ELECTRONICS Australia

with HIFI NEWS

NOVEMBER, 1978 AUST $1.40* NZ $1.40

EMI'S NEW SYDNEY RECORDING STUDIOS

PLOT BIORHYTHMS ON YOUR COMPUTER

NEW FM TUNER HAS DIGITAL READOUT, CLOCK!

THE LOGICAL CHOICE

SONYS NEW TC-K7II

REDUCING WOW & FLUTTER TO LESS THAN 0·045%

Introducing the King of Sony's new K series cassette decks. The outstanding TC-K7 II with Sony's most advanced electronic and mechanical engineering.

This is a deck that not only has specifications that are superior to many open reel decks but features easy to operate, gentle touch, logic controls in all tape transport modes. There is no need to push the stop bar when changing modes and should the wrong mode be selected accidentally, no damage can occur to your tapes or your deck. All modes including "record mute" can be activated from the optional remote control unit (RM 30).

How do Sony achieve that incredibly low wow and flutter figure (0.045% WRMS). Firstly by using a two motor system, each designed to do a specific job. One motor is for reel drive and Sony's New Tri-Duty Motor handles the capstan drive. The Tri-Duty Motor is a superb piece of engineering and with its servo system,speed variations caused by either line voltage fluctuations or tape load are virtually eliminated.

The TC-K7 II features a "Double" integrated, recording and play back level indication system. Dual, high quality VU meters are augmented by three instant reacting LED peak level indicators, set at "0" and at +4 and +8 dB, so that the oversaturation of recording circuits can be prevented.

Naturally the TC-K7 II has Dolby but it also has an MPX filter defeat (Filter off) mode, a record mute facility and a three position memory rewind and replay facility. The tape select system has three step bias and three step equalisation selectors, giving nine possible positions, for optimum performance from a wide variety of tapes.

At the heart of this deck there's Sony's Ferrite and Ferrite head, hard and highly polished, like black diamond, to give years of head life.

The combination of Sony engineering and research with logic controls and Sony's new Tri Duty Motor produces a cassette deck that must be the choice of discerning Hi-Fi enthusiasts: A sound logical choice.

CHECK THESE EXCEPTIONAL SPECIFICATIONS

Frequency Response	20 Hz — 18,000 Hz (FeCr)
	20 Hz — 17,000 Hz (CrO2)
S/N Ratio	60 dB (FeCr, Dolby off, peak)
Wow and Flutter	0.045% WRMS
Harmonic Distortion	1.3%

SONY®

Research makes the difference.

GAC S 9655

ELECTRONICS Australia

Australia's largest selling electronics & hi-fi magazine

On sale the first Monday of each month

VOL. 40 No. 8 NOVEMBER, 1978

You've asked for it — here it is! Our new hifi FM-AM tuner, to mate with your Twin-25 or 40+40 amplifier. It features full digital frequency readout, plus an inbuilt clock as well. The story starts on page 46.

Home computer show

Melbourne's first Home Computer Show is coming up in December. See our story on page 91 . . .

On the cover

One corner of the ultra-modern mixdown suite in EMI's new recording studios. (See Hifi News). On the lower left is a close-up of the computer controlled Neve console and, beyond it, a TV colour tube display of instantaneous signal amplitudes. At the lower right is Alan Parsons, a specialist in electronic music, who rates the new complex as "state of the art" from the viewpoint of a producer.

FEATURES

SEASAT-A: *Studying the World's Oceans* 10
SYDNEY UNIVERSITY'S FIRST COMPUTER *And its descendents* 12
ELECTROMAGNETIC INTERFERENCE *A problem of growing concern* 16
THE RETURN OF THE STEAM LOCO? *Proposed modern design* 20
MELBOURNE'S FIRST HOME COMPUTER SHOW 91

HIFI NEWS AND REVIEWS

ADVANCED NEW RECORDING STUDIOS AT EMI *Computerised mixing* 31
REVIEW: TECHNICS SL-230 BELT DRIVE TURNTABLE
Has front mounted controls, electronic servo drive 37

PROJECTS AND CIRCUITS

RECORDER CUEING UNIT *Use it as a super doorbell!* 40
PLAYMASTER AM-FM STEREO TUNER *Features full digital readout* 46
AN ELECTRONIC THERMOMETER *Measures absolute temperatures* 53
BBD AUDIO DELAY AND REVERBERATION UNIT *For organs* 54
IMPROVING THE DIGITAL PHOTO TIMER *Longer periods, hold function* 62
HOW TO EXPAND YOUR 2650 MINI COMPUTER *Buffering, I/O ports* 70
PLOT BIORHYTHMS WITH YOUR TRS-80! *Impress your friends* 82
HARD COPY FOR YOUR MOTOROLA D2 KIT *Using low cost printer* 87

AMATEUR RADIO, CB SCENE, DX

THE IONOSPHERE, SUNSPOTS AND LONG DISTANCE CONTACTS 103
AMATEUR RADIO *Increasing 28MHz activity, ITU news, RTTY* 107
REVIEW: YEASU FTV250 TRANSVERTER *Extends HF to 2 metres* 113
SHORTWAVE SCENE *Australia moves into new MF spacing plan* 115

COLUMNS

EDITORIAL *Computers and unemployment — again* 3
FORUM *TV channel 5A and the threat to the 2M amateur band* 24
THE SERVICEMAN *You're never too old to learn* 64
RECORD REVIEWS *Classical* 96
RECORD REVIEWS *Devotional, popular and jazz* 98

DEPARTMENTS

NEWS HIGHLIGHTS 4 — CIRCUIT & DESIGN IDEAS 79 — MICROCOMPUTER NEWS & PRODUCTS 94 — NEW PRODUCTS 118 — BOOKS & LITERATURE 123 — INFORMATION CENTRE 125 — MARKETPLACE 126 — INDEX TO ADVERTISERS 128 — NOTES & ERRATA 125

Now. Two 3-way 40 watt speakers with nine tonal choices

Save about $50 per hour while you assemble them

Even if you didn't know them by number, you probably heard about the Philips AD12K12 MK11 Speaker Kits.

Because they are now a no.1 best-seller.

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Editorial Viewpoint

Computers and unemployment — again

You may recall that in last month's leader on computers and unemployment, I noted that the subject was a complex one and that it was hard to say much about it without sounding trite or superficial. Yet at the same time the implications are so profound that I felt it necessary to make some comment, calling for much more research and planning.

Of course we won't get much worthwhile research or planning until those in positions of power and influence take the matter seriously, and have a genuine desire to tackle the problems in a responsible fashion. Unfortunately if one is to judge from some of the recently published comments by a top computer industry executive and a leading politician, this still seems a long way off.

In the September 15 issue of the publication "Pacific Computer Weekly" the managing director of IBM Australia, Mr Alan Moyes, is quoted as saying that talk about high technology destroying jobs was emotional and uninformed. He was also quoted as saying that there was no evidence to relate technology to a receding level of employment, and that "The problem is not technology — it is unemployment".

Mr Moyes' comments were apparently supported by Victorian Premier Mr Rupert Hamer, who is quoted in the same story as saying that technology did not destroy jobs, but transferred job opportunities elsewhere.

I don't know about you, but I find these comments unbelievably inane and short sighted. How anyone with the knowledge and experience of Mr Moyes or Mr Hamer could offer them seriously and with any sincerity, I am at a loss to understand. Surely no one can honestly doubt that the prime motivation for introducing automation is the opportunity it offers for reducing labour costs. And in the real world, this must inevitably mean fewer jobs. If automation merely shuffled the jobs around, as these gentlemen appear to be claiming, what would be the motivation for introducing it?

To suggest, as Mr Moyes apparently did, that there is virtually no connection between automation and unemployment seems an incredible denial of the facts. As does Mr Hamer's explanation that job opportunities are simply transferred "elsewhere". Perhaps he means Elsewhere, that wonderful place where according to the weather forecasters it is always fine and sunny.

To take this sort of extreme "technological apologist" position seems to me just as foolish and unproductive as the opposite Luddite position of claiming that all technology is bad.

I do note that Mr Hamer has since announced a major conference on unemployment, to be held by the Victorian Government in December. This certainly seems a positive step; I only hope that the conference won't limit its horizons by glossing over the effects of technology.

— Jamieson Rowe

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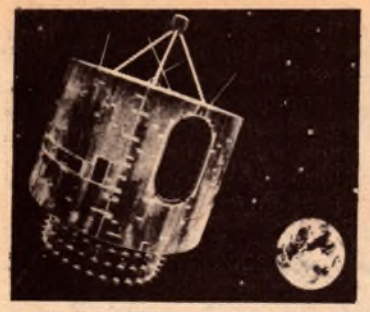


News Highlights

Task force plumps for satellite

After looking at the arguments for and against a national communications satellite for Australia, the Federal Government's interdepartmental "task force" has made a strong recommendation in favour of the proposal. In its report it recommends strongly that a statutory authority be set up as soon as possible, to plan and implement a satellite system.

The task force inquiry was set up last year under Chairman Mr H. White, the general manager of the Overseas Telecommunications Commission. Its 228-page report was tabled in Parliament by the Minister for Post and Telecommunications, Mr Tony Staley.

The majority recommendation of the report is that $180 million be spent on building a national communications satellite system, to be in operation before 1985. The system is envisaged to include two initial satellites, to be launched in 1984 and having an operational life of eight years. A third satellite would probably be launched in 1987, with others to follow later to maintain the system in operation.

Primary objective of the satellite system would be to provide improved communications and broadcasting over the entire country, including remote areas.

Stressing its conviction that such a system be embarked upon without delay, the report asserts:

"The task force believes that further delay will only serve to retard development of the nation's advanced technologies . . ."

The recommendations of the report are seen as a setback to Telecom, which argued against the proposal. If the satellite system is implemented, Telecom would presumably lose a significant slice of its revenue.

The Government has deferred making a decision on the report until December 31, leaving the matter open for public debate.

GE wins $1.8m fuel cell contract

Contracts totalling nearly $1.8 million have been awarded to General Electric to support initial studies on advanced fuel cells — battery-like devices that convert the chemical energy in fuels directly into electricity.

The larger of the contracts, from the US Department of Energy (DOE), will support work at GE's Research and Development Centre, Schenectady, NY. The company's Energy Systems Programs Department, also in Schenectady, will evaluate various fuel cell power system designs in parallel contract, awarded by the Electric Power Research Institute (EPRI).

Valued at $1.4 million, DOE's research and development contract provides funds for the first phase of a program to perfect and demonstrate advanced "second generation" fuel cells, which employ a molten carbonate electrolyte.

Communications for S. Aust. Railways

A $300,000 data transmission system that will improve driver safety and combat vandalism on Adelaide suburban trains will be installed by South Australian Railways this year.

Manufactured by Philips-TMC (Radio Communications Division), the SI 10,000 Status and Identification System allows constant communication between train drivers and base control in the SA Railways suburban transport network.

While driver safety and vandalism prevention are important, aspects of the new system, communication from base control can also alert drivers to possible delays due to weather, traffic density, crossing malfunctions, etc. At present the only method of driver-to-base communication is through the driver leaving the train to telephone.

When a train driver wishes to communicate with base control he presses a "call request" button on his unit. This request shows on the base console, with the train route number. An "acknowledgement" is flashed to the driver's unit and the channel is open for communication. In an emergency a special button is pressed by the driver which gives immediate communication with control.

Initially the Philips order will supply 62 train units, 4 base stations and 1 central console to SAR, the first railways system in Australia to install microprocessor computer techniques for communications.

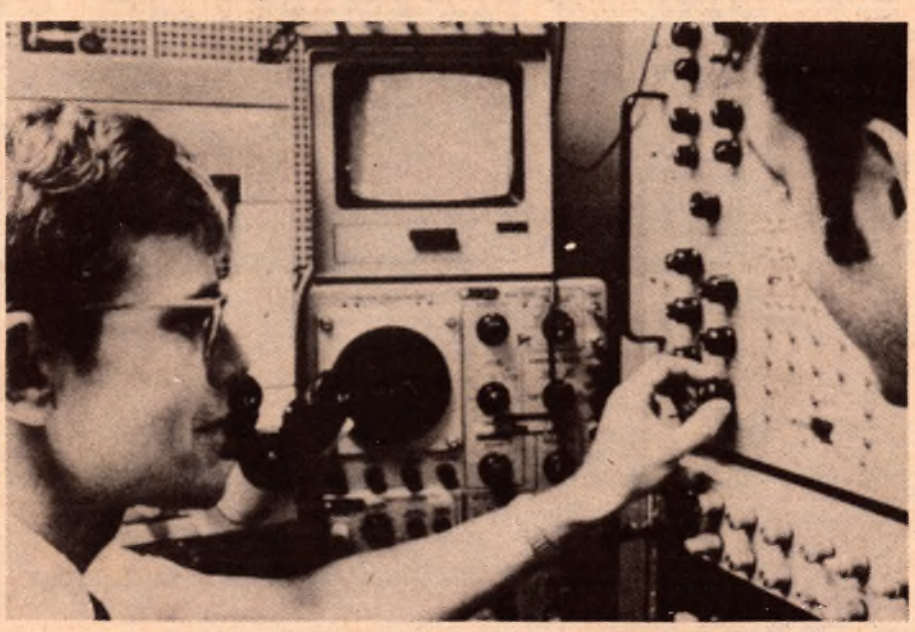
IBM scientists discover 'light bubbles' in thin films

Scientists at IBM's San Jose Research Laboratory have discovered that microscopically small sources of light in electroluminescent thin films can become mobile under certain conditions.

When a voltage oscillating at a high enough frequency is applied across one of these thin films, tiny light-emitting filaments — each about one micron in diameter — appear to pour out from isolated points in the material and to swarm randomly about in it.

In the IBM experiments, an ac voltage is applied to the manganese-doped zinc sulphide film via sets of crossed metallic lines about 1mm wide, the horizontal lines being deposited on one surface of the material and the vertical lines on the opposite. When voltage is applied to a pair of intersecting electrodes, the intersected area of film will emit light. Each such area encompasses some tens of thousands of individual light-emitting filaments. It is these individual filaments that can become mobile.

As the frequency of the applied voltage reaches the neighbourhood of 10kHz, the threshold of filament mobility is achieved. Looking at the light-emitting filaments through a microscope, one can see the tiny spots of light moving in small, discrete steps from one location in the material to another. On close examination, it appears that the illumination is being



transferred from one site to another through a process in which the emission from a filament is extinguished at approximately the same time as emission from another begins.

Raising the frequency of the applied voltage still further—about 50kHz—causes the mobility of the light bubbles to increase as they wander over relatively broad areas of the film. When one bubble approaches another, they repulse each other. Isolated regions in which the mobile bubbles are generated can be clearly seen in microscopic views of the material, and at high frequencies, hundreds of the moving points of light appear to pour out of these sources like water from a bubbling spring.

The locations of the sources of mobile filaments are thought to be associated with microscopic defects in the polycrystalline structure of the zinc sulphide films.

New cable resists 750°C for hours

A new robust cable developed in Britain continues to function — lighting an electric lamp — despite being subjected to over 30 minutes of continuous gas flame at 750°C.

Called the FP200 cable, it has been designed to withstand three hours of continuous burning at this temperature, but in tests has continued to function after six hours! In this type of cable the conducting core is surrounded by silicone rubber that is not destroyed when subjected to fire, but burns to a hard white material that is just as effect an insulator as the original silicone. This keeps the wires apart and prevents short circuits.

The cable is particularly suitable for wiring safety circuits such as fire alarms and emergency lighting where high standards of reliability and performance are required in the event of fire. In one striking example a factory wired with FP200 was recently gutted, but all the overhead lights continued to burn.

An order has recently been completed for Britain's Central Electricity Generating Board for the Dungeness "B" nuclear power station, where 50

kms of FP200 will be used for the vitally important reactor emergency shutdown control circuits.

Apart from its fire resistant qualities, the new cable is surge resistant, moisture resistant and does not "age".

Enquiries to Pirelli General Cable Works Ltd, PO Box 4, Western Esplanade, Southampton, S09 7AE, England.

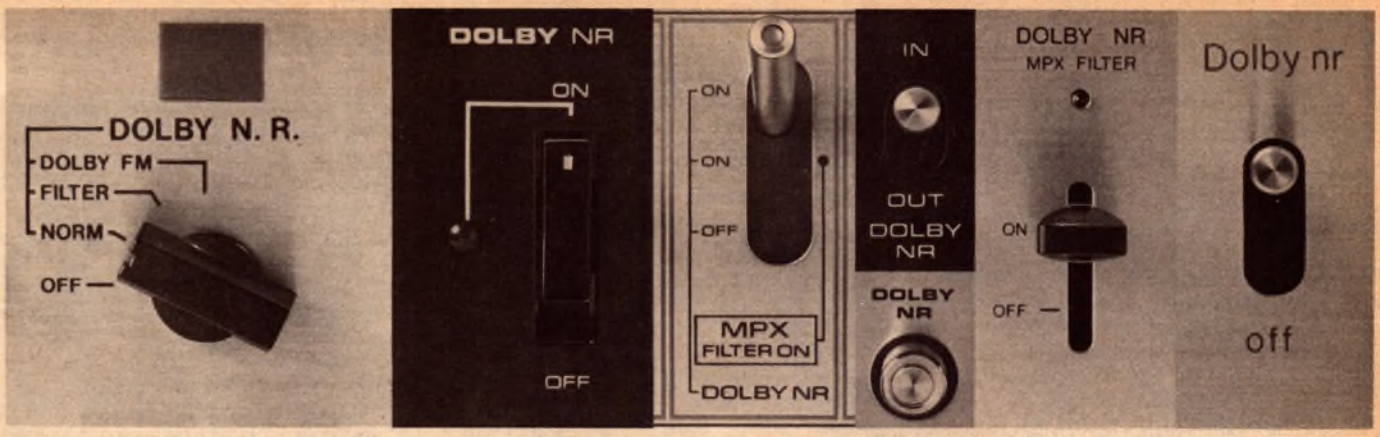
Victorian conference on solar energy

The Victorian Government has announced plans to hold a comprehensive conference on solar energy in February next year. Titled "Solar Energy Today", the conference will be the first of its kind to be held in the southern hemisphere.

The conference is being co-ordinated by the Victorian Solar Energy Research Committee in conjunction with the Department of Minerals and Energy, the Gas and Fuel Corporation of Victoria, the State Electricity Commission of Victoria, and the Australian and New Zealand Section of the International Solar Energy Society.

Some of the world's leading authorities on solar energy utilisation will present papers at the conference. They will come from the United States of America, Brazil, Japan, Denmark, France, West Germany and Australia.

In conjunction with the conference, there will be an exhibition of solar equipment from overseas and Australia at the University of Melbourne. For further information, contact the Victorian Solar Energy Research Committee, 7th Floor, 151 Flinders Street, Melbourne. Telephone 654 4388.



When what's built-in is not enough.

Still hearing some "SSSSSSSS," even though you're using good tape and the noise reduction system in your deck? Don't blame the tape. Chances are, that noise reduction system doesn't have what it takes to give you totally noise-free recordings.

The answer: a dbx II tape noise reduction unit. All of our models give you 30 dB of noise reduction at all frequencies, plus 10 dB extra recording level headroom. Without altering the sound of your music, either. The best that Dolby* B can offer is 7-10 dB of noise reduction. Besides, Dolby and other typical systems operate only at high frequencies, allowing low frequency noises to remain. And as experts know, they require level matching. dbx II doesn't require any level matching whatsoever, because its true mirror image compression/expansion operates linearly on all frequencies and your music's entire dynamic range.

*Dolby is a registered trademark of Dolby Laboratories, Inc.

This all means that the live performances, FM broadcasts and record albums you tape will have their full dynamic range preserved, with no audible tape noise added. So, if you're unhappy with the noise reduction system in your tape deck, consider a dbx II. We make 3 models: the 122, for two-channel tape noise reduction; the 124 for four-channel tape noise reduction, or simultaneous off-tape monitoring of the noise-reduced signal; and the 128 combination tape noise reduction system/dynamic range expander, which lets you make tape copies of your recordings that sound better than the original.

The dbx difference is the difference between some tape noise and no audible tape noise at all. Hear it at your dbx dealer soon.

