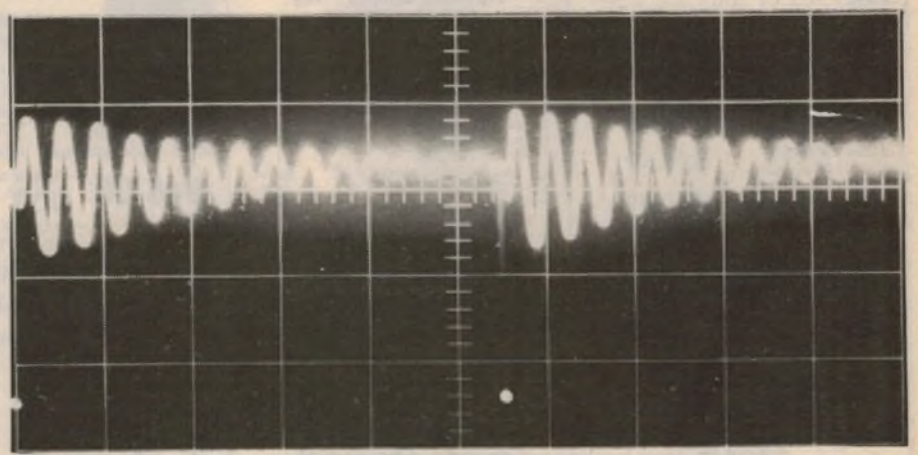


This is actual size artwork for the Analog PCB.

That completes the wiring. Setting up the analog circuitry involves adjusting the 1MΩ trimpot until the output of the op amp IC25, with no input signal connected, has an output DC voltage equal to half the reference voltage. This is done by measuring the reference voltage from pin 6 of IC27 with a voltmeter or oscilloscope and adjusting the 1MΩ trim pot until pin 6 of IC25 is set to half the voltage reference.

The adjustment is necessary to allow the incoming signal to be symmetrical about the centre of the reference voltage allowing maximum signal levels to be converted before clipping occurs. Note that the two 10MΩ resistors may require swapping around to achieve the adjustment.

The front panel of the Digital/Analog Storage CRO Adapter is rather cluttered with the many controls. These controls have functions which are divided into three broad sections; the Input, Trigger, and Timebase. The Timebase controls were discussed in the article of the November 1980 issue as was the Set, Delay +/−, Internal/External controls of the Trigger section.



This shows the tracer superimposed on a non-repetitive waveform.

The analog signal to be stored is fed to the "Analog input" socket and the "Analog out" is connected to the oscilloscope. The Digital/Analog switch should be in the Analog position. The Attenuation and Gain controls adjust the signal level to the A-D converter.

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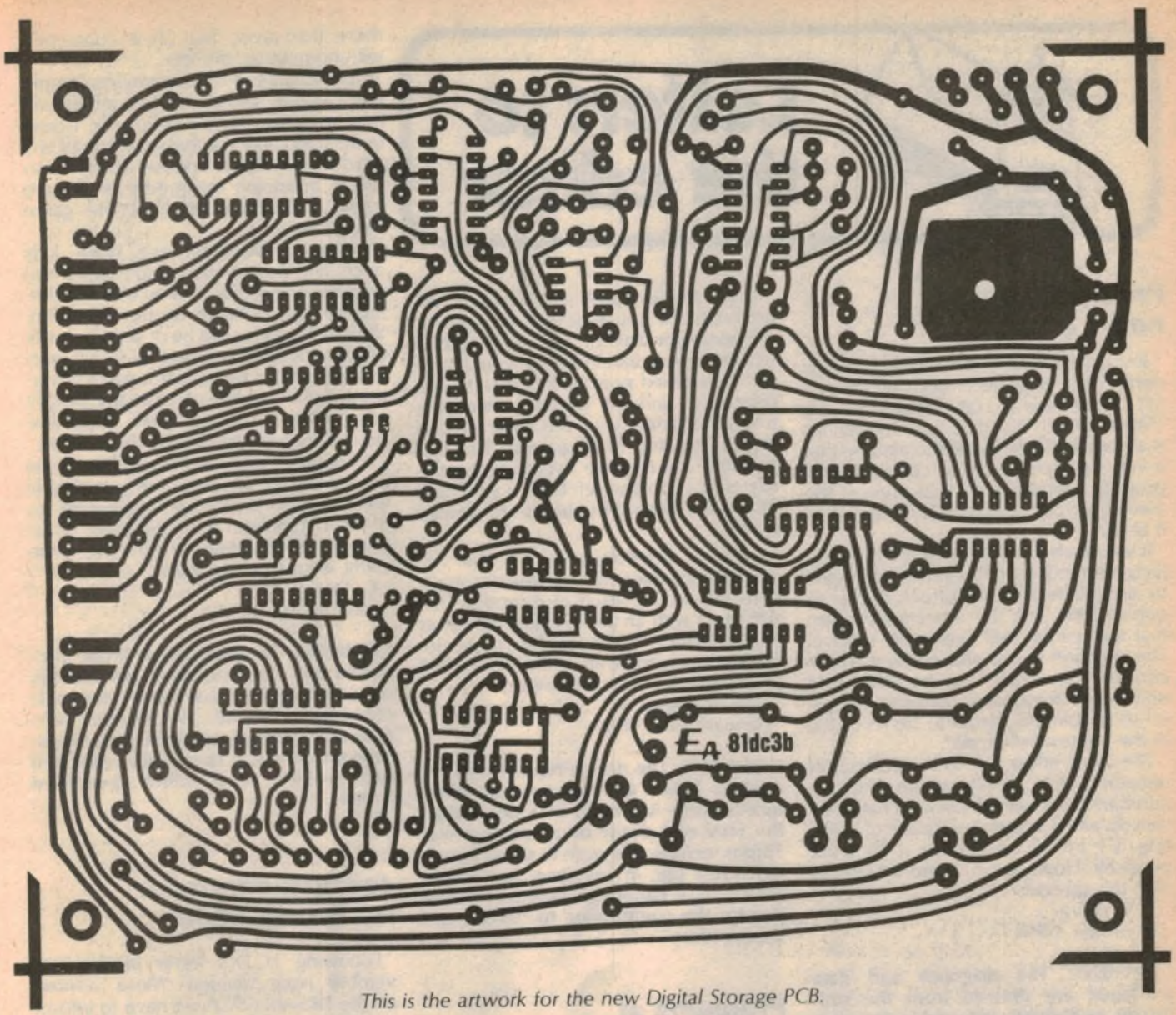
1S4	5Y3	6BH8	6BL4	6DZ7	6J5GT	7GS7	12BE6	35C5	6350	PL504
1S5	5Z4	6BC5	6CQ6	6DR8	6K7G	7N7	12BQ6	35A5	OA3	G737
1R5	6A8G	6BA7	6CM6	6DT6	6K6GT	7R7	12BA6	35W4	OC3	A741
1T4	6AM8	6BF5	6CW7	6DS8	6SA7GT	7V7	12BZ7	32A8	VR150	UCH81
1A5	6AN6	6BW7	6CM7	6EM7	6SQ7GT	9U6	12CU5	50EH5	S130	UBC41
1K3	6AQ6	6BW4	6CY7	6ES6	6SJ7GT	9AQ8	12J8	58	VT121	UCH42
1J3	6AS6	6BR7	6CG8	6ET6	6SK7GT	9AK8	12K5	75B1	EF50	UCL82
1M5	6AS8	6BF6	6CS6	6F5	6SS7	11LY6	12H6	90AV	VR91	ECH33
1C7	6AL5	6BN4	6CU5	6FC7	6S4A	12AV7	12SH7	117Z3	VT76	QS150/45
2A6	6AQ7	6BC8	6CZ5	6GJ7	6U4	12AT6	12SJ7	217C	UAF42	Z303C
2C51	6AH4	6B07	6CB6	6GK5	6W6GT	12AE6	12V6	955	UF41	

● Please indicate a substitute should any of your selection be out of stock ●



This is the artwork for the new Digital Storage PCB.

can be accomplished by use of the DC/AC/HF/LF Trigger selection, +/−, Int/Ext, Trigger Level as well as the Delay. Normally the AC Triggering would be used, but in some situations it may be necessary to trigger only on a low frequency, high frequency signal or a true DC level, in which case one of these can be selected.

The Trigger level control allows the adjustment of the voltage or position on the waveform where the Analog storage will begin.

For the signal to be converted correctly, the maximum voltage swing of the A-D converter must be limited to less than 5V. To do this some experimentation with the attenuation and gain controls will be necessary.

When setting the Gain and Attenuation controls, it should be noted that at the highest Gain control setting, a bandwidth of 100kHz is not available. Even so, this maximum gain setting is useful when storing waveforms at low frequencies, say below 20kHz.

Apply the signal, with the filter in the off position and a suitable timebase selected for the signal frequency. With maximum Gain (fully clockwise), the Attenuation knob should be gradually rotated from a fully clockwise (maximum attenuation) position while manually continually retriggering with the Set switch. It may be necessary to adjust the Trigger Level control for reliable triggering. At the point where clipping of the waveform just begins to occur is the correct setting. Back off the Gain control until no clipping is evident.

Once a signal has been stored successfully, the filter can be switched on and the tracer signal will appear on the oscilloscope screen along with the stored waveform. It can be important to know where the start of the stored waveform begins and this can be determined with the tracer setting at 1/256. Since with this setting the number of tracers occur only once (at the beginning and end of memory) the start of memory is to the right of the tracer.

Mentioned earlier, there is a maximum timebase limit which can be used for analog storage. This maximum is the 512us setting. On replay of the signal at this setting, the access time of the memory approaches the rate of the memory address clocking and consequently glitches in the converted waveform can result. Lowering the timebase to 16.38ms and lower settings and readjusting the CRO timebase will eliminate this problem. The filter operates at around this timebase and should be set to the highest timebase which gives no attenuation compared to the unfiltered signal.

A few comments on the availability of components: The A-D converter, the DAC0800, is available from Rifa Pty Ltd of 2 Cross Road, Hurstville, 2220, and from Semtech Pty Ltd of 1 Johnston Lane, West Lane Cove 2066, at approximately $3 each in one off quantities. The other components difficult to come by such as the 1% resistors, DM2502 SAR. the LM361 and the 2112 memories can be obtained from Radio Despatch Service of 869 George Street, Sydney 2000.

Letters to the editor

Problems with notes & errata

Just a couple of observations regarding publication of projects both by EA and ETI. If we are to take notice of the "Notes and Errata" that both magazines maintain, it would be safe to assume that a very fair percentage of constructional projects contain errors that prevent the assembly from operating as designed or if at all.

It would also indicate that the said projects were not subsequently constructed by an independent constructor prior to publication using the exact information that the readers will eventually receive. The situation is fast approaching where construction should not be attempted until after a reasonable period has elapsed to enable any errors to be recorded in the "Notes and Errata".

The latest effort was in the Selectalott regarding IC1 (4017) where the pin numbers are reversed. Luckily I had used sockets and it was only a matter of inverting IC1 in the socket for it to work perfectly. Hope to win Lotto eventually with this device.

T. V. Askin,
Doonside, NSW.

COMMENT: The diagrams and data published are derived from the prototype, as normally pictured in the same article. It is extremely difficult to obviate all errors, and Australian magazines are not the only ones that have problems. However, we have just instituted a new checking procedure which will hopefully improve matters.

High quality AM radio reception

Whilst going through some old copies of your magazine the other day, I came across an interesting series of articles entitled "A New Approach to High Fidelity Radio Reception" in the July and August 1950 editions.

This technique of radio station selection is a novel one and the theory of operation, as given by Mr Hosken, appears to be sound. Given modern components, it should be possible to build this tuner and have it perform satisfactorily. Perhaps, however, there may be a basic flaw which the author and myself have overlooked?

There are two problems which at the time made it impracticable, at least for the home constructor: the use of coils in which the inductance and Q would have to be matched reasonably close to the prototype; and the use of a four-gang tuning capacitor with the rotor of one section isolated from ground. The first problem can now be overcome by the use of pot cores which have a very high Q and the second by the use of varicap diodes.

Further development of the RF amplifier coupled with a low-distortion detector should result in a modern hifi AM tuner with an almost ideal bandpass characteristic. I would be most interested to read your comments on the practicability of this technique.

Robert Tregea,
Pennant Hills, NSW.

COMMENT: The design represented yet another brave attempt to win better quality from AM radio at a time when the only real domestic alternative was 78rpm records. The urge to do so now is much less but, in any case, one would seek a less daunting approach. Thank you for the contribution to "Circuit and Design Ideas".

Problems at the "grass roots" level

Just a few thoughts that have worried me for some time. In the days of Radio and Hobbies your magazine had a lot of appeal to the beginner. These days, young people need an interest or hobby more than ever, but EA is concerned with computers and kits.

How about some basic projects, simple and carefully explained; also articles on how to repair pocket radios etc. I can't understand why you have never had any articles on repair and servicing – so much transistor equipment is thrown away and do-it-yourself is the game nowadays.

Anyway, remember we were kids once, and now there are so many more who need to know how to use a soldering iron and what to do from then on. Your magazine could be of service to the country by teaching people to be practical instead of being just a trade advertising publication. Not so many people can afford to buy that expensive prematurely obsolete junk these days!

A couple of projects I would like to see are a DC-AC inverter for a portable welder, and protective equipment to prevent damage to equipment from voltage surges due to lightning, switching, etc on power lines.

G. Stark,
Montefiores, NSW.

COMMENT: In part, your letter prompted our observations in last month's editorial that the "grass roots" electronic scene has changed. We couldn't help note that, while pleading for more beginners' projects, you specifically requested two projects of a rather specialised nature.

Joystick controller for Dream 6800

Following J.C.D.'s letter in the November issue headed "More wanted on the DREAM 6800" we have to inform you that we have published details of how to add a joystick controller to the Dream 6800 using just three PIA lines in our November newsletter.

G. Samways,
NSW 6800 Users Group,
c/- 27 Georgina Avenue,
Keiraville, NSW 2500

Basic Electronics

For the beginner, or for the hobbyist as a reference book and almost certainly the most widely used manual on basic electronics in Australia.

It is used by radio clubs, in secondary schools and colleges, and in WIA youth radio clubs.

Begins with the electron, introduces and explains components and circuit concepts, details the construction of simple receivers. Separate chapters on test instruments, servicing, amateur radio, audio techniques, stereo sound reproduction.

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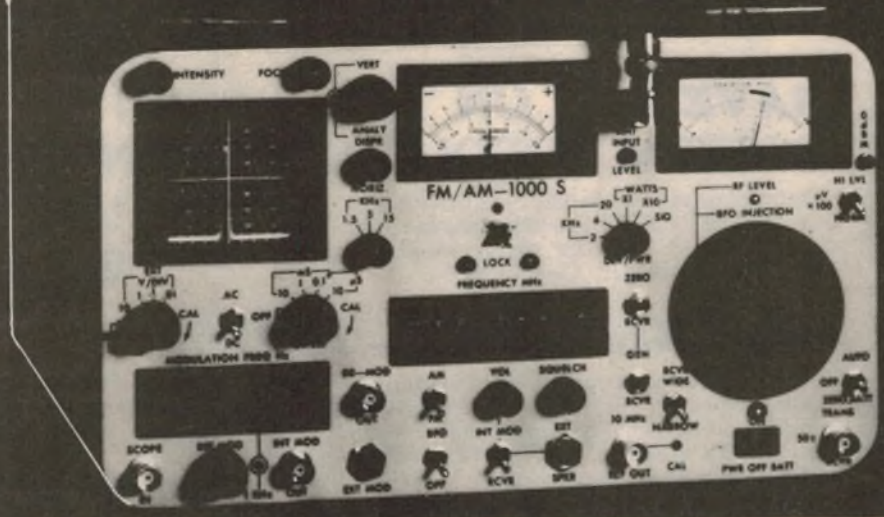

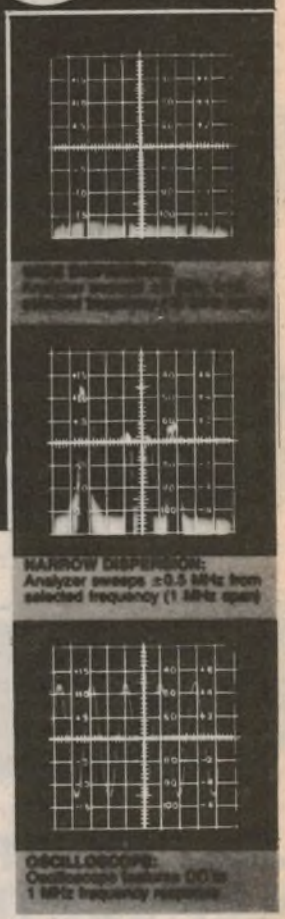

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NOTE: Does not include the new WARC bands.

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Amateurs' world-wide satellite gets go-ahead

This month's notes contain several items of good news for amateurs, particularly Australian amateurs. A launch date has been set for the Phase IIIB amateur satellite, Australian amateurs have been given a combined novice/limited licence category, and the Australian Draft Frequency Table provides for several new amateur bands, with virtually no losses.

AMSAT has been informed by the European Space Agency that the Phase IIIB amateur communications satellite has been "selected for L7 launch" scheduled for February 24, 1982.

That announcement was published in the November/December, 1980, issue of "ORBIT", the official magazine of the radio amateur space program.

The Phase IIIB satellite is the replacement for, and will have all the capabilities of, the Phase IIIA which was destroyed when the European Space Agency launch vehicle Ariane failed shortly after takeoff on May 23, 1980 (see EA page 89 July, 1980).

The AMSAT Phase IIIB satellite will be capable of providing repeater quality contacts to all stations within its optical range, be they local or up to half way around the world. There will be no skip zones in this new satellites communications band. For the first time, the technology used to provide the reliability, predictability, and convenience of a two-metre repeater will be applied to world-wide coverage. The potential for international nets, Jamboree-on-the-Air, RTTY and computer, emergency, and public service communications is tremendous.

The Phase IIIB satellite is a million dollar project funded by amateurs around the world, assisted by donations from commercial organisations and space agencies. But the technical expertise and ability to build a communication satellite to the highest standards of international space research comes entirely from within the amateur fraternity.

The benefits to be gained from this project appear to be almost unlimited. For the amateurs themselves there will be the simple pleasure of being able to converse with amateurs in distant countries, plus the practical experience they will gain from this new technology. And at community level there will be benefits in education, or in times of national emergency.

Amateurs world-wide, together with those interested in amateur radio, are invited to join the Radio Amateur Satellite Corporation (AMSAT) and receive regular news as to the status of the Phase III program and other AMSAT projects in "ORBIT" magazine.

Three of the personalities associated with WICEN activities during New Year's Eve festivities at the Sydney Opera House: Howard Freeman (left), VK2NL, NSW State WICEN Co-ordinator; John Bishop, Deputy Director of Festival of Sydney; Ray Williams, VK2ARW, Senior Superintendent of Police, B Division, City of Sydney.

Application for membership should be sent to: AMSAT, PO Box 27, Washington, DC 20044, USA.

Dues are $US16 for 1981; $US200 for life membership.

Draft Radio Frequency Table

On December 22, 1980, the Minister of Communications, Mr Sinclair, released the draft radio frequency table for Australia. This table is the outcome of the World Administrative Radio Conference held in 1979 by the International Telecommunication Union, of which Australia is a member. This draft was subsequently released for public comment on February 16, 1981.

Proposals relating to amateur frequency allocations in Australia are: No changes to 80, 20, 15 and 10 metre bands. A change is proposed to the 1.80MHz to 1.86MHz band which is available to amateurs and shared on a secondary basis with radio navigation. The proposal is that 1.80MHz to 1.825MHz be an exclusive amateur band and 1.825MHz to 1.875MHz be allocated to amateurs, secondary to radio navigation.

The present amateur allocation 7.000MHz to 7.150MHz remains unaltered. However, the draft proposal increases the allocation from 7.150MHz to 7.300MHz on a no-interference basis.

The new bands 10.100MHz to 10.150MHz; 18.068MHz to 18.168MHz and 24.890MHZ to 24.990MHZ, allocated to the amateur service worldwide by WARC 79, are provided for but the draft proposal does not state when they will become available in Australia.

For the six metre band, it is proposed that the 50.00MHZ to 52.00MHz segment be allocated to broadcasting (primary) and amateur (secondary), with the segment 52.00MHZ to 54.00MHz remaining amateur exclusively.

No changes are proposed to the two-metre and 70 centimetre bands.

The current footnote relating to temporary amateur use of the 576MHz band does not appear in the draft proposal.

The band 1215MHz to 1300MHz secondary amateur service was changed at WARC 79 to 1240MHZ to 1300MHz.

AMATEUR RADIO

No changes are proposed to any higher frequency amateur bands, including all amateur bands and amateur satellite bands above 40GHz allocated by WARC 79.

A NEW CALLSIGN SUFFIX in the block "KAA to KZZ" has been introduced by the Department of Communication for those amateurs who hold both limited (AOLCP) and novice (NAOCP) licences. This combined licence will be issued over the counter upon application. The new fee is $15.00.

For example the holder of a limited and novice licence in NSW could have the callsign VK2KAT, VK2KEY, VK2KIM, VK2KVA etc. The same applies to other call areas by substituting the appropriate figure.

Royal Signals Amateur Radio Society

Membership of the RSARS is open to any serving member of the Royal Corps of Signals. Associate membership may be granted to any member of the British Army, any serving or retired member of the Commonwealth Signals Corps, or a member of any branch of the Commonwealth Army in a signals section.

Daily nets for overseas and local members are held at 1200UTC on 21.170MHz; every Wednesday for Australian and New Zealand members at 1000UTC on 3.605MHz; and every Saturday at 2300UTC on 28.450MHz for Australian, New Zealand and Canadian members.

The VK/ZL chapter of RSARS has been allocated the callsign "VK2DRS".

From December 1, 1980 the chapter will be issuing awards available only RSARS members.