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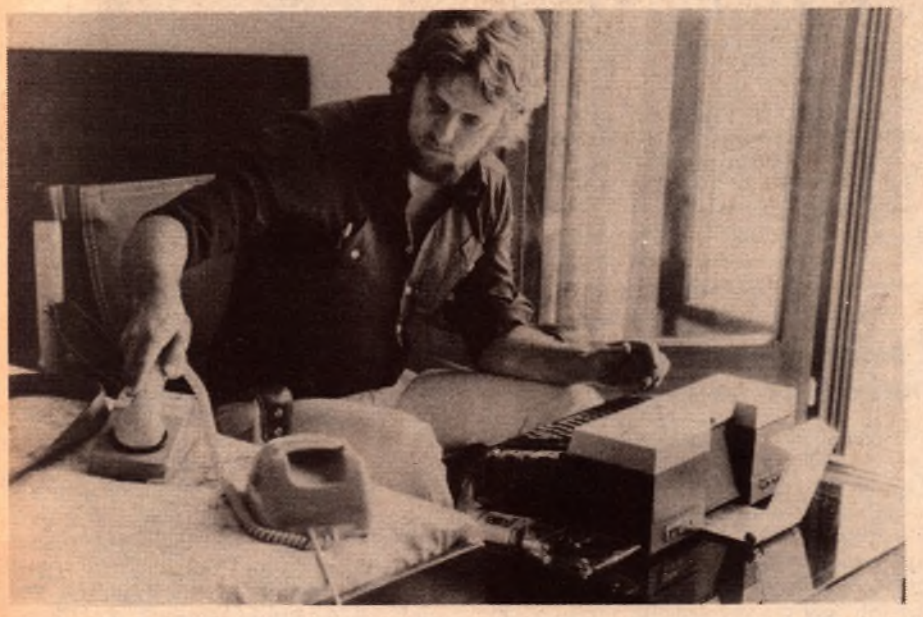
NEWS HIGHLIGHTS

Portable terminal for reporters



Most journalists are familiar with the phrase "slaving over a hot typewriter". In fact, not since the invention of the typewriter has there been any significant technological contribution to facilitate the task of writing.

That situation could now change, thanks to the development of "Scrib" by Swiss company J. Bobst & Fils. Scrib is a reporter keyboard equipped with a portable and independent microcomputer for text processing and transmission. It is an entirely new concept, enabling journalists to create copy, correct it, and transmit the final story via telephone or telex.

The journalist keys his text on the Scrib typewriter keyboard, which is absolutely silent. If required, he can designate typefaces such as bold, semi-bold or italics.

As the journalist writes he is able to check his text on a mirror-reflected screen. With the help of a search routine, the author can weed out repetitive words, locate mistakes, and immediately correct his text without soiling the final copy.

The resident memory contains more than 10,000 characters and may be expanded to 26,000. And if this is insufficient, the writer can store copy on cassettes, each holding 33,000 characters.

Transmission speed over ordinary telephone lines is 30 characters per second, or around four quarto pages in two minutes. Transmission of information is possible in both directions, so that an exchange can take place between the editor and the journalist.

Scrib is distributed in Australia and New Zealand by Vickers Sales Pty Ltd, 78-86 George St, Redfern, NSW 2016.

3000A supply

A constant current source capable of supplying up to 3,000 amps DC at 2.4 volts has been built by Statronics Pty Ltd for the DC Measurements Department at the new National Measurements Laboratory, Ryde, NSW.

The supply replaces banks of batteries previously used for measuring large precision shunts and is capable of working into loads as low as 0.5 milliohms.

Housed in a 2-metre high 19-inch rack, the supply uses a double wye rectifier assembly consisting of 96 TRW hot carrier rectifiers with separate transformer secondaries.

PCM audio disc uses laser pickup

NV Philips of the Netherlands has announced the development of the Philips "Compact Disc", a new sound reproduction system said to provide sound quality far superior to anything available on the market today in audio records or tapes.

The Philips Compact Disc system consists of a player and discs which are played back optically by means of a diode laser mounted in a pick-up arm. The sound information is recorded digitally with a 14-bit linear pulse coded modulation encoding system. Since no physical contact is required for playback (the records are not played back mechanically via a stylus), the audio information can be guarded by a protective layer, and thus the reproduction is not influenced by dust, scratches and fingerprints.

The Compact Disc System, which Philips consider to be the system of the future, has a signal-to-noise ratio and a dynamic range better than 85dB, and a frequency response of 20Hz to 20kHz. Multiple channel systems can be realized easily with ideal channel separation.

High information density on the single-sided optical audio record provides an attractively long playing time of one hour in stereo with a record diameter of approximately 110mm. The information is recorded with a constant tangential velocity of 1.5m/sec.

Philips expect the new system to be made available by the early 1980s at a price comparable to that of a good quality hi-fi record player.

USA to have Prestel/Viewdata

Prestel — the re-named British Post Office Viewdata service that links the phone to the television set to give users access to advice and information — will be available to users in the USA next year, according to Mr Peter Benton, the British Post Office's Managing Director of Telecommunications.

Speaking barely a week after the news of Hong Kong's plans to try out the British invention, Mr Benton said that the American launch resulted from an agreement in principle on a USA licence for Prestel. This had been reached between the British Post Office, inventors of Viewdata, and Insac Data Systems Ltd — the firm set up by the National Enterprise Board to market British computing systems and software overseas.

Under the agreement, Insac will open a Viewdata service from a computer in the USA within six months of the start of a public Prestel service in the UK — planned for the first quarter of 1979.

NEWS HIGHLIGHTS

LOCKHEED STUDYING SOLAR CELLS

Automated production of photovoltaic cell assemblies, aimed at sharply reducing the cost of generating electricity directly from the Sun, is being studied at Lockheed under a one-year US Department of Energy contract, managed by NASA's Jet Propulsion Laboratory at Pasadena, California.

The goal of the Low-cost Solar Array Project (LSA) is to produce electricity at 50 cents (US) a peak watt in less than 10 years to supplement the nation's power supply. Present costs are more than $US11 a peak watt.

A peak watt is the amount of electrical power that can be generated when solar cells are exposed to bright sunshine on a summer day, the ideal condition. Potentially, solar energy can generate up to 1000 peak watts per square metre of surface.

Silicon solar arrays have been used for years to reliably power spacecraft, but their application to terrestrial needs has been limited by high production costs.

Under the contract, Lockheed will review today's production technology to determine what should be retained and will investigate possible new techniques that would help to achieve the goal of lower cost, according to Project Leader Mike Lopez of Lockheed Manufacturing Research organisation.

The contract will also include experiments with ion implantation of selected impurities to form junctions (enabling the cell to generate electricity when exposed to direct sunlight) and laser annealing (a candidate process that could supplant the high-cost thermal processes now used to distribute impurities).

Motorola wins Phoenix solar grant

Motorola has just come out with a $US370,000 grant from the US Department of Energy to design a proposed 500kW demonstration solar power system. A further $US90,000 went to Arizona Public Service Company, an electric utility which will work with Motorola on the design.

The design will be based on Motorola's new solar concentrator modules, described in the August issue of "Electronics Australia". Following completion of the nine-month design study, Motorola and Arizona Public Service Company stand to get an estimated $US6 million to $US8 million contract to build the system at the Phoenix International Airport.

Radiosondes sold to Asia

Philips has received export orders for over 6000 weather radiosondes during 1978. The countries placing the orders were Malaysia, Thailand, Singapore and Pakistan.

The radiosonde was designed and manufactured in Australia at Philips-TMC's radio communications factory in Clayton, Victoria. It consists of a balloon-borne telemetry package which measures and relays to a ground-based receiver continuous data on the temperature, humidity and pressure (height) of the upper atmosphere. Such data is essential in the production of meteorological data for weather prediction and general aviation.

Manufactured by R. F. Systems Pty Ltd, this communications console forms part of a new range of radio and telemetry equipment recently introduced by the company. Included in the new range are 25W transceivers operating in the 70-85MHz and 148-175MHz bands, and a range of VHF FM repeater-base stations. Enquiries to RF Systems Pty Ltd, 98 Guthrie St, Osborne Park, Western Australia 6017.

Business Briefs:

● Toshiba (Australia) Pty Ltd is to enter the business equipment market, according to a recent announcement by managing director Trevor Thacker. Already, Toshiba has introduced an extensive range of pocket calculators, with a selection of desk-top models (both with and without print-out facilities) expected by the end of the year. Further new product releases in the business equipment area are anticipated in the new year.

● Video sales in Australia are booming according to Mr Derry Weis, owner of Consolidated Video Industries of Double Bay and Sydney's largest independent retailer. His company has recently announced the opening of new outlets in Parramatta (corner of Argyle and Fitzwilliam Sts) and Newcastle, and more are planned.

Consolidated Video Engineering markets a comprehensive range of new generation VCR equipment, with the 5-hour Grundig 4004 and the 3-hour VHS Akai VS9300 said to be leading sales at the moment.

● Brewo Electronics Pty Ltd has recently taken over Telefunken sales and service from Chartwell Distributors Pty Ltd. The newly acquired Telefunken range will be handled jointly with the Grundig range, which Brewo Electronics has been handling in NSW since November, 1977. The company's address is International House, 104 Bathurst St, Sydney.

● A new range of 5kW and 10kW AM transmitters has been released by TBC Pty Ltd, 79 Mahoneys Rd, Forrest Hill, Victoria 3131. The range was originally designed by American Electronic Laboratories, but has been re-engineered to suit Australian conditions. The new transmitters are manufactured by TBC in Australia using Australian-sourced major components.

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RELIABLE
All components are rated in excess of their required values. Automatic insertion and testing reduces human errors. Flow soldering ensures maximum reliability of soldered joints. You get the built-in reliability for which Telequipment scopes are renowned.

EASY-TO-SERVICE
Primary circuits are constructed on only three boards in a "u" configuration. The amplifier and time base boards pivot around the regulated power supply making for excellent accessibility. Wherever possible standard commercial components have been utilised throughout, simplifying acquisition.

LOW COST
Just check our prices. Because you know there is a lot more to cost than just the price, you'll see there's real value for money in these Telequipment 'scopes!

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TK17

SEASAT-A:

studying the world's oceans

A new satellite has been circling the Earth 14 times every day for the last few months. Called Seasat-A, it was launched by the US National Aeronautics and Space Administration in late June to determine if microwave instruments scanning the world's oceans from space can provide useful scientific data for oceanographers, meteorologists and commercial shipping.

Seasat-A, the first satellite designed specifically to study the world's oceans, was launched on June 27 this year from the US Western Test Range at Vandenberg Air Force Base in Lompoc, California. Currently it is sending back information on surface winds and temperatures, wave heights, currents, ice conditions, ocean topography and coastal storm activity to NASA ground stations throughout the world.

The satellite is in a circular orbit at an altitude of 800 kilometres, with an inclination of 108 degrees and an orbital period of around 101 minutes. It therefore provides a complete global coverage every 36 hours approximately.

Basically Seasat-A is designed to prove the feasibility of employing an operational, multiple-satellite Seasat network to monitor the world's oceans on a continuous and mainly real-time basis. Such a system could provide ships at sea with detailed charts of routes updated twice daily to show the latest weather conditions, sea state and hazards. Long range use of such a system could influence ship design, port development and the selection of sites for such off-shore facilities as power plants.

Other potential users of Seasat data include commercial fishermen, oil exploration firms, weather services, pollution control agencies, coast guards and navies.

The basic part of Seasat-A is an Agena three-axis stabilised spacecraft, a vehicle which has been used successfully in some 300 previous space missions. To the Agena is attached a sensor module carrying a variety of sensors and related scientific equipment.

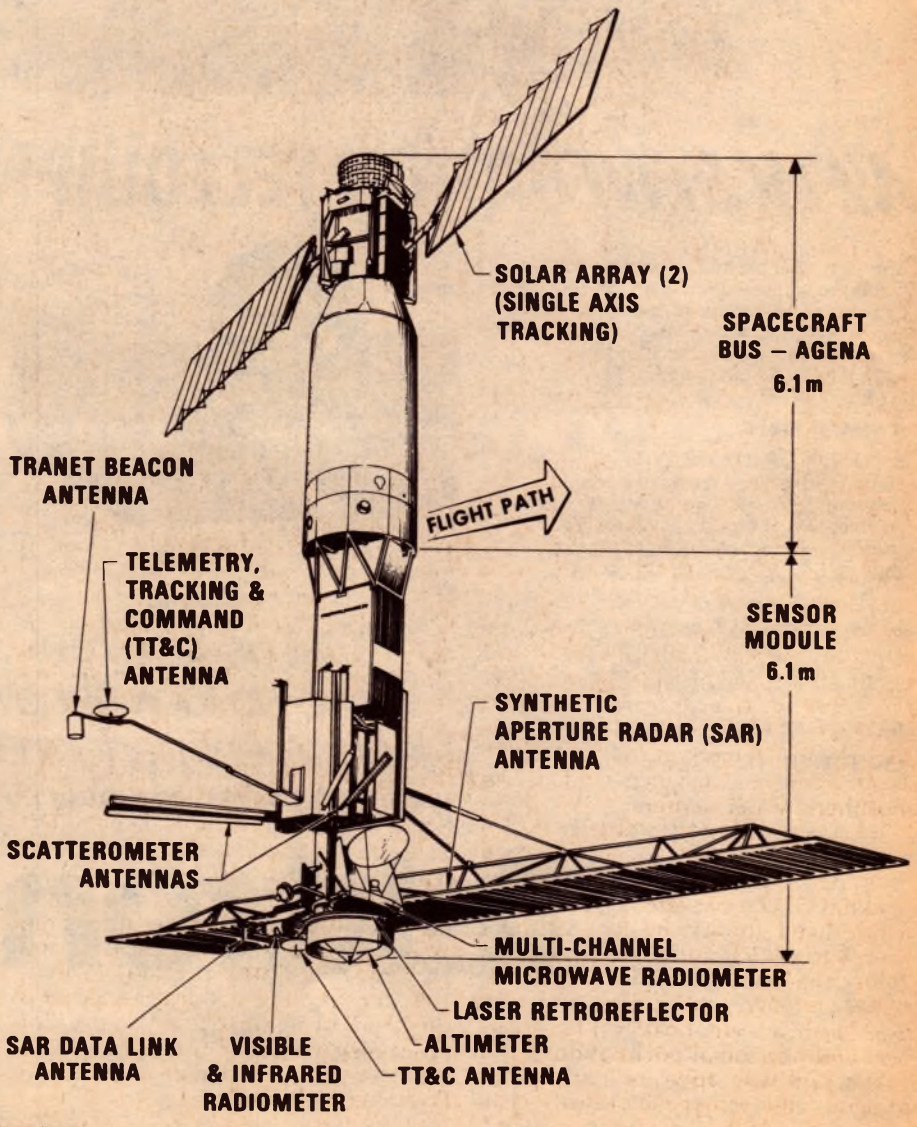
The Agena "bus" and its sensor module were launched using an Atlas F primary vehicle, with the Agena itself as the secondary vehicle. At launching the total vehicle measured 34.61 metres high and 3 metres in diameter.

In orbit, the Agena and sensor module weigh nearly 2.3 tonnes and measure 12.2 metres long. The satellite "stands on end" in orbit, with its axis at right angles to the flight path. The sensor module is nearest the Earth, with its sensor and communications antennas facing downwards. Two solar cell arrays with a total area of 14.5 square metres are deployed from the rocket engine end of the Agena, and these are used as the satellite's primary power source. The panels rotate on one axis to provide a minimum power output of 700 watts. Energy storage is provided by two nickel-cadmium batteries.

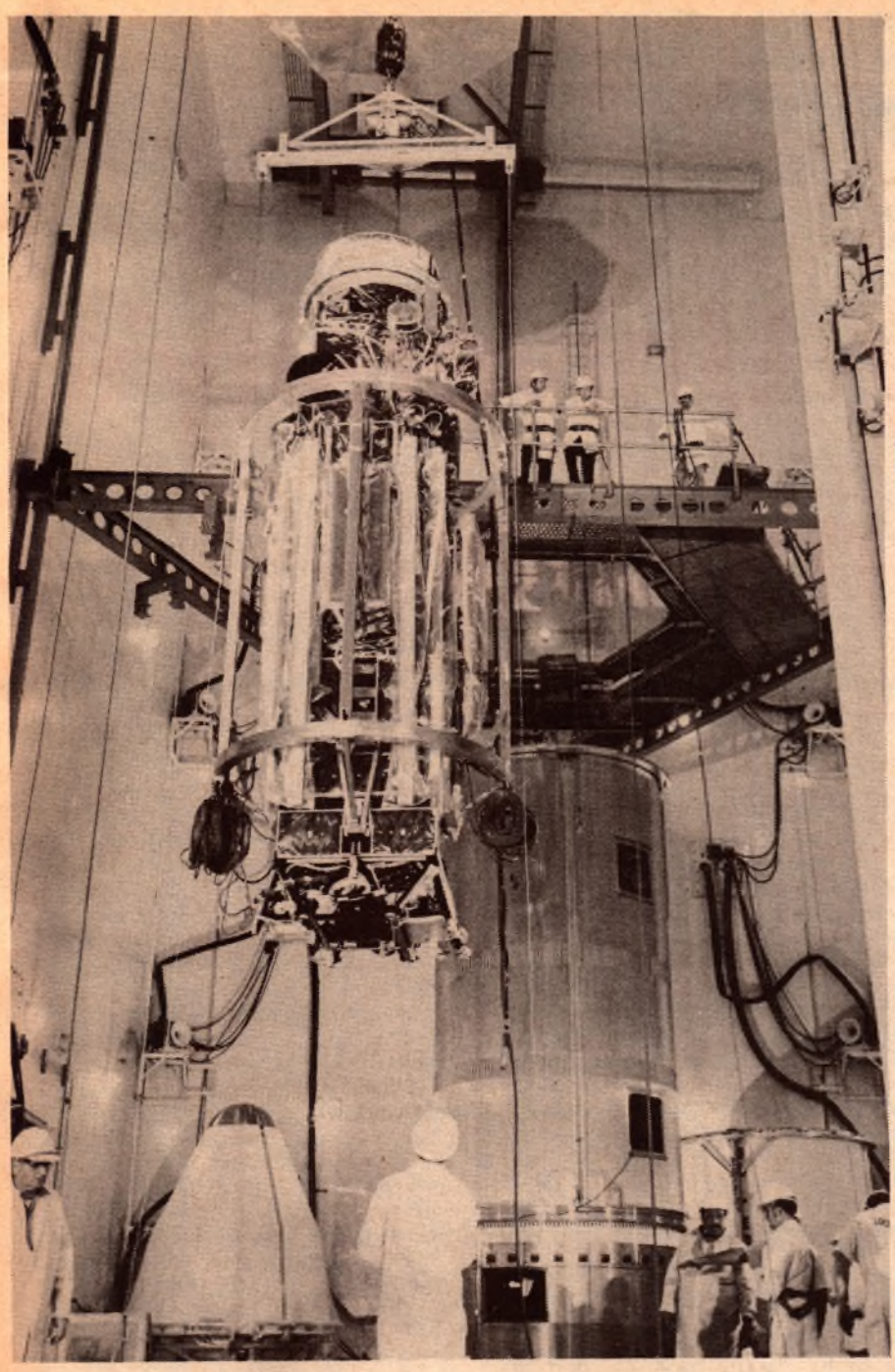
Normal power requirement of the satellite is around 700 watts in orbit, but can exceed 1200 watts for brief periods.

There are four microwave instruments in the sensor module section of the satellite. These are a scanning multifrequency radiometer, a radar scatterometer, a synthetic aperture radar and a radar altimeter. A fifth instrument, a visual and infrared radiometer, provides supporting data.

The scanning radiometer (SMMR)



This sketch shows how Seasat-A looks in orbit, with the various functional parts identified.



The sensor section of Seasat-A being hoisted onto the Agena vehicle earlier this year, in Lockheed's acoustic testing chamber in Sunnyvale, California. This was for pre-launch vibration tests.

scans some 25 degrees either side of the satellite's orbital track, to observe a swath about 690km wide. It measures radiation at five frequencies from 6.6GHz to 37GHz, and is used to derive sea surface temperatures (to within about 2 degrees C), wind speed and atmospheric water content.

The microwave scatterometer (SASS) measures fine-scale ocean surface roughness caused by surface winds. Its readings can be converted directly into wind speed (to within 10% or 2m/s from 4 to 48m/s) and direction (within 20%). The SASS generates a 14.6GHz signal at 100W peak power, and uses four fan-beam antennas that have vertical and horizontal polarisation.

The synthetic aperture radar (SAR) provides all-weather pictures of ocean waves, ice fields, icebergs, openings in sea ice, land, snow cover and coastal conditions. It produces images with a resolution of 25m, over a 100km swath.

The antenna array for the SAR is the single most obvious deployment on the satellite. In orbit it is 10.7 metres long by 2.1 metres wide, supported by a frame which maintains its flatness. The SAR sensor generates a 1.275GHz chirp signal at 1000W peak power that is radiated to Earth, reflected and received by the antenna array. It is then amplified, converted to 2.265GHz and transmitted to Earth in analog form.

At the tracking stations the signal is digitised and stored on tape, for processing into radar images by NASA's Jet Propulsion Laboratories in Pasadena, California.

The fourth microwave instrument is the radar altimeter, which traces a path from 2 to 10 km wide directly below the satellite. It measures average wave height to within 10% over a range of 2 to 20 metres, and also the height of the satellite itself above the ocean — to within 10cm!

The altimeter generates a 13.56GHz chirp signal of 2kW peak power, and uses a parabolic antenna 1 metre in diameter.

The visual and infrared radiometer (VIRR) is used primarily to provide supporting data for the four microwave experiments. It provides images of atmospheric conditions, cloud coverage, ocean and coastal features, and also sea surface temperature maps.

Radiation emitted from Earth is collected by an elliptical scan mirror and directed into a dichroic beam splitter. Infrared radiation is sent to a bolometer detector, while visible radiation is sent to a silicon photovoltaic detector.

Data from all of the satellite sensors except the SAR may be sent to Earth in real time at 25 kilobits per second. Alternatively it may be stored on either of two data recorders, with a capacity of about 350 million bits, for transmission to a ground station during a pass. The playback data transmission rate is 800 kilobits per second, the 32:1 ratio allowing more than 2 orbits of data to be transmitted in less than 7 minutes.

The SAR data cannot be recorded, as it operates at a data rate of 110 million bits per second. SAR data is thus sent only in real time, limiting its use to orbit segments over ground stations.

Data communications for the satellite are handled by S-band systems operating at 2106 and 2287MHz, with the lower frequency used for command uplinks. Main Downlink transmitter power is 1W, with a separate 5W transmitter used for SAR data.

Three independent systems are used to track the satellite and control its orbit and attitude. One system uses the S-band transmissions for ranging, relying on the fact that satellite transmissions are phase-locked to received signals. A second system uses "TRANET" ground receivers tracking a dual frequency 162/324MHz doppler beacon transmitting from the satellite.

The third tracking system uses a world-wide network of laser stations, which beam laser signals at "corner cube" retro-reflectors on the satellite.

Prime contractor for Seasat-A was Lockheed Missiles & Space Co, of Sunnyvale, California.

If this first ocean satellite lives up to expectations, it could lead to a full-scale global monitoring system.

September 12 this year was the 22nd anniversary of the official opening of SILLIAC, the first computer at the University of Sydney and one of the first in Australia. SILLIAC, a thermionic valve computer of extraordinary bulk, reached from floor to ceiling and consumed some 35 kilowatts.

Sydney University's first computer

Hailed as being able to do "three months' work in ten minutes", SILLIAC was one of the most advanced computers of its time, being a modified version of the historic ILLIAC machine, designed and built at the University of Illinois.

Today, after 22 years of rapid technological growth, the computing power of SILLIAC can be surpassed by a microprocessor chip weighing less than 30 grams, and computers have become such familiar tools of research that keeping track of their numbers on campus is a major auditing exercise.

With the increasing demand for computing power, the University of Sydney has acquired and discarded two to three generations of computers since SILLIAC.

It now has a major "time-sharing" computer, the CYBER 72, which can simultaneously serve more than 120 terminals located throughout the University. By rapidly switching attention from terminal to terminal, the CYBER gives each user the illusion of having the computer to his or her self.

In addition, there are several other medium-scale computers which service specialised areas such as the Library, Engineering, Computer Science and Administration, as well as dozens of smaller computers with highly specialised applications.

Although the official opening of SILLIAC was not until 1956, its history dates back to the appointment in 1952 of Professor Harry Messel as Head of the School of Physics.

One of his first major undertakings was to establish in 1953 the Nuclear Research Foundation which had, as its first Governor, a well-known Sydney philanthropist, the late Sir Adolph Basser.

When an offer was received from the University of Illinois to supply, at almost no charge, all the circuit diagrams and programs from its historic ILLIAC machine (now on display in a Washington museum) an appeal was launched early in 1954 to raise a sum of £50,000 to build the machine locally.

Soon after the appeal was launched, Sir Adolph Basser personally offered the entire sum to the University, and the computing laboratory was named after him in honour of this donation.

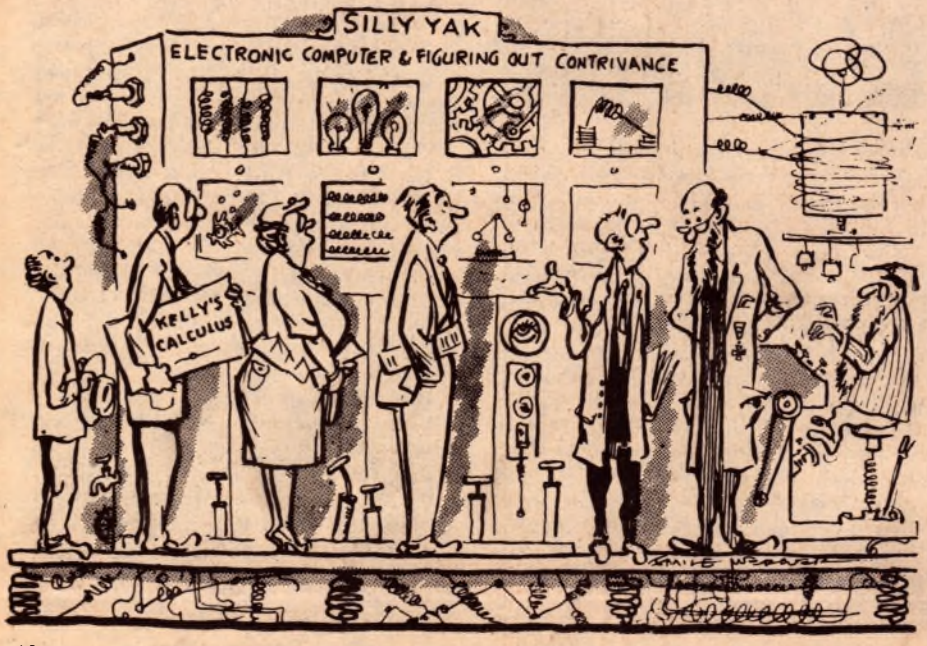
With finance assured, the late Mr Brian Swire was appointed Chief Engineer and spent several months in Illinois studying the prototype machine. He returned in February 1955 to supervise the construction of our own version, and work commenced on the manufacture of the framework, panels, chassis and power supplies.

The electrical chassis were delivered in August 1955 and wiring commenced. Finally, on June 4, 1956, the new computer was able to run a test program.

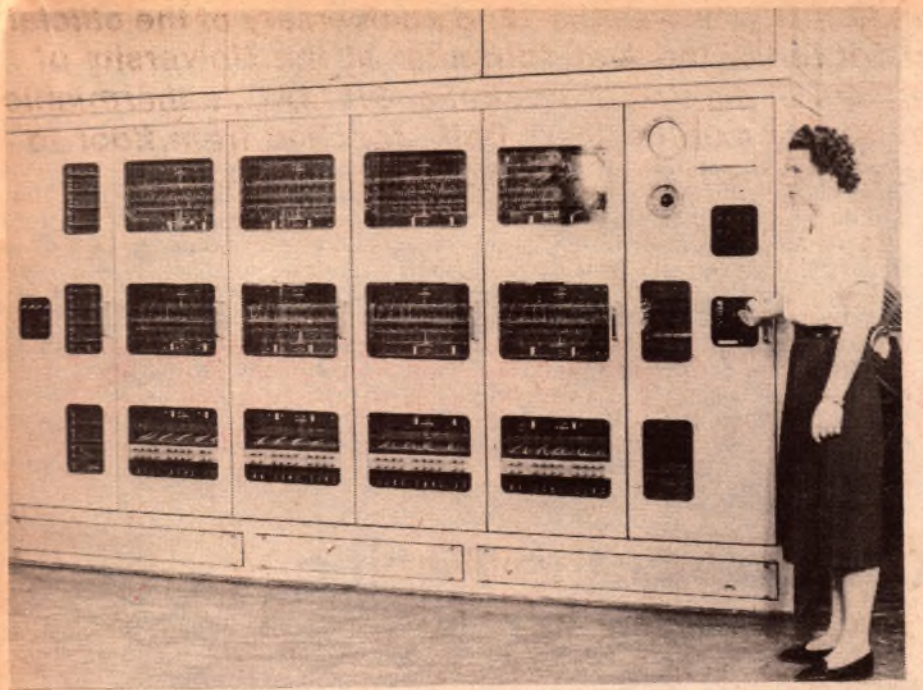
Its first official production run was a scientific calculation lasting 65 minutes which it performed for Dr J. Blatt (now of the University of NSW) on July 5th, 1956.

SILLIAC was a thermionic valve machine with cathode ray tube memory. The mainframe reached from floor to ceiling and consisted of a completely enclosed cabinet about 3.7m long and 0.8m deep.

It had 2800 valves consuming 35

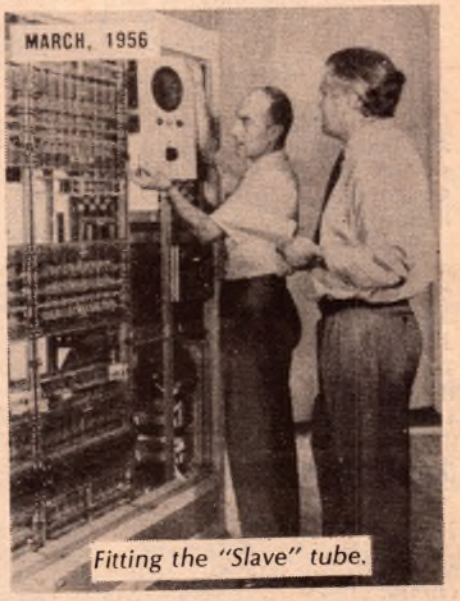


"They want to know how to work out the figures that determine the winning number in a jackpot lottery" — SILLIAC as seen by Sydney Sun newspaper cartoonist Emile Mercier.

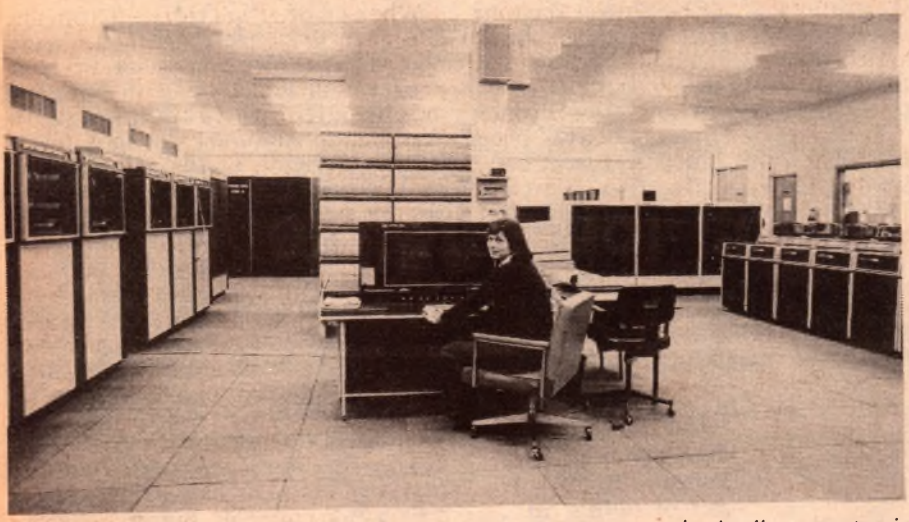


Manufactured by STC, SILLIAC cost around £75,000 and took 2½ years to build. It employed some 13 miles of wire, had 2800 valves, and consumed 35kW.

Units arriving.



Fitting the "Slave" tube.



Twenty years later — Sydney University's CYBER 72 "time-sharing" computer is linked to more than 120 terminals throughout the campus.

Trying the tape equipment.

kilowatts, to store, manipulate and change numbers. The whole thing was cooled by circulating chilled air through the cabinet. There were hinged panels at the front and back with perspex windows, through which the contents of the various registers could be seen displayed in neon lights.

On January 3rd, 1956, while SILLIAC was under construction, Dr John M. Bennett was appointed Senior Numerical Analyst and took charge of the programming side of the embryonic Adolph Basser Computing Laboratory.

By 1961, the teaching and research activities of the Laboratory had expanded to the extent that it was made a full department within the School of Physics and on September 4th of that year Dr John Bennett was appointed as Professor of Physics (Electronic Computing). The new department was called the Basser Computing Department.

SILLIAC continued to serve as the University's principal computer until in 1964 the English KDF 9 was installed. After this, there was a gradual shift of workload to the KDF 9 until, in its latter years, apart from running a few programs for sentimental reasons, SILLIAC did little else but act as a magnetic tape controller for the KDF 9 to which it was linked.

An interesting output device connected to SILLIAC was a loudspeaker, intended to assist the operator in determining when the machine had stopped. It also provided endless amusement for the more erudite

Sydney University's first computer

programmers who quickly found that it was possible to generate a series of tuned square waves and play music. The last few weeks of the computer's life were spent entertaining the senior students of Computer Science by playing an enormous variety of popular and other tunes.

On May 17th, 1968, at a moving ceremony, SILLIAC sang the well known Funeral March by Chopin and Handel's Dead March from Saul. The power was turned off by the Vice-Chancellor, Professor Bruce Williams, and thereby ended an era.

The computing power of the Basser Department was greatly enhanced in 1967 when, through the generosity of IBM Australia, an IBM 7040 1401 system was installed.

In 1970 it was decided to make a clear delineation between the academic and service functions of the Basser Computing Department. To this end a sub-department was established known as the University Computing Service and Mr Bob Donnelly was appointed Manager in 1972. This became a separate unit within the School of Physics and was renamed the Basser Computing Centre.

A substantial grant from the Australian Universities Commission enabled the purchasing in 1973 of a new large-scale computer system from Control Data (Australia). A new building was constructed and the computer, a CYBER 72, was installed, without ceremony, in mid-1974. With the change of premises the name University Computing Centre was adopted.

Computer network across the Pacific . . .

The first program was run on the SILLIAC in July 1956, and in those days scientists were delighted to have just one computer to work with. Now, 22 years later, computer scientists at Sydney University are working on ways of "networking"; that is, linking many computers together on a regional basis to share computing power and information.

This has been made possible by the revolution in telecommunications which allows not only pictures and sound, but vast amounts of digital information suitable for input or output to computers, to be relayed around the world via satellite.

Several years ago, the Basser Department of Computer Science at the University joined PACNET (Pan Pacific Educational Computer Network) which carries out networking experiments via the geostationary NASA satellite ATS-1, transmitting to the entire Pacific region (more than 40% of the Earth's surface).

On the roof of the Physics Building (only a short distance from the room which used to house the old SILLIAC machine) two antennae now point skywards to a fixed position where the ATS-1 satellite maintains its orbit 36,000km above Christmas Island in the Central Pacific.

The antennae cost only $200 each to build, and look like ordinary household TV aerials which have sprouted and grown to about 10 times their original size. They are the most dramatic sign that "networking" is going on inside the Physics Building, even though technically they are about the least complex part of the work.

The really complicated work has been going on inside, in the air-conditioned room which was once the home of one of SILLIAC's successors, the IBM 7040, before the operation of the University's main computer was hived off to independence in a separate building. Here, with a mixture of smart-looking "off-the-shelf" computers and "do-it-yourself" boards of chips and switches built within the Department, the hardware has been developed to convert radio signals from the satellite into readable print-outs.

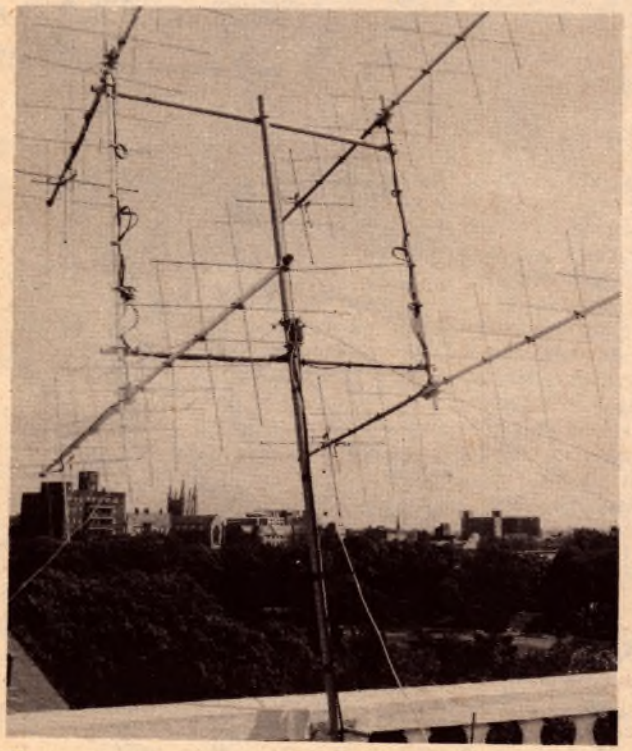
A visitor to the Department is shown a bewildering variety of miniature circuits, modulators and "packet" switching facilities. (A "packet" is a convenient fixed amount of information into which messages can be divided for transmission.) This equipment "wraps up" message or data information and forms a "packet" by appending sender and addressee information.

The transmission speed is 9600 bits (ie about 1000 characters a second). In a talk given at last year's ANZAAS conference in Hobart, Professor John Bennett, of the Computer Science Department in the School of Physics, pointed out that a decade ago, people settled for sending information at Telex rates of 100 bits (say 10 characters) a second, and talked hopefully of 2400 bits a second.

Now 48,000 bits a second is common, and a system is being developed to carry gigabits a second; a gigabit, 10^9 bits, is about the contents of the *Encyclopaedia Britannica*," he said.

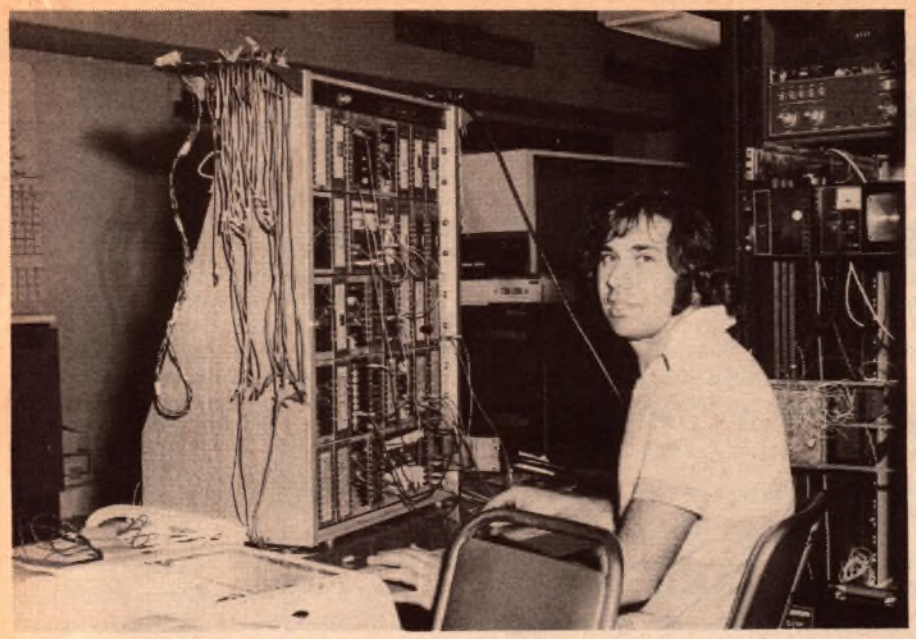
The main purpose of the experiments in the Department of Computer Science, however, is not to maximise the speed of transmission, but to achieve an acceptable speed reliably with low-cost equipment.

Explaining the background to the University's involvement in network-



Vast amounts of information, suitable for input or output to computers, can be relayed around the world via satellite.

Pointing towards geostationary satellite ATS-1 — one of the two antennae used by Sydney University for PACNET. Satellite re-broadcasts with a power of just 40W!



Senior Technical Officer Remo di Giovanni demonstrates the microprocessor-based data processing system. The system converts received radio signals into a form suitable for input to the Digital PDP-11 and Burroughs 1726 computers.

ing, Computer Science Lecturer Dr Ian Parkin said PACNET had originated from a US financed project linking by radio a number of terminals on the campus of the University of Hawaii.

"This project (appropriately named ALOHA) turned out to be a very interesting experiment because it used a new cost-saving idea: single-channel, random access communication," said Dr Parkins.

"Instead of giving a separate channel to each terminal, which would have been quite expensive; it was possible for each terminal to send off its "packet of information and take the chance that it did not collide with another packet from a different terminal.

"If a collision did occur, the packets were sent out again after a suitable delay until they were received and acknowledged.

This "cocktail party' kind of conversation between the terminals and the central computer proved effective. "Given the availability of a suitable satellite it was appropriate to set up PACNET, a similar experiment with terminals communicating around the entire Pacific area," he said.

Realising the significance to Australia of low-cost data communication in scattered communities, both within the country and in the Pacific, Professor John Bennett instituted membership of PACNET several years ago. About 15 months ago, the Department's radio equipment came on air, and since then trial receptions and transmission have been carried out, and continual improvements have been made to the equipment.