Full information on activities and membership may be obtained from Les Simons, VK2NLE, secretary RSARS VK/ZL Chapter, PO Box 402, Double Bay, NSW 2028, or telephone (02) 337 6325.

Radio Club News

MOORABBIN AND DISTRICT RADIO CLUB has produced a 20A heavy duty power supply with over voltage cut-out. This is a low-cost, easy-to-construct fixed or variable supply. It has an output range from 5 volts minimum to 20 volts maximum, has short-circuit protection, and automatic thermal shutdown.

The unit was described in the December, 1980 issue of the club's journal "APC". Most of the components may be obtained from the club by writing to: Projects Officer, Moorabbin and Districts Radio Club, PO Box 88, Bentleigh East, 3165.

WAGGA AMATEUR RADIO CLUB: On Saturday December 6, 1980 members of the club provided a field station and amateur radio display at the "Life Be In It" leisure day exposition at Bolton Park, Wagga. The purpose of the day was to expose the public to various hobbies and activities so that they could make inquiries to the people involved. The club put on a good display with the club station VK2WG operating portable on most HF and VHF bands using phone, CW and RTTY modes.

There was a large display of equipment both commercial and home built and a wide range of antennas. Signs explaining the use of the equipment, photographs, and QSL cards were also used to advantage.

The activities extended from 10am to 3pm and proved a good publicity exercise for the club.

LIVERPOOL AND DISTRICTS AMATEUR RADIO CLUB will conduct their Field Day at the Catherine Field Hall, Catherine Field Road, Catherine Field on Sunday, March 22, 1981.

Amateurs, their families and friends are invited to attend.

For full details contact Sam Anderson, VK2VVK, Secretary LDARC, C/- 105 Willan Drive, Cartwright, NSW 2168.

Wicen News

WICEN AT THE OPERA HOUSE: Sydneysiders who joined in the New Year's Eve festivities organised by the City of Sydney Festival Committee at the Opera House and Circular Quay may have been surprised to learn that amateur radio played a small but significant part in the smooth running of the entertainment.

The Festival organisers asked WICEN to provide communications between three main centres, plus the two key personel in charge of the whole organisation. One centre was at Circular Quay West, one at the Custom House Plaza, and the third at Mrs Macquarie's Point, from where the fireworks display originated. The two personnel were Mr John Bishop, Deputy Director of the Festival, and Mr David Burwood, Program Manager.

In spite of very short notice, 13 WICEN members volunteered, and this allowed for backup facilities over vital links. The crowd was smaller than on previous occassions, and extremely well behaved, so that there was a minimum of crowd control traffic involved.

Most of the messages involved coordination of the various entertainment presentations, in particular the fireworks display, the start of which had to be synchronised with the musical presentation at midnight.

Altogether it was a most successful exercise. The Festival organisers were extremely happy with the results, while the WICEN members gained just that much more experience in message handling.

WICEN AT THE AIR SHOW; As in past years, WICEN from the Sydney area has been asked to provide ground communications for the Schofields Air Show

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12.	Shock	Less than 5ppm for 50cm Hammer Shock Test
13.	Package size.	

to be held over the weekend March 28-29, 1981.

WICEN AT THE SURF CARNIVAL: The Southern Section of Sydney WICEN has been asked to provide communications for the Australian Surf Championships to be held at Wanda beach, north of Cronulla, in late March, or early April, at a date yet to be fixed. The Championships are to be hosted by the Wanda Surf Life Saving Club. WICEN preparations for the event are now under way.

Overseas News and Technical Snippets

NEW ZEALAND RECIPROCAL AGREEMENTS: The ZL0 series of callsigns will be issued to amateurs under the terms of reciprocal agreements with the country concerned. Such authorisations are valid for periods up to one year and renewable on application provided that the holder's own country licence remains current. An example of the callsign would be ZL0AA/VK2. Further details are given in "Break-in" December, 1980.

The foregoing became effective on January 1, 1981.

COMPUTERISING AMATEUR RADIO is the theme of the editorial by Joe Kasser, G3ZCZ in November/December 1980 issue of "ORBIT", pointing out that AMSAT has been pioneering the application of microcomputers to amateur radio. The Phase III spacecraft's automated telemetry, tracking and command stations have been designed around a microcomputer.

There are a number of articles featuring microcomputers and digital techniques in that issue. However, it is pointed out that computers are only one facet of the amateur radio space program.

UOSAT – an amateur satellite for science due for launch this year – will carry scientific experiments as well as a slow-scan television (SSTV) camera. This amateur satellite will be ideal for use in classrooms all over the world for live demonstrations of space research. It will also carry an on-board microcomputer and will send back data in digital format, designed for computer processing.

This is a joint AMSAT – University of Surrey (England) project.

SSB TRANSCEIVER using Plessey SL1600 intergrated circuits: An interesting article by James M. Bryant, G4CLF in the December, 1980 issue of "Break-in" gives construction details, printed board layout, and parts list.

The article states that the 10.2cm by 7.6cm board contains the heart of an SSB transceiver capable of working at any frequency from 10kHz to 500MHz.

The article concludes, "This transceiver board is small, inexpensive and easily constructed. It has high performance and allows the advanced radio amateur to build himself a transceiver which equals or exceeds the performance available from expensive commercial equipment".

NEW AMATEUR BANDS which were allocated at WARC 79, and which will probably come into use in 1982, have been in the news for some time, particularly as a sales feature for new amateur HF equipment.

For the operator who runs a Yaesu FT-101B an article in November, 1980 issue of "73 Magazine" describes how that unit can be modified to cover the new allocations.

The modification suggests that the WWV position on the bandswitch be used to cover 10.0MHz to 0.5MHz, the 11 metre position be modified to cover 24.0MHz to 24.5MHz, and the 160 metre band be sacrificed to cover 18.0MHz to 18.5MHz.

ANTENNAS, like all amateur equipment, have now become items that can be purchased over the counter. The ease of construction and the economics are factors often overlooked when considering this item.

In "CQ Magazine" January, 1981, three types of antenna are discussed, two home-built for HF bands, and one commercially produced for VHF/UHF bands.

The first is the old and tried WINDOM or off-centre fed Hertz. One comment by the author is "Look at the Windom", named after the amateur who developed it and wrote it up for publication in the 1930's.

"...(it) is a popular compromise antenna that boasts many of the desirable characteristics of the centre fed tuned-feeder all-bander, yet exhibits a reasonably constant feedpoint impedance that makes matching and loading the transmitter easier than with the tuned feeder antenna.

"... look at the Windon from the standpoint of a practical and inexpensive solution to the one antenna for all bands problem."

The second is a mobile HF tri-bander called the "Horical" by its designer, Gerry Tynan-Blundun, ZE3JL. Starting off with a ten metre vertical, then adding another section to resonate on 15 metres, and another section for 20 metres made the whip too long for mobile use.

Out of that situation came the "Horical" by bending the 20 metre extention into an inverted "L" to give clearance of about 0.5m above the car roof. The horizontal section runs to the front of the car, supported above the windscreen on a short mast. No loading coils are used. A sliding sleeve in the 10 metre section serves as the tuning device. Aided by an impedance transformer, the SWR is stated to be 1.25 to 1.

The third antenna, a commercial unit, needs no mounting holes in the vehicle. A high impedance coupling and tuning unit mounts inside the glass windscreen and is capacitively coupled through the glass to the whip antenna mounted on the outside. Since it is an end fed design, a ground plane (normally the car body) is not required. This is an ADVAVTI Research and Development product and models are available for 144MHz, 220MHZ and 450MHz bands. It is claimed to have superior radiation and full omni-directional capabilities.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

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The Australian CB SCENE

WANTED: A little more care and consideration

While there are any number of encouraging aspects to CB radio, one cannot help becoming somewhat downcast, at times, from what one hears on the CB bands, whether it involves licenced CBers or straight-out "pirates".

In saying this, I am not referring only to abuse and obscenity, undesirable as they are, but also to sheer bad manners and lack of consideration for others. One would not expect to encounter much of the behaviour in an ordinary community situation, so why on the air?

Perhaps the same isolation and anonymity which encourages some to public profanity, encourages others to be rude and anti-social. A sad self-comment, I fear.

Then there are those who seem to feel an obligation to hold forth on various subjects, when the microphone is open, often without having bothered beforehand to check on their facts, or to think the matter through. They do no credit to themselves or to the stature of the CB fraternity.

For example, I recently heard an old time CBer (one of the original licence holders in this State) laying down the law to a newcomer and claiming that the RB-14 says people speaking to others in close proximity have precedence on a channel over those who may be talking to someone a little further away!

According to this ill-informed operator, a person talking to his mate a street away has preference (as far as channel usage goes) over someone talking over a distance of a couple of blocks or in the next suburb!

If he was right, then I still have something to learn about RB-14. I wonder when he last read the document for himself?

And then I could mention the operator who diligently chases "skip" stations, only to become quite pre-occupied as to whether they have a legal call sign so that he can talk to them!

By so doing, he prevents other operators from pursuing an interesting QSO, which isn't very considerate. More than that, he has been known to hold forth for lengthy periods, quite overlooking to inject his own callsign at the requisite intervals! In short, in the act of lecturing all who will listen on one aspect of RB-14, he breaks another! Ugh!

Another source of annoyance is the number of operators I hear on the SSB call channel making a contact and then QSYing, still on the SSB mode, down to an AM channel. I know that some AM operators leave much to be desired, but then so do a number of side band operators, UHF operators, and a few amateurs. Two wrongs don't make a right; they simply make matters worse!

After all, the people who use AM have paid for their licences, too, and have just as much right to operate as anyone else.

The organised usage of the CBrs frequencies is what the band-plan is all about. It is there to try to give everyone a fair go. And remember that the AMers only have 10 channels with one mode – less actually if you take out the Emergency, Call and Highway channels. Against this, SSB operators have an effective 14 channels (counting both modes) plus the call channel.

Think about the chaos which would occur if the AM operators decided that they were fed up with it all, and decided to use all 18 channels for their operations. Not a pleasant thought, is it? So how about using a bit of consideration and sticking to the band plan?

THE IRISH ARE COMING!

We had a most pleasant visit from the Deputy National Director/International Liaison Officer of the NCRA, Reni Barnes, his wife Sheila and their doll of a daughter, two years old Rene, over the festive season. It was terrific for me to

Britain's "open channel" may come too late

According to the February issue of "Practical Electronics" magazine, the CB scene in Britain has emerged as a virtual re-enactment of what happened in Australia a couple of years back.

Perhaps it's not surprising because the situation there is a product of a similar system of administration; in fact, it's the one that Australia largely inherited. The main difference is that events have taken a little longer to happen.

As was the case in Australia, CB transceivers are being imported and sold with the full knowledge of the Government. The offence occurs when they are used, even to listen to CB type transmissions, according to the letter of the law.

However, the general restrictions on listening date back to the turn of the century and are virtually untenable in an era of general coverage receivers. Suppliers take advantage of this.

According to "Practical Electronics", they circumvent the enforceable prohibition on transmitting by snipping a wire which will immobilise the transmitter. It is up to the customer whether he later chooses to restore the connection!

After a great deal of argument, the Government has professed to be in favour of an "open channel" facility (we mustn't acknowledge it as CB) on some segment other than 27MHz, it issued a green paper and is now currently awaiting industry response.

But "Practical Electronics" feels that the action may prove to be too little, too late. A large number of 27MHz transceivers have entered the country and been put on air, without the intervention of standards of any kind. The same thing has happened with wireless telephones. Apart from deliberate flouting of regulations, the situations had led to wide misunderstandings of the law.

At the root of the problem says the writer – editor Mike Kenwood – is the fact that the public does not see the use of CB radio as an anti-social crime. Especially has this been the case since the Government accepted the principle of open channel radio.

What they haven't done is match it with appropriate action. In the meantime, the pressure continues to build to accept 27MHz as a fait accompli.

finally meet Reni's family.

Reni tells us that around 30 Irish CBers will be coming over for the NCRA's 1981 Convention, which is to be held in Sydney around November next. Can you imagine it? Sydney will never be the same again!

Terry Watkin (National Director NCRA) and I both received presents from the Irish CBers. Terry's was straight forward . . . a bottle opener with the Irish emblem on it. Not so, mine. I received an egg timer (again with the emblem on one end).

Now, we all know that egg timers run for (usually) three minutes. You won't believe this, but mine runs for three and a quarter minutes one way – and three and three quarter minutes the other! Only the Irish would think of that one. We kept checking our watches to make sure we weren't going out of our minds!

But seriously: to Kevin, Pat and the gang over there in Ireland, we both thank you, and look forward to seeing you in November.

Still with an Irish theme . . . the folks over there use "handles" similar to the Americans, so you can expect to hear call signs such as Captain Sinbad, King B, Graverobber and so on when they arrive. That should shake Sydney SSB operators up a bit.

Personally I can't wait to hear all those Americans with an Irish accent. More news on their arrival as it comes to hand.

THE MAIL BAG

Hearty congratulations go to our roving reporter, Ken Upton (Omega One). Ken's wife, Shirley, is doing her bit to increase the CB population by presenting him with a son, Warren. That has to be the best name around for a boy . . . my son's name is Warren also! I know the announcement is a little late, but I didn't get the news till after my last deadline.

I thought that there were lots of Emergency Monitoring groups around, but I guess I must be wrong! Despite my requests for information from and about them, there has been very little response. As yet, I haven't officially heard about CREMC, the new Council of monitoring groups. I can only do so much. How about helping me to help you.

And what about the CB Clubs? Here is your opportunity to let other people know what you are doing, and about yourselves. If you are planning a social "do" and you would like it advertised, I am only too willing to help you there as well. All I ask is that you allow about eight weeks for your information to be published.

Well, that's about it for another month. Please join me for another issue. And, now that most of you are back from your annual leave, take time out to drop me a line about your ideas, your activities and what's doing in your local club or group.

Jan Christensen

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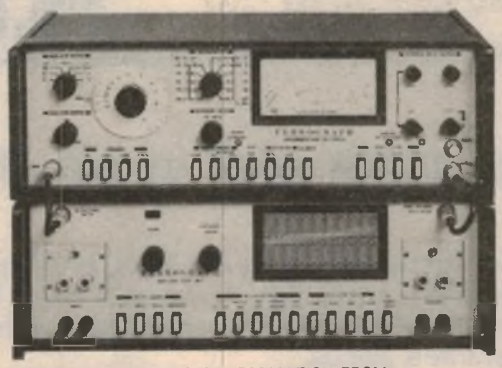

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SHORTWAVE SCENE

by Arthur Cushen, MBE

New Zealanders score well in big DX contest

Last October, the Radio Monitors International Program, broadcast from the Sri Lanka Broadcasting Corporation, featured a major DX contest. Results to hand indicate that two New Zealanders and one Australian figured in the first three places.

The contest consisted of three phases: firstly, the listener had to identify 20 radio stations in a series of quiz questions; secondly, the contestant had to tune in to as many Adventist World Radio outlets as possible; the third section was to identify 20 radio stations by their tuning signals.

The contest attracted several hundred entries from more than 25 countries, the only area from which no entries were received being Africa. Highest concentrations of responses came from India and Japan; in Japan alone, there were more than 50 prize winners. A total of 2000 verification cards were issued to those who entered the contest.

The international winner was Bryan Marsh of Auckland, New Zealand. Bryan was placed first, having also filled third place in 1978 and fourth place in 1979 contests. He is a keen radio listener of many years standing.

Second place was filled by a Sydney listener, Andrew Ellwell, while third place went to Douglas Doull of Auckland, New Zealand, a well known blind radio listener. Douglas actually won the 1978 contest.

The only other successful contestant from Australia was Robert Chester of Adelaide who took place 22. A total of 298 prizes were awarded to the contestants and these were donated by many broadcasting organisations, book publishers and DX Clubs.

DUBAI EXPANDS SERVICE

After several months of testing, Dubai Radio and Colour Television has been heard on a regular schedule, although still using several test frequencies. Using three 300kW transmitters, the broadcasts have been heard from 0225UTC on 9505, 11755 and 21700kHz with a news bulletin in English at 0330UTC. On other occasions the frequencies have been 9640, 11940 and 21700kHz.

The second series of transmissions have been heard from around 0700UTC until closing at 1100UTC; this includes a news bulletin in English at 1030 and, at 1040, a program of news about the Middle East. This transmission has generally been on 11755, 17775 and 21700kHz. During the broadcasts, reception reports have been requested, to be sent to the External Service of Radio Dubai, PO Box 1695, Dubai, United Arab Emirates. According to the announcement, the shortwave transmitters are beamed to Europe. The news bulletins are a relay of a domestic English language program which is relayed from the local FM service.

ASIAN SIGNALS

Radio Pakistan broadcasts a slow-speed news bulletin in English at 0230UTC on 17835, 21590 and 21745kHz. This broadcast is well received on the first two frequencies and lasts for 15 minutes. It has been observed that the frequencies announced at the opening of the transmission are 17835, 21580 and 21724kHz but the last two frequencies are not correct.

The signals of Radio Tashkent in Uzbeckistan are heard on new frequencies, with the English broadcasts 1200-1230 and 1400-1430UTC. The frequencies of 5945, 6025, 9540, 9600 and 11785kHz are used but the first listed is the only one received at good strength.

Bryan Marsh of Auckland, NZ winner of what is said to be the World's biggest DX contest, listening on a Sony ICF2001.

TRANSKEI RADIO

A verification letter from the new Radio Transkei, heard on 3950kHz, has been received. The station uses the slogan Capital Radio and broadcasts from one of the new homelands in South Africa. According to the Director of Technical Services, the South African terrain has caused problems in reception of both the medium and shortwave signals, and reports from outside South Africa are often better than those from within the country. The station operates on 603kHz medium-wave for countrywide coverage and 594kHz for coastal coverage. On shortwave, the station uses 3950, 7235 and 9765kHz. The transmissions are on 3950kHz 0300-0530 and 1600-2300UTC; 7235 0400-1700UTC and 9765 0530-1600UTC. The station also sent a car sticker, a schedule, returned the IRC and verified with a letter from the Director of Technical Services, Capital Radio.

RED CROSS BROADCASTS

The International Committee of the Red Cross at Geneva, Switzerland, will conduct tests again this year using the transmitters of Swiss Radio International. The broadcasts on Monday are in English and French and on Wednesday in German, Spanish and Arabic. The frequency of 7210kHz is used and the broadcasts are 0600-0700, 1130-1230 and 1700-1800UTC. The dates for the broadcasts for the balance of the year are March 23 25, April 27 29, May 25 27, June 27 29, July 27 29, August 24 26, September 21 23, October 26 28, November 23 25 and December 28 30. Reports are appreciated by the Radio Division of the International Committee of the Red Cross at Geneva, Switzerland.

DX PROGRAMS RE-TIMED

"New Zealand Calling", the program carried by Radio New Zealand External Service, and which includes a Mailbag and DX information, is broadcast on the first and third Monday of each month. This month, it undergoes a time change as New Zealand moves back to standard time and

will be broadcast now at 0405 and 1015UTC. The first broadcast is scheduled to be on 15485, 17860kHz and the second transmission on 11945kHz.

All India Radio introduced a DX Corner in November and this has now been re-timed to the second and fourth Monday of each month, with a broadcast at 1040UTC for listeners in Australia and New Zealand. The frequencies of 15205 and 15285 give the best reception. In the past, the program has been broadcast on the first and third Monday. The program of DX information from All India Radio Delhi is also carried at the following times: 1040, 1435, 1930, 2125 and Tuesdays at 0040UTC.

MEDIA NETWORK

From May, the popular Radio Nederland DX Juke Box program will be retitled Media Network. DX Juke Box has been on the air for 20 years, broadcasting information for shortwave listeners world wide and has many times been voted the world's most popular DX session on shortwave.

The program in the past consisted of popular music interspersed with DX information and technical news, but a new format has taken place since Jonathan Marks has become compere of the program. This is the reason for the new name. Each week there is a DX Report from one part of the world; on the first Thursday Arthur Cushen's Pacific Report; on the second Thursday from Richard Ginbey in South Africa; the third Thursday from Dan Robinson in the United States, and the fourth Thursday from Victor Goonetilika of Sri Lanka. Arthur Cushen has been broadcasting on the program since 1966, while the other three contributors are relatively new to the session.

DX Juke Box will continue until May and then Media Network will be the title of the program and it will be heard on Thursdays at 0750UTC on 9715 and 9770kHz and repeated at 0850UTC on 9715kHz. These transmissions are from the Radio Nederland Relay Base at Bonaire and the programs originate from the studios in Hilversum, Holland.

AFRTVS MOVES TO LA

The Armed Forces Radio and Television Service, after moving from Los Angeles to Washington some years ago, is to return to the west-coast and will again make its headquarters in Los Angeles. During World War II and later, the headquarters and studios were located in 1016 North McCadden Place, Los Angeles 38, California. In those days the network was known as Armed Forces Radio Service and used transmitters in Delano and Dixon for most of the transmissions to this area, with call signs such s KCBR and KNBC.

The AFRTVS has recently been heard on 26000kHz with a relay from the Philippines and opening at 0600UTC and closing at 1400UTC. They also operate 0015-1600 and 1400-1900 on 21670 and 1900-0015 on 15385kHz. The move back to Los Angeles is expected to result in some major program changes, as AFRTVS will be concentrating on the Pacific and Asian area in the future.

PEKING EXTENDS SERVICE

Radio Peking now has 19 English broadcasts a day beamed to listeners in all five Continents. The station has many fine programs and the mail is answered in "Listeners Letterbox", broadcast on a Sunday and Tuesday. The transmission to Australia and New Zealand is at 0830-0930 and repeated 0930-1030UTC on 9860, 11600, 11720, 15120 and 17635kHz.

Radio Peking also has a transmission in Cantonese to Australia on 12110 and 15180kHz from 1000-1100UTC.