Connections from the radio through various microprocessors to the Department's Digital Equipment PDP-11 and Burroughs 1726 computers have been established. Data packets are received daily from Japan via the ATS-1 satellite.

The satellite re-broadcasts with a power of only 40 watts — something like the power of a small light globe. It isn't surprising that the packets are sometimes "corrupted" by noise and interference upon arrival. One of the significant associated research topics involves the use of error-detecting and error-correcting codes to ensure minimal corruption of communications by noise interference.

At the beginning of last year, members of the Department of Computer Science were pleased to find that their radios and aerials could be put to good use even when the satellite was not handling digital information.

The Department was approached by groups wishing to use PEACESAT, a different network of stations operating through the ATS-1 satellite for voice conferencing . . . a rather more sophisticated variation on the "school of the air" in the Australian outback.

PEACESAT uses the satellite on the same frequency as PACNET, but at a different time of the day. It is used for educational, medical and community conferences. Australian educational and medical authorities have expressed interest in using the voice conferencing facilities at the University to discuss common problems with similar authorities throughout the Pacific region. PEACESAT may permit double usage to be made of the radio equipment that has already been assembled for PACNET.

This story courtesy "The Gazette", publication of The University of Sydney.

Electromagnetic Interference

. . . a problem of growing concern

Electromagnetic pollution is fast becoming a serious problem in industrialized countries. Already, in the United States, there have been reports of interference to all types of electronic equipment ranging from heart pacemakers and TV sets to giant computers.

by FREDERICK P. McGEHAN*

Blasting zone ahead. Turn off 2-way radio!

This is a sign commonly seen along highways where repair or construction is underway. It is perhaps the public's clearest indication that there is a problem called electromagnetic interference (EMI for short).

Most people are not familiar with the term EMI. However, many do know what can happen if a driver operates a mobile radio while passing through an area where there is blasting: the radio can generate a signal that triggers blasting caps on dynamite. The result can be disastrous. Hence the sign.

This is just one very small example of EMI, a problem that has been growing rapidly in the last two decades to the point that the skies over our large cities have become literally choked with electromagnetic radiation. The sources are legion: radar installations at airports, radio and television broadcasting towers, CB and mobile radios, and even sensors buried in our roadways that tell the traffic lights when to change.

The terms "electromagnetic smog" and "electromagnetic pollution" have been coined to describe the consequences of all this radiated energy. Its proliferation in our environment results in interference with all types of electronic equipment, from mammoth computers to TV sets and heart pacemakers. Where the electronic devices are used to control a vital function — such as regulation of the heartbeat — EMI can be dangerous.

The military is concerned because it uses electronic control systems in very sophisticated ways. And among its many concerns, the military recognizes that a stray electromagnetic signal might accidentally damage or even detonate munitions.

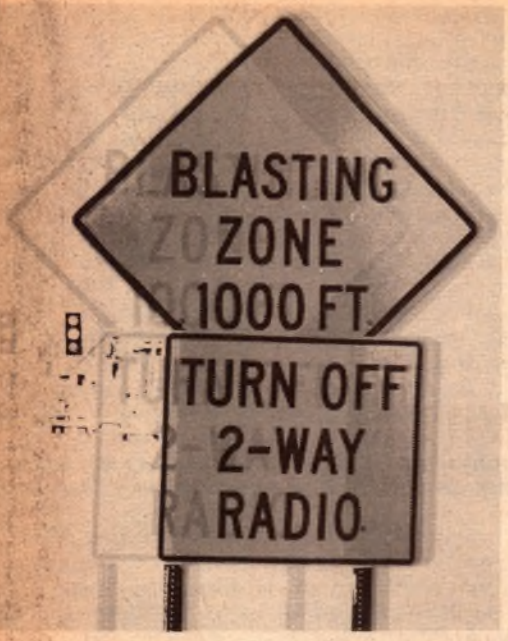
In addition to the interference problems, there is increasing concern on the part of the medical and scientific communities over the biological effects of this radiation on humans and animals. Initially it was believed that electromagnetic radiation produced only a heating effect in living tissue. Lately there has been evidence to suggest that there may be long-term, subtle consequences possibly involving the nervous system.

EMI problems have aroused interest in several federal agencies in the United States, including the Environmental Protection Agency, the Department of Transportation, the White House Office of Telecommunications, The Federal Communications Commission, and the Department of Defence. Many of the organizations have come to the National Bureau of Standards through its Electromagnetics Division in Boulder, Colorado, for assistance. They have come for help in determining the EMI environment and the susceptibility of individual pieces of electronic equipment to interference, and for help in finding ways to evaluate effective protection of equipment intended to prevent interference.

The electromagnetic story goes back to 1873 when James C. Maxwell, director of the Cavendish Laboratory, Cambridge University, postulated the existence of electromagnetic radiation. This theory was confirmed in 1888 by German physicist Heinrich Hertz who produced the first man-made electromagnetic wave. Succeeding inven-

*F. P. McGehan is a public information specialist with the NBS Program Information Office in Boulder, Colorado

Electromagnetic interference has caused problems with anti-skid braking systems, and poses a threat to future electronic engine controls.



tors, most notably Guglielmo Marconi, devised equipment to generate and receive electromagnetic waves, particularly in the radio range of the spectrum. As a result, the world witnessed first wireless telegraphy and then voice transmission, which came to be known as radio.

Although entire industries were spawned by these discoveries, the amount of man-made electromagnetic radiation in the environment was relatively small until World War II. Most of the radiation resulted from radio broadcasting.

The discovery of microwaves in the 1930's, and their application to radar during the war, led to new sources of electromagnetic radiation. After the war, radar was adapted for civilian uses and microwaves were used, among other ways, for long distance telephone communication.

The development of semiconductors, which allow more electronics to be placed in smaller and smaller configurations, added new sources of and targets for electromagnetic interference. The electronics revolution has now progressed to solid-state integrated circuitry and microprocessors that have resulted in low-priced CB radios and land-mobile transceivers and in applying control systems to difficult problems.

The consequence has been a dramatic increase in electromagnetic irradiation. At the end of World War II there were only six television stations in the USA; today there are more than 1000 stations that transmit to 120 million television sets. In the same period, the number of radio broadcasting stations jumped from 930 to 8000. And a whole new era of broadcasting was ushered in with the popularization of CB radios. There are some 15 million licensed CB radios in homes and vehicles across the United States.

In 1975 the US Federal Communications Commission received more than 100,000 complaints concerning radio interference — and the FCC estimates that fewer than one in ten interference problems gets reported. The Commission figures 9 million people will experience TV interference from CB radios in the year ending June 30, 1979.

The EMI problem promises to continue to grow, particularly in the automotive industry, as mechanical parts and devices are replaced with electronic components. A foretaste of this came in 1975 when a National Highway Traffic Safety Administration regulation required the use of anti-skid braking systems on all new trucks and buses. To comply with the stringent NHTSA regulation, the industry chose systems that are electronically controlled.

Unfortunately it was found that in some cases the operation of a CB radio in the truck or bus or in an adjacent vehicle was enough to trigger the braking mechanism. Because of this and other problems, the regulation was suspended for more than a year while bugs in the new braking systems were worked out. Some 18,000 new trucks were recalled in 1975 because of the EMI problem.

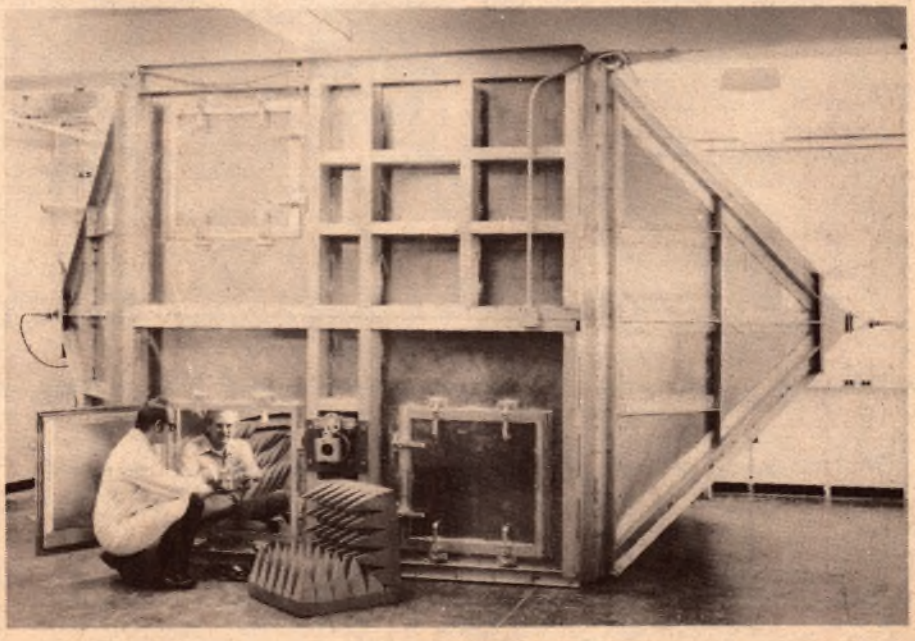
Detroit has already begun introducing electronic controls — microprocessors — on selected lines of automobiles and wants to begin using them extensively within the next few years. These microprocessor-based systems will be programmed to minimize exhaust pollutants, manage fuel consumption, advance the spark, monitor safety functions, and optimize transmission shifting. In addition, air bags, which may become a mandatory safety device in future years, are triggered by electronic controls.

Auto makers are fearful that their heavy investments in these new systems could be compromised by EMI. At an NBS-sponsored conference on EMI at Gaithersburg, Maryland, in July 1977, automotive engineers called for more government-sponsored research on EMI and the electromagnetic environment in which vehicles operate in order to avoid overdesigning their new electronic control systems and to assure their safety for public use.

Another recommendation made at that conference was for the increased development of modern measurement methods to compare the performance of individual small electronic components to that of large integrated systems in the face of mounting EMI problems. Interestingly, NBS is developing methods to measure both the impact of components on the electromagnetic environment and of the environment on the components. And the task is not easy.

Part of the difficulty lies in the nature of electromagnetic waves and the way they propagate (transfer energy). At a distance comparatively far from the radiating source, the waves are relatively easy to measure and techniques for doing so have been known for a long time. The wave's shape is well defined at such a distance, and, if you were standing in front of it and could see it, it would resemble a plane of material moving towards you. Measurement under these circumstances usually requires instrumentation and good practice that recognize and identify reflections from the ground and other objects that can obscure the primary signal.

Below shows NBS' transverse electromagnetic cell. Electrical and electronic equipment can be tested inside the cell for susceptibility to electromagnetic interference.



Electromagnetic Interference . . .

However, most important in terms of EMI and the biological consequences of electromagnetic irradiation is the so-called near field. This can be comparatively close to the radiating object, say from a few centimetres or metres for a CB radio or land-mobile radio up to two kilometres for a satellite tracking station. It is here that the waves have not yet formed into a pattern and measurement is exceedingly difficult. "You can't take the same kind of instruments used for measuring the far field and put them in the near field and expect to achieve meaningful results," says Charles K. S. Miller, manager of NBS' EMI measurement program.

A second difficulty in approaching the EMI problem is the sheer number of interfering signals. If the interference were caused by a single signal, "it would be easy to tackle," Miller notes. By pinpointing the frequency and amplitude of the incoming signal, it would be possible to develop a shield and provide filtering on incoming wires to protect the electronic component from EMI at any one frequency. But that is not the case in nature or in the world as man makes it.

"In the living environment you have a phenomenal number of different signals", Miller says. They come from radio and TV broadcasting stations; mobile radios in police cars, trucks and cabs; marine band radios; CB radios; and even satellites. Other devices include radar sets, garage-door openers, burglar alarms, active traffic sensors, arc welding machines, electric motors, auto ignition systems, and the corona of high-voltage power lines.

Miller sees the environment becoming messier as new, consumer-oriented products come onto the market that radiate weak electromagnetic signals. He cites as examples the types of antiburglar devices for use in businesses and homes that employ microwaves, and the new TV and electronic games. He also believes the frequency components and waveform characteristics of new communications systems might add complications that are not presently anticipated.

Still another difficulty in guarding sensitive electronic components against EMI is the fact that some of the equipment, particularly when used in motor vehicles, is constantly moving in and out of different electromagnetic environments. In addition to worrying about EMI from broadcasting and radar stations, designers of electronic components for vehicles must take into account such things as electromagnetic sensors buried in the roadway to trigger traffic lights. A stray signal could cause a braking system to malfunction at an intersection and place the lives of the driver and others in danger. And, in addition to planning for all current electromagnetic environments, the designer has to try to anticipate future uses for electromagnetic waves and the corresponding potential for detrimental changes to the environment.

Two US federal agencies in particular, the Environmental Protective Agency and the Department of Transportation, are interested in measuring the sources and amount of electromagnetic radiation in the environment. In its efforts to protect the public from non-ionizing radiation, EPA is interested in developing a data base on electromagnetic radiation for major US cities. With such a base, the agency could determine over a period of years whether the electromagnetic environment is deteriorating, and if so, by how much. The Department of Transportation is interested in measuring the EM environment around vehicles to define typical serious conditions to which automobiles will be exposed.

In its work for DoT, the NBS Electromagnetics Division performed on-site measurement studies utilizing specially designed instrumentation near vehicles that were equipped with mobile radios. The NBS measurements showed, to the surprise of the auto industry, that the near-field electromagnetic environment frequently was higher than the currently accepted US Standard for EM radiation exposure. Miller believes that the seriousness of this problem will increase as manufacturers encase electronic components in plastic rather than in metal and as metal shells are replaced by plastic ones in new vehicles. Current plastics offer no shielding against EMI.

High EM field levels around vehicles, Miller believes, not only endanger the functioning of electronic components but also pose potential health dangers to vehicle occupants. Ironically, he

notes, some of this irradiation comes from the very CB and mobile radios the drivers use.

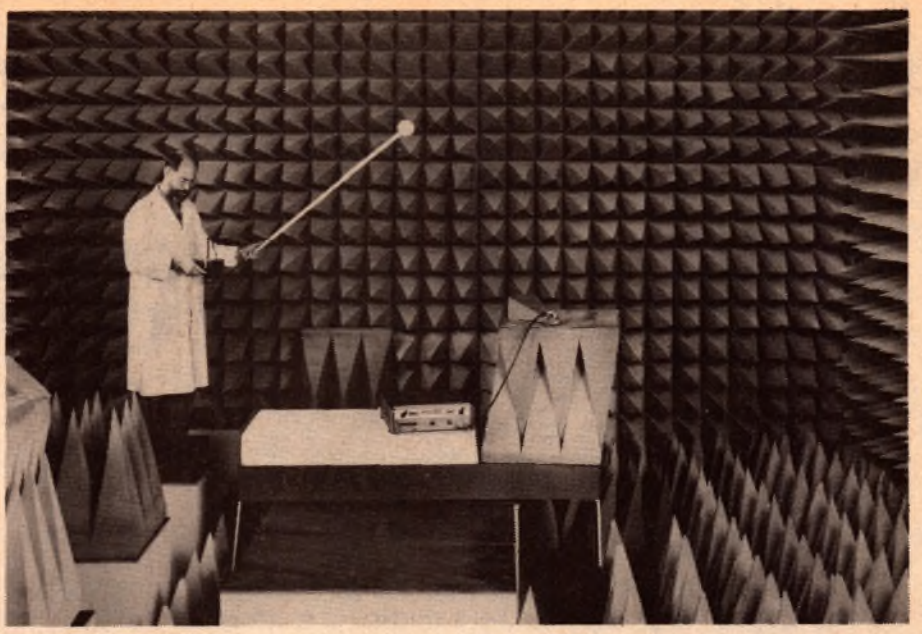
Working for the Federal Aviation Administration (FAA), NBS has been developing EM measurement instrumentation, methodology, and data so the FAA can determine radiation levels around antenna sites and airports and in airplanes. The FAA is interested in avoiding or minimising EMI problems that would disrupt navigational equipment, electronic displays for instrumented landings, electronic controls on the ground and in aircraft, and telecommunications. The FAA is also concerned for the health and safety of people who use equipment that produces high electromagnetic fields. As in many other areas of EMI measurement, the expertise and equipment to make the complex measurements do not exist in private industry and can be found only at NBS.

Indeed, over the past several years the Bureau has pioneered the development of novel instruments that can measure both the electrical and magnetic fields contained in EM waves. In 1973 a group of scientists in NBS' Electromagnetics Division won an award from *Industrial Research Magazine* for their development of a portable probe, called an electric energy density meter, that can be used to measure EM emitted by such diverse sources as navigational systems, microwave ovens, and radio and TV transmitters.

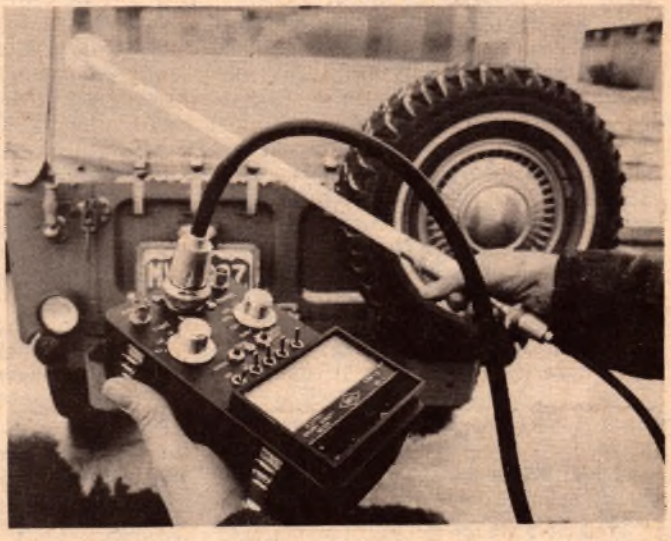
Another notable NBS contribution has been the development of the transverse electromagnetic (TEM) cell. This, essentially, is a large "clean room" where electronic machines and components can be tested for susceptibility to known sources of EMI or for EM output. In its most recent version, NBS has constructed a TEM cell that measures three metres by three metres by six metres and resembles somewhat a large, square boiler. The cell provides a three-quarter cubic metre test volume. More precise data on a component's vulnerability to EMI can be determined in the TEM cell's controlled environment than in the outdoors where the EM environment is continuously changing and hard to define.

In the decade since NBS first conceived the TEM cell for the EMI measurements, a number of others have been constructed for use by the military as well as by private industry. AC Spark Plug, Motorola, RCA and Zenith are some of the firms that have adapted the TEM cell for their own EMI measurement and testing programs. The performance of the cell is limited by its size, and its size limits what it can test.

NBS is currently constructing an anechoic chamber at the Boulder laboratories. The absorbent material in this large room will prevent EM signals from bouncing or reflecting off walls and disturbing delicate measurements. "It's the difference between trying to take pictures in a room made of mirrors and a room with a soft, low-reflecting background," Miller says.



Dean G. Melquist, an electronics technician with NBS/Boulder laboratories, checks the radiation pattern of a waveguide horn in an anechoic chamber.



The NBS-developed electric energy density meter. Here, the unit is being used to measure the RF energy level around a CB antenna mounted on a vehicle.

Because the concern over the question of "electromagnetic smog" is relatively recent, the mechanisms for defining and combating the problem are still being developed. The government needs to coordinate the activities of the nine separate federal agencies that are now involved in some aspects of regulating EMI. Another need is for a common language of EMI. "Right now there are tremendous ambiguities," says Miller, noting that a communications expert and an electronic engineer may have different and therefore confusing ways of defining the same EMI phenomenon.

The urgency of these needs may become apparent over the next few years as more and more electronic control devices are introduced and as medical science uncovers new facts about the effects of long-term, low-level exposure to EM radiation.

One area that is sure to receive attention is the workplace. Some seven million workers are exposed daily to electromagnetic radiation as it is used in various industrial processes such as curing plastic and plywood and operating large arc welding machines. In some industrial measurements taken by the National Institute for Occupational Safety and Health, the EM fields in the working place were at least as high as 2600 volts per metre (where the standard is 194 volts per metre). The fields may have been higher, but the NIOSH instruments, provided by NBS, could not measure above 2600 volts per metre!

Reprinted from "Dimensions", journal of the National Bureau of Standards, Washington, DC.

The return of the steam loco?

The coming oil energy "crunch" could change the face of railways, by bringing back the steam locomotive. But a modern steam loco would be quite different from the dirty, smelly designs of past years. Just how different is revealed in this article.

by PROF. M. THRING, DR J. SHARPE and P. Le SUEUR*

When the steam railway locomotive reached the peak of its development, in the 1930s, it was only a step away from those of early 19th-century design, though bigger and more powerful. Engines of that sort, with hardly any updating, still run today. It is no wonder that the emergence of diesel and electric locomotives led people in the industrialized countries to regard steam locomotives as old-fashioned and obsolete. Other countries followed the trend, with a few notable exceptions, and steam rapidly began to disappear from the world's railways.

This, no doubt, would have been the end of the story, except for one vital factor — the energy crisis, and the oil shortage in particular. Without oil, at least with present technology, there could be no motor-cars and no aeroplanes. The world would be heavily dependent upon its railways for land transport, but without oil for the diesel locomotives.

Electrification, using coal-burning or nuclear power stations is one answer, but there are many railways that would be prohibitively expensive to electrify. For these, another form of power would be needed.

To raise steam is easy but, to many, the idea of actually going back to this tradition is repellent. True, the steam locomotive was dirty and smelly; its ash had to be emptied and it needed stoking, oiling and lighting up hours before it began to work. Its thermal efficiency was at best only eight per cent, but it did have many advantages often overlooked today: it was reliable, its failures seldom leading to complete immobility; it could produce a vast, instantaneous power, and it lasted seemingly for ever. It was also capable of running with remarkably little overhaul (though at the expense of efficiency), a fact appreciated in countries where skilled fitters were few and fuel was plentiful.

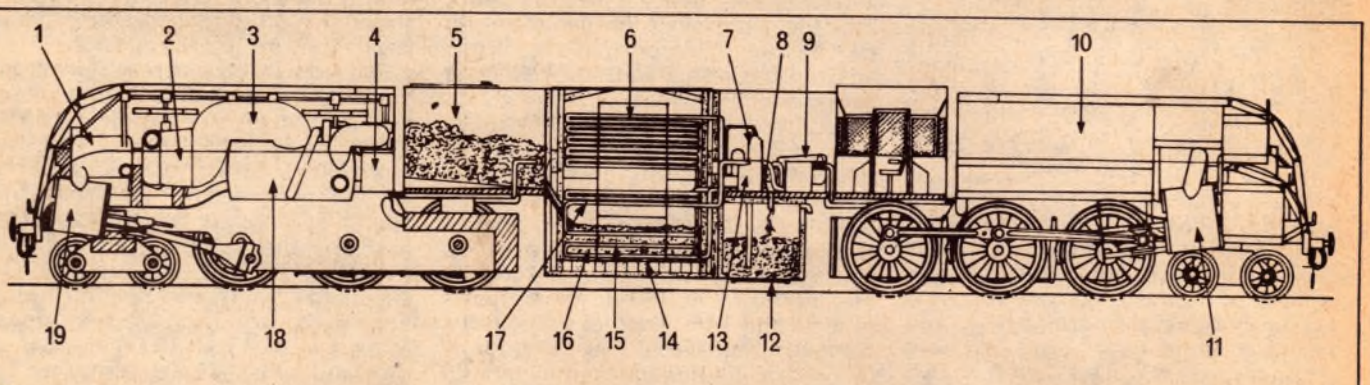
But, most important of all, it could run on anything that could be burnt, including coal, oil, wood, gas, peat and sugar-beet.

Here, then, is one possible form of railway power for the future. But we need a steam locomotive that has all the important advantages and none of the big disadvantages of the conventional machine. Above all, it should have a thermal efficiency comparable with that of diesel and electric locomotives.

Our research project, sponsored by the UK Science Research Council, is concerned with the mathematical modelling of steam cycles that could be applied to an advanced, efficient steam railway locomotive. Although we have not yet completed the mathematical model, a very promising design of locomotive has already emerged.

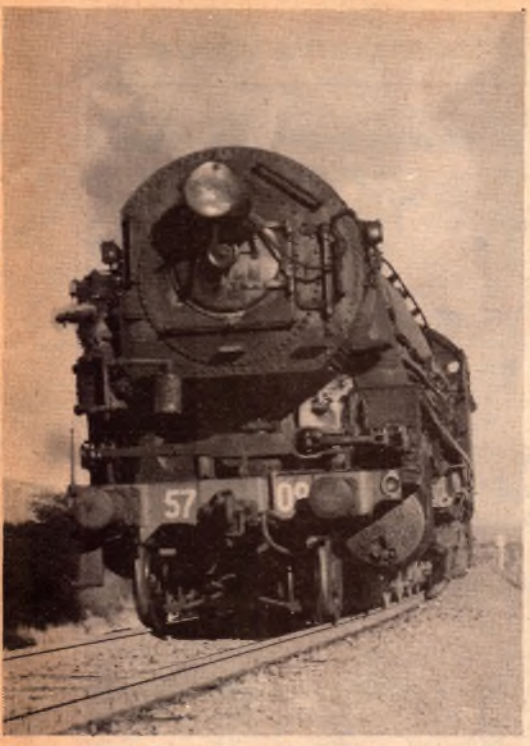
Our main aim was to design a locomotive that would burn coal instead of oil. Coal-burning gas turbines

*Department of Mechanical Engineering, Queen Mary College, University of London.



1	Compressor	5	Coal bunker	9	Auxiliary turbine	13	Heat accumulator	17	Superheater tubes
2	Turbine	6	Feed heater tubes	10	Radiator panels	14	Distributor plate		
3	Exhaust branch	7	Starting gas cylinder	11	LP cylinder	15	Bed evaporative tubes	18	Condenser
4	Hot well	8	Feed pump	12	Emptying hatch	16	Fluidized bed	19	HP cylinder

Sectional elevation of the proposed locomotive. It is designed for a maximum continuous power output of 2.5MW with an overall thermal efficiency of 24.5 per cent. Overall length would be around 27 metres.



Perhaps things will never be quite like this again, but we couldn't resist publishing the above picture of one of the old D57 "Mountain" type locomotives. The D57 weighed 230 tonnes and was one of the most powerful steam loco classes built in Australia.

were considered but there are big problems of erosion of their blades. It soon became clear that an expansion engine using a conventional Rankine cycle, with water for the working fluid, would be the best choice. Other fluids could be used, but their merits are small compared with their cost, scarcity, and danger in use.

Having decided on a steam locomotive, our next step was to find ways to raise its thermal efficiency from the usual eight per cent to the diesel's 20 per cent or so. With a Rankine cycle, this can be done in two ways: by raising the boiler pressure and by reducing the engine exhaust pressure. Railway engineers had appreciated this in the 1920s and 1930s, and many unconventional locomotives were designed in attempts to attain a better overall cycle efficiency by one or other of these means.

To raise the boiler pressure above about 2MPa (megapascals) needed a water-tube rather than a fire-tube boiler. This allowed very high pressures to be used, but to keep the termperatures to a reasonable level for a long boiler life, we finally settled on a mean pressure of 4.5MPa. We had to reduce the exhaust pressure and, bearing in mind that a conventional steam locomotive exhausts to the atmosphere, in this instance we had to arrange to exhaust below atmospheric pressure or to a vacuum. This meant condensing the exhaust steam. The lower the condenser pressure, the higher the cycle efficiency, so we chose a pressure of 7kPa (kilopascals), because this gave us the lowest condenser temperature that would still allow cooling by atmospheric air.

We planned to pump the condensate back to the boiler, which meant complete recycling of the water, apart from the small steam losses through glands and stuffing boxes, so we could use softened water to contribute to long boiler life.

The next aim was to ensure pollution-free combustion at maximum efficiency, with automatic stoking and ash removal. All this could be achieved by employing fluidized bed combustion.

A fluidized bed comprises a quantity of inert material, such as sand, supported on a perforated 'distributor plate'. When air is blown through the plate, large bubbles form and agitate the bed, causing it to bubble up and behave rather like a boiling liquid. In this instance, the motion of the locomotive would aid the fluidization.

Coal sprinkled on such a bed burns at about 900°C and very efficiently heats evaporation tubes immersed in the bed. The hot gases leaving the bed can be used in gas turbines, but for reasons already stated we planned to use them to superheat the steam instead, and to heat the feed water.

A fluidized bed produces virtually no pollution. Its temperature is too low for ash to fuse or for impurities such as potassium and sodium to vaporize, while the large amount of excess air in it prevents carbon monoxide forming. Adding limestone to the sand stops sulphur dioxide being given off.

Ash is removed by blasting the mixture of sand and ash from the bed into a cyclone, with an injector operated by bleeding off some of the fluidizing air. Separated by centrifugal action, the ash rises in the cyclone and is deposited into an ash well ready for emptying. The sand falls into a sand well and is returned to the bed by another air injector.

The bed does not need expensive pulverizing machinery. It can burn coal in lumps of any size up to 25mm and, with only simple adjustments, can be made to burn any other fuel. A hopper or screw is all that is needed to feed in the fuel, which spreads itself across the bed; this is in contrast to the accurate stoking that an ordinary grate needs. The combustion efficiency is better than 98 per cent and the bed can be started up from cold in about 30 minutes, using propane gas mixed with the fluidizing air and ignited by an electric spark.

For railway traction it is necessary to have a large starting torque, with lower torques at running speeds. Reciprocating steam locomotives always provided this, which is why we chose a reciprocating engine for our

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The return of the steam loco? . . .

design. However, at the low-pressure end of the cycle the volume of the steam is so enormous that reciprocating engines cannot handle it. A turbine can accept far larger volume flow rates and is ideally suited to the low-pressure end, but it develops its maximum torque at its top speed, which, as had been found in the past, means having a complicated gear box or an intermediate transmission system, either electrical or hydraulic, to adapt it to locomotion.

Trying to match the direct high-pressure cylinder drive with a low-pressure turbine and associated transmission was soon found to be highly undesirable. Therefore, we adopted a system originally invented by Gotaverken, a company in Sweden, for use on steamships. It uses the turbine power to drive a steam compressor, which compresses and reheats the steam between the high-pressure and low-pressure cylinders of the reciprocating engine. The theoretical loss through using mechanical power to heat the steam is less than the loss in a turbine transmission used for propulsion.

In our proposed system, each engine unit condenses its own steam in a conventional shell-and-tube condenser cooled by circulating water. The water is cooled in radiators built around the outer shell of the locomotive, by the surrounding air. Of all the condensing systems used in locomotives in the past, this one has proved the most successful; the total space it takes is far less than when direct air-cooled condensers are used, because the heat transfer is better. These condensers can also provide the heating for the train.

The turbines also drive the radiator cooling fans, the cooling-water pumps and the 'wet-air' pumps but, to make the boiler unit self-contained, an auxiliary turbine is included to drive the blower for fluidizing the bed and the reciprocating feed pump. A direct-current motor drives the blower when starting from cold, drawing its supply from batteries which are recharged by the same machine working as a generator when the auxiliary turbine is running. The auxiliary turbine exhaust is mixed with the incoming feed water to provide first-stage feed heating.

The locomotive is designed to be controlled by only one lever, in addition to the 'dead man's handle' and the brakes. The lever activates a hydraulic control system, synchronizing the operation of the locomotive's various parts. The cylinders' poppet valves and cut-off controls are intended to be hydraulically operated, too. If anything should fail, the driver could over-ride the automatic system and continue operating the undamaged parts of the locomotive by means of a complete set of manual controls.

Our work on the economics of the locomotive proves that it would be superior in all ways to diesel and electric traction. First and foremost, its overall thermal efficiency has been calculated as 24.5 per cent. This is equivalent to a diesel locomotive's peak efficiency, but if we plot our locomotive's efficiency against speed the curve is flatter than a diesel's, which means that our machine would be the more efficient over most of the range of operating speeds.

The capital cost would be less than that of a diesel, which has a large, complex engine. All the steam-cycle components are available 'off the shelf', and have been tried and tested in other branches of engineering. It would be cheaper than an electric system, of course, which has to include the electric conductor and installations. The steam machine would need no more maintenance than a diesel does; it would be cleaner and would produce less pollution, as already explained.

It would be more reliable too, rarely stopping dead as a diesel does when it breaks down, or an electric locomotive when the overhead wires fall down. What is more, the eyesore of miles of

Continued on page 125

Forum

Conducted by Neville Williams

TV channel 5A and the threat to the 2-metre amateur band

As expected, the editorial in the September issue, relative to TV channel 5A, triggered reaction in amateur circles ranging from concurrence to consternation. Hopefully, however, it will have had the desired effect of prompting amateurs to organise facts and figures to back up their many words on the subject.

The problem presently facing the amateur fraternity is largely a flow-on from the vigorous and successful campaign by commercial and hifi interests to recover the band 88 to 108MHz for FM broadcasting. This has forced the Government to revise drastically their use of the various TV channels, with a much greater emphasis on channel 5A. Occupying the frequency band 137-144MHz, it is immediately adjacent to the 144-148MHz amateur band, giving rise to apprehension that there will be mutual interference between the two, with the amateurs ultimately having to concede their rights to unhindered operation.

It so happens that TV channel 5A has been operating for many years, serving the Wollongong area about 80km south of Sydney. It has always been seen as an odd frequency in terms of spectrum planning and antenna design but there has been no obvious pattern of contention in that area arising from its proximity to the 2-metre band.

Therefore, when Victorian amateurs in particular began to be alarmed by a proposal to make wider use of channel 5A, we were surprised to find Wollongong quoted as a sorry example of what to expect.

By "we", I mean members of our staff who are active on the 2-metre band, plus our Amateur Band correspondent Pierce Healy. As I said in the editorial, we started asking deliberate questions, but with a negative result. Not even the local radio inspector seemed to be aware of any significant problem!

It therefore seemed obvious to us that the kind of argument doing the rounds in early August, when the editorial was written, would not hold up at a departmental and parliamentary level. Hence our remark to that effect, and the clear implication that amateurs would need to "demonstrate and document" the likely problems in the field, rather than rely on statements that might, too easily, be shot down in flames.

A file full of protest letters will impress upon politicians that there is a group in the community called amateurs and that they feel strongly about a certain matter. To that extent the letters will have served their end.

But it is vitally necessary to remember that departmental authorities and politicians are also under a lot of pressure from competing interests who are not the least bit concerned about amateurs.

Faced with such pressures, the authorities may well take refuge in facts, or what pass for facts at the time. Far from being an example of chaos, a casual look at the NSW South Coast could well provide them with the assurance that "she'll be right mate!"

Elsewhere on these pages we reproduce, in somewhat abbreviated form, a letter to hand from Stephen Gregory, VK30T, who did a lot of the early stirring in this matter. I suggest you read it.

In summary, the amateur case, as put, may be re-stated thus — and it begins to hang together:

- The amateur service has already suffered from the introduction and adoption of TV channel 0 (45-52MHz) because of mutual interference with the 6-metre amateur band (52-54MHz). The position will be compounded by wider use of channel 0 and the reported intention to reduce the 52-54MHz amateur band to a secondary service.
- Having thus been squeezed out of the 6-metre band, the 2-metre band has become doubly important to the amateur fraternity for a whole variety of transmission modes and objectives. Increased use of TV channel 5A will inhibit use of this band also, particularly in respect to the more technically ambitious modes.
- The situation on the NSW South Coast is non-typical because 2-metre amateur activities there have tended to gravitate around FM and repeater techniques in the high end of the band from 146 to 148MHz. The few amateurs who have sought to operate with higher power and other modes towards the low end of the band have, in fact, run into interference problems. Confirmation of this is available from . . . .
- In other states, wider use has been made of these other modes. These are the activities which are currently threatened, as will be further evident from the field test data attached.
- If amateurs, operating legitimately within their own 2-metre band, are obliged to cease transmission in the event of interference, they will simply not invest in high technology equipment and the pool of communications technology skill, already at risk in Australia, will be further diminished.
- The Government should seek some other course along which to reorganise the television broadcast service as, for example, by utilising the UHF spectrum wherever possible.

That last point brings me back to the September editorial and to the final remarks in the letter, as quoted. I repeat: the editorial was not written to "knock" the amateurs, who are well represented on our technical staff, but to prompt a more systematic marshalling of the facts which might support the amateur case. Having had some involvement in the recent Broadcasting Tribunal hearings for FM licences, I am keenly aware how an inadequately supported case can be torn to shreds by those who have a mind to challenge.

It is also fairly clear that many of those who read the editorial never got beyond the first few pars, in terms of their reaction, and completely ignored the "constructive advice" with which it concluded. Let me repeat the three relevant paragraphs:

"Assuming that greater use does have to be made of channel 5A to help clear the FM band, the critical thing is therefore to pressure the authorities to do what they have already done for many other translators: to feed them via UHF.

"A further and logical step would be to instal, not just a UHF link, but a UHF service in parallel with the main 5A regional. Viewers could be encouraged to use the UHF signal to reduce dependance on 5A, and to hasten the day when it could be phased down and out.

"Indeed, it should be possible, as funds permit, to parallel other

Instead of knocking the amateurs . . .

Dear Sir,

In common with several persons from Western Victoria, your concept of two metre operation stems from your experience of the 2m FM system. I'm sure you are aware that there is a world below 146MHz where narrow band SSB and CW transmissions take place. It is this world that is threatened, not that of the toy radios.

My earlier comments were based on information obtained from amateurs residing in Wollongong and outer areas such as the Blue Mountains where viewers watch the distant TV channels. I also spoke with an amateur in Goulburn to reconfirm what I had already experienced when I worked there: the total wipe-out of the input to the National Translator by any two-metre low-end transmission.

For sure, amateurs can reduce power and still access repeaters successfully, and minimise reports of interference. Maybe one of the reasons that few reports reach the RI's lies in the number of mobile transmitters that are not identified during their generally short trips through suburbs.

In Melbourne, all 6m FM traffic is mobile or at power levels less than 250 milliwatts if based at home. Even this small amount can wipe out a TV set.

Last year, during a rally, the test pattern disappeared from the screen of a TV set in a Newcastle shop window — presumably because I hit the button on 146MHz with 25 watts.

I am aware of the total lack of SSB activity on the South Coast near Wollongong, because my friend VK5CHL tells me of the waste of time when he keys 400 watts towards Sydney.

VK2BHO will tell you what he told me about the 5A problem from Warilla if you care to ask him.

Hugh VK5BC doesn't operate 144 SSB anymore because he is 15 miles from the TX and causes untold interference to several TV sets.

Hams in Mildura working tropo through Berri are experiencing hash and white noise at 90 miles, and out here at Hamilton 0 fills the lower end of six with hash and that's 180 miles.

VK3YII and VK3ZBJ together with VK3AHJ have produced a video tape showing all the signal to signal ratios and adjacent channel levels to cause severe wipeout of sound and picture on 5A. This was conducted under laboratory conditions. In the field with inferior antenna installations, the situation worsens.

Next time you are talking to your unconcerned RI or a true Wollongong VHF'er, ask if they operate 2m SSB as distinct from 2mFM.

If I am permitted access to a high power tropo station for one weekend I can show you just how the reports roll in. I managed 68 for six metres during one 30 minute Japan opening in October 1976.

The east west path through Hamilton is the best tropo path in Australia. Three moon bounce stations use the low end and all are within the access area of the outlying translators. Many more use medium and high power for Oscar and tropo working. The other night we had the first auroral propagation on two in 38 years, but I noticed only VK5, 3 and 7 on the air. Where were the 2's?

In the past five years two contacts have occurred to VK2 area on two metres. Recently a very rare tropo to Bathurst occurred. For the same period there have been literally hundreds of QSO's beween VK6, 5, 3 and 7 on 2m tropo.

I suggest that lack of low-end activity in NSW, not lack of interference that is responsible for the absence of complaints.

You mention the word "emotive". Since 1962 I have seen one metre and the lower half of six, both go; 576 earmarked for the mythical UHF TV service and then 11 metres.

There is a suggestion that six will be dedicated as a secondary service to amateurs during WARC, and now they're sticking 100kW worth of old channel 3 Canberra in the middle of about $20,000 worth of two metre gear, in Western Victoria and SE South Australia.

Not content with the main Tx site 15 miles from Hamilton, they intend to swing the translators at present taking 3 over to 5A. Three translators are on the main highways where extensive 2mFM occurs. Two more are in larger provincial towns, with two more still to come. And get this: one will take 5A and spout it out at UHF.

Mt Arapiles near Horsham will have a 400 watt unit taking 5A so that's the end of 2mFM in Horsham.

I suppose you know they slipped an 0 in at Tamworth at 400 watts and ended 6 metre operation there?

Also Harry in Gympie, VK4ZHG will tell you a little about 5A up there as well as 0 on ground wave from Brisbane.

I met with Mr Fraser recently and the meeting didn't exactly boost my faith in the fact that there will be support coming from within the cabinet. I believe that commercial interests have dealt a death knock to the 2 metre band in Australia. However I'm not prepared to sit back and await the knock on the door.

Neville, with your position as an Editor you can get to the root of things in a way that none of us can. So instead of knocking us, how about adding your weight to our cause down here; that's if you are interested? I'm quite sure the 5A convenors would be glad to hear from you with some constructive advice.

STEPHEN R. GREGORY VK3OT,
(Box 622, Hamilton 3300).

FORUM — continued

troublesome VHF channels with a UHF service, so that our spectrum problems will gradually wind down rather than up!