BROADCASTS FROM ROME

Rome Radio has two daily programs in Italian for reception in Australia. The morning transmission 2050-2130UTC is on 7235, 9575 and 11800kHz, while the second broadcast for evening reception 0830-0930UTC is on 9580, 11810, 15330, 17780 and 21690kHz. A broadcast in English 0350-0410 is on 11905, 15330, and 17795kHz. Reception of these three transmissions is fair but interference has been noted on several of the frequencies. At 0830UTC 15330 and 21690 are received without interference. The transmission in English at 0350 can be heard on 11905 or 15330kHz.

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.

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NEW PRODUCTS

Three LCD Multimeters from Hioki

Three liquid crystal display multimeters from Hioki of Japan, the 3207 Digital Pocket Hi Tester, the 3208 Calcu Hi Tester and the 3209 Digital Hi Tester, are each intended to fill particular roles. They feature highly visible displays, good quality switches, alarm signal continuity checks and diode junction testing.

The 3207 is a basic multimeter and comes in an impact resistant case measuring 60 x 150 x 13mm (W x H X D). Mass is about 120 grams. With these specifications the tester is ideal for use in the field and fits easily into a shirt pocket.

The 3208 has the same features as the 3207 with the addition of a built-in scientific calculator. The overall dimensions of this model are 75 x 170 x 20mm (W x H x D). Mass is about 250 grams. This tester is ideal for design work particularly since the measured value can be transferred to the calculator, allowing calculations to be performed directly.

The 3209 is a larger instrument again, with tilting bail, BCD output and capacitance measurement and it is intended for use in the laboratory. Overall dimensions are 190 x 80 x 210mm, including knobs and feet. Mass is approximately 1kg.

The LCD displays on each meter are high contrast types and are visible over a wide range of viewing angles. Overrange indication is by means of a flashing "1" which is displayed at the most significant digit. Polarity indication is by means of a minus symbol, for negative voltages.

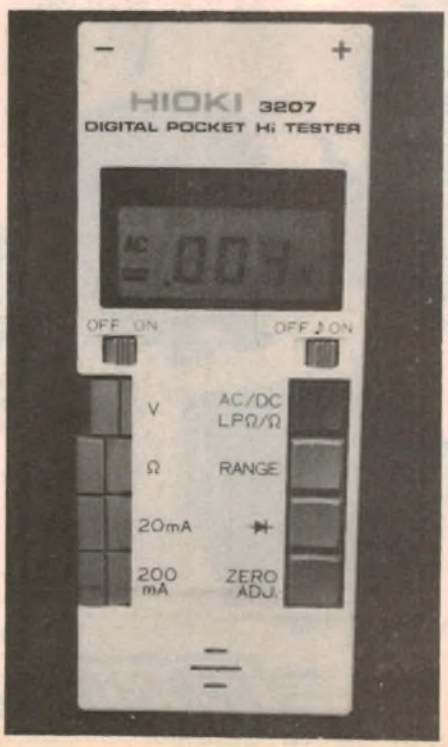
The function select switches on the 3207 and 3208 are similar to one another. They have four pushbuttons along the left hand side of the meter for selecting Volts, Ohms and either of 20mA or 200mA. These are easy to use with one hand and give positive action. Extra to these are the AC/DC, LP Ohms/Ohms; Range; Diode; and Zero Adjust momentary contact pushbutton switches.

The AC/DC LPΩ/Ω key switch allows selection of either AC or DC measurement when the Volts function is selected. At first switch on the display defaults to DC and Automatic Ranging. One push of the above mentioned switch will provide an AC measurement and AC is written on the Display. This also is Automatic Ranging. A second push of the switch will again provide DC measurement.

When the function switch is in the Ohms mode, the display defaults to Auto and Ohms. A push of the LP Ohms/Ohms switch will provide the Low Power selection. A further push of the switch will bring the measurement back to normal Ohms again. This Low Power Ohms is very useful for measuring in-circuit resistors, since the low current will not turn on any diode junctions which may affect the reading.

The Zero Adjust keyswitch allows the reading to start from zero from a particular value, for an offset reading, and can also zero the Ohms function selection.

The 3209 tester operates differently from the other two meters. Function selection is with front panel pushbutton switches and provides for AC/DC, Volts, Amps, Ohms, Capacitance and Diode test. Manual range switches select from Low, Medium and High ranges and displays the appropriate unit. In other words, mA, μA, nF and μF are displayed. No zero adjustment is available on the meter ranges except for the capacitance measurement, where the lead capacitance can be zeroed out by rotating a small plastic knurled knob called "C Adj".



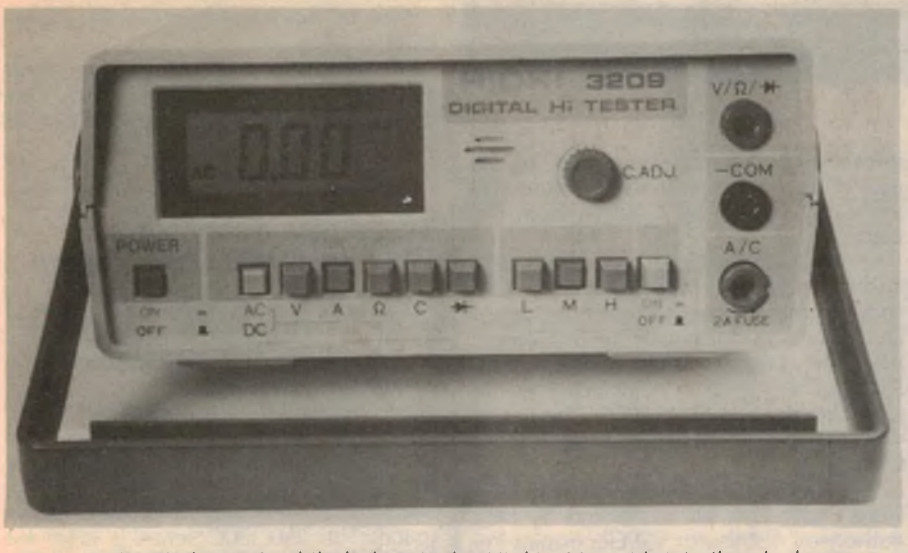
All the meters have an alarm for continuity checks. This is a useful feature allowing the user to check a circuit without watching the display. The response time for the alarm to sound takes over one second. The alarm also operates as an overload warning and function and range switch warning. Each of the meters have a different method of switching on and off the alarm feature. The 3207 has a slider switch, the 3208 a contacting plug within the battery compartment, and the 3209 a push switch.

Switching the meters on and off is done in all three meters with power on switches. The calculator on the 3208 however has an on and on/off switch on the display. This allows the calculator and meter to be operated independently.

The calculator of the 3208 is a powerful unit, which operates in algebraic arithmetic, rather than reverse-polish notation. Many functions are available and most keys serve more than one function. The "F" and "MODE" keys serve to allow a particular function to be selected. The display will show what mode the calculator is in, in other words an "M" on the display shows that a value other than zero is in the only available memory; DEG, GRAD, or RAD tells the operator what angle unit is in operation, and so on.

As well as the simple +, −, × functions, the calculator has x!; ln, log, sin, cos and tan and their inverses as well as several other functions. Statistical functions are available such as Standard Deviation, Mean Value summation, Sum of Squares etc. The calculator is an eight digit floating point system from 10 to the power 7, to 10 to the power −2 and has scientific notation from 10 to the power −103 to 10 to the power 104.

DC voltage ranges for the 3207 and 3208 are 200mV, 2V, 20V, 200V and 1000V on both the Auto Ranging and manual range. The AC voltage ranges are 2V, 20V, 200V and 600V. The 3209



Above is the Hioki 3209 while below is the Hioki 3208 with inbuilt calculator.

has AC and DC ranges of 200mV with auto ranges to 2000mV, 20V to 200V, and 200V to 1000V.

DC and AC mA ranges for the 3207 and 3208 are 200mA and 200mA. The Ohms ranges are 200Ω, 2kΩ, 200kΩ and 2000kΩ for the normal Ohms range and all are available for the LPΩ function except for the 200Ω range. The 3209 has AC and DC current ranges of 20/200mA, 200/2000mA and 2A. Ohms ranges are 200/2000Ω, 20/200kΩ and 2/20MΩ.

The capacitance ranges available for the 3209 meter are 2/20μF, 200/2000μF and 2/20μF.

Accuracy of the 3209 is quite good. Generally all the figures for accuracy are better than ±1% of the reading ±0.5% of full scale ±1 digit. The best accuracy is obtained on the Low DC V range at ±0.2% of reading ±0.1% full scale ±1 digit. Accuracy of the capacitance measurement is a little higher at ±1.5% of rdg ±0.5% fs ±1 digit on the low and medium ranges.

The 3207 and 3208 have very similar accuracy specifications which are considerably poorer than the 3209 meter. Generally the accuracy is better than ±1% of reading ±10 digits. Best accuracy is obtained on the DC V Range where ±0.7% rdg ±4 digits is specified.

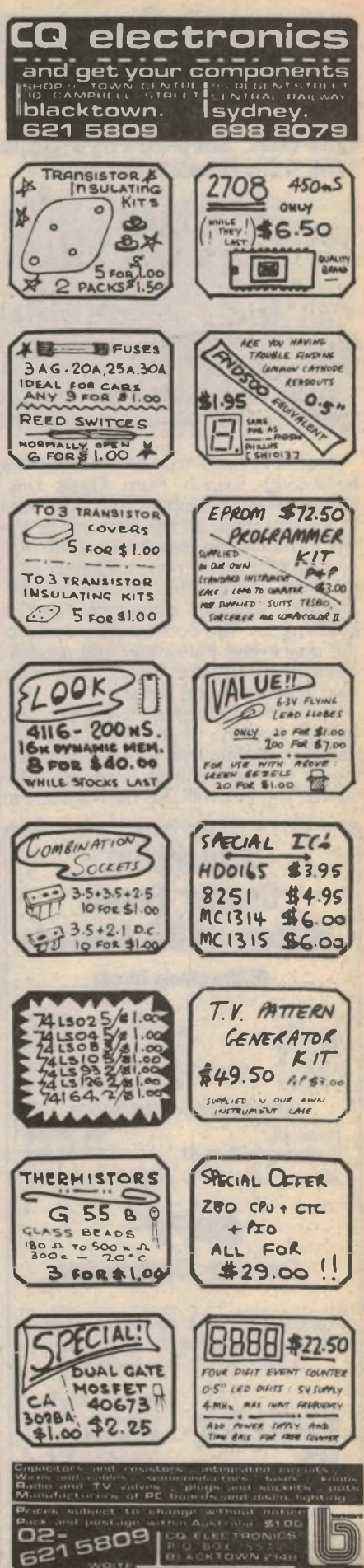
We checked the accuracy of the meters and found them to meet most of the specifications claimed. Each of the meters were consistent in their readings and showed similar results with all connected in series for a current measurement. The 3209 meter, under this test, demonstrated its superior accuracy.

We found the frequency response of the 3209 in the AC voltage range to meet the specifications of 40Hz to 20kHz in the Low range, up to 10kHz in the Medium range and up to 1kHz in the High range. With the 3207 and 3208, however, we could not duplicate the claimed 40Hz to 500kHz on the 2V range. The upper response was near 1kHz. We verified the 40Hz to 1kHz in the 20V range and 40Hz to 500Hz in the other ranges.

We also checked the "normal mode" rejection ratio of the DC voltage ranges. This term is a measure of the rejection ratio of AC voltages superimposed on DC. This was easily tested by using a transformer in series with a DC voltage reference. We noted no change in the DC reading of any of the three meters with the AC voltage impressed on the DC voltage, even though the peak AC voltage was as high as the DC voltage.

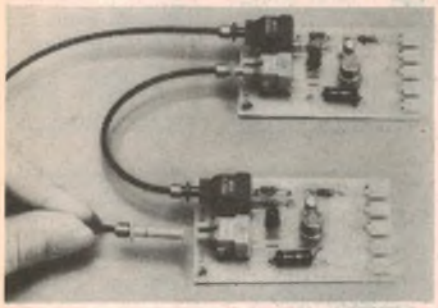
Overall, each of the meters represent a worthwhile instrument for their given application and deserve consideration when in the market for a digital multimeter.

Recommended retail price for the 3207 is $96 plus 15% tax where applicable, the 3209 is $169 plus 15% tax and the 3208, $283 plus 15% sales tax. Trade enquiries should be directed to H. Rowe and Co Pty Ltd, Unit 1, 127 Newbridge Road, Moorebank, NSW 2170. (JC)



New Products

Low cost, Snap-in, Fibre Optic Link from Hewlett-Packard



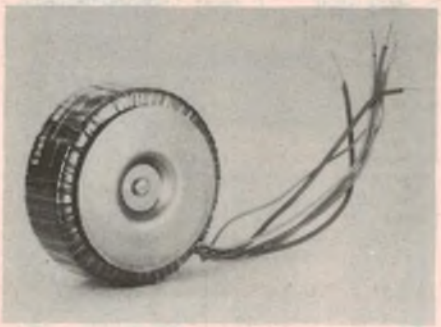
Hewlett-Packard has just released the HFBR-0500 Snap-in Fibre Optic Link. Hewlett-Packard supplies, in kit form and as discrete units, all the elements of the link including the transmitter, LSTTL/TTL compatible receiver, one millimetre core diameter plastic fibre in bulk or terminated lengths, connectors and a polishing kit. The connectors snap-in to the dual-in-line transmitter and receiver modules which are colour coded for field installation and repair.

The HFBR-0500 series Fibre Optic Link can be used for short length inter- or intra-system data links to solve common mode or high voltage isolation problems. The link will also have a place in educational organisations, due to its ease of interfacing with other circuits and the easily viewed light output from the cable.

Access is available to both the anode and cathode pins of the transmitter LED to allow the designer to optimise system layout and performance by implementing the proper drive configuration. Detailed information is included in the kit in Application Note 1009: "Designing with the HFBR-0500 series Snap-in Fibre Optic Link".

Priced at around $60, the HFBR-0500 Fibre Optic Link Kit is stocked by HP's authorised distributor VSI Electronics Pty Ltd, 21 Chandos St, St Leonards, NSW 2065.

Toroidal transformer for the Playmaster Mosfet Amplifier



Electronic Agencies has announced the release of a special toroidal power transformer suitable for use with the Playmaster Mosfet Stereo Amplifier. This transformer will be included in all kitsets of the new amplifier supplied by Electronic Agencies.

Manufactured in the United Kingdom by ILP Transformers, a division of the large Ian L. Potts electronic group, the toroidal transformer has a diameter of 106mm and a height of 50mm, including mounting washers.

The transformer is supplied complete with mounting kit consisting of a centre bolt, and two large steel and two neoprene washers.

Tested in a Playmaster Mosfet Stereo Amplifier, the toroid transformer produced essentially the same power output figures as those obtained with the Ferguson PF4361/1 conventional power transformer.

Noise figures were also similar to those obtained with the Ferguson, ie good. Lest it be thought that the noise figures should have been better with the ILP toroid, we should point out that the Ferguson transformer has a special copper shielding strap – similar to those installed in the majority of cathode ray oscilloscopes – to minimise stray 50Hz electromagnetic hum fields.

Price of the transformer is $44.90, including sales tax.

Our sample was supplied by Electronic Agencies, 115-117 Parramatta Rd, Concord, NSW, 2137. Telephone enquiries to (02) 745 3077.

Three new dual-colour LED indicators from Philips

Data sheets on Dialight's new types of "bicolor" LED indicator lights are now available from Philips Electronic Components and Materials.

Each of the LED indicators described incorporates a red and green chip in a single package, effectively doubling the amount of information that can be displayed for the same amount of panel space. The 550-3000 Series is ideal for PCB mounting; the 559-3000 Series snap-in mount, for use in communications equipment, computers and instrumentation; and the 521 Series are for use on PCBs and for panel mounts, with Model 521-9177 serving as a polarity indicator.

Detailed product descriptions and applications are provided in each data sheet, along with product photograph, schematics, tables of operating characteristics and table of absolute maximum ratings.

All three data sheets are available by writing or calling the Sales Department. Philips Elcoma, 67 Mars Rd, Lane Cove, 2066. Phone: (02) 427 0888.

Natron multi-colour digital panel meter

Tecnico Electronics has introduced the Natron CDPM mulit-colour digital panel meter which has been designed to give clear and quick indications of readouts above or below preset limits. In addition, facilities are provided for adding an external audio alarm which will sound when colour changes occur.

The CDPM has all the features of conventional DPMs, but in addition changes

the colour of the digits displayed at desired input levels. These levels are adjusted by trimmer potentiometers, accessible by removal of the snap-off bezel. Standard colours are green, yellow and red. The sequence of colour changes can be arranged to specified requirements and other colours can be substituted on request.

Sensitized Copper Board Riston 3000 Coated

(Fibreglass Base)

	Single	Double
36 x 24	$45.00	$57.00
24 x 18	$22.50	$30.00
18 x 12	$12.50	$16.00
12 x 12	$ 8.00	$10.75

OTHER SIZES ON APPLICATION

Developer $4.25 litre
Concentrate (1 = 4) $9.50 litre

All plus 15% ST & Freight if applicable

APF

Colour Computer

Full business and games capability.
Console Monitor Power Supply.
$865 + ST if applicable.

KALEX

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Heidelberg 3084
(03) 458 2978
Telex AA 37678
MELTON
(03) 743 1011

ELECTRONIC COMPONENTS & ACCESSORIES
● SPECIALIST SCHOOL SUPPLIERS

NEW!

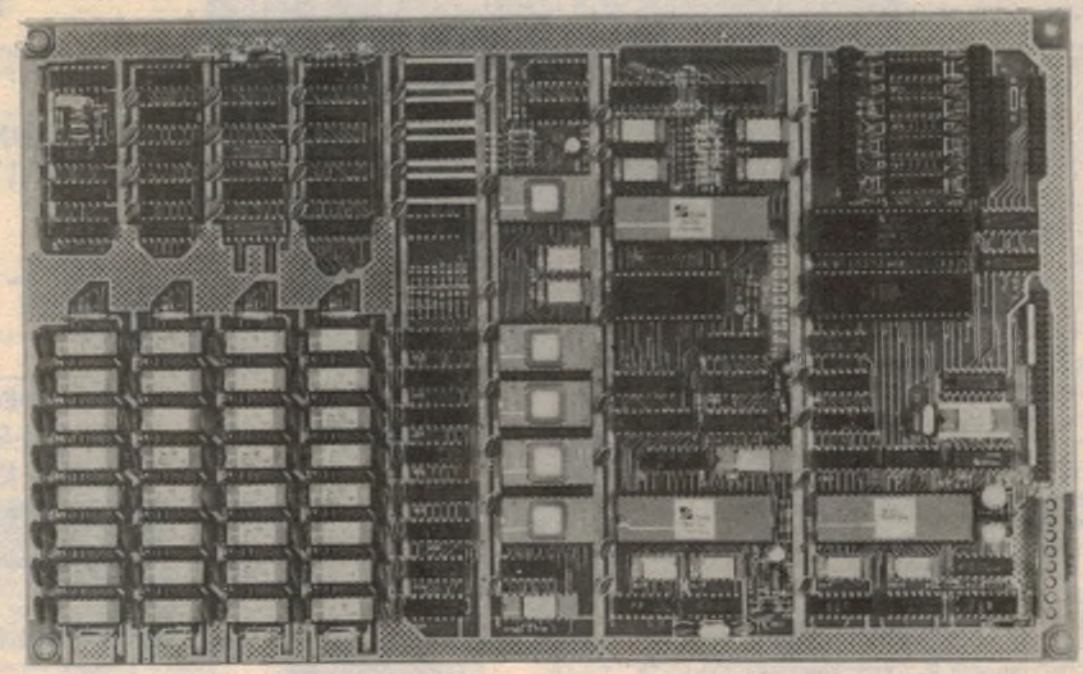
"THE BIG BOARD"

OEM - INDUSTRIAL - BUSINESS - SCIENTIFIC

SINGLE BOARD COMPUTER KIT!

Z-80 CPU! 64K RAM!

NEW!



THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure; and you have a total Business System for about 1/3 the cost you might expect to pay.

$695.00 (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN
SAME AS AN 8 IN. DRIVE
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user. our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $95

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $45

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter or Real Time Clock. Set of all parts: $25

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. modified by MICRONIX SYSTEMS to run on Big Board is available for $150.00

TERMS CASH CHEQUE OR BANKCARD (MIN $100 DEP)

ALL PRICES PLUS TAX IF APP

REGISTERED PACK & POST $5.00

Bankcard Mail Orders Welcome

Please debit my Bankcard

Bankcard No .....

Expiry Date .....

Name .....

Signature .....

RITRONICS WHOLESALE

425 HIGH ST., NORTHCOTE VIC

481 1923 489 7099 PO BOX 235

Copy of manual and assembly instructions $15. Refundable on purchase of board. Photocopy exchanged for original. Delivery ex stock.