While amateurs would like to see a summary abandonment of TV channels 0 and 5A, a hard fact of life may well be that it is not an immediate option for the Government:

- They are under pressure to provide more FM and more TV outlets.
- They simply cannot go on piling more TV transmitters on to a reduced number of VHF channels, as witnessed by the fact that the recent changeover in Newcastle to 5A has given evidence of co-channel interference with the Bateman's Bay translator, 218km to the south!
- There could be a sharp public and commercial reaction to any attempt to impose a UHF service in an area where a significant proportion of the receivers did not cover UHF.

However, if the Government is locked into the use of channel 5A protem, it is not locked into the situation of having to feed a whole array of translators from 5A, off air. It would have the option of requiring that the translators be fed via a UHF link and this would obviate one very obvious hazard.

At last count, something like 30 translators throughout the commonwealth already operate in this manner.

We went on to suggest that, as funds permit, the controversial transmitters be paralleled, not just with a UHF link but with a complete UHF transmitter, as the first step towards taking pressure off the VHF channels.

We still think that those suggestions are "constructive"!

Earlier on, I stressed the need for amateurs to marshall all their facts, if their cause is to stand up to scrutiny by the administration. An example of what may otherwise happen is provided by a situation reported in a recent issue of the US journal "Stereo Review".

By way of explanation, there have been a very large number of complaints to the American FCC about penetration into audio equipment by the signals from CB, amateur and other transmitters. For the most part, the offending transmitters have proved to be within specifications, the problem usually turning out to be one of inadequate shielding and/or filtering within the audio equipment.

Out of this none-too-pleasant situation has come proposed legislation, which would officially identify the nature of the problem and make it an obligation that all future audio equipment exhibit much greater resistance to RF penetration.

Not unexpectedly, the proposal has delighted the transmitter operators, in that it virtually lets them off the hook. However, it has stirred up a hornets' nest of opposition from the manufacturers and distributors of audio and other affected equipment.

They see the FCC as a potentially biased body, likely to be involved in framing, interpreting and administering any such legislation. They distrust the methods which the FCC may use to define and measure field strengths against which audio equipment must be proof. They are worried that the FCC could impose "cures" for RFI on the industry which would compromise ultimate equipment performance.

The report in "Stereo Review" concerned a US Senate sub-committee hearing, concerned with the conflicting points of view, and attended by "heavies" from the FCC, National Bureau of Standards, Consumer Affairs, the hifi and broadcasting industries and the ARRL.

Early witnesses testified to the difficulty and cost of setting up and administering standards, from the viewpoint of both Government and industry. It was one thing to plan legislation; it was quite another to make it work!

It then fell to the ARRL spokesman to support the cause of RFI legislation which, and I quote, "has always been spearheaded by ARRL members".

The ARRL presentation started off in fine style with the spokesman producing an array of "props" — capacitors, chokes, shielded wire, etc, plus an official ARRL booklet on how to deal with RFI.

Why was everybody getting so fussed?

Unfortunately, they left themselves wide open to be shot down in flames because the RFI booklet was dated 1951! Again I quote:

"The ARRL people seem to be of the opinion that the kind of response-affecting filtering that may have been acceptable in 1951 would be equally acceptable today".

The lesson is painfully obvious: if amateurs are not to be shot down in flames, they have to keep their powder dry and protect their flanks.

Ouch!

From the NSW WIA news broadcast 17-9-78

"On the channel 5A situation, material is now being gathered together to prepare a technical submission to the minister. Not too much information has been forthcoming, particularly from amateurs in areas where channel 5A TV already operates. If nothing further comes to hand, a technical submission will have to be made with the material available. Divisions will have noticed the emphasis being placed on UHF TV channels to replace channels 5A and channel zero."

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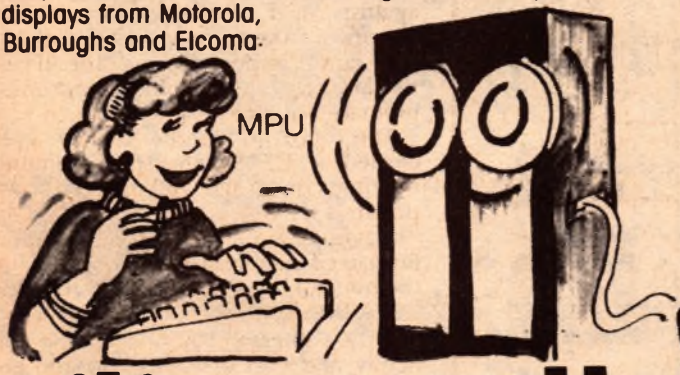

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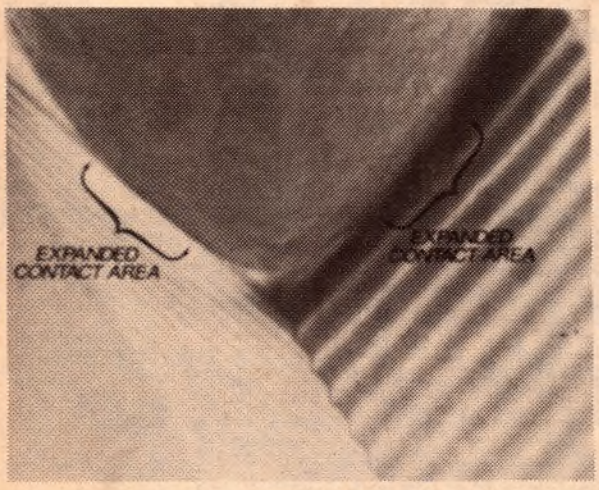
Kitty Puckett checks out 45 rpm stamper, while auditioning one at 33⅓ rpm.



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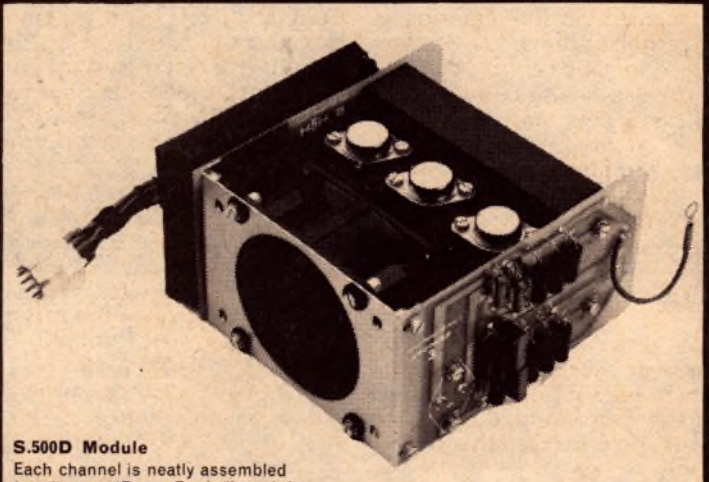

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UP-TO-THE MINUTE RECORDING STUDIOS INSTALLED BY EMI

by NEVILLE WILLIAMS

Traditionally in the forefront of the Australian recording industry, EMI are currently rebuilding and re-equipping their studios in Castlereagh St Sydney, giving them a recording complex in world class. Amongst the many facilities is a huge mix-down console, capable of complete computer control.

To the average person entering a recording complex, the actual studios provide the automatic centre of attraction. With their sometimes odd dimensions, wall panelling and carpeting, they have a highly functional atomsphere, heightened by an assortment of microphone booms and stands, cables, moveable partitions, non-squeak chairs and other paraphernalia.

When a recording session is in progress or a rehearsal, the whole scene comes alive and the studio seems more than ever the place to be. Admittedly there may appear to be some activity in the room behind the glass panel, but it's low key relative to the main action!

But talk to the technical staff at EMI, Castlereagh St, and you find that the emphasis is more the other way. The studios and what happens in them is taken almost for granted; for them the real interest lies behind the glass panels; in the equipment which allows them to assemble the sound into the form in which you will ultimately hear it.

The equipment now coming into service is just about the ultimate in present-day analog technology and represents a deliberate choice by EMI engineering management: to re-equip with the best right now, and worry about a switch to tomorrow's digital techniques only when they are proven and available.

It was in 1926 that the then Columbia Graphophone (Aust.) Ltd set up the first Australian recording studio at Homebush, one of Sydney's nearer western suburbs. The move more or less coincided with the industry changeover to electrical recording.

Five years later, in 1931, Columbia amalgamated with the Gramophone Company (HMV) and output from the Homebush studios increased markedly. It was further increased in 1936 with the recording of serial episodes for playing on Australian radio — serials like "Dad and Dave", "Martin's Corner" and "Courtship and Marriage". In the following years, those early transcriptions, carrying the EMI label, turned up in a variety of overseas countries, and some of the episodes still enjoy the occasional re-broadcast.

It so happens that the very first issue of this magazine in monthly format — then titled "Radio & Hobbies" — told the story: "How George Edwards Makes Transcriptions". The date was April 1939 and the serial specifically mentioned: "Inspector Scott" — an astute crime buster who managed to solve every crime right on cue each Friday evening! The 12-minute recordings for each episode were made direct-to-disc, on 15-inch wax coated masters.

In the early 1950s, EMI transferred their recording activities to a new 3-studio complex in their Castlereagh St, City building. They incorporated all the then forward-looking architectural and acoustic features, and an array of then-modern electronics. Five EMI type BTR2 tape recorders were provided for mastering but — just in case — the disc cutting room was so placed that direct visual access to the studio could have been arranged. It never was!

It is a tribute to those responsible that, while there has been progressive up-dating, the basic complex commissioned in 1954 has only recently had to be stripped out and rebuilt. Even so, the Company was most reluctant to take the original large studio A out of commission, because of its long and wide acceptance as a desirable venue for large-group recording.

1939 *A somewhat hazy but historic picture from our first issue as a monthly magazine. From the left: George Edwards, a man of many voices; his wife, Nell Stirling; and scriptwriter Maurice Francis, recording a radio serial at the EMI/Columbia studios in Homebush.*

But the recording scene has changed profoundly in the last decade. Modern pop music is performed and monitored at a much higher level than the music of yesteryear, so that considerably more acoustic isolation is necessary between studio and control room, and between each and the remainder of the complex. Accurate monitoring and mixing is impossible if sound can be heard direct from the studio while, conversely, performers can be disturbed by echoes from the control room speakers.

Again, many modern musicians become deeply involved in production and mix-down, with the result that the control room needs at times to accommodate, not only the technical equipment and the balance engineers but musicians and others who want to be directly involved in shaping the final sound. It means space, room to relax and listen, and an acoustic environment reasonably representative of a domestic lounge room.

The remodelled recording complex occupies two floors of the Castlereagh St building. On the seventh floor is a reception and waiting area, administration centre and a general office. There are technical workshops, disc and tape mastering rooms, a small commercial studio with control room and an installation about which EMI engineers are particularly enthusiastic — a complete new "state of the art" mix-down suite.

On the eighth floor is a large foyer area for musicians, tape and equipment storage rooms and two studios complete with individual control rooms. Studio A is even larger than it was originally, with a generously proportioned control room protruding into one corner, giving excellent visibility from the control centre. Studio B is less spacious but still large enough to accommodate a group of 20 or more musicians.

The system under which the complex operates assumes that the respective studios and their control rooms will be used primarily for recording onto multi-track master tape. This done, the tapes are taken to the special mix-down room on the seventh floor where the operators have, at their fingertips, every needed facility for mixing down to a stereo master recording. More about this later.

Experience has shown that the mix-down process can typically occupy about one third the production time for an album. By transferring this work to the special mix-down suite, not only can it be done more efficiently, but it frees the studios and control rooms for their prime purpose.

The success of the system depends, to a large degree, on having totally uniform — and accurate — listening conditions in the control rooms and mix-down suite. Uniformity and quality would obviously be at risk if staff and producers continuously had to make value judgements about balance, depending on the room in which the work was being done.

1954 *The main EMI recording studio, commissioned in 1954 and only recently dismantled. Note the extra viewing port just below the ceiling line. Intended to facilitate direct-to-disc recording, it was never used for this purpose, all mastering being done on tape.*

It is also important to have a high degree of compatibility between equipment, partly for the same reason and also to facilitate the task of those having to use it.

With these requirements in mind, EMI's Studio General Manager, Nigel Wake, visited a number of overseas studios and spoke with many well informed acousticians before deciding upon the acoustic philosophy that should be used, with particular reference to the control rooms and mix-down suite.

This led to the rejection of what has often been the philosophy to date: to aim for (but not necessarily achieve) listening accuracy at any point in the control room.

The design philosophy now preferred by EMI is to aim for — and realise — a super-accurate listening area at the control console, hopefully extending to the area immediately behind the console, where additional personnel can be accommodated.

In an effort to achieve this, the control room provides appropriate frontal acoustics with a carefully placed stereo

1978 *The new EMI studio B, attractively finished in deep maroon and green, with lighter buff panels. Beyond the doors is a separate annexe which can accommodate a grand piano or other instruments which the producer may wish to isolate acoustically from the main studio.*

If he were around today we know he would use it.

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B308A

Specs with a purpose!

Sansui's new amplifiers

Sansui's all-new integrated amplifiers have absolutely astounding specifications. Compare them with any others in their class, and Sansui comes out far ahead. But what really makes Sansui's new amplifiers so superior is that all these great specs have a single purpose — outstanding sound quality.

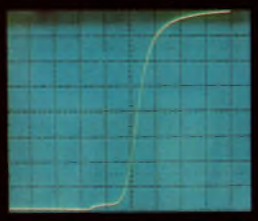
Take response speed, for example. Your amplifier doesn't move, but it does respond. The more rapid its response, the cleaner and the more accurate the sound. That's why the AU-717, for example, features an advanced DC power amplifier design. Sansui's DC amplifier eliminates all capacitors in the signal path and even in NFB loop so amplification is direct without coloration and phase delay. Response is astoundingly rapid — the proof is in the ultra-high (60v/μsec.) slew rate and ultra-rapid rise time (1.4μsec).

But Sansui didn't strive for such outstanding specs just to be able to print impressive figures. On the contrary, Sansui research showed that to achieve accurate reproduction and reduce signal loss, lightning-fast response was essential.

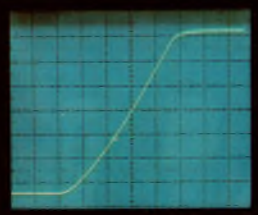
In addition, special circuits were incorporated to achieve new levels in stamping out TIM (transient inter-modulation distortion), a type of distortion that is now receiving high priority. Still another important benefit of Sansui's DC amplifier is the ultra-wide frequency response from zero (DC) to 200,000 Hz.

The final result is music with a purity and clarity that must be heard to be believed. All the dimensions of complex musical sounds — the wide dynamic range, the sudden pulsive signals, the nuances of barely perceptible but critical overtones in the ultra-high frequencies — all these are now crystal clear, all are proof of Sansui's new levels in superior sound quality. Impressive power is 85 RMS watts per channel, 20 — 20k Hz, and total harmonic distortion at rated output is 0.015%. That means it can be considered non-existent as far as the human ear is concerned.

SLEW RATE & RISE TIME



AU-717
Slew Rate: 60V/μsec.
Rise Time: 1.4 μsec.
V: 10V/div.
H: 1 μsec./div.



A CONVENTIONAL AMP.
V: 10V/div.
H: 1 μsec./div.

Keep in mind that though the AU-717 is special, it's not special for Sansui. Each and every amplifier on the left-hand page embodies the same Sansui commitment to outstanding sound quality. All controls have been carefully thought out and designed for their specific purposes. Sansui has no place for gadgets and gimmicks in its dedication to the ultimate in hi-fi.

The AU-517 and AU-317 also feature the same DC power amplification as the AU-717, and offer 65 and 50 RMS watts respectively. The AU-217 and AU-117 offer 30 and 20 RMS watts respectively, but are not to be under-rated. In fact, they represent exceptional values in low distortion and true hi-fi performance.

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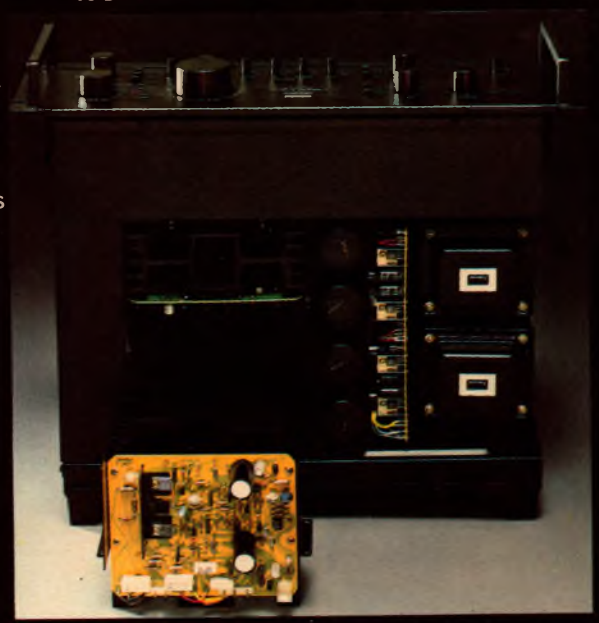

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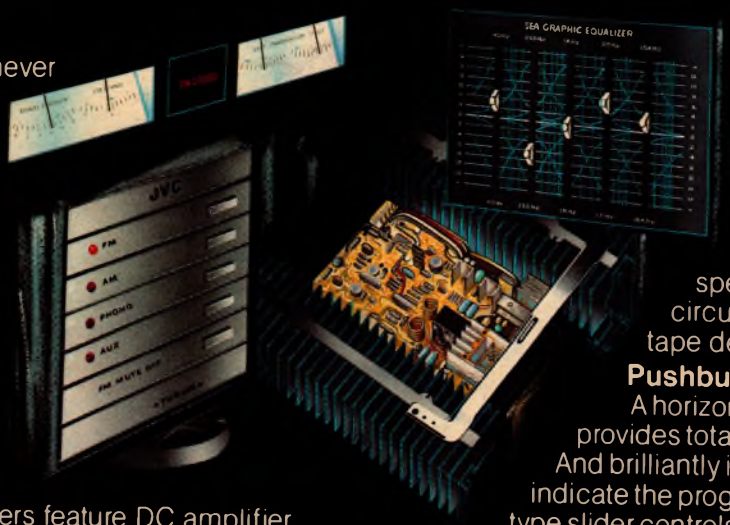

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JR-S 401 (top), JR-S 201 (bottom left) & JR-S 301 (bottom right)

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JR-S501 * @ 8 Ohms, both channels driven from 20Hz-20 KHz, with no more than 0.03% THD.

WT87/78

pair of loudspeakers and reflective, non-parallel surfaces. However, the structure and treatment behind the monitoring position is such that the "real wall" offers total broadband absorption, effective to below 30Hz. In essence, once the sound passes the ears of those at, or close to, the console, it is not reflected back.

Nigel Wake was aided in the design by Peter Dix of the Central Research Laboratories, with further input from EMI's on-the-spot Engineering Manager Steve Schurtz, and Operations Manager Brian Walker, who provided the basic information for this present article.

While architectural considerations dictate structural differences between the studio control rooms and the mix-down suite, the acoustical treatment aims to achieve a uniform result. Questioned about evaluation procedures, Brian Walker indicated that they involved not just subjective judgements, but methodical measurement using gated pulse signal source, fractional octave filters and calibrated microphones in the listening area.

An unusual feature in the mix-down suite and control rooms is the provision of two distinct loudspeaker systems, mounted back-to-back on a rotating table and enclosed in an acoustically transparent cube. The speakers provided are JBL 4320's and Tannoy HBD 385A's. The latter have been modified to a Thiele B3.5 bass alignment and give a measured frequency response within plus and minus 2dB from 30Hz to 16kHz, at the listening position without equalisation. This, with test signals through the console and a QUAD 405 loudspeaker drive amplifier.

The two sets of monitoring loudspeakers were necessary to accommodate two distinct preferences which have emerged in recording centres around the world. Some engineers, artists and producers have become accustomed to one type or the other and the rotating table gives them a freedom of choice.

The most imposing single item in the control rooms is the huge Neve 8078 40-channel recording console, the latest and most sophisticated model. These are supplemented by a variety of fixed and portable ancillary equipment: supplementary patching facilities, Dolby and DBX processors, digital delay lines, parametric equalisers, dynamic voice stressers, and other gadgetry which is variously loved and despised by recording specialists. EMI's philosophy is have the facilities available. What is used and how it is used is a matter for the client.

An eye-catching unit, mounted to one side of the main console, is a display using the blue, green and red guns of a normal 26-inch TV colour tube. To either side of the screen, a single column of light about 1cm wide shows the instataneous peak amplitude of the left and right stereo signals: blue near the bottom (low amplitude); green over the normal range; red when the signal amplitude hits a predetermined overload level.

In between the outer bars are two distinct groups of bars giving a similar columnar display of the amplitude of frequency segments in the respective channels.

The colour tube display may be switched to two other modes. Push a button and it can display the instantaneous signal amplitudes in all channels, being far more visible and peak-sensitive than the long lineup of traditional VU meters. A sudden red flash at the tip of one of the green columns alerts the engineer to an excessive peak level in that particular channel.