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

RESISTORS

150 ohm, 5W	20c
10 ohm, 5W	20c
47 ohm, 5W	20c
12 ohm, 3W	20c
2.5 ohm, 3W	20c
33 ohm, 3W	20c
8 ohm, 10W	25c
4000 ohm, 10W	25c
100 ohm, 5W	20c
330 ohm, 10W	25c
220 ohm, 5W	20c
5 ohm, 5W	20c
220 ohm, 10W	25c
950 ohm, 3W	20c
115 ohm, 5W	20c
10 ohm, 5W	20c
1k ohm, 5W	20c
5000 ohm, 5W	20c
6.8k ohm, 3W	20c
3300 ohm, 10W	25c
6800 ohm, 10W	25c
1500 ohm DUAL, 21W	50c
50 ohm, 5W	20c
330 ohm, 5W	20c
1k ohm, 5W	20c
820 ohm, 5W	20c
12 ohm, 10W	25c
470 ohm, 7W	20c
4700 ohm, 4 5W	20c
5000 ohm, 10W	25c
8.2 ohm	5W
3.3K	7W
27 ohm	5W
10K	7W
2.5 ohm	3W

CAPACITORS

0.0039uF, 1500V	20c ea
6N8, 1500V	20c ea
0.0068uF, 1500V	20c ea
1200PF, 400V	10 for $1
0.068uF, 400V	5 for $1
2200PF, 630V	10 for $1
0.47uF, 250V	10 for $1
0.10uF, 400V	5 for $1
0.082uF, 160V	10 for $1
26k, 250V	10 for $1
0.041uF, 400V	10 for $1
0.033uF, 250V	5 for $1
0.027uF, 100V	20 for $1
220uF, 10V	10 for $1
1uF, 350V	10 for $1
470uF, 40V	5 for $1
1000uf, 16V	25c
2.2uF, 200V	10 for $1
0.047uF, 1500V	50c
47uF, 25V	4 for $1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF, 63V	$1
0.47uF, 400V	50c
680K, 250V	25c
012, 250V	25c
15NF, 250	10c
120K, 250V	20
10uF, 315V	25c
0.056, 250V	10c

Slide Pots

250K-50K	3 for $1
Dual 500K	3 for $1
1 Meg	3 for $1
2 Meg	3 for $1
Including Fancy Gold Knobs	
25K dual	2 for $1

SPECIAL

100 mixed resistors, all useful	$2
100 mixed capacitors, fresh stock	$2

AUDIO LEADS

3.5m to 3.5m, 7ft	75c
3.5m to 6.5m, 7ft	75c
6.5, 7ft	50c

MICRO SWITCH

5A, 250V AC	75c ea

TUNING CAPS

2 and 3 gang	$1 ea.
Min 2 gang	50c

FUSES

0.5A, 2A, 3.25	10 for $1
In line fuse holders	30c
RCA jack plugs and sockets	40c pair
1A, 10 for	$1

SPECIAL TRANSISTORS

AD 161-162	$2.50 pr
BSC 901A	$1.50 ea.
BC 548	10 for $1
AD 149	$3 pr
OC9554	50c
BD202N	50c
BD135	50c
2NC055	$1

ELECTROS

470uF, 25V	5 for $1
400uF, 10V	5 for $1
47uF, 63V	5 for $1
350uF, 16V	2 for $1
27uF, 160V	5 for $1
25uF, 63V	10 for $1
22uF, 160V	10 for $1
47uF, 16V	5 for $1
47uF, 200V	5 for $1
220uF, 10V	10 for $1
68uF, 16V	10 for $1
100MFD, 350V chassis mount	$1

- Telescopic aerials, $1.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, $5
- Line output transformers, 1200 to 3/ohm, 5 watt, $1
- Power supply units, filtered, 240 to 20 volt, $12

Power leads 240 volt, suit most tape recorders, radios, etc. $1 each.

TV Stick Rectifiers 20SC, $1.00.

Philips Colour TV Convergence Boards, $3 each.

455KC IF Transformers for valve radios, $1 each. Also aerial and OSC coils, 75 cents each.

POTS ROTARY

½ Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7.500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/Ohm	50c
½ or 1 Meg Switch	50c
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K, 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

HOR Drive 3021 transformers for colour TV $2
TV Colour Convergence Units 11270.44 x 6 ..... $3

PILOT LIGHTS

Screw in 6.3V	10 for $1.50
24V	10 for $1.00
Pilot light holders	$1.50

- Car radio suppressors, 3 for $1
- 3 position slide switch, 50c
- Toggle switches, 25c
- 2 position push button switch, 50c
- 6 position push button switch, $1
- 4 position push button switch, 75c
- Transistor ear plugs & leads, 3 for $1
- In-line fuse holders, 4 for $1
- 4 pole 2 position rotary switches, 50c

Pick up Cartridges BSR universal type Ceramic Stereo $5
Audio Technica AT6 diamond stylus stereo $12

DIODES

OA 626	4 for $1.00
OA 662	4 for $1.00
EM 410C	4 for $1.00
DS 150A	50c
DSY 130YO	50c
OA 636	50c
HR 15	50c
Diodes BYX 55, 300	30c
BY 188	30c

STEREO AMPLIFIER SOLID STATE 5 watts RMS per Channel $25

PP NSW	$1.50
Interstate	$2.50
WA TAS	$3.50

Special: 100 mixed capacitors, fresh stock, all useful. **$2.00**

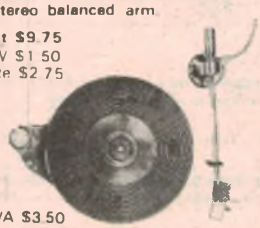
SPEAKER SPECIALS

15 ohm 4" — 2 for $2
5x3 15 ohm 2 for $2
6x9 15 ohm $5 each
5x7 15 ohm $4 each
8x4 15 ohm $4 each
6x4 15 ohm $3 each
5" 3.5Ω or 15 ohm $3.50 each

SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm.

240 volt $9.75
PP NSW $1.50
Interstate $2.75
WA $4



$250 WA $3.50

Miniature speaker and drive output transformers ..... $1 pr

Special mixed tag strips ..... 10 for $1

24V MOTORS

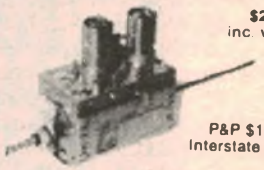
Reversible

Only $2.50 ea.

SPEAKER SYSTEMS

Inc one 6 x 4 speaker, 5W RMS, $4.75 ea. P&P: NSW $1.80, Interstate $2.80, WA $4. (For singles or pairs.)

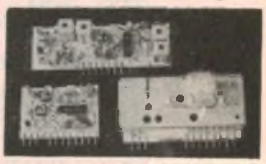
TV TUNER VALVE TYPE



$2.50 inc. valves

P&P $1.00
Interstate $2.50

SUPER SPECIALS
FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY $22
P&P $1.00

TRANSISTORS

2N3055	$1.20
SE1002	4 for $1
BF459	50
B544 DE6	50
C106 F1	50
TIP 110	50
608EK	4 for $1
BCS54813	10 for $1
2SB186	50
2SA101	50
BD263	50
BSB405	50
2SB77	50
2SB303	50
AC187	50

VU & BALANCE METERS

STEREO VU **$3.00**

12Kn 100uA **$2.00**

PHILIPS TV TUNERS

Transistor NT3024, NT3032, Colour — P&P $1.

$10 ea.

New Products

For further information contact Tecnico Electronics PO Box 520, Clayton, Victoria 3168.

Solar panels — Amtex is agent for Photowatt

A new solar energy company, Photowatt International Inc, has recently been formed by the solar division of Sensor Technology Inc, USA, and a subsidiary of the French firm Compagnie General d'Electricite (CGE). The company has already started solar cell production from a new factory in Phoenix, Arizona.

Sensor Technology is heavily involved in several US government-funded solar energy development programs. In the past three years, the company has manufactured about 7000 solar panels, mainly for use in navigational aids.

Local agent for Sensor Technology Inc is Amtex Electronics, who advise that they will also be handling products for the new company. Good stocks are held in Sydney, and include five different panel sizes and five cell sizes.

For further information contact Amtex Electronics, 73 Archer St, Chatswood 2067 (see advert p113 this issue).

Solderless breadboarding system

A.P. Products Incorporated of the USA has introduced a modular breadboarding system called "Hobby-Blox", which can be used for both simple projects by beginners as well as more advanced projects up to professional level.

Hobby-Blox consists of a range of compatible plastic trays and modules, constructed from an acetal copolymer. A standard tray measures 79mm wide × 160mm deep, and accepts 70mm wide modules which are "keyed" to slide into the trays.

Trays are moulded so that they interlock side-by-side, while accessory "extender clips" are available to allow trays to be attached end-to-end.

Buss strips, 12.7mm wide × 160mm deep, provide two rows of 60 continuous tie-point terminals for power and ground distribution. These may be interlocked together and/or between adjacent trays.

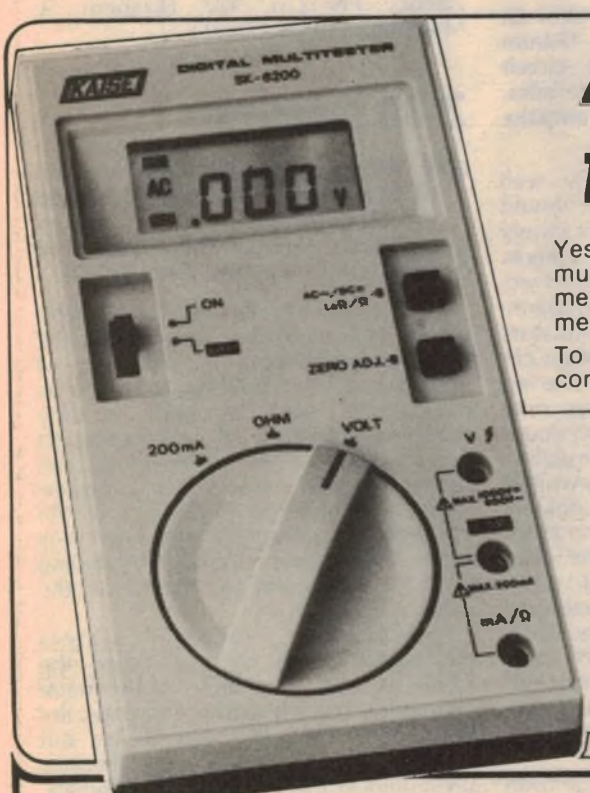
A wide range of compatible modules is available and includes terminal strips with 0.1 inch spacing suitable for DIPS, "side-to-side" continuous distribution strips, discrete component strips for larger items, binding post strips, 9V battery holder strip etc. All these modules

are intended for solderless connections.

The Hobby-Blox system provides for a vertical tray (accepting the abovementioned modules), which "keys" into a standard horizontal tray. Also available are three vertical modules intended for (1) a 50mm loudspeaker, (2) a switch and indicator panel, and (3) a blank panel which can be cut or drilled as required.

A.P. Products make available two "starter packs", one for discrete component projects, the other for integrated circuit projects. Each starter pack includes a tray, several Hobby-Blox modules and an illustrated booklet which contains 10 projects with instructions for assembly.

Our samples were supplied by Radio Despatch Service of 869 George St, Sydney, NSW, 2000 [phone (02) 211 0816]. National distributor is Xenitek Pty Ltd, 10 Wattle Rd, Brookvale, NSW, 2100.



Auto ranging for $69.50!

Yes, the convenience and precision of an auto ranging digital multimeter is now within the reach of everyone. These four new meters cover virtually all general purpose needs, and offer precision measurement in a compact, rugged and highly usable package.

To operate, all you do is select volts, ohms or milliamps, and connect the probes—the unit does the rest!

Model SK-6200 features:
- 20 ranges
- Auto ranging in all modes
- Auto polarity indication
- Single button zeroing
- Overrange indication

$69.50
+ tax if applicable

Convenient audio continuity test & overload indication
No more waiting for the display to settle when you're checking continuity! When the probes are connected across less than 19 ohms in the ohms range, a tiny buzzer sounds to indicate continuity.
Model SK-6100 ***$108.00*** + tax

Full 10 Amp AC/DC current ranges
These two models are identical to the SK-6200 and 6100 respectively, with the addition of 10A AC and DC current ranges.
Model SK-6220 ***$79.50*** + tax
Model SK-6110 ***$118.00*** + tax

Imported and distributed by:
Standard Components Pty Ltd
10 Hill St Leichhardt N.S.W. 2040
Telephone: (02) 660 6066

available from:
N.S.W. Radio Despatch Service; David Reid Electronics; Emtronics.
Victoria Ellistronics; G.B. Telespares; David Reid Electronics; ECQ Electronics; J.H. Magrath & Co. Pty Ltd. **W. Australia** Reserve Electronics
Queensland Audiotronics; ECQ Electronics; St Lucia Electronics.
South Australia Bee Jay Electronics. **Tasmania** George Harvey Electric, Launceston.

Books & Literature

PASCAL, large and Tiny

PASCAL, by David L. Heiserman. Published by TAB Books 1980. Soft covers, 350 pages, 130mm x 209mm, illustrated with Pascal programs and flowcharts. Price $12.50.

The growing popularity of PASCAL as a computer language on both mainframe computers and microcomputers can be gauged by the large number of PASCAL manuals being published. So this book is not unique, but it does differ from other PASCAL manuals in that it discusses Tiny PASCAL and in particular, the Microsoft version designed for TRS-80 computers.

While standard PASCAL is available for microcomputer systems it usually requires a minimum of 32K and two disk drives, ie a CP/M system. Since this is beyond the means of many programmers, a scaled down version called Tiny PASCAL was written in 1978 by two graduate students at the University of Illinois. A summary of their language was published in BYTE magazine and since then Tiny PASCAL compilers have been written for the North star and TRS-80 computers. Typical system requirements for Tiny PASCAL are 16K of RAM and a cassette interface.

The author explains PASCAL in much the same way as in other introductory microcomputer texts, such as BASIC manuals. Starting with a step-by-step discussion of how to load the PASCAL tape. He then goes on to show how to compile sample programs, then run and edit them. The next chapter introduces syntax diagrams, which are a simple graphical method of showing the structure or syntax of the language. This is then used to explain how simple PASCAL programs can be written.

Each new PASCAL feature or command is introduced as it is needed in the following chapters starting with WRITE and READ, then arithmetic expressions, IF THEN ELSE, REPEAT UNTIL, WHILE DO, FOR TO DO and so on.

There are a large number of PASCAL program listings to illustrate various points and give the reader a real "feel" for the language.

Many of the programs also have entertainment value like "Russian Roulette", "Hangman", "Headlines", "Space Ranger", and so on.

Differences between standard PASCAL and Tiny PASCAL are also mentioned. To name a few: Tiny PASCAL also provides MEN and INKEY functions to make it more compatible to the microcomputer environment; on the debit side Tiny PASCAL only has integer variables, one dimensional arrays, and does not have such features as pointers, records, constants, type declarations or sets; – this of course is a limitation of the Tiny PASCAL language, not the book.

If you have MicroSoft's Tiny PASCAL running on your system, or if you are considering adding it, then we can highly recommend this book. It certainly covers every aspect of the language in an easy to follow style, and the wealth of programming examples and computer dialogue should be a great help. (R. de J.)

Cooking without water

IC ARRAY COOKBOOK: by Walter G. Jung. Soft covers, 200 pages, 152mm x 228mm, illustrated with circuit diagrams and device characteristics. Published by Hayden Book Company Inc, USA, 1980. Price $10.00.

IC arrays are not particularly well known in the hobbyist field so we should first explain that these devices are simply an array of active IC circuit components such as transistors, diodes, zeners ec. The devices are uncommitted, ie the individual connections to the transistors etc are brought out so that custom circuits can be built up as required. The important advantages of IC arrays over discrete transistors etc is the high density, matched specifications and flexibility.

The author, Walter G. Jung has written a number of other "Cookbooks", notably on IC timers and opamps and this latest cookbook is written in the same clear and practical style. He starts out with a discussion of the basic construction of NPN and PNP IC transistors and their characteristics, eg the variation of GBW and Hfe with collector current, input offset voltage, breakdown voltage and matching of Hfe and Vbe between transistors on the same array.

In the next chapter the common elements of IC circuits are discussed such as constant current sources, eg zener biased, current mirror, Wilson and logarithmic current sources. Also discussed are zener diode regulators, "amplified" zeners Vbe multipliers, bandgap voltage references, level shifters, differential amps and composite stages. All these topics are clearly explained with circuit diagrams and simple formulae. It's worth noting that these topics are unique to integrated transistors because they rely on the close matching of Hfe and Vbe which is typically better than 10%.

Chapter three completes the first of two sections of the book and is actually a mini-catalog, listing the various arrays available. There are, for example, general purpose arrays containing three independent NPN transistors plus a differential pair, high current arrays with independent transistors or common collector or common emitter arrays, differential amp arrays, high frequency transistor arrays and diode arrays.

Section 2 of the book covers the application of IC arrays with individual chapters devoted to Voltage regulator; reference and power supply circuitry, Amplifier Circuit Techniques, Oscillators, Logic stages and Miscellaneous Circuits. While I would have to question the usefulness of IC arrays in some applications, such as regulated power supplies, and logic circuits, many of the circuits presented are at least interesting from a design point of view.

All together the subject is well covered and the numerous circuits and simple design information also make this book of general interest. Our review copy came from McGill's Authorised News Agency Pty Ltd, 187 Elizabeth St, Melbourne, 3000. (R.deJ.)

Z-80 Design

Z-80 MICROCOMPUTER DESIGN PROJECTS by William Berden Jr. Published by Howard Sams & Co of Indianapolis, Indiana. Soft Covers, 208 pages, 280 x 215mm. Price $17.50.

This is another in a series of books written by William Barden. Considering the author's background in the field of education and computing, it comes as no surprise that this book is very readable and above all, informative. Its major objective is to introduce the reader, whether he or she be a professional or hobbyist in electronics, to the concepts of computers, and how they work. This is done by gradually building up a working computer based on the popular Z-80 CPU.

The working computer system developed in the book is called the EZ-80. Using a simple home-made keypad and seven-segment display, the computer allows the user to try out almost all of the ideas and theories presented in the book. Several applications are also talked about, some of these requiring a few additional components in order to get them up and running. So much for that, now let's take a look at the book itself.

Starting with a complete breakdown of a computer system, the first chapter introduces the reader to the concepts of a CPU, computer memory, firmware, software and binary notation. The chapters that follow go on to discuss the architecture of the Z-80 and some of its signal characteristics. The other features which are covered are the input and output (I/O) of the system.

The Z-80 instruction set is covered quite thoroughly, together with the different addressing formats. The next few chapters deal with the constructional aspects of the EZ-80, the programming of the EPROMs for the monitor software, the construction of an EPROM programmer and finally a full diagnostic run on the machine.

The final nine chapters present a number of projects using the EZ-80. Each chapter outlines the idea of the project, provides details on any additional hardware that may be required and then discusses the software routines used.

Some of the projects described are; a microcomputer educator, a combination lock, a morse code generator, a telephone dialler, and a music synthesiser.

All in all I feel that this is a very worthwhile book for any person with even only a passing interest in the workings of computer system.

The review copy came from McGills Authorised Newsagency, 187 Elizabeth Street, Melbourne, 3000. (G.C.)

Basic Electronics

ELECTRONICS — BUILD AND LEARN. By R. A. Penfold. Stiff paper covers, 104 pages, 207mm x 135mm, illustrated by diagrams and pictures. Published 1980 by Newnes Technical Books. Price in Australia $8.00.

As distinct from a theoretical course in electronics, this book by R. A. Penfold puts the reader straight to work with scraps of wood, hardboard, and a collection of electronic bits and pieces. The object (a) is to get the reader started with hands-on experience and (b) to build a demonstrator with which he/she can probe the characteristics of components yet to be encountered.

It will, of course, involve some outlay over and above the cost of the book.

Thereafter, the reader is introduced to passive components, semiconductor devices, operational amplifiers, oscillator and radio circuits, and pulse and logic circuits. The intention is that they should be set up and made to work in the demonstrator. Circuits and some are given with that end in view.

The book is not intended as a substitute for a conventional study course, but it should provide excellent back-up assistance, giving substance to what otherwise might be pure theory.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (W.N.W.)

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PHILIPPE ENTREMONT: "An attractive recital . . ."

DOHNANYI — Variations on a Nursery Song.
STRAUSS (Richard) — Burlesque for Piano and Orchestra.
LITOLFF — Scherzo from D Minor Piano Concerto. Phillipe Entremont (piano) with the National Philharmonic Orchestra conducted by Otto Kamu. CBS Stereo Masterwork SBR236015.

Many readers will remember Entremont's visit quite a few years ago. Then he was an elegant young Frenchman given to technical exhibitionism which took the form of playing fast passages at almost incredible speed, without always paying full attention to striking the right notes!

According to his homely picture on the record sleeve, he has now fattened up a little and is the proud father of a handsome young boy photographed with his arm affectionately round his father's shoulder. His playing nowadays has also matured considerably. He still plays fast passages, very fast indeed, but is more particular about hitting the right notes.

He presents an attractive recital of works that were popular about the time he visited here and, although they may have aged a bit, they are nonetheless still very enjoyable to listen to, when played as well as is done here.

It is so long since I heard Dohnanyi's Nursery Rhyme Variations that I had forgotten just how enjoyable the work could be to hear once again. It is a witty piece, the "Twinkle, Twinkle Little Star" tune dropping with refreshing innocence out of a formidable introduction that promises things of much greater weight.

From there it goes through a series of most ingenious variations, encompassing many different forms and finishing with a noble chorale, before it again regales us with its simple little origin.

Despite his retention of his formidable technique, Entremont plays it admirably even if, in doing so, he is a little straitlaced. He just fails to capture all the work's humour, although he does manage to get some of it into his reading. He makes it sound brilliant but very easy — no mean feat — and the

work is still full of pleasant surprises especially if you, like me, haven't heard it for some time.

Also on his program is Richard Strauss' early piano-orchestral piece Burlesque, which I used to like very much indeed but which now sounds a bit on the long side. Characteristically, Entremont plays it brilliantly, although it lacks a little in brio. But the orchestral part is not so satisfying, especially the recording of the timps. They play a very important role in the work but often don't sound in the proper pitch, producing just a few dull thumps from time to time. Otherwise it goes well enough.

The final work, the well known scherzo from Litolff's D Minor Piano Concerto goes really brilliantly. This is a piece that pianists seem to choose, competing with each other to discover who can play it the fastest! I would nominate Entremont an easy winner. It flashes through at tremendous speed although every note is accurately struck and is beautifully clear of its fellows on either side. It is a superb example of sheer virtuousity at its best. (J.R.)

NORMA (BELLINI): "A fine recording"

BELLINI — Norma. Complete Opera. Renata Scotto (Norma); Giuseppe Giacomini (Polliono); Tatiana Troyanoa (Adalgisa); Paul Plishka (Oroveso) with the Ambrosian Chorus and the National Philharmonic Orchestra conducted by James Levine. Columbia Stereo Masterworks 79327.

Make no bones about it, this is a fine recording of Norma despite its occasional shortcoming. Its greatest merit is due to Renata Scotto's realisation of the grandeur, nobility, yes, and even tenderness, which are all expressed more movingly than in the performances of the recent great Norma's I've seen live.

These include Sutherland and Callas. The latter was in Paris, with Callas in poor form and singing — it was announced before the curtain — against doctor's orders. Shortly afterwards, she retired.

Scotto's is a truer realisation than either of these rivals'. That it has not the perfection one seeks, usually unsuccessfully, in performers of the role, is due to the fact that her voice has developed an irritating vibrato at times, and a tendency to shrillness in the top register. (For that matter Callas, even at the peak of her career could shriek her top notes disturbingly in her best stage performances and studio recordings.)

One feels that Scotto's technique remains unimpaired and that it is only the instrument she is using that doesn't quite measure up to its user.

Goodness only knows, there is so little true bel canto about nowadays, compared to Bellini's time, that only the merciless would condemn her for her gallant try. I can't think of any other soprano making a more moving appeal in the role today.

Even in the composer's day, the merits won in singing (bel canto) were often compromised by the acting which, in the main, consisted of a few operatic acting cliches, futile when not hilarious!

But, just as the recording picks out Ms Scotto's shortcomings, it is no kinder to others in the cast. The principals sing beautifully at times, but there are moments when their failings in this faithful recording are as if viewed under a microscope.

The Adalgisa (Tatiana Troyanos) sometimes displays the extreme vibrato

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

of a Russian female singer, though she too has her moments.

Amongst the men, tenor Giacomini stands out with a fullness of tone often reminiscent of a baritone. Don't forget that some of the greatest tenors started as baritones, especially with the great Jean de Reske in mind. At any rate, Giacomini's voice has plenty of good quality weight behind it, without betraying true Italian style.

On the other hand Plishka is not ideal in a typical Italian role, although his singing is expressive enough. The chorus is good, which is more than can be said about the performers in the minor roles and the orchestra is good but obedient to Levine's rather too bellicose direction.

Bellini doesn't work best that way. A little more smoothness and a trifle less dominance is the key to Bellini's simple but effective scoring, both for voice and orchestra. This is a good set, although its rivals will be worth a hearing before making a final choice. (J.R.)

☆ ☆ ☆

BALAKIREV — Thamar (Symphonic Poem).
GLAZUNOV — Stenka Razin (Symphonic Poem).
RACHMANINOV — The Cliff. Original Melodya issued in Australia to members of the World Record Club. Stereo. WRC — R06391.

I have been waiting for a good recording of this opulent Eastern symphonic poem for many years. The only one I have had is the old mono version by Ansermet and the Swiss-Romande (Decca) put out in the very first days of LP recording.

Diaghileff used the music for a story ballet about a beautiful princess living in a lonely castle in the Caucasus Mountains. She would lure aristocratic (rare) passers-by to enter by waving a silk scarf — a la Tristan — out of a turret window, make love to them, then stab them and throw their bodies down a waterfall at the back.

This ballet was something like the story Balakirev had in mind when he wrote the work but Fokine adapted its every gesture marvellously for the ballet. When I was very young it was one of my favourites.

Balakirev, most of whose music was of fine quality — although nowadays neglected — had an important role. He was the founder of the "Famous Five" — the nationalistic school of Russian composers who, in the middle of the last century, comprised such figures as Mussorgsky, Rimsky-Korsakov and Borodin. An occasional bar reminiscent of Rimsky's Scheherazade, in Tamar, illustrates the relationship between the two composers.

The old Decca was miserably recorded according to modern standards and the present one, under review, is better. Svetlanov gives a more luscious reading than did Ansermet who, by the way I heard conduct it for Diaghileff back in the late 1920s.

But, excellent as the rest of the Svetlanov version is, I found three passages that disappointed me and which I had waited to hear for so long.

In the score, there are three magnificent climaxes in which the brass play a blood-tingling role. In this recording, all three passages are obscured by the rest of the orchestra and the result is a disappointing blur. Otherwise, it is a good performance, although the original Russian Melodya engineering is nothing to rave about.

On the reverse side is Stenka Razin. Diaghileff's usual program consisted of three short ballets separated by an unusual — for the period — orchestral piece. On the Tamar program it was usually Stenka Razin and the conductor of this used to be the young Eugene Goossens. It receives a respectable reading here, the conductor mercifully keeping down the quotation from the Song of the Volga Boatmen. The fill is a very acceptable reading of Rachmaninov's The Cliff, usually translated as The Rock. (J.R.)

☆ ☆ ☆

SAINT-SAENS — Piano Concertos Nos. 2 and 4. Philippe Entremont (piano) and the Capitol Orchestra of Toulouse conducted by Michel Plasson. CBS Stereo Masterwork SBR236017.

Entremont figures again on this disc in a stylish account of two Saint-Saens' Piano Concertos. Apart from the soloist's performance which at all times occupies the attention of the listener, I was surpised at the excellence of the provincial Toulouse Orchestra. Toulouse is not a great city, just an average large French town best known for the miracle of its cassoulets — the memory of which after many years still seems to linger on my palate. I have eaten many elsewhere but nothing like those of Toulouse, even at Carcasonne.

But I must revert from my greed to the music of that old Chauvinist Saint-Saens, against whom the accusation of mediocrity can still be applied. It shows up here in an always exquisite workmanship in two amiable concertos, undistinguished except for the brilliant Scherzo in the G minor, which still re-

THE RITE OF SPRING . . .

"Impressive if you like the music"

THE RITE OF SPRING, Stravinsky. Lorin Maazel and the Cleveland Orchestra. Stereo mastered digital, Telarc DG-10054. (From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone 07 343 1612.)

This much-recorded orchestral spectacular is a natural choice for display on Telarc's digitally sourced label. There are periods of whisper quietness, possible only because of the minimal noise level; there are tonal complexities which need the low intermodulation character of the system; there are poundings on drums so persistent and so vivid that I expected other members of the household to match them at any moment by poundings on the door of the listening room.

The regular Telarc double-fold jacket introduces the conductor, the orchestra and the system but allocates most of the space to the composer and the work — originally a ballet score but more commonly now a concert performance dramatising ancient Slavonic fertility rites.

As to the performance, it is sufficiently recent for not many reviewers to have sorted out their reaction in relation to something like twenty other performances sprinkled through the record catalogues. (What one person can keep track of that many?)

Sufficient to say that David Ranada in "Stereo Review" has criticised Maazel for a tendency to turn Stravinsky's "mechanistic and fragmented" music into a kind of "Debussy with a beat". It seems likely however that Maazel may have done so quite deliberately and that many will prefer his reading on that very account.

However, the same critic concedes that the recording is technically outstanding — the best yet of the work — and that the total effect is tremendously effective — a "must hear" disc!

Whether you like the music is a personal matter but, sonically, the uncluttered acoustics of the Cleveland's Severance Hall, the uncomplicated mic placement, the complete absence of console knob twiddling, and the recording system, add up to a most impressive disc. (W.N.W.)

tains its popularity as a solo excerpt. It still has the capacity to make an old admirer like me move to its beguiling rhythm.

I admit that Saint-Saens' writing – at least much of it – suffers from what the late Donald Tovey so wittily described as showing "lack of inexperience". But he has written some memorable melodies. What about Softly Awakes my Heart from Samson and Delilah? And he seldom put a foot wrong when he came to the unadventurous style of his period, an attitude which infuriated his juniors.

The recording is a little more forward than his Dohnanyi variations and is all the better for it. The Dohnanyi etc, was recorded in London last year, the Saint-Saens Concertos in Toulouse nearly four years ago. Both discs will be enjoyed by those who can still appreciate clean workmanship by the composer, spirited orchestral playing and stylish solos. (J.R.)

☆ ☆ ☆

MOZART: Piano Concertos No. 14 in E flat major, K.449 and No. 26 in D major, K.537 ("Coronation"). Tamas Vasary, piano and conducting the Berlin Philharmonic Orchestra. DG stereo disc 2531 207.

This is a disc of surprises; in the first place, I had known of Vasary only as an interpreter of 19th-century works, particularly as an outstanding Chopin player – I hasten to say that his Mozart readings are exceptionally fine. Also, it is some time since I've heard the Berlin Philharmonic directed by anyone other than Karajan, let alone directed from the keyboard; their response is all one could wish for and Mr Vasary must have found their co-operation very heartening indeed.

K.449, the first of six concertos Mozart was to write in 1784, is quite rarely heard; the only first-rate performance of recent years was Brendel's and his approach to Mozart is so utterly different from Vasary's that no question of any comparison can arise. Yet, they are equally valid interpretations and I cannot really arrive at any preference for either one. I am especially taken by the lyricism attained by Vasary in the Andantino and by the cadenza he has devised for the finale. His sensitive pianism never lets him down and his control of the orchestra is firm, yet delicate.

The "Coronation" concerto, despite its promising title, is very poorly represented in the catalogue and has not, as far as I know, been recorded by Brendel as yet; probably the best relatively recent issue was of the Barenboim reading which had a mixed reception. Vasary's interpretation, both as soloist and as conductor, plus as author of all the cadenzas and many minor embellishments is first-rate in every respect; as Mozart did not complete the details of the solo part in his manuscript, this work gives much scope to a musicianly pianist, such as Vasary. The only thing to be added is that the orchestra performs beautifully and the recorded sound, throughout, is beguiling. (P.F.)

☆ ☆ ☆

PROKOFIEFF – Alexander Nevsky. Elena Obratsova (mezzo); London Symphony Orchestra conducted by Claudio Abbado. DGG Stereo 2531 202.

I cannot be enthusiastic about this product. Prokofieff won a solid reputation as a writer of film music but his background to Alexander Nevsky is seldom exciting. The recording is not good, the chorus

Music of another era

THE 250th COMMEMORATION OF MARTIN MARIAS. The Oberlin Baroque Ensemble with James Weaver, harpsichordist and August Wenzinger, viol. Stereo, Gasparo GS202. (From MR Acoustics, PO Box 165, Annerley, Qld 4103. Phone 07 48 7598.)

Most of the albums I have had to date from MR Acoustics have emphasised recording technology in one form or another. There is no hint of anything technically special about this one, although it does not attract any significant criticism, either. The modest dynamics of the chamber ensemble pose no special problems with peak amplitude, while effectively masking any surface noise, apart from the occasional click.

Detailed notes on the reverse side give the background of Martin Marais, who died in 1728, leaving a rich heritage of compositions for the viol and for related chamber music.

They also detail the Baroque Ensemble, based at Oberlin, Ohio – comprising players who specialise in performances using authentic or close copies of period instruments for historic compositions. August Wenzinger (viol) and James Weaver (harpsichord) also receive high praise for their unique insight and abilities.

Most of side 1 is devoted to "Pieces a trois Violes (in G Major), from Livre IV. Pieces a une et trois Violes" (1717). Then follows "Pieces de Viole d'un gout Etranger from Livre IV".

On side 2 is a bright "Sonnerie de Ste Genevieve du Mont de Paris" and "Pieces en Trio in E Minor" (1692).

While the performance would have potential appeal to anyone partial to chamber music, its prime appeal would doubtless be to the specialist or the student looking for music with a particular connotation. (W.N.W.)

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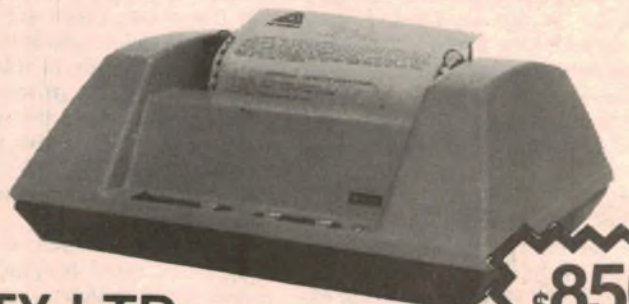

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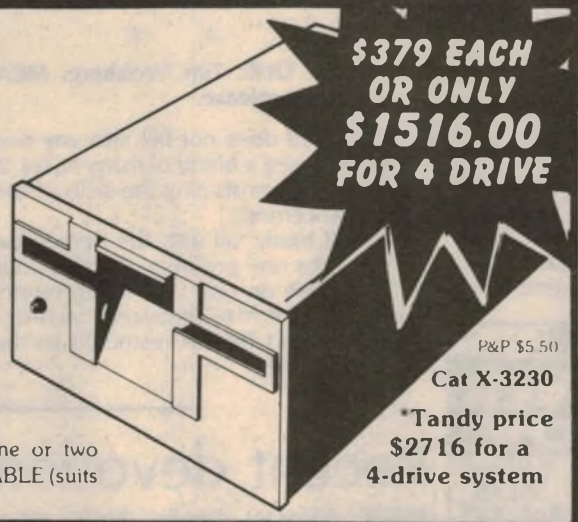

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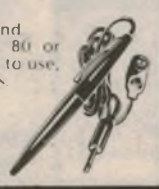

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too far away from the mike and, even with the translation provided, the Russian is almost impossible to follow. The soloist is miscast and is always uncomfortable in the low register.

The music can be made to sound very impressive indeed, especially when played by Previn, but this is hard to come by nowadays. Not recommended. (J.R.)

☆ ☆ ☆

THERE AIN'T NO AGE FOR ROCK 'N' ROLL. The Veterans Avenue L37422 Festival release.

This fun record has been put together by a bunch of elderly session musicians. The lead singer, at the tender age of 73, is Jimmy Norris who is well known as a busker outside Harrod's store in London. Not surprisingly, the vocal quality is somewhat obscure but the overall musicianship is nothing short of superb.

None of The Veterans is named but I would like to hear more from them, preferably as straight instrumentalists.

There are eleven tracks, including the title track which had a lot of air play some months ago, the others are: I Wanna Hear Ya – No More Smoking – We Don't Feel A Thing – When Bruce Is On The Booze – Nigel Gold Grows Old – Tap Dancin' – Logical Doggerell – He's A Very Happy Hobo – This Old Refrain – Golden Age.

Some of the lyrics have a tinge of sadness but the whole thing is well worth a hearing. (N.J.M.)

☆ ☆ ☆

PARTY OF ONE. Tim Weisberg. MCA 5125 Astor release.

This record does not fall into any one category, being a blend of many styles of music, all demonstrating the skills of the artists concerned.

It could easily fall into the demo disc class but for one problem, the atrocious surface noise on side one which utterly spoils an otherwise enjoyable record, I only hope this fault is restricted to the review pressing.

The tracks are: Katie – Magic Lady – I'm The Lucky One – Everyone Loves A Mystery – Page One – Party Of One – What's Going On – Don't Keep Me Waiting, Girl – Amber – Power Flower.

The themes range from rock to neo-classical, with a bit of everything in between. It is certainly a showcase for the talents of Tim Weisberg and his fellow musicians. (N.J.M.)

☆ ☆ ☆

THE BEST LITTLE WHOREHOUSE IN TEXAS. By Larry King, Peter Masterson and Carol Hall. Stereo, original cast album from Universal Pictures. MCA-3049. Astor release. Also on musicassette.

"Little whorehouses" pop up in quite traditional musicals, but never so described, and always in low key. Here it's the central theme, developed in fourteen songs and a finale. Some will see it as fun . . . a send-up; others will see it as totally objectionable, and you won't need me to help you take sides.

But, if you do want the album as a reprise of the show, you will find the recording quite okay and the diction easy to follow. (W.N.W.)

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Recent devotional releases

WILLIE NELSON Family Bible, MCA Songbird MCA 3258. Astor release.

It is a pleasant change to hear a record of Gospel music, with just a solo voice and piano and guitar accompaniment, instead of the full orchestral treatment. It is reminiscent of one's early days in Sunday School, with just the piano as backing.

Six of the titles are in the public domain (they have been around so long) the others are more recent:

By The Rivers of Babylon – Stand By Me – It Is No Secret – There Shall Be Showers Of Blessing – Softly And Tenderly – Tell It To Jesus – Family Bible – In God's Eyes – Revive Us Again – An Evening Prayer - Kneel At The Feet Of Jesus.

Willie Nelson's voice has the suggestion of Kentucky Blue-grass about it that grabs your attention in a way that a singer with a full backing group might not. Well worth a listen. (N.J.M.)

☆ ☆ ☆

NEVER ALONE, Amy Grant. Myrrh MSB 6645. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135.)

Amy Grant brings a fresh strong young voice to work on a dozen tracks, ranging in style from heavy rock to ballad to bossa nova. Quite a few of the lyrics have been written by Amy Grant, either on her own or in collaboration with other musicians.

The titles are: Look What Has Happened To Me – So Glad – Walking Away With You – Family – Don't Give Up On Me – That's The Day – If I Have To Die – All I Ever Have To Be – It's A Miracle – Too late – First Love – Say Once More.

The lyrics are given in full on the record sleeve and obviously display a deep and abiding faith with those that wrote them. The record quality was excellent throughout, with a really great backing on all the tracks. (N.J.M.)

☆ ☆ ☆

TERRY CLARK. Melodies. GNR 8111 Good News Records, a division of Word Inc. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

Ten thought-provoking lyrics, with a mainly rocking theme, make up this interesting offering from California based Terry Clark.

The Sleeve gives the full lyrics to the following: There's The Light – Clap Your Hands – Jesus Is At The Wheel – Just A Matter Of Time – River – Melodies – A Little Rock 'N' Roll – Pickin' – Following – Father Of Light.

Terry Clark plays piano on all the tracks with backing from John Ferraro on drums, Kenny Lee Lewis on bass, Larry Lingle and Jon Linn on Guitars, Geoffrey B. Leib on keyboards and Burleigh Drummond on percussion.

Like most other productions from the Word stable, the technical quality is really excellent. (N.J.M.)

Evergreen humour

THE BEST OF STANLEY HOLLOWAY. The Lion and Albert, and other favourites. Mono, World Record Club WRC R-06197.

This one has been mentioned before but can hardly be passed over in the context of nostalgic humour.

Whatever roles Stanley Holloway may have filled more recently, for those in this reviewer's generation, he will be remembered best for his whimsical monologues, which were so popular in the 30s.

There are 17 of them here – the popular ones and others which came later or which didn't get as much air play. Best known are the adventures of Young Albert, but a similar number feature Sam of 'Pick Up Tha' Musket" fame. Then there's "The Beefeater", "The 'Ole In The Ark", and so on.

Thanks to the vinyl LP pressing, they sound better than they ever did on the old Shellac 78s. So grab a copy for your collection. (W.N.W.)

★ ★ ★

THE BEST OF FLANAGAN AND ALLEN. Mono, World Record Club WRC-R06347.

While this album is attributed to Flanagan and Allen, most of the tracks are by Bud Flanagan. As the notes indicate, Chesney Allen had to give up stage work in 1946, on doctor's orders.

But that doesn't alter the fact that the 18 tracks will provide a real trip down memory lane, for those whose memories extend back into the 30s. Theirs is the mix of humour, pathos and nostalgia that fitted so naturally into the pattern of old-time revue.

You'll remember some of these: Underneath The Arches – Home Town – Maybe It's Because I'm A Londoner – Umbrella Man – Nice People – Galloping Major, etc.

Although recovered from old recordings, the original EMI team who did the job, did it very well. The sound is dated enough to fit the material, but not so dated as to compromise a single word, in terms of clarity. (W.N.W.)

World Record Club, 605 Camberwell Rd, Hartwell 3124. (03 29 3636).

IMMORTAL JAZZ CLASSICS. RCA 50. Released by World Record Club.

Anyone with even just a passing interest in jazz and the big band sound of the 30s and 40s should hear this double album, originally released to commemorate the first jazz album recorded by the Victor Company in 1917.

One record is a 12" 45rpm replica of "Livery Stable Blues" and the "Dixie Jazz Band One Step" played by the Original Dixieland Jazz Band on that historic occasion. When you consider that the recording was an acoustic job, without the benefit of microphones, amplifiers and all the gear available to recording engineers today, RCA have done a startling job in remastering such a difficult record.

The other 12" 33rpm record in the set is no less interesting, with 19 tracks of big band jazz with such names as Benny Goodman, Duke Ellington, Louis Armstrong, Glenn Miller, Fats Waller, Tommy Dorsey, Muggsy Spanier, Al Hirt and Pete Fountain to name most of them. Some of their signature tunes on the record are: Bugle Call Rag – Take The "A" Train – Dinah – Basin Street Blues – In The Mood – Just A Closer Walk with Thee – South Rampart Street Parade – Down The Road Apiece – At The Wodchopper's Ball – Tuxedo Junction – When The Saints Go Marching In.

When you consider the varying ages of some of the masters used, the overall quality leaves no room for complaint. (N.J.M.)

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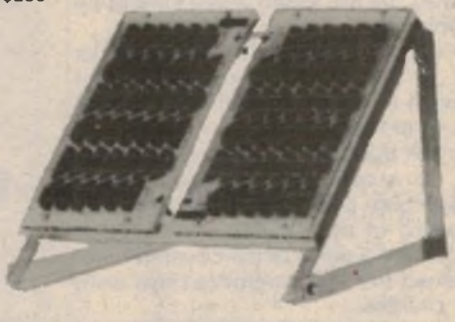

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Graphics for the TRS-80

HIRES-80

As most people will be aware, there are already a large range of additional products available for the Tandy TRS-80, not all of them from Tandy either, so it should come as no surprise that another new product has made an appearance. Cisa Microcomputing of Sydney have just released a high resolution graphics board that fits into the keyboard housing of the TRS-80 system. This converts the standard Tandy graphics from 48 × 128 pixels to a resolution of 192 × 384 pixels.