In a third mode, the display shows the phase relationship between signals in the respective stereo channels, a matter that is important to a disc cutting engineer, particularly in respect to low frequency signals.

Normally, the signal from the console is fed to the master tape recorders, and here EMI have made another deliberate decision. Each control room is provided with a pair of StuderA-80 16-track recorders, fully remotely controlled and installed behind motorised sliding glass doors

Sixteen-track machines have been favoured because they use wider tracks and offer rather better figures than the comparable 24-track model. Many recording jobs can be done with a single 16-track machine but, if more tracks are required, the second machine can be invoked with a control track on each and computerised electronics providing a total of 30 program

Comment by Alan Parsons

In Australia recently to promote his electronic music album "Pyramid" Alan Parsons had a close look at the new EMI facilities, with a possible view to using them in a future production. His comment: "The studio represents everything state of the art technology can achieve. Not only does it offer to the producer a wealth of automated equipment but also a fine team of experienced staff to back it up." Work is already forthcoming from other overseas producers.

Ultra low distortion audio generator

The Sound Technology model 1410A audio signal generator provides ultra low distortion sine waves and SMPTE intermodulation test signals. Output is both balanced and isolated. Coverage is from 10Hz to 110kHz at levels —90 to +27dB in 0.1dB steps. From The Dindima Group Pty Ltd, P.O. Box 113, Balwyn, ViC. 3103.

tracks, completely phase locked.

According to Brian Walker, the advantage of the wider tracks — and the larger recovered signal — is far from being marginal. Measurement has shown that, with all tracks open, the noise level from the 32-track equipment is 8dB lower than from the 24-track equipment.

When reinforced by DBX noise reduction, the available signal/noise ratio is impressive, to say the least.

Standard 24-track machines are available in the mix-down suite to handle customer recordings, as also are standard stereo mastering recorders — all remotely controlled.

The Neve console in the mix-down suite is actually the Neecam computerised version, which Brian Walker described to me as "the most human orientated automation system, with motorised slider gain faders on each of its 40 channels". When the console is under computer control, the system does not operate in a covert manner; the motorised faders execute all the individual motions that the engineer has programmed into the syste, and he can see it all happening.

In practice, the engineer(s) use the console as normal, intermixing the channels to obtain the kind of sound they want. The difference is that the attached computer observes every movement of every fader and records it on a floppy disc memory, time synchronised with the master tape(s). It can replay any segment of the mix-down, observe any experimental changes that the operator may make and, on command up-date the disc memory to the operator's preference.

At the end of the operation, it can take over and repeat the entire mix-down precisely and automatically for recording on to a stereo tape master.

Not only does this obviate the need for voluminous notes or a feat of memory, but it has another important spin-off.

Stereo mix-down masters — the source of most consumer discs and cassettes — have had to be recorded on tapes which will offer as much headroom and other desirable characteristics as posssible, consistent with freedom from print-through during storage. Unfortunately, the two requirements tend to be in conflict.

With the new equipment, EMI can store the original 16-track tapes, along with the floppy disc memory. At any time, they can turn out a new stereo mix-down master — on tape selected only for its signal performance characteristics. Since it need not be stored for lengthy periods after producing a record lacquer, print-through characteristics can largely be ignored.

And that leads straight into another interesting possibility: the mix-down can go straight to a disc cutter, as many times as may be required, and without the intervention of a stereo master tape. As Brian Walker put it: "Many of the advantages of direct cut, without the hassles!"

A new phono cartridge just released by Empire, and designed for use in radio broadcast studios, is appropriately designated as the "Broadcast One". It incorporates a rugged aluminium cantilever, with tie wire, to withstand back cueing but minimises the increase in tip mass by using a naked diamond. The coil configuration has been arranged to reduce sensitivity to hum fields, while the moving iron design makes for easy stylus replacement without risk of upsetting performance. Details from Concept Audio Pty Ltd, 13 Rickard Rd, Narrabeen 2101.

The JVC colour video recorder pictured is notably economical (30W from the AC mains), notably compact (453mm x 147mm x 314mm) and notably light (13.9kg). Priced at $1295 for the basic recorder, it will store three hours of program on one $28.50 cassette. It can record off-air independantly of the domestic TV receiver, will play prerecorded features, and be used with a video camera for home taping, or with further attachments for taping from home movie film. For details of the JVC-VHS system: Hagemeyer (Australasia) BV, 25 Paul St, North Ryde, NSW Tel. (02) 887 1444.

DINDY MARKETING (AUST.) PTY LTD announce release of the latest edition of their "Dindy News", the cassette user's catalog. Said to be "jampacked with interesting articles and exciting cassette and accessory bargains" the release is timed to coincide with Christmas buying. Those not on the mailing list may obtain a copy by writing and mentioning this announcement. Their address: P.O. Box 555, Tweed Heads, NSW 2485; or by phoning Dindy on (075) 364 629.

TBC PTY LTD (short for Television Broadcasting communication) advise that they are producing a line of FM broadcast transmitters, suitable for either mono or stereo, for the band 88108MHz. The exciter offers flat frequency response, negligible phase error and a frequency stability of plus and minus 300Hz from —10c to +50C; circuitry is all solid state. Power amplifiers available, also solid state, offer powers of 100, 200 or 250W, or up to 1000W with parallel operation. For details: TBC Pty Ltd, Suite 17, 79 Mahoneys Rd, Forest Hill 3131. (03) 878 7444.

TDK cassette head demagnetiser

While owners of cassette decks are usually aware of possible problems with head magnetisation, many hesitate to go poking around the head with conventional demagnetiser probes. A demagnetiser unit distributed by TDK neatly solves this problem. It consists of a battery powered oscillator, assembled inside a conventional cassette case. It is simply loaded into the deck, as for the "Play" mode, with the deck not powered or with the playback gain control(s) at zero. As the head moves forward, it contacts a small pressure plate which simultaneously activates the oscillator and couples the energy to the head pole pieces. It needs to operate only for about one second. When the deck "stop" switch is activated, the oscillation tapers away automatically. For further details: Convoy International Pty Ltd, 40 Dowling St, Woolloomooloo, NSW 4011. Tel. (02) 358 2088.

REAL POWER LINE UP

sanwa

AX-303TR

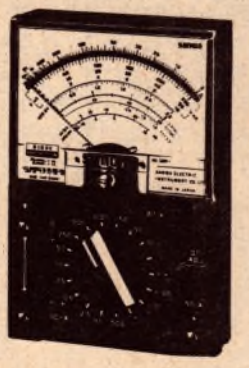
44μA meter movement — Si diode protection against pulse input.
Measures hFE (0-1000) by using the extra connector.

N-501

2μA suspension movement — 0.05mA/1mV resolution.
Double protection — fuse & Si diode.
Constant 1MΩ input impedance (ACV) — RF-diode rectified current direct to movement.

BX-505

Fast-response, 24μA movement — fuse & diode protected with high resolution factor. (0.4μA/scale division)
Revised scale marking — intermediate readings readily determined.



U-60D

44μA movement — quality performance, diode protected.
Temperature measurement of −30°C to +150°C with extra scale.

CAM-250D

Clamp meter
Economical and multi-function. Single motion core arm.
Compact yet provides 4 ranges on ACA and 2 ranges on ACV.

PDM-500/C

Performs as low resistance ohmmeter besides insulation tester.
Measurement, scale calibration and battery check are all operated by pushbutton switches.
Has constant voltage impressed irrespective of the value of resistance checked.

N-501

● ±DCV 0-60m 0-0.3-1.2-3-12-30 0-120-300-1.2k-30k (w/HV probe) ● ±DCA 0-2μ 0-0.3-0.3-1.2-3-12-30m 0-0.12-0.3-1.2-12A ● ACV 0-3-12-30-120-300-1.2k ±2.5% Freq. 20Hz to 50kHz ● ACA 0-1.2-12 ● Ω x 1-x10- x 100-x 1k-x 10k-x 100k (max. 200M) Batt. 1.5V x 1 & 9V x 1 ● dB −20 to +63

AX-303TR

● ±DCV 0-0.3-3-12-30-120-300-1200 ● ACV 0-6-30-120-300-1200 ● ±DCV 0.60μ -3m-30m-0.3-12 ● Ω x 1- x 10- x 1k- x 10k (max. 20M)

U-60D

● DCV 0-0.1-0.5-2.5-10-50-250 -1k-25k (w/HV probe) ● DCA 0-50μ -2.5-50-500m ● ACV 0-2.5-10-50-250-1k ● Ω x 1-x 10-x 100- x 1k (max. 5M)

BX-505

● ±DCV 0-0.12-3-12-30-120-300-1200-30k (w/HV probe) ● ±DCA 0-30μ -3m-30m-0.3-12 ● ACV 0-6-30-120-300-1200 ● ACA 0-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

CAM-250D

● ACA 6-30-60-300 ● ACV 300-600 ● kΩ 0-50k ● Batt. 1.5V x 1

PDM-500/C

● V/Ω rated 500V/100M ● Scale range 0-0.1-100-200m (1st effective scale range underlined) ● Ω 0-100Ω ● Power source AM or UM-2 x 3

WF **WARBURTON FRANKI**

● ADELAIDE 356-7333 ● BRISBANE 52-7255 ● HOBART 23-1841
● MELBOURNE 699-4999 ● PERTH 277-7000 ● SYDNEY 648-1711
● AUCKLAND N.Z. 79-7781 ● WELLINGTON N.Z. 698-272

Technics SL-230 Automatic Turntable

The Technics S1-230 is a fully-automatic belt-drive turntable which is supplied with cartridge. A trend-setting feature is the mounting of all frequently-used controls along the front edge of the deck and not underneath the perspex lid. This means there is less likelihood of dust landing in the record grooves.

One result of having the controls along the front edge is that the styling of the SL-230 is a little different from the majority of turntables with which it must compete. Some may say that the line-up of seven controls is a gimmick, but it really does make more sense than having them spread at random underneath the cover.

Dimensions of the SL-230 are 430 x 126 x 375mm (W x H X D) and mass is 4.6kg. About 50mm clearance is required at the rear of the deck to allow the perspex cover to open fully. The cover is detachable and has integrally moulded hinge-plates rather than detachable metal hinges. Whether the plastic hinges are strong enough, only time will tell.

Apart from the platter, tone arm and motor, virtually all the construction is of plastic, of one sort or another. We must admit to having reservations about the general lightness of construction, although it did not seem to prejudice performance in any way.

Technics describe the motor in the SL-230 as a "frequency generator servo controlled DC motor" which means that it is a brushless DC motor (really an AC induction motor) with tachometric feedback. The feedback is generated within the motor housing and not from the rotating platter as might be thought.

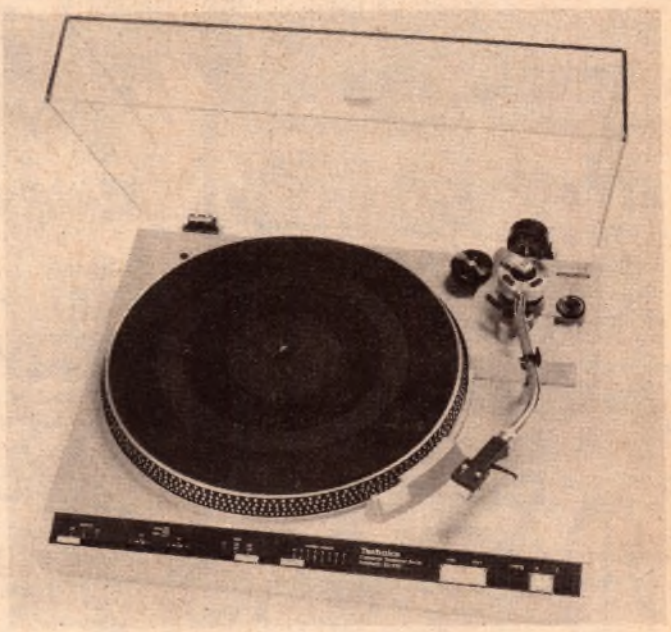
Because the motor is not tied to the mains system, speed change can be effected by switching rather than moving the belt up or down a stepped pulley. This undoubtedly has contributed to the move of all the controls to the front edge.

At the extreme left of the control strip is the speed change switch which provides two speeds: 33 and 45 rpm. Next are two thumbwheel knobs, which provide 6% adjustment of either speed. A mains-powered strobelight and strobe markings on the platter periphery provide a speed reference, albeit with the relatively poor short-term accuracy inherent in the mains supply frequency.

In the centre of the control strip are sliders which select the disc size to be played and the number of times to be repeated. The record can be played up to six times in succession or repeated endlessly. The "memo-repeat" control, as it is called, moves along the scale by one step, each time a playing is completed.

On the right-hand side of the control strip are the most oft-used controls: stop-start and cueing. The cueing facility is damped for both lifting and lowering.

An S-shaped tone-arm of unusual appearance is fitted to the SL-230. Technics have turned the usual gimbal mount system on its side, but whether or not any advantage is gained by this ploy is not stated or inferred. Longitudinal balance and vertical tracking force setting is provided by a rotatable counterweight which has a range of 0 to 4 grams and calibrations in 0.1 gram steps.



With controls lined up at the front, the Technics SL-230 presents a neat and attractive appearance.

Anti-skating force is set by a small knob near the tonearm base.

The two-core mains flex has a moulded two-pin plug, similar to that fitted to electric shavers. No mains earth connection is required or, in fact, desirable, since this is a double-insulated appliance. This is one advantage of the predominantly plastic construction.

The length of shielded cable is 1.2 metres and cable capacitance is 140pF in each channel which is higher than ideal for CD-4 operation but suitable for the EPC-270C moving magnet cartridge which is fitted as standard.

A spherical stylus is fitted to the cartridge, which is rated to track at 1.75 ±0.25 grams. At 2 grams, the cartridge handled the +16dB drum test track on the W&G 25/2434 test disc with only slight mistracking, which is a fair result.

Frequency response of the cartridge was flat from 20Hz to 18kHz within limits of ±2.5dB. Channel separation was good although it was much better from right-to-left at over 35dB in the midrange, than from left-to-right, at 25dB. Channel balance was within 2dB over the whole audio range. Waveform of sine and square waves was generally good.

Overall sound quality of the cartridge was quite good, although doubtless some buyers would want to upgrade to a more expensive cartridge.

Wow and flutter was difficult to quantify. It was possible to obtain quite low measurements at times, as low as 0.1% (DIN 45507), but occasional large random variations tended to make nonsense of those readings. While audible on constant tones, wow and flutter was not at all apparent on normal records.

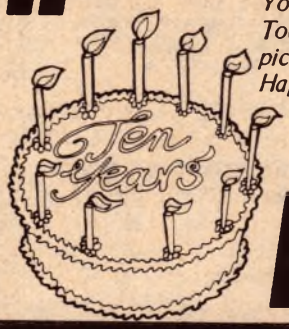
Rumble was quite low and negligible compared to that on ordinary disc pressings.

We could find little to fault the automatic operation of the turntable — it operates silently and treats the cartridge and records gently. The cueing works well, too.

Recommended retail price of the Technics SL-230 is $199.95. Further information can be obtained from high fidelity retailers or from National Panasonic (Australia) Pty Ltd, 57-59 Anzac Parade, Kensington, NSW 2033 (L.D.S.)

DICK SMITH 10th BIRTHDAY BONUS SALE!

Yes! It's our tenth birthday — but you get the goodies! Save heaps now by buying now. Here are a few of the incredible bargains you'll find in Dick's 8 page 'Tenth Birthday Mailer' You'll find a copy inside the October issues of Electronics Today and CB Action. Or call into a Dick Smith store and pick one up.
Happy Birthday!



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- FRENCH VOLTABLOC
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FROM $1.20

Each cell — 50 mm diam. x 8 mm thick. Ideal for all heavy duty applications — model boats, portable transmitters, repeaters . . . Supplied ready for you to charge — Easy to clamp in series for higher voltage applications (i.e. 10 gives 12 volts).

Cat. S-3302 .. .. $1.50
Were $3.90 Now $1.50 1-9, $1.20 10 up

1.2Volt - HUGE ONE AMPERE HOUR CAPACITY (YES! OVER TWICE THE CAPACITY OF OUR NORMAL NI-CADS)

FANTASTIC VALUE! Bumblebee 2-Way Radio LESS THAN COST!

OUR GIFT TO YOU! BIRTHDAY BONUS

D-1510

Look at these features:
- Maximum 5 watt power allowed for long range
- Tremendous 2 year guarantee — not 3 months
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- Has all 18 channels, talk to truckies for road conditions, call home base stations and emergency channel when you need it. NO, this is not a discontinued, throwaway line offered by some backyard operator — it's a famous DICK SMITH Designed for Australia, maximum range — BUMBLEBEE.

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SALE

Lock Down Aerial

- Vandal Proof
- 5 extensions
- 330 mm underhang clearance
- Very popular
- Was $7.95 in 1977

A-7300

NOW **$6.50**

LCD CALCULATOR

LIQUID CRYSTAL DISPLAY
ONLY 6 mm THICK
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Cat. Q-3020 WAS $24.50 NOW $19.50

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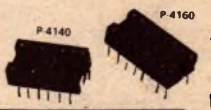

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Cat. P-4140 — 14 pin DIL IC socket
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D-6015	27.155 CB CH16	$4.00
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D-6019	27.195 Aust. CH16	$4.00
D-6024	27.240 CB	$5.00
D-6027	27.270 CB	$5.00
D-6033	27.330 Bush Fire	$5.00
D-6088	27.880 Marine	$5.00
D-6089	27.890 Marine	$5.00
D-6090	27.900 Marine	$5.00
D-6091	27.910 Marine	$5.00

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This is a coil type filter wound on a high density ferrite core. Used for tenacious whines.

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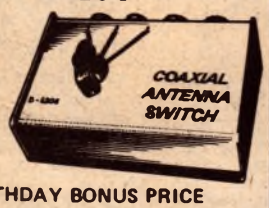

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5" dia. 8 ohm horn speaker. Ideal for CB and PA work.

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SPEAKER LEAD PACK

Now only $1.00

Handy pack consists of 25 ft of Fig 8 heavy duty speaker flex, ideal for high power hi-fi and P.A. applications. Supplied complete with 4 insulated wire nuts for easy termination.

Cat. W-4015 .. .. $1.00

WOT'S NEW?

CHESS CHALLENGER
Microcomputer chess game....

You play a real chess game against the computer — match wits — and try to beat it (yes, you can beat it if you're good enough)!

An ideal gift for the person who has everything . . . The incredible computer-controlled chess game allows three orders of difficulty — so there's no fear even if you are a raw beginner. YOU play the computer — match wits — and try to beat it (Yes, you can beat it !) Comes complete with chess men and integral board, power supply and instructions. Buy now for Christmas on our easy terms (to approved personal shoppers).

Personal Shoppers: Easy terms are available to approved applicants on this item.

Cat X-1250 ONLY $299

PARTS FOR NEW KITS

TANK TV GAME (See October ETI)
Complete kit, including instructions .. Cat K-3475 .. $39.50
SEPARATE PARTS:
PCB (only) .. Cat H-8620 .. $3.85
AY-3-8710 IC .. Cat Z-6856 .. $17.50
Fully built RF modulator .. Cat K-6040 .. $3.00
Fully built audio modulator .. Cat K-6042 .. $4.50

MODEL TRAIN CONTROLLER (See October EA)
Not produced as a kit — all parts available from stock:
PCB only .. Cat H-8355 .. $3.75
Zippy box .. Cat H-2752 .. $3.75
2N3055 transistor .. Cat Z-2145 .. $0.95
2N3053 transistor .. Cat Z-2130 .. $0.80

VARI WIPER Mk 2 (See September ETI)
Not produced as a kit — most parts available from stock:
Relay .. Cat S-7125 .. $4.80
C106Y1 SCR .. Cat Z-4315 .. $1.00
2N2646 (DS2646) unijunction .. Cat Z-1786 .. $1.20

UNIVERSAL MOVIE MIXER (See September E.A.)
Complete kit, including instructions .. Cat K-3492 .. $49.50
SEPARATE PARTS:
PC Board (only) .. Cat H-8354 .. $2.95
50k A curve 45mm slider pot .. Cat R-1980 .. 85c
Knobs to suit slider pot .. Cat H-3780 .. 40c

FET INPUT AC-DC VOLTMETER (See September E.A.)
Not produced as a special kit — all parts available ex stock:
PC Board only .. Cat H-8353 .. $2.75
1mA MRA-65B Panel Meter .. Cat Q-2060 .. $12.50
Fabricate your own meter scale using the Scotchcal process:
8005 black Scotchcal photo-sensitive aluminium .. Cat H-5694 .. $6.00
CA-3140 FET op amp .. Cat Z-5417 .. $2.50

DIGITAL DIAL (See September E.T.I.)
Not produced as a special kit — most parts available ex stock.
PC Boards:
ETI 550 .. Cat H-8619 .. $2.20
ETI 591 A/B (suit special Dick Smith LT-303 7 segment displays .. Cat H-8617 .. $4.00
ETI 591C (suits yellow H/P 5082-7663 displays) .. Cat H-8618 .. $1.80
ICM 7217A up-down counter IC .. Cat Z-5416 .. $16.00
5082-7663 yellow 10.9mm 7 segment display .. Cat Z-4160 .. $4.50
LT-303 red 7.6mm 7 segment display .. Cat Z-4103 .. $1.50

LIGHT SHOW CONTROLLER
Not produced in kit form — most components normal stock.