Known as the HIRES-80, the board comes fully assembled and tested, and is accompanied by an 18-page manual and a program cassette. It is up to the purchaser to install the board into the computer, but for those people who do not feel confident in doing so, they can make arrangements to have the board installed by Cisa. The manual provides instructions on the installation procedure, and if followed "to the letter" there should be no problems.

We were provided with a HIRES-80 kit to fit to our TRS-80 system and what follows is our account of the installation and use of the unit.

The box that the unit comes in is rather large, to accomodate the manual and the flat cable connectors that terminate the board in the TRS-80. The board is mounted on a piece of foil covered foam to protect the MOS memory chips from static charges.

The first thing that one thinks of upon seeing the board is; "how the devil is it to be connected into the system". The flat cables are all terminated with dual-in-line plugs, but the lack of vacant sockets in the TRS-80 makes this a little difficult to comprehend at first. The solution, as it turned out, was quite simple.

The DIL plugs are actually pushed over the top of selected ICs in the TRS-80, the pins being splayed out as it were, to make contact with the IC pins. Two of the plug pins, diagonally opposed, are soldered to the IC pins to hold the plug in place. The other pins make satisfactory friction contact and require no soldering.

Installation also requires three tracks to be cut on the TRS-80 printed circuit board, and the addition of a 4.7kΩ resistor.

The installation procedure is in itself quite simple for the person with a reasonable soldering skill, but all the same, it requires patience and concentration. The process took about one and a half hours all up and when it came to testing it out we were happy to find that it worked first time round. The instructions in the manual are clear and concise.

We then took a good look at the operation of the board, and the way in which it works is rather interesting.

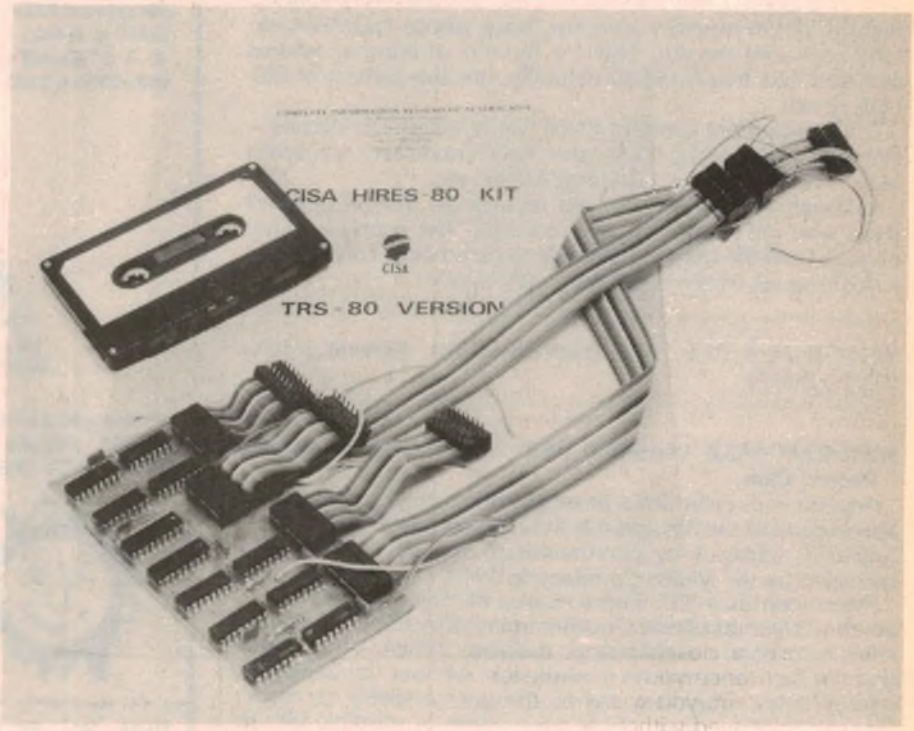
The standard graphics in the TRS-80 occupy ASCII codes 128 through to 191. The HIRES-80 has 1K of its own memory on board, and this also happens to be mapped in such a way that the characters stored in it also have ASCII codes 128 to 191. What this means is that either the standard graphics or the high resolution graphics can be selected, but not both at the same time.

HIRES-80 has three modes of operation; low resolution (standard graphics), high resolution (HIRES-80 graphics) and program mode, to allow the high resolution graphics to be programmed. Each of these three modes is selected by the data held in a mode control latch, this being memory location 13427 decimal. The three modes can be selected at any time in a program by poking the mode control latch with the appropriate data byte. The three data bytes for the modes are: low-res=2, high-res= and program=10. Therefore, if we are to select the high-res mode, then we would use the following program line: POKE 13427,6. Yes! it's as simple as that.

The 1K of memory on the board is divided up into 64 blocks of 16 bytes each. The graphics characters consist of a 6-wide by 12-deep matrix, which means that they are programmed with 12 bytes of data, the remaining four in each character block being redundant.

To program the characters in the HIRES-80 it is necessary to place it in the program mode, and then with either a machine language routine or poke statements from BASIC, load the character RAM with the required bit patterns to produce the wanted character. One thing worth noting at this stage is the fact that the memory in the HIRES-80 is actually mapped over the top of the video RAM in the TRS-80.

The tape supplied with the HIRES-80 has two programs: a demonstration program, and a second called "CREATE", used to help in the programming of the high resolution graphics. It does this by drawing up a 6 × 12 grid on the screen



The Cisa HIRES-80 kit consists of an assembled PC board, program cassette and instruction manual.

HIRES-80 GRAPHICS

and asking you which of the squares on the grid are to be filled. When the character design has been finalised it provides 12 bytes of data which are then used in BASIC program DATA statements to POKE the values into the HIRES-80 RAM. While the character is being designed, it also appears on the screen in actual size so the user can see how it will look when it is used in graphics plotting.

Although the CREATE program does the job of designing the graphics characters well, it does take a lot of time. The other factor that did not appeal to me was the fact after the designing process, I was left with a set of DATA statements which then had to be programmed into BASIC. After some thought, I was able to re-write the CREATE program so that the whole character can be designed in one shot, and then entered directly into the HIRES-80 memory, without the need for resorting to BASIC DATA statements A short machine language driver is then used to save the character data on tape for use at a later date, in the form of a SYSTEM program.

Now that we have discussed the graphics, there is another bonus provided by the HIRES-80; lower case characters. The character generator in the TRS-80 is in fact programmed with lower case characters as well as upper case, but the lower case has been disabled in the Model 1 TRS-80's. When HIRES-80 is fitted, the lower case character set is re-enabled.

The first thing that one notices with regard to the lower case characters is the fact that all the error messages in the BASIC ROM are written in lower case, and not upper case as normally displayed. Also the SHIFT key works in reverse fashion to the normal typewriter mode in that a shifted character is lower case, while an un-shifted character is upper case.

Well, that just about says it all. It is now up to you to find your own application for the HIRES-80, and if you are into computer games then you will certainly want to take a closer look at this product. In fact, once you have installed it into your system, you will wonder how you ever managed without it.

Cisa have also announced a System-80 version of the HIRES-80, but this is not as yet available as a kit.

The cost of the TRS-80 version is $225 and an extra $25 fitting charge if you opt not to do it yourself. The System 80 version sells for the same price but the fitting charge is $45. A kit version for the System 80 is expected to be available in the near future.

For further information contact Cisa Microcomputing Pty Ltd, 159 Kent Street, Sydney, NSW 2000. Phone (02) 241 1813. (G.C.)

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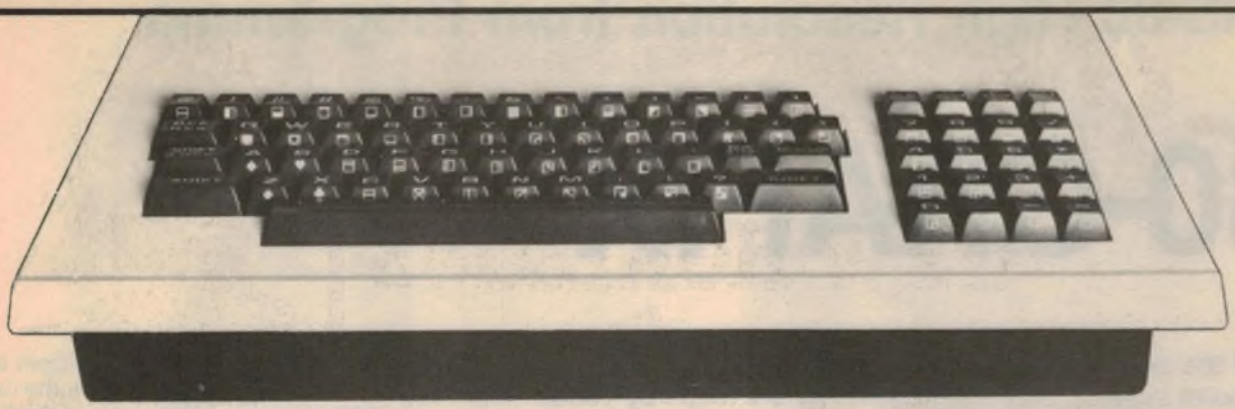

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Mlvl 395a

TRS-80 High Resolution from Programma

80-GRAFIX

Of all the add-on products that are available for the Tandy TRS-80 computer system, only a small minority are made by Tandy. The vast majority are manufactured by dozens of small companies. One of these companies is Programma International Inc of Los Angeles in California, USA. They have recently released a small board that adapts the TRS-80 for high resolution graphics.

The standard graphics resolution of the TRS-80 is 128 × 48 pixels, which only allows crude graphics to be implemented. But with the addition of the Programma 80-GRAFIX, the TRS-80 has a graphics resolution of 384 × 192 pixels. These pixels are not individually addressable, but rather addressable as characters in a 6 × 12 matrix. The reason for this will become a little more obvious later on.

An advantage of 80-Grafix is that no part of the memory map is taken up by it exclusively. As it happens, Grafix is mapped over the top of the video RAM (locations 15360 to 16383 decimal).

The way in which it works is really quite simple: the standard graphics normally occupy ASCII codes 128 to 191, but when Grafix is enabled, the characters which are stored in its own 1K of RAM are mapped over to replace the standard graphics, and these too occupy ASCII codes 128 to 191. What this means is that only one set of graphics characters, either the standard or the user definable, can be used at a time, not both together.

Grafix is actually controlled by the data present at the outputs of I/O port 255 decimal (FF hex) which is also the cassette interface port.

There are three modes of operation for the 80-Grafix: standard graphics, high resolution graphics and a programming mode that allows the 1K of RAM on the 80-Grafix board to be programmed with the alternative character set.

The 1K of memory in the 80-Grafix is divided up into 64 blocks which form 64 user definable characters, each 16 bytes long.

We mentioned earlier that the user definable characters consisted of a 6 × 12 matrix, so this means that we only need 12 bytes to define a graphics character, with the last four bytes in each character block being redundant.

The way in which the TRS-80 distinguishes between alpha-numeric and graphics characters is by looking at the most significant bit in each byte of the video RAM. If the bit is set on (logic 1) then it knows to place a graphics character in that particular screen location, whereas if the bit is set low or off (logic 0) then it places an alpha-numeric character in the addressed screen location. The video RAM does not contain the bit patterns to form the characters, rather it contains the ASCII codes for the various characters that are to be displayed. These are then referenced to a character generator which contains the bit patterns to produce the characters on the screen.

When set to the programming mode, 80-Grafix uses the video RAM as its programming "data buffer". In this mode the user's data is moved to the screen which is then read as the image of the programmable character generator, and then copied into the memory of the 80-Grafix. To prevent a lot of garbage from appearing on the screen, any character with an ASCII code of 128 or higher is blanked out, but only in the programming mode.

The installation of the board into the TRS-80 keyboard housing is a job that takes about an hour or so. The main requirement for the installation is reasonable soldering skill.

As supplied, the board comes fully assembled and tested, so that the only further requirement is termination to the circuitry of the TRS-80. There are four flat cable connections to the 80-Grafix, these being terminated on the other end by DIL plugs. The idea is that the DIL plugs are just pushed over the pins of certain selected ICs, relying on the friction between the IC pins and the prongs of the DIL plugs to make a reliable connection. The method suggested in the manual is to use a drop of glue or a small piece of double sided tape between the top of the IC package and the underside of the DIL plug to hold it in place.

The method that we used was to solder two of the prongs of the DIL plugs to the pins of the IC, these being diagonally opposite each other. In other words, pins 8 and 16 say, are soldered, while the others are left free – the friction of the other pins is sufficient to ensure a reliable connection. In the case of one of the DIL plugs, a pin of the IC that it is to fit over has to be cut free from the board, and then bent to a horizontal position. The IC in question is Z11. (If this IC happens to be in a socket in your particular system, then it can be removed altogether and replaced with the DIL plug.)

The beauty of this method of installation is that no tracks have to be cut on the main printed circuit board, which means it is a simple task to remove the 80-Grafix and return the computer to its original condition, if desired.

The board has been designed in such a way that it actually fits into one of the plastic molded feet in the computer housing, and therefore requires no further mounting apart from double-sided tape to secure it into the "foot".

Operation of the 80-Grafix once it has been installed is the fun part of the deal. It is simple to use and the results obtainable with it are in a word, "incredible". This is readily demonstrated by loading the first demonstration program on the cassette that is provided with the 80-Grafix.

(Continued on p142)

The kit is comprised of the built up circuit board, the instruction manual and the cassette tape containing demonstration programs.

SWTPC

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Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Machine Language and Hexadecimal code

Although nowadays few people need to program computers in their native "machine language", it can still be worthwhile if you know a little about it. This is particularly true if you plan to progress from BASIC and other high-level languages to programming in assembly language.

Even if you've so far only been concerned with computer programs written in BASIC, you've probably heard terms like "machine language" and "hex code" bandied around, often by those keen to impress you with their grasp of computing. You also may have seen lists of strange-looking numbers, which have letters of the alphabet sprinkled among the normal numerals. Things like this have probably been enough to make you think that machine language is terribly complicated, and something you couldn't possibly hope to understand.

Well, it is a little more involved than BASIC, but it isn't all that bad – particularly when you grasp the relatively simple concepts involved. And although you'll probably never need to worry about actually programming in machine language, it can be very handy if you do understand those simple concepts. Knowing just what the computer is actually doing deep inside its "cocoon" of software insulation can be a big help in puzzling out why a program doesn't do what you expected, especially if you find yourself programming in assembly language. So let's take a quick look at machine language, and see if we can dispel some of its mysteries.

The first thing to remember is that a computer is basically a whole bunch of logic gates and flipflops (remember those?), connected together to form what the designer chooses to call a "central processor", a "memory" and various other functional blocks. All information which is processed by these blocks and passed back and forth between them is in the form of binary numbers: strings of zeros and ones, represented by logic voltage levels.

You probably knew this much already. But you should also realise that it's not just the information **processed** by the computer which is in the form of binary numbers – the actual **instructions** which control the computer's operation are in this form also. So in their ultimate form, all computer programs are nothing more that a sequence of binary numbers. Regardless of the "language" in which they are written, they must be translated into this form before they can actually be "run".

This, then, is what is really meant by "machine language". Another term sometimes used to mean the same thing is "object code" – meaning the actual code used to control the machine itself.

Let's look at a few simple examples, taken from the machine language "instruction set" of the popular Z-80 microprocessor which forms the heart of many current computers like the System-80 and TRS-80.

The following 8-bit code instructs the Z-80 to return from a subroutine, for example:

1100 1001

While this 16-bit code instructs it to negate (derive the negative equivalent, in 2's-complement binary arithmetic) of the number in the Accumulator register:

1110 1101 0100 0100

And this 24-bit code tells it to take the number stored in a particular memory address, and load it into the Accumulator:

0011 1010 1100 0101 0111 1110

Strings of ones and zeros like these may be fine for computers, but for humans they are impossibly unwieldy. Because of this, people who have to work with computers at the machine language level have evolved a way of making things easier for themselves. They represent the strings of binary ones and zeros by hexadecimal digits, or "hex code" for short.

How does hex code come into it? Well, hex code is simply the system of numbering based on 16, instead of 10 as in our familiar decimal system. And with a base of 16 it needs a total of 16 number symbols, so it uses the normal 0-9 for the first 10, and then the first six letters of the alphabet. So in hex you count 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, 10, 11, 12, 13, . . . and so on. Below is a table setting out hexadecimal, binary and decimal equivalents.

BINARY	DECIMAL	HEXADECIMAL
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

Because 16 happens to be the fourth power of 2, it turns out that one hex digit can be used to represent each group of four binary ones and zeros. Using this equivalent allows those long strings of ones and zeros to be shortened to hex numbers only a quarter as long, which are much easier to remember and manipulate. For example the "return from subroutine" instruction code given above simply becomes "C9", while the "negate number in Accumulator" code becomes "ED 44". Similarly the "Load Accumulator from memory address" becomes "3A C5 7E".

At first sight these may not look much easier to work with than the real binary machine code, but once you get used to them they really are much easier to use and remember. The thing to bear in mind is that the hex code is used purely for human convenience; computers themselves understand only the binary "machine code".

Well, there you have it – a quick look at machine language. And nowadays that's about all you need to know, because even if you do need to produce machine language programs, there's no need to program even in hex code yourself. Thanks to translation programs called Assemblers, your job can be much easier. We'll look into Assemblers and "assembly language" next month.

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Microcomputer News & Products

Spectrum-II to the packing shed

A Sunraysia fruit packing factory beside an orange grove near the banks of the Murray River is the site of the 200th installation of the Australian designed and made Spectrum II minicomputer.

The Spectrum II, designed and built by Webster Electronics Pty Ltd, will control all the packing and administrative details.

Besides the accounting software dealing with fruit packing, the system will also produce a quarterly profit and loss statement and handles the payroll for its staff of 30.

The $22,000 system sold to the Co-op consists of a Spectrum-IID, a video data terminal and a line printer, plus software. The Spectrum computer handles up to 2.52M-bytes of mass storage and has a 64K-byte on-board memory.

D. D. Webster Electronics has been manufacturing its Spectrum-II range of minicomputers for three years. Most of its 200 installations are in city areas although a small rural market is being established.

For further information contact: D. D. Webster Electronics Pty Ltd, 17 Malvern Street, Bayswater, Vic. Phone (03) 729 8444.

Speech synthesis chip from General Instrument Microelectronics has 16K ROM

A speech synthesis chip, designed to generate synthetic human speech or other complex sounds, has been launched by General Instrument Microelectronics. The new chip, which the company is calling the SP-0256, was unveiled at the Electronica '80 exhibition in Munich recently.

The 28-pin device is intended for use in many professional and consumer applications, including control equipment and instrumentation, automotive warning systems, test and diagnostic equipment, etc.

Although designed primarily for use in single chip form, it is available in association with the company's PIC microcomputer and speech ROMs in a module, to suit the customer's application. These might require complex word repertoires or very high quality speech synthesis.

The chip has an on-board ROM capacity of 16K and externally connected ROM may be used to expand its capability considerably. The total addressing range of the chip is 491K bits, and up to 3825 sequences (usually words or phrases) which may be called up directly.

The SP-0256 chip is capable of reproducing up to 256 discrete sequences without extra ROM, each sequence being called by loading its 8-bit address into the command register of the device.

The quality and fidelity of output is normally significantly better than telephone voice quality and approaches that obtainable by domestic AM broadcast receivers.

The chip is extremely easy to interface to systems due to its single +5V power supply requirements, TTL compatible levels and single 8-bit input port. Customers will therefore be able to design speech output into their systems quickly and inexpensively.

General Instrument say that the new chip is a considerable advance in low cost "solid-state" speech synthesis and will lead rapidly to many product applications.

For further information contact Daneva Control Pty Ltd, 66 Bay Road, Sandringham, Victoria.

Electronic concepts market Onyx Computer Systems

In response to recent announcements in the press implying the existence of only one "exclusive" distributor for the range of Onyx 8-bit and 16-bit computers, Electronic Concepts wish to inform that it has a long standing relationship and dealer agreement with Onyx Systems Inc since early 1978. Indeed a considerable number of systems have already been placed and installed as powerful office computers.

The unique architecture (built-in disk and backup cartridge), and the fact that the Z8000 based 16-bit computer will run a fully supported version (version 7) of the highly regarded UNIX operating system by Bell Telephone makes Onyx a desirable product.

Electronic Concepts are also the exclusive distributors of the now famous Apple II computers in Australia, and have sold close to 4000 systems in the last three years.

For further information contact R. J. Hoess, Electronic Concepts Pty Ltd, Ground Floor 55 Clarence Street, Sydney, NSW 2000. Phone (02) 290 2422.

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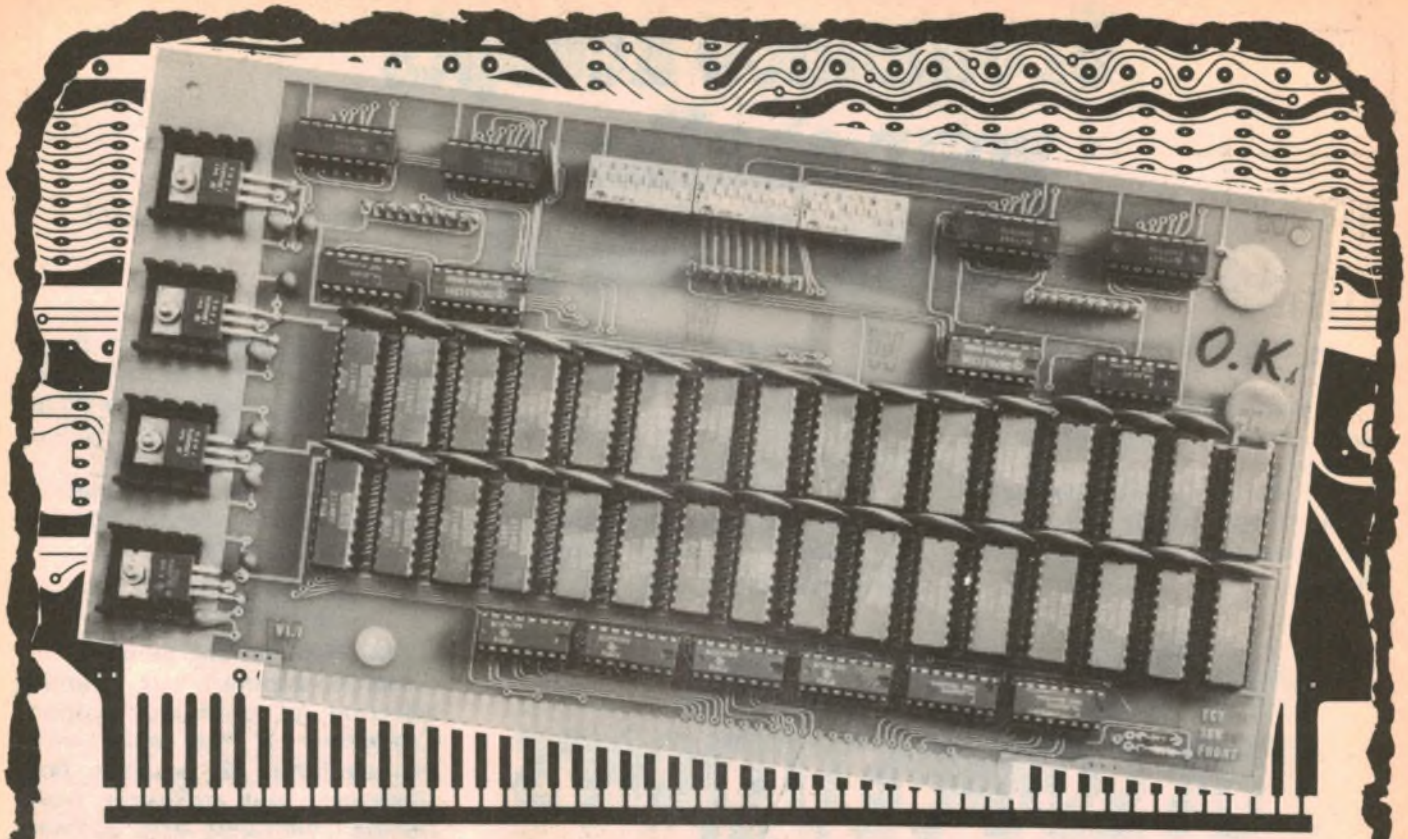

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AT.009

HP2642A Terminal has optional mini disc for mass storage

A new CRT display station from Hewlett-Packard fills a niche between "smart" terminals and programmable or "intelligent" terminals. The new HP 2642A offers one or two flexible mini-disc drives. It has its own dedicated file system, enhanced editing capabilities, and a simplified forms design utility. The terminal can perform many off-line operations, formerly requiring computer interactions, such as data entry and document preparation, then batch them to a host computer for processing.

The 2642A has built-in memory for 88 lines of 80 characters each, eight user-definable screen-labelled soft keys to execute predetermined functions, display enhancements including underline, half-bright, blink, and inverse video in any combination, a large-character and match character set, and a line drawing set.

Standard with the HP 2642A is a 270K-byte double-sided, double-density, 5¼-inch flexible mini-disc drive for convenient text storage off-line. With an optional second drive total disc storage becomes 540K bytes. The system supports named, sequential, variable-length data files, which may have alphanumeric names of as many as 10 characters. The files may be of indefinite length, as the flexible mini-disc media may allow.

Options available on the 2642A include a second flexible mini-disc or a dual integral cartridge tape which replaces the flexible mini-disc support. Additionally, the HP Shared Peripheral Interface is an option that enables the user to connect up to eight 2642A's and printers.

Hewlett-Packard's 2642A CRT Terminal is offered with flexible mini-disc option for local mass storage.

The price of the HP 2642A display terminal is $8437. With the second mini-disc drive, the list price is $9687. The HP 2642A is offered with cartridge tape units instead of mini-discs (for backwards compatibility with earlier modules) for $7812. Standard Hewlett-Packard volume and OEM discount schedules apply.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Victoria. Telephone: 89 6351. Branches in Adelaide 272 5911, Brisbane 229 1544, Perth 386 5455, Canberra 80 4244 and Sydney 887 1611. Also in Auckland and Wellington, New Zealand.

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80-GRAFIX gives the TRS-80 an effective screen of 384X192 pixels, versus the normal 127X192 for the TRS-80, 80X50 for the CBM/PET, or the 280X192 of an APPLE II. As an added feature, 80-GRAFIX offers you lower case characters at no additional cost. Of course, you can also create your own set of up to 64 original characters using the supplied Character Generator software.

The 80-GRAFIX board is simple to install (note that this voids your Radio Shack warranty), and programming is done through BASIC. 80-GRAFIX opens up a whole new realm of software development and excitement never dreamed of for the TRS-80!

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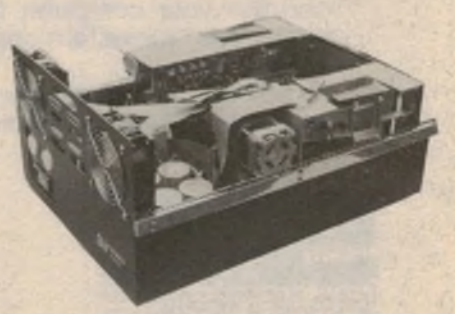
26MB of Winchester Disk complete with controller and easy backup. Disk has special capacity to only back up files accessed during the last period. Disk operating system CP/M.



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Mensa computers provide a service network throughout Australia at major service centre locations to minimise response time to service calls. To ensure that equipment will operate at peak performance, engineers and technicians are trained to ensure the highest possible standard of service.

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No this isn't a "Hard Disk". We used to call it that, sometimes. But somebody muddied the water.

"Hard Disk", unfortunately, now calls something else to mind. That little bitty guy with no backup capability and no way of switching media? It's a "Hard Disk" to work with, all right, in business applications. Some even say "Impossible Disk".

We'd like to avoid confusion between our Cameo database solution and the one that doesn't work so well. The Cameo DC-500 subsystem employs a decade-proven **cartridge** disk. Our backup capability is built in, and takes four minutes. The ability to switch applications (by exchanging the removable cartridge) means you can use your computer for more kinds of work. A ten megabyte (5 fixed + 5 removable) subsystem costs $5995, for your **TRS-80 (Mod. I or II), Apple, 6800 or S-100** computer.

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Microcomputer News & Products

Speech synthesis from Telesensory

A. J. Distributors Pty Ltd has provided some interesting information on a new synthesizer module released by their principal, Telesensory Systems Inc of the USA. Telesensory Systems has been involved in speech synthesis since 1975 with its products having been primarily developed for disabled persons. Recently a Speech Products Division was set up to serve the commercial and industrial OEM markets.

Telesensory Systems' new speech synthesizer module can accommodate both standard and custom vocabularies up to a total of 256 utterances. The new Series III Speech Module consists of TSI's own speech synthesizer as well as vocabulary data memory, an on-board speech filter and an audio amplifier. Its TTL compatible I/O and +5V single supply simplify interfacing the module to a microcomputer.

The memory can be any combination of one or two 16K, 32K or 64K ROMs or PROMs providing up to 128K bits. For example, Series III can accommodate one 32K ROM for a TSI standard vocabulary plus one 16K bit PROM for a special-use custom vocabulary. Vocabularies can be provided in English and most other languages.

With the Series III, about 100 seconds of speech can be stored in ROM memory so individual words and phrases can be retrieved on command. When provided with an 8-bit parallel binary address code and a START signal, the Custom ROM Controller fetches appropriate data from the ROM and converts the digital information to an analog audio signal via an on-chip D/A converter. The analog signal is then filtered and amplified on the module resulting in a clear, intelligible male voice.

Additional information may be obtained from A. J. Distributors Pty Ltd, 44 Prospect Rd, Prospect, SA, 5082. Phone enquiries to (08) 269 1244.

AED move house

AED Microcomputer products have announced the opening of their new store at 130 Military Road, Guildford, NSW. The new premises have a large airy showroom, administration offices, workshops, development laboratory and design offices and seminar room.

AED handle what they believe to be the largest range of S-100 and CP/M related products available in Australia. Special parts and software not normally available in Australia can be imported to customer order.

AED also announce the release of a new S-100 compatible disk system. Priced about midway between the usual single and double sided drives, AEDISK is a double-sided, double-density 200mm system. The controller used is the latest version of the tried and proven Morrow Disk Jockey IID. Drives and controllers are available separately, although the complete package includes CP/M 2.2. A special version of CP/M is available at no extra charge.

Capacity per disk is 1.2M-byte, but the system will also handle single sided and single density media for software installation etc.

Single and dual drive systems are available. In the latter case the drives may be supplied in separate housings, or in a single case mounted either side by side or stacked.

For these and other S-100 related products contact Acoustic Electronic Developments Pty Ltd, 130 Military Road, Guildford, NSW, 2161. Phone (02) 632 6301 or (02) 632 4966.

Microworld has a new range of S-100 products

Microworld have just announced that they now have a new range of S-100 boards including a new Z-80 processor board, a multi-user serial I/O board, a double density floppy disk controller board, and a 64K bank selectable memory board.

The Z-80 CPU board features include 4MHz operation, high speed serial and parallel I/O utilising DMA or programmed control, eight vectored priority interrupts, and a real-time clock.

The multi-user serial I/O board is intended for use in extended systems requiring up to eight additional serial I/O ports. Features of this board include: 16 maskable vectored priority interrupts, RS-232C interfaces with full handshake, asynchronous or synchronous operation with asynchronous baud rates up to 19,200. It is available in four or eight channel versions.

The floppy disk controller board will control up to four mini-floppy or four standard floppy drives using IBM soft sectored formats. It features 1K of on-board buffering, DMA controlled data transfers and the performance characteristics of the NEC 765 controller chip.

The new memory board features I/O port addressing for bank select with 256 switch addressable I/O ports for the memory bank addressing. The memory is configured as four totally independent 16K software selectable banks, with each bank addressable on a 16K boundary.

For further information on these products contact Microworld, 54 Power Street, Hawthorn, Vic 3122. Phone (03) 819 2411.

Club News:

Queensland Sorcerer user group has new committee

The committee of the Queensland Sorcerer Users Group has undergone some changes. The new office holders are:

PRESIDENT: Geoff Snell
VICE PRESIDENT: Jim Myers
SECRETARY: Kelvin Saggers
TREASURER: Bob Baxter
COMMITTEE MEMBER: Barry Watson

The new postal address for the group is now: K. R. Saggers, Secretary, "QSUG", C/- 43 Stubbs Road, Woodridge, QLD 4114.

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Enables you to define every pixel on the 40 column Commodore's screen. Comes complete with driver software, logic board, mounting brackets and extensive documentation.

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Now you can increase the memory capacity of your 40 column screen Commodore by 8K increments to a maximum of 40K. Requires special connector for first 8K.

CALL FOR PRICES

ASSEMBLER DEVELOPMENT SYSTEM

This system — the MACROTEA — includes a text editor, monitor and macro assembler all in ROM on a high quality printed circuit board. Connects to the memory expansion port. Needs no tape loading. Assembles 16K source text in 10 seconds!

PRICE $550.00

SOUND GENERATION

Gives you the opportunity to program the Commodore for up to 4 voices or instruments. Much pre-programmed music already available.

Sound Board only:	$ 88.00
Board & Simple 4 Voice Software:	$110.00
Board & Instrument Music Software:	$150.00

EXTRA BASIC COMMANDS

Add extra commands to your Commodore Computer's BASIC!

Programmers Toolkit —	AUTO, RENUMBER, FIND, TRACE, APPEND, DELETE, DUMP, STEP, HELP.	Old Rom PETS:	$75.00
		All others:	$60.00
Disk-O-Pro —	All Toolkit commands plus the BASIC 4.0 disk commands, plus SCROLL, PRINT USING, etc.	3000 Series CBM:	$90.00
Command-O —	As for Disk-O-Pro but for BASIC 4.0 Commodores	BASIC 4.0:	$90.00

All prices exclude Sales Tax at 15%. All prices are correct at time of printing but subject to alteration without notice. Mail orders are welcome, please specify model of computer and any enhancements already added. If ordering via Bankcard/Master Charge/Visa, please specify card number and expiry date. Please add $1.50 per item for postage within Victoria and $3.00 per item for postage elsewhere in Australia.

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Further, Cromemco computers are of a rugged, all-metal construction that immediately tells you these computers are built to be dependable and long-lived.

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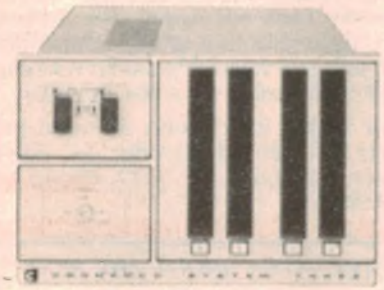
The nature of their construction also promises versatility and long life. Built with easily-accessible card slots, these computers can be configured to meet the needs of an almost endless variety of applications.



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SuperSoft's Gallery of CP/M Masterworks

SUPER-M-LIST: A complete, easy to use mailing list program package. Allows for two names, two addresses, city, state, zip and a three digit code field for added flexibility. Super-M-List can sort on any field and produce mailing labels direct to printer or disk file for later printing or use by other programs. Super-M-List is the perfect companion to TFS. Handles 1981 Zip Codes!
Requires: 48K CP/M
Supplied with complete user manual: $75.00 manual alone: $10.00

TFS-Text Formatting System: An extremely powerful formatter. More than 50 commands. Supports all major features including:
- left & right margin justification
- user defined macros
- dynamic insertion from disk file
- underlining and backspace

TFS lets you make multiple copies of any text. For example: Personalized form letters complete with name, address & other insertions from a disk file. Text is not limited to the size of RAM making TFS perfect for reports or any big job. Text is entered using CP/M standard editor or most any CP/M compatible editor.
Requires: 24K CP/M
Supplied with extensive user manual: $85.00 manual alone: $20.00
Source to TFS in 8080 assembler (can be assembled using standard CP/M assembler) plus user manual: $250.00

TEXT PROCESSING

DIAGNOSTICS I: Easily the most comprehensive set of CP/M compatible system check-out programs ever assembled.
Tests:
- Memory
- CPU (8080/8085/Z80)
- Terminal
- Disk
- Printer

To our knowledge the CPU test is the first of its kind anywhere. Diagnostics I can help you find problems before they become serious. A good set of diagnostic routines are a must in any program library. Minimal requirements: 32K CP/M. Supplied with complete user manual: $75.00 Manual alone: $ 5.00

DIAGNOSTICS II: Includes all of Diagnostics I, plus:
- Every test is "submit"-able
- A complete Spinwriter/Diablo/Qume test has been added (Serial Interface only)
- Output may be logged to disk
- Expanded memory test
- Expanded terminal test
- Expanded disk test

Diagnostics II provides the next level in system maintenance.
Requires: 32K CP/M
Price: $100.00 Manual only: $15.00

SYSTEM MAINTENANCE

UTILITIES I: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!).
Includes:
GREP: Searches files for a specified string
SORT: In core sort of variable length records
CMP: Compare two files for equality
PRINT: Formatted listings to printer
PG: Lists files to CRT a page at a time
plus more

Requires: 24K CP/M
Supplied with manual on discette: $60.00

UTILITIES II: Many new programs not available elsewhere. Includes these "file" utilities:
DIFF: Source comparitor
PR: Powerful multicolumn output formatter
CAT: Concatenate files
RPL: Substitute strings in files
plus more

Requires: 24K CP/M $60.00
Supplied with manual on discette

UTILITIES

ANALIZA: An amazingly accurate simulation of a session with a psychiatrist. Better than the famous "ELIZA" program. Enlightening as well as fun. An excellent example of Artificial Intelligence.
Requires: 48K CP/M, CBASIC2
Cost: $35.00

ENTERTAINMENT

Z8000 CROSS ASSEMBLER: Supports full Z8000 syntax, segmented and unsegmented mode, full 32-bit arithmetic, hex output, listing output, "downloader".
Requires: 56K CP/M $500.00
1 year maintenance $300.00
manual alone $ 50.00

Z8000 tool

"TINY" PASCAL II: We still call it 'Tiny' but it's bigger and better than ever! This is the famous Chung-Yuen 'Tiny' Pascal with more features added. Features include:
- recursive procedures/functions
- integer arithmetic
- CASE
- FOR (loop)
- sequential disk I/O
- 1 dimensional arrays
- IF...THEN...ELSE
- WHILE
- PEAK & POKE
- READ & WRITE
- REPEAT...UNTIL
- more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs. SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.
Requires: 36K CP/M. Supplied with complete user manual and source on discette: $85.00. Manual alone: $10.00

STACKWORK'S FORTH: A full, extended Forth interpreter/compiler produces COMPACT, ROMABLE code. As fast as compiled FORTRAN, as easy to use as Interactive BASIC.
SELF COMPILING: Includes every line of source code necessary to recompile itself.
EXTENSIBLE: Add functions at will.
Z80 or 8080 ASSEMBLER included.
Single license, OEM licensing available.
Please specify CPU type: Z80 or 8080
Supplied with extensive user manual and tutorial: $175.00
Documentation alone: $25.00

SSS FORTRAN: The SSS FORTRAN compiler is fast, efficient, and complete (full 1966 ANSI standard with extensions). The RATFOR compiler compiles into FORTRAN allowing the user to write structured code while retaining the benefits of FORTRAN. The FORTRAN supports many advanced features not found in less complete implementations, including: complex arithmetic, character variables, and functions. Complete sequencial and random disk I/O are supported. SSS FORTRAN will compile up to 600 lines per minute! Recursive subroutines with static variables are supported. ROMable ".COM" files may be generated. SSS RATFOR allows the use of contemporary loop control and structured programming techniques. SSS RATFOR is similar to FORTRAN '77 in that it supports such things as:
- REPEAT...UNTIL
- WHILE
- IF...THEN...ELSE

SSS RATFOR is supplied with *source code* in FORTRAN and RATFOR.
System Requirements & Prices:
SSS FORTRAN requires a 32K CP/M system
SSS FORTRAN with RATFOR: $325.00
SS FORTRAN alone: $250.00
RATFOR alone: $100.00
(Sold only with valid SSS FORTRAN license)

PROGRAMMING LANGUAGES

TERM: A complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette! With TERM you can send and receive ASCII and Hex files (COM too, with included conversion program) with any other real time communication between users on separate systems as well as acting as timesharing terminal.
- Engage/disengage printer
- error checking and auto retry
- terminal mode for timesharing between systems
- conversational mode
- send files
- receive files

Requires: 32K CP/M
Supplied with user manual and 8080 source code: $150.00
Manual alone: $15.00

INTERCOMPUTER COMMUNICATIONS

ENCODE/DECODE: A complete software security system for CP/M. Encode/Decode is a sophisticated coding program package which transforms data stored on disk into coded text which is completely unrecognizable. Encode/Decode supports multiple security levels and passwords. A user defined combination (One billion possible) is used to code and decode a file. Uses are unlimited. Below are a few examples:
- data bases
- payroll files
- programs
- tax records

Encode/Decode is available in two versions:
Encode/Decode I provides a level of security suitable for normal use.
Encode/Decode II provides enhanced security for the most demanding needs.
Encode/Decode I: $50.00 Encode/Decode II: $100.00 manual alone $15.00

SOFTWARE SECURITY

CP/M Formats: 8" soft sectored, 5" Northstar, 5" Micropolis Mod II, Vector MZ, Superbrain DD/QD

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Microcomputer News & Products

16-bit micro from National Semiconductor

Santa Clara, CA, January 12, 1980 – The first wafers of the proprietary NS16032 microprocessor were produced on December 15, 1980 at National Semiconductor's plant in West Jordan, Utah, the company's most modern fabrication facility. Evaluation and debugging of the complex, 16-bit microprocessor are being performed now at National.

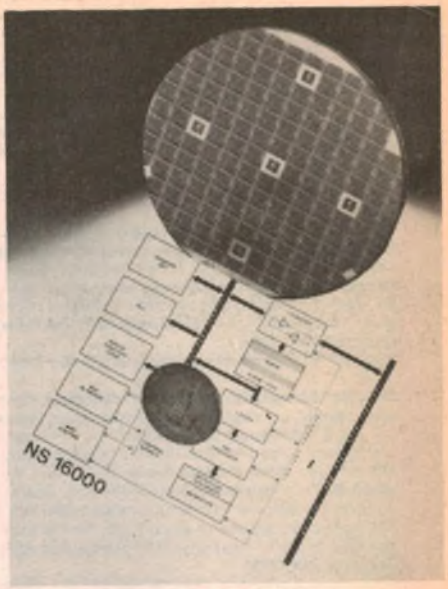
The development of the CPU, which measures 84,000 square mils, was a comprehensive effort taking 25 man-years. It is the most advanced addition to National Semiconductor's broad line of microprocessors.

Along with the production of the first silicon wafers, National has also announced a cooperative agreement with Fairchild Camera and Instrument Corporation to second source the NS16000 family of devices.

The agreement calls for the exchange of mask making data for National's NS16032 CPU and systems-oriented devices with data on Fairchild's dedicated peripheral circuits. National will employ its proprietary XMOS process to produce the NS16000 devices, while Fairchild will use its own compatible process. Also included in the agreement is a provision for development of future NS16000 family products.

By combining state-of-the-art MOS technology with a very advanced architectural design philosophy, the NS16000 family brings mainframe computer processing power to VLSI (Very Large Scale Integration) processors.

The family supports a wide variety of system configurations, extending from a minimum low-cost system to a powerful 16 megabyte system. The NS16000 devices consist of a selection of CPUs supported by a set of peripherals and slave processors that provide sophisticated interrupt and memory management facilities, as well as high-speed floating point operations.



National Semiconductor's new 16-bit micro.

The NS16000 family will be fully supported by a complete family of development systems, compilers, operating systems and board level products.

For further information contact National Semiconductor on (02) 439 6865.