UPGRADED 40/200MHz FREQ. COUNTER (See August E.A.)
Same style as previous kit, but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz — by adding a single 95H90 IC the range is extended to 200MHz.
Complete kit for 40MHz, inc. instructions. Cat K-3437 .. $99.50
95H90 IC to extend range to 200MHz .. Cat Z-5360 .. $12.50
SEPARATE PARTS:
PC Boards (set of two top quality boards) .. Cat H-8346 .. $8.50
MC10116L IC (triple differential amplifier) .. Cat Z-5415 .. $1.95
MM-5369M IC (oscillator – divider) .. Cat Z-5781 .. $3.50
74C926 IC (4 digit counter) .. Cat Z-5414 .. $12.00
3.579545MHz crystal (new low price!) .. Cat K-6031 .. $3.00
LT-303 7 segment display .. Cat Z-4103 .. $1.50
All other components are normal stock lines at all of our stores.

PHOTO TACHOMETER (See August E.A.)
Although we do not produce a full kit for this project, all parts are normal stock lines at all of our stores
PCB (only) .. Cat H-8352 .. $1.80
FPT100 phototransistor .. Cat Z-1950 .. $2.00

NEW 10 GAME TV GAME KIT (See July E.A.)
Complete kit, including instructions .. Cat K-3491 .. $49.50
SEPARATE PARTS:
PCB (only) .. Cat H-8344 .. $3.95
Fully built RF modulator .. Cat K-6040 .. $3.00
Fully built audio modulator .. Cat K-6042 .. $4.50
AY-3-8600 IC .. Cat Z-6852 .. $15.00

NEW! MULTIMETER AND TRANSISTOR TESTER ALSO MEASURES 'C'

You've probably seen our incredible Multimeter/Transistor Tester. Now it's improved — 3% accuracy, able to measure 50kV or RF to 30MHz with optional probes . . . PLUS it now has an inbuilt oscialltor enabling it to measure capacitors from 50pF to 50uF. It could be the handiest piece of test gear you own . . .
Now what did that someone want for Christmas? Cat Q-1140
$69.50

RF PROBE
Enables your Q-1140 or Q-1136 to be used as an accurate RF voltmeter up to 30MHz – ideal for CB service work!
Cat Q-1138 .. $12.50

HI-VOLT PROBE
Want to measure TV EHT or vehicle ignition HT? Use this probe to extend the capability of your multimeter to 50kV.
Cat Q-1025 .. $22.50

STOP PRESS.....STOP PRESS.

NEW AM/FM STEREO TUNER MODULE
As used by Leo Simpson in the new Playmaster Tuner (EA Nov. '78). Just add 12 volt power supply, switches & tuning dial and you have an AM/FM stereo tuner for about $100 less than a commercial unit with comparable performance.
Cat. F-4610 FANTASTIC VALUE AT

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C90LN	C-3065	$1.95 ea	5
C60UD	C-3070	$2.40 ea	5

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Cat. P-4260 .. 14 PIN .. 85c ea
Cat. P-4262 .. 16 PIN .. 90c ea

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MAJOR DICK SMITH DEALERS: While there is not enough room to list all our dealers, shown below are the names and addresses of dealers who stock a large range of our products.

Overland Communications	11-53 Wollongong St, Fyshwick ACT. Ph 80 4307
Trilogy Elect. Supplies	40 Princes Hwy, Wollongong NSW. Ph 83 1219
Sound Components	78 Brisbane Street, Tamworth NSW. Ph 66 1363
Hitel Hi Fi	145 Queen Street, St Marys NSW. Ph 623 4442
Don House Electronics	2 Merriwa Street, Gordon NSW. Ph 498 1398
DGE Sales	44 Brown Road, Newcastle NSW. Ph 69 1222
M&W Electronics	48 McNamara Street, Orange NSW. Ph 62 6491
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GCG Communications	385 Mulgrave Road, Cairns QLD. Ph 54 1035
The Elect. Hobby Centre	1045 Gold Coast Hwy, Palm Beach QLD. Ph 34 1248
Premier Sound	239 Musgrave Street, Rockhampton QLD. Ph 27 4004
Sumner Electronics	97 Mitchell Street, Bendigo VIC. Ph 43 1977
Aero Electronics	123A Bathurst Street, Hobart TAS. Ph 34 8232
Devon Electronics	45 Ashburner St, Devonport TAS. Ph 24 4216
Advanced Electronics	5A The Quadrant, Launceston TAS. Ph 31 7075
A.E. Cooling	Town Cntr. Peoples St Bldg, Elizabeth SA. Ph 255 2249
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Altronics	105 Stirling Street, Perth WA. Ph 328 1599
BP Electronics	11 Duke Street, Albany WA. Ph 41 2681

406EA11

Use as a musical doorbell or for recorded commentaries:

Recorder cueing unit

The original intended use for the unit described in this article was as a musical doorbell. However, it can also be used to provide recorded commentaries for slide shows and similar sequential events. A standard cassette recorder is used, with the messages or commentaries recorded sequentially, but separated by short gaps.

by DAVID EDWARDS

Several electronic doorbells have been described in this magazine in recent times. All of these have used either discrete digital circuitry or a microprocessor to produce monotonic tunes. A choice of tunes can be provided by these units, with the tune actually played selected by some form of switch.

In this article, we describe a simple add-on circuit for a standard cassette recorder, which will enable it to reproduce any desired tunes or commentaries at will. If an endless cassette is used, the tunes will automatically repeat themselves.

The method used to sense the end of each tune is quite reliable, and does not rely on control tones recorded along with the tune. Instead, the audio output from the recorder is monitored. When a gap in the tune is reached, the current to the drive motor is disabled, stopping the tape.

The current consumption of the control circuitry is quite low, so that it is quite feasible to power it from the recorder. With some types of recorder this can be achieved without any modifications, by using only the standard input/output sockets normally provided.

Referring now to Fig. 1 and Fig. 2, we can discuss the operation of the system. We will assume that a tape has been produced as shown in Fig. 1, containing alternate messages and gaps, and that this tape has been loaded into the recorder with gap 1 opposite the playback head. We will further assume that the tape transport mechanism is disabled by the motor control, as shown in Fig. 2.

The control circuitry is shown in block diagram form in Fig. 2. It consists of four basic sections: a monostable pulse generator, a peak rectifier, an inclusive OR gate, and the previously mentioned motor control circuit. The OR gate is used to combine the outputs of the monostable and the peak rectifier, so that either can control the recorder motor.

Operation of the system is as follows: when the bell push is operated, the monostable is triggered, and via the OR gate it turns on the tape motor. The monostable has an on time similar to the length of the gap in the tape, so that by the time its pulse has ended, message 1 is being reproduced by the recorder replay amplifier.

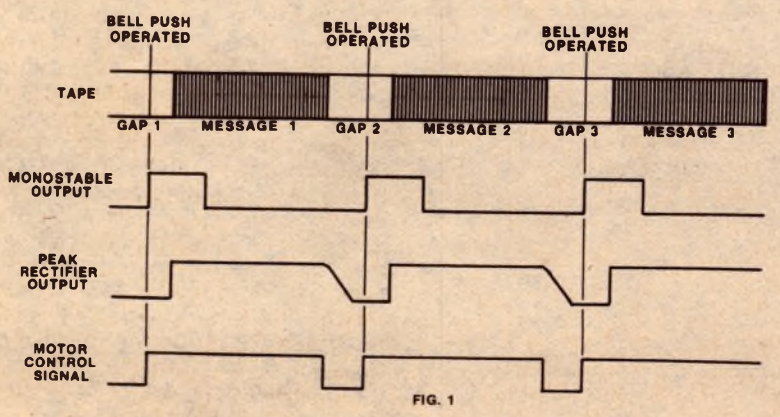


FIG. 1

This signal is applied to the input of the peak rectifier, whose output is at a high level whenever the message is present. This keeps the recorder motor operating for the duration of the message, which must be longer than the period of the monostable.

When gap 2 reaches the replay head, the signal at the output of the peak rectifier disappears, and this removes the drive from tape motor. The decay time constant of the rectifier is arranged to be shorter than the duration of the gap, so that the tape is stopped before message 2 reaches the replay head. This ensures that the tape will stop in the gap, and not continue on into message 2.

Nothing will happen after the tape stops, until the bell push is operated once again. The sequence of events will then repeat, and message 2 will be reproduced. If an ordinary tape is used, it will have to be manually rewound after the end is reached. This can be avoided by using an endless loop cassette, which will repeat its messages endlessly, without the need for any rewinding.

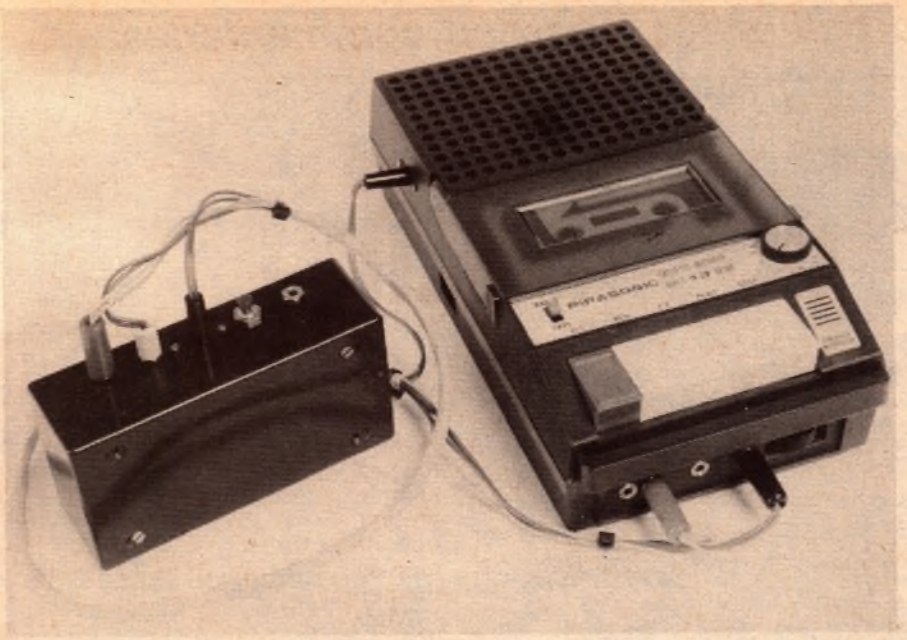
While this system was originally conceived as a musical doorbell (it can play Beethoven, rock and roll and even the Goons!), we have since realised that it has many other uses as well.

One possible use is in providing a recorded commentary for a slide show. This would be an asynchronous rather than a synchronous show, since the operator would still have to operate the slide change button. But this could be arranged to trigger the cueing unit so that the next message on the tape could be played, giving the details of the new slide.

When the message finished, the operator would have the choice of adding a few extra comments (or answering questions), or selecting the next slide and its message.

Another possible use would be in providing synchronised sounds for a model train layout. A series of whistles and other train sounds could be recorded on an endless cassette, and a

The diagram at the left shows how the messages and gaps are recorded on the tape, while the one on the right is a block diagram of the cueing unit.



series of trips arranged around the track. Then, as the train passed each trip point, the appropriate sound could be reproduced.

Turning now to the main circuit diagram, Fig. 3, we can discuss the actual circuit realisation. The principle active components are supplied by an LM3900 quad Norton amplifier. Four additional discrete transistors are also employed, along with a number of silicon diodes.

Amplifier 1 is connected as a monostable, and is triggered from a differentiated positive going pulse generated by the bell push. The component values chosen give an output period of approximately five seconds.

Amplifier 2 performs the OR function, and in addition provides some hysteresis for the switching action, to ensure that the output transitions are clean. A fixed bias current is provided into the negative input, which normally holds the output in the low state.

This bias can be overcome by either the current supplied by the output of amplifier 1, or by the current provided from the output of amplifier 4. This latter amplifier is connected as a precision half-wave rectifier, and has a very rapid attack time. The decay time constant, determined by the 47uF capacitor and 27k resistor, is rather longer: approximately two seconds.

This time is sufficiently long so that normal pauses such as occur in speech do not cause the output of the OR gate to go low. But it is sufficiently short that when a gap of about four seconds occurs in the tape, the output will go reliably low.

The hysteresis provided by the 1M resistor between the output and positive input of the OR gate is sufficient to prevent jitter at the gate output. This gives a degree of noise immunity to the system.

The output of amplifier 2 is inverted by the BC548 transistor, and used to trigger a second monostable (amplifier 3), which has a period of about one second. Because of the inversion, this monostable triggers at the end of the output pulse from the OR gate.

This second monostable is used to disable the input of the precision rectifier, by clamping the + input to ground via BC548 transistor. This prevents a form of feedback instability, caused by transients appearing in the audio output of the recorder when the motor is switched off.

The gain of the precision rectifier (amplifier 4) is set by the ratio of the 10k and 1M resistors. This can be varied if required by changing the value of the 10k component. However, the values we have chosen should suit most recorders.

Two alternative motor control circuits have been shown in Fig. 3. Each of them use a Darlington configuration, made from readily available silicon transistors. The NPN version is intended for control of motors where the switching is done in the negative or earthy line, whereas the PNP version is intended for use in the positive or active line.

Since in each case the output tran-

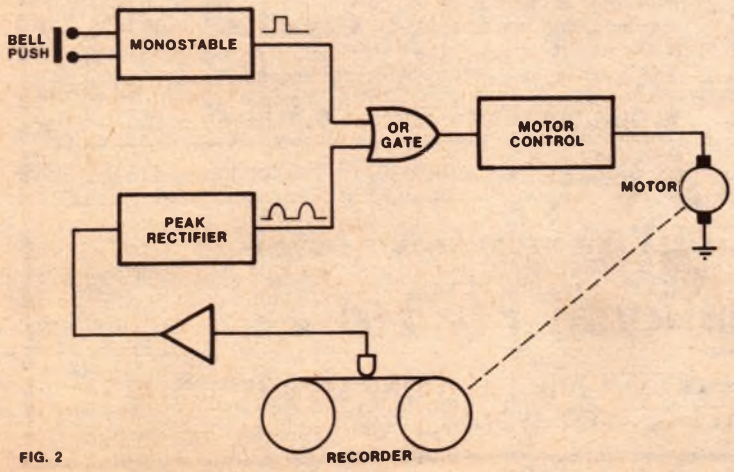


FIG. 2

PARTS LIST

SEMICONDUCTORS
1 LM3900 quad Norton operational amplifier
3 BC548 or similar NPN transistors
1 BC327 or BC337 silicon transistor (see text)
7 1N914 or similar silicon diodes

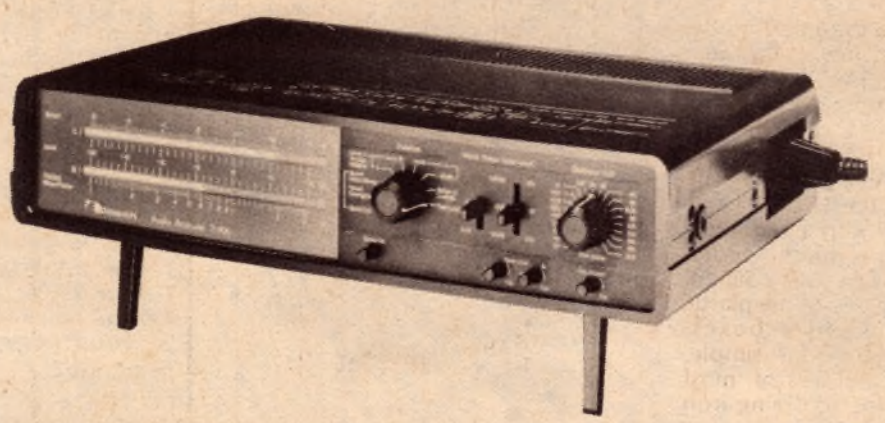
CAPACITORS
1 2500uF 16VW axial lead electrolytic
1 47uF 16VW radial lead electrolytic
1 15uF 16VW tantalum electrolytic
1 4.7uF 25VW tantalum electrolytic
1 0.1uF polyester
2 0.001uF polyester

RESISTORS
(all ¼W)
2 10M
2 3.3M
6 1M
3 100k
1 47k
1 27k
4 10k
3 1k
1 100 ohm

MISCELLANEOUS
1 printed circuit board, coded 78db11, 104 x 56mm
1 Zippy box, 130 x 68 x 41mm
2.5mm and 3.5mm phone plugs and sockets (see text)
1 miniature N.O. bell push (see text)
1 8 ohm speaker (see text)
Solder, machine screws and nuts, hookup wire, PCB pins

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

NAKAMICHI T-100 Audio Analyzer



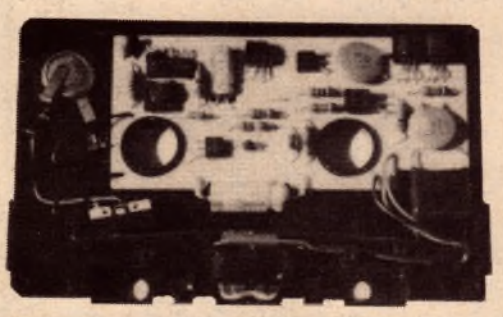
NAKAMICHI T100 AUDIO ANALYSER.
The T100 combines a VTVM, a distortion analyser and a wow/flutter meter. All levels are displayed on a bar graph display which utilises a plasma panel working on the gas discharge principle. This display effectively has zero mass making the system infinitely faster and more accurate than conventional meters. Originally conceived as a tool for the serious tape recorders, the analyser also provides valuable information about pre-amplifiers, amplifiers, turntables, phonograph cartridges, loudspeakers and microphones. The T100 audio analyser will be equally at home in the recording studio, the laboratory, the test bench, the audio showroom and listening room.

SPECIFICATIONS FOR T100 AUDIO ANALYSER

OSC	20-20kHz. Spot frequencies + pink noise
Level Meter	-80dB to +30dB
	Average or peak ballistics
Wow & Flutter Meter	Measures din peak AWTD or UWTD
Distortion Meter	Measurement frequency 400Hz.
	Range 0.01% to 3%
Noise Level Meter	Range -100dB to -10dB
	1 HF A Curve
	Output impedance: 600 ohms
	Input impedance: 50k ohms
Dimensions	13½ (W) x 3 (H) x 9½ (D) inches
Weight	4.3 kilograms, 9.5 pounds
	Carry case supplied

TDK HEAD DEMAGNETIZER

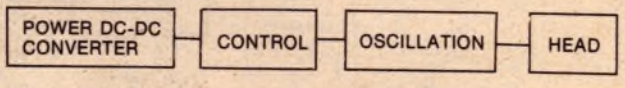
(Inside the HD-01 package)



WHY YOU NEED TDK'SNEW HEAD DEMAGNETIZER
Every time you use your cassette deck, its record and playback heads build up a magnetic charge, independent of your front panel controls. This charge becomes critical after about 30 hours of use, and begins to cause distortion, loss of response at high frequencies, decreased output level, and mid-range noise build-up of 5 to 7dB. The TDK head demagnetizer cassette solves the problems instantly and restores your heads to top operating condition, so you can get the most out of music.

HOW TO OPERATE THE TDK HEAD DEMAGNETIZER
Although the TDK head demagnetizer is a sophisticated electronic device as illustrated below, you don't need any technical expertise to use it. It is completely automatic, battery-operated, and portable. Simply pop it into your machine, like any other cassette, with the front side LED facing up. Press the "Play" switch and remove after one second.

BLOCK DIAGRAM



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TELEX AA23111, CABLES CONVOY SYDNEY.

Cueing unit

sistor is operated in a saturated mode, power dissipation is low. Maximum output current is 500mA.

Power supply decoupling is provided by a 100 ohm/2500uF RC combination. Total current drain is approximately 10mA, and consists essentially of the quiescent current of the LM3900.

The circuitry is all contained on a single printed circuit board, coded 78db11, and measuring 104 x 56mm. This is a neat fit inside one of the plastic and aluminium "Zippy" boxes. Construction should be quite simple, and within the capabilities of most readers. A fine pointed soldering iron will be required.

Care will be required, however, in the connections to the recorder. These should be sorted out before the output stage is fitted to the PCB. Due to the circuit variations