Australia to manufacture Semiconductor Wafers?

According to a report in the Pacific Computer Weekly, a decision on whether or not a $100 million semiconductor wafer manufacturing plant will be built in the Australian Capital Territory, is expected to be made in the very near future.

National Semiconductor has put a proposal to the Australian Government to build the plant, providing a subsidy of $30 million is offered.

It is likely that discussions between a Government negotiating team and the company will take place in California soon. The outcome of those talks could be announced by the new minister for the Department of the Capital Territory, Michael Hodgeman, in about one month.

According to sources, Federal Cabinet is keen to get the semiconductor wafer manufacturing plant in Australia, and several front benchers believe an attractive proposal can be put to National Semiconductor.

Early predictions are that up to 1500 people will eventually be employed at the plant.

New 12-bit CMOS DAC is uP Compatible

Warburton Franki recently announced the introduction by Beckman Instruments, Inc of a new line of 7500 series DACs and ADCs.

Significant to this range is the Model 7581C, the first CMOS DAC to offer both microprocessor compatibility and low cost, versatile analog circuitry of its manufacturer's 7580 and Burr-Brown's DAC-80 equivalents. This 36-pin device offers many other features that make it attractive for D/A designs:

- TTL or CMOS compatible
- Serial or parallel input formats, switch selectable
- 4 quadrant multiplication capability, permitting a user to input an external reference, and convert it from plus to minus without error – a feature not found on the DAC-80.

The 7581C primarily serves designers of process control systems, monitoring equipment, instrumentation and medical equipment. It can also be multiplexed to handle applications requiring the simultaneous monitoring of several events.

For further information contact your nearest Warburton Franki office.

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TRENDCOM Printers
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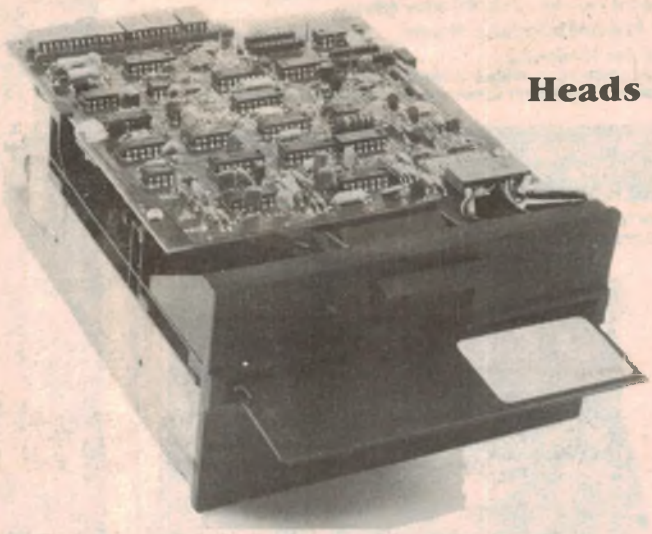

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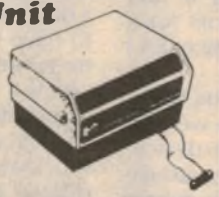

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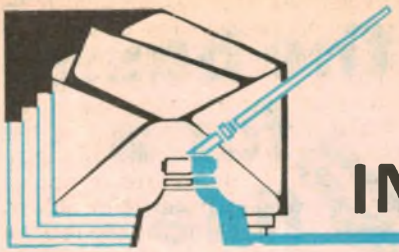

INFORMATION CENTRE

HIFI DISTORTION: Recently I completed a Dick Smith kit for your Playmaster 40/40 amplifier and 3-75L 12" 3-way system. Both kits were superbly engineered and there were no problems with either. The purchase of an Akai tape deck completed the system for my purposes. The reason that I am writing is to enquire about the amount of distortion which one should expect from the system at high volume settings.

Quite a lot of trouble was spent in sealing the speaker boxes. From my observations it appears to be the bass speaker because, it is not the amplifier as full volume setting on the amplifier and part volume setting on the output of the tape deck gives no distortion at normal listening levels, and higher treble settings on the controls appears to noticeably reduce the distortion. My lack of familiarity with hifi systems prompts me to ask whether the distortion is normal. (D. C., Thornton, NSW.)

● The Playmaster 3-75L and 40-40 amplifier are capable of good results at all volume settings provided that neither the amplifier or the loudspeakers are over-driven. We do not understand how boosting the treble on the amplifier can perceptibly reduce the distortion from the system unless, by doing so, you can reduce the overall volume setting of the amplifier and thereby reduce the possibility of overload. We assume that you have not set the tweeter attenuators on the loudspeakers for maximum treble cut.

DREAM 6800: I have just finished constructing the DREAM and found that when it was powered up that it had no response to the signal output of the VHF modulator.

I have thoroughly tested the board using a CRO and have found the required waveforms (as per your trouble shooting guide). The output pins on the PCB are emitting the required waveforms also. Could it be that the UM1082AUSO modulator is not compatible with the output of the board?

● The signal levels coming from the DREAM are quite suitable for connection to the modulation input of the UM1082. Since these signals seem to be OK we would suggest that the error is likely to be in the UM1082's power supply. The nominal operating voltage is 6.5V and this can be obtained from a simple zener power supply consisting of a 470 ohm resistor between the +12V and the power supply and a zener from that point to ground. A .0047μF capacitor should also be connected across the power supply for decoupling.

METAL LOCATOR: I am constructing the Metal Locator which was described in the November, 1979 issue. I am enquiring if 40 turns of 27 SWG will do for the coil and I am unable to find a 455kHz IF transformer that will fit the PC board. Please send me the address of the company that you obtained the Aegis ST45C 455kHz transformer. (J. V., Queanbeyan, NSW.)

● The Aegis ST45C 455kHz transformer is available from Radio Despatch Service, 869 George Street, Sydney, 2000. The search coil specifies 26 SWG wire at 50 turns around a 180mm diameter, however, the 40 turns and 27 SWG wire will be sufficient if this is all the wire you have available.

PHOTOGRAPHER'S EXPOSURE METER: Being an amateur photographer, I have found a need for an enlarging exposure meter in order to reduce the number of test prints required when doing a series of enlargements. Have you published a circuit for such a device, and if not, would you consider such a circuit for a future project. (A. R., Aldinga Beach, SA.)

● We have not published a circuit for an enlarger exposure meter, but we will keep the idea in mind. Such a device, when calibrated, could certainly reduce the wastage of test pieces when enlarging each negative.

TV SOUND QUALITY: With the current interest in some quarters of getting better quality sound from the TV set, would it be possible for your technical staff to come up with a design for a TV sound tuner which could be used with a stereo amplifier. Such a unit could possibly use the Philips tuner advertised by L. E. Chapman regularly in Electronics Australia, at the modest price of $10.

Pioneer Electronics have such a unit on the market in America, but from the enquiries that I have made, there does not appear to be any plans to introduce a model here in Australia at this time. American reviews of the Pioneer model claim that while the sound quality is substantially better than that from the TV set, and in fact approach FM standards, the tuner is in fact much less complicated than the average FM tuner.

Finally, I wonder if it would be possible to use more Tandy Electronics components in some of your projects, as some of the components you have been using, while readily available in Sydney and I suppose Melbourne, are hard to find in Adelaide? We do have quite a few Tandy Stores spread around Adelaide and suburbs. Congratulations on a very interesting magazine. I look forward to your comments. (B. P., Glenelg South, SA.)

● Regarding the use of Tandy Components, it would appear that their stocks can supply most of the components for our circuits. The alternative to personal shopping in the Tandy Stores is to use mail order, which is quite popular and efficient. Most Sydney and Melbourne component suppliers provide a mail order service and will be able to supply the relevant components unavailable in Adelaide.

We shall keep the suggestion of a TV sound tuner project in mind.

LIGHT CHASER: In your August issue you published a circuit for a light chaser in which you issue a warning that there is a dangerous situation where it is possible to have full mains voltage on the Triacs even with the switch in the off position.

Now I would respectfully suggest that in the interests of safety that in the future any circuit that has the possibility for shock even if the mains switch is off, be revised or not published at all. It's all very well including a warning in the text, but there are a considerable number of young people who in the heat of trying to locate a fault can forget the warning and give themselves a lethal shock. Surely this is the last thing that we should encourage.

May I suggest a simple alteration to the circuit? Simply change the switch to a double-pole, double-throw type and extend the active lead from the 3-pin outlets directly to the switch. In this way the switch becomes a mains switch and completely isolates the whole circuit from the supply. I would also incorporate a fuse in the line to the switch for added protection of the components.

Thank you for a very interesting

magazine, I look forward to it each month even if it is a couple of months late due to postage. (D. C., Auckland, NZ.)

● We agree with your sentiment that safety is extremely important but simply switching the active lead to the mains sockets is not the solution. Firstly this would require the switch to be rated for the full load of the Light Chaser, ie 10 amps, so a much larger switch would be required. Secondly the Light Chaser must be switched on anyway to perform servicing.

One solution however is to use an isolation transformer or alternatively, a core-balance relay. The core balance relay provides protection since it removes the mains voltage should an imbalance in the active and neutral currents occur, ie when someone accidentally touches active wiring.

MOTOR SPEED CONTROL: I use a Gem Faceting Machine which is not fitted with a motor speed control. This machine is driven by a ¼hp, 1425rpm 240V/2.8A continuous rated motor. The only speed control available to me at present is by means of a two step pulley which is not satisfactory. I require a speed control arrangement which will permit variable speeds between 100 and 1000rpm.

Would you kindly advise if a variable speed control is available for use with this motor and the cost of such. Alternatively please advise if a suitable variable speed motor of lesser power, ⅛hp is available and the cost of same. (C. O'R., Roma, Qld.)

● The ¼hp motor used with your machine is probably an induction motor which cannot be controlled to run at a lower speed. This type of motor always operates at close to synchronous speed (in phase with the mains generated field). Reducing the voltage or available current will only lower the possible torque available from the motor rather than dropping the speed significantly.

The alternative is to use a "universal" brush-type motor as used in electric drills. This type of motor can be controlled very effectively. We published a Speed Control for Electric Drills in the July, 1976 issue. Reprints of this article are available through our information service for $3 which includes postage.

SHORTWAVE RECEIVER: I have been getting your magazine for almost a year now, and was very interested in the shortwave receiver project (November, 1980, File No. 2/SW/77). Could you please inform me of relevant coil winding details so that I can use the receiver to listen to the commercial FM stations.

Also, would there need to be many modifications to the circuit board so that I could receive the FM broadcast in stereo as well.

Thanking you for your excellent magazine which has given me many informative hours of reading. (F. O'R., Wargul, Vic.)

● Our shortwave receiver is versatile but it is intended only for operation up to 30MHz. Trying to make it run in the region of 100MHz and to detect FM is asking too much. Sorry.

ELECTRONIC CHESS GAMES: I can't remember reading anything about electronic chess games. They are advertised with 10 degrees of difficulty for $130, so the components that comprise these units can't be particularly valuable or numerous. The complexity of the game with so many moves makes me wonder how they work. (D. K., Waverley, NSW.)

● The games which you mention are all based on microcomputers and have their programs stored in a very large memory array. Typical programs for these machines occupy some 18K of memory, all of which is of the read only variety. These memories are also programmed in the manufacture of the devices at the die stage, and would therefore be very difficult to duplicate. We reviewed the Voice Chess Challenger in February, 1980.

TV SIGNAL/STRENGTH METER: Have you published a project for a meter to be used for comparing/optimising the performance of TV antennas? I have not seen such a project and yet it seems one which would interest many enthusiasts. After all, most of us have "goggle boxes". (R.V.H., North Parramatta, NSW).

● We have not published a project along the lines you describe, R.H. although we agree that it could be popular. Such a device would only be able to measure signal strength though and would be of little use in optimising antenna performance as far as ghosts are concerned. We will certainly have a look at the project concept although we can make no promises.

PARABOLIC DISH ANTENNAS: I would like to know the name of a dealer who might have literature on parabolic dish antennas for sale, as I am planning to construct one myself in the near future. The main purpose of this venture is that it may be useful for receiving satellites and experimenting with moon bounce communications. (G. P., Townsville, Qld).

● We are not familiar with any dealers in the type of antenna in which you are interested. However, you may be able to get some help from fellow amateurs who are interested in the same subject. We understand that members of the Illawarra Amateur Radio Society, PO Box 1838, Wollongong 2500 may be able to help.

TV CRO: As the Lissajous patterns displayed on the average oscilloscope are a little on the small side to gaze at raptly for hours, would it be possible to provide a circuit that would allow an old black and white TV to be used for this purpose. Another point regards engine analysers such as those used in service stations. It would be handy to be able to use an old TV set to display the ignition system waveforms. (R.B., Ongarue, NZ.)

● It is not possible, as far as we know, to use the TV/CRO Adapter to display Lissajous patterns. This is because there is no effective way of controlling horizontal trace deflection due to the inherent video switching system used by the adapter. Our answer concerning use of the adapter as an ignition analyser was covered in last month's issue.

METAL LOCATOR: I have constructed the 1979 Prospector Metal Locator from the EA design and found it every bit as good as you claimed.

Further to the original design I have added a meter circuit which has proved very effective, also an audio amplifier feeding a small loudspeaker. These additions have greatly improved the detector.

Although my "Prospector plus" is now a very useful unit, I still desire to extend the unit to include a discriminator circuit so that I can differentiate between ferrous and non-ferrous metals, and it is here that I seek your help; can this be done and is there a likelihood of a new Prospector project along these lines?

If a new project is not likely could you suggest a technical publication from which I could gain the information on discriminator circuitry. (H.L.P., Willaston, SA.)

● We do not intend to do a metal locator in the near future since we have not yet found a design which offers relatively straightforward construction, ie, a simple search coil, along with true discrimination and ground effect exclusion. When we do we will certainly publish the circuit.

Unfortunately, we cannot refer you to any useful references on the subject.

MODEL TRAIN LIGHTING: It is good to have projects from time to time in Electronics Australia for model trains such as the bipolar controller in the November 1980 issue.

Would it be possible to have a project for a system to control points and associated lights, preferably LEDs without the use of relays? This would need a ½-second pulse to the appropriate side of the switch motor accompanied by a continuous supply of current to an outlet for the lights, the direction being controlled through a miniature toggle or rocker switch at the control panel. The circuit for the lights

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Specification:
10Hz to 600MHz guaranteed (5Hz to 750MHz typical)
Sensitivity ≤ 10mVRMS — 100MHz, 50mVRMS — for 100 to 450MHz, 70mVRMS 450 — 600MHz Temperature Stability 0.1ppm/C

Gate time .1 sec 1 sec 10 secs Ageing rate .≃ ± 5ppm/year.
Accuracy 1ppm + 1 digit.
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Specification:
10Hz to 1GHz 15mV — 30mV sensitivity will resolve 10Hz at 1GHz.

ageing rate ± 5ppm/year.
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FUNCTION GENERATOR 5020.
Specification:
1Hz — 200KHz in 5 ranges sine, square & triangle wave
High 10Vpp 600
Low -40dB
TTl out drive 10TTl loads
DC Sweep input give 100:1 frequency range output & offset control.
PRICE Kit $200 + tax = $230
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would best be at the points, and be controlled by the pulse to the switch motor.

The pulse source could be common to a number of points. Further refinements could be – light indication at the control panel in the direction of the points – signal always at red in reverse direction, controlled possibly by the polarity of the line.

There may be circuits covering this already published in other magazines or books. If you know of such I would appreciate it if you could let me have any information available. (L.A.P., Carlton, NSW.)

● We shall consider an article along the lines you describe. For your interest, we published a series of articles on model train lighting in 1967: October, November and December 1967 (File Nos. 2/MS/12, 13, 15). Photostat copies are available for our Information Service at $3 per article.

DIGITAL FREQUENCY COUNTER: I have constructed the EA Digital Frequency Counter and can only obtain zeroes on the display board. Supplied in the kit was a MC10116P in lieu of the MC10116L indicated on the circuit, but the suppliers say it performed satisfactorily in their test set-up. As I do not have the original EA articles, I would appreciate it if you could advise possible causes of my problem. In the past I have completed many EA projects, and this is the first time I have experienced a failure. (R.H.D., Yass, NSW).

● Whilst we have not tried the MC10116P in the frequency counter, we do not think it would be the cause of your problems. You mention that you do not have the original EA articles dealing with the design, construction, initial switch-on and alignment of the counter. These were in two parts, published in August and September, 1978. We think that if you can acquire this information, you will be able to solve your problem. Photocopies of these articles (File Nos. 7/F/23 and 7/F/25) are available from our Reader Service as detailed in the panel on this page.

TIME SWITCH: Have you considered running a constructional article for a 240VAC power time switch, along the lines of the "bedroom timers" which are currently available? These are at times not accurate enough for some applications. It seems to me that a unit based on the type of micro-electronics used in modern digital clock radios would be capable of control to the minute, or even second, and would thus fill the bill. I have been reading your magazine since 1972, and still consider it to be the best of its type on the market. (S. D., Greenwood, WA).

● Thank you for your kind remarks S. D. We ran an article entitled "Four-Digit LCD Clock and Control Timer" in the April, 1980 issue of EA. This is quite a versatile device, and we imagine that it would satisfy your requirements. Stocks of this issue are still available at $2 per copy plus 70c for packing and postage.

COUNTDOWN TIMER: I am a keen sailor and regularly compete in handicap races. In order to start properly an accurate clock or watch is needed to time from the five-minute signal to the start. I would like a clock which could count backwards from five or ten minutes. Could you suggest a method of obtaining a countdown clock from a standard clock chip? (P. T., Pullenvale, Qld).

● We know of no standard clock chips which could be used in the way you describe. You would have to design a circuit of this type around a presettable up/down four-stage counter such as the 4029. We featured a signal photo timer using this device in our April 1978 issue. (File No. 3/PT/9.)

MANTLE RADIOS: I obtained your address from the only magazine in this field that our small newsagency had on its shelf.

My question is, do Astor, HMV, AWA or similar recognised brands still make 240-volt electric mantle radios?

I am presently working on the West Coast of Tasmania where radio reception is virtually non-existent, especially on a clear day. My R1400D National is not up to it at all, despite having an outside aerial.

As television is the in thing nowadays, I was almost laughed out of the shop when I enquired about a powerful broadcast band mantle radio as against a transistor portable.

I would be most grateful for any help or advice. (I. W., Savage River, Tas.)

● Sad to report, we know of no local manufacturers of mantle radios in Australia. Still, even if they did it is likely that you would still have the problem of poor radio reception. Your location is apparently in a deep valley or gorge where broadcast signals do not penetrate. In this situation, even the most sensitive broadcast receiver may be hard put to obtain reasonable reception.

Short of purchasing a more sensitive "communications" receiver, we can only suggest a bigger and higher antenna, preferably with lighting arrestors fitted.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Notes & Errata

DIGITAL ENGINE ANALYSER (October 1980, File No. 3/TM/16): There is an error on the PC board concerning the 0.1uF capacitor connected to pin 7 of the 555. It should be connected to pin 6 of the 555, as shown correctly on the circuit diagram on page 45. While the PC board will still work in spite of this error, it may not be possible to calibrate the tachometer function within the range of VR1.

Also the power supply connections to the LM339 are shown reversed on the circuit diagram. Pin 3 of the LM339 should be +5V and pin 12 ground. The PC board is correct in this respect.

CEYLON VOICE (January 1981, File No. 1/MS/22): The 100uF/25VW electrolytic capacitor in the parts list should be 1000uF.

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Grafix . . . ctd from p120

Another program on the tape places a lower case character set into the graphics memory, and this lets you use the keyboard as a normal typewriter keyboard. Unshifted characters are in lower case while the shifted characters are upper case. This can be used to write programs but it must be kept in mind that if the program is to be printed out, the lower case characters will all come out as upper case ones. An exception to this would be the use of the word processor program, which will permit the printing of lower case characters.

The next program on the tape is called "CREATE" and is used to design the characters. It does this by drawing up a large 6 × 12 grid on the screen and, using a co-ordinate system, you fill each of the required locations with a dot. All the while this is happening, an actual size character is being built up just to the right of the grid, while below the grid the data statements that you will need to use to program the characters are being put together. Although this program does a satisfactory job of designing the graphics, it could be improved upon.

Even so, the Programma Grafix-80 gives the TRS-80 the full graphics capability of competitive machines such as the Exidy Sorcerer. And that is a big advantage.

The price for the 80-Grafix is $149.95 plus 15% sales tax. For further information contact Paris Radio Electronics, 7a Burton Street, Darlinghurst, NSW 2010. Phone (02) 357 5111. (G. C.)

Monorail . . . ctd from p22

tion does not depend on wheel-to-track friction, gradients up to 10% can be handled at full speed. The no-contact motors are also used for skid-free braking, supplemented by mechanical wheel brakes for parking and emergencies.

Switching at track junctions is done on the cars themselves by swiveling guide rollers, and is computer-automated. There are no moving points on the guideway needing regular maintenance or heating in winter. Cabintaxis move slowly but surely. MBB figures average travel times will be 50% shorter than by private car or other street vehicle in city traffic.

Tiny three-seat cabins only four metres long are planned for flexibility and economy on lines where traffic varies widely between peak hours and slack periods. These might be used on an extended 32km, 38-station network now envisaged for Hamburg.

The individual monorail cars could do a lot to speed people and reduce road congestion in cities. They could be on call around the clock. The scheme is heavily funded by the German Federal Ministry of Research and Technology — which makes its chance of success pretty good.

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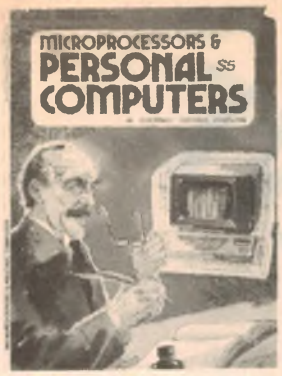
***Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles and catalog mentioned here.**



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Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

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AP3529

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1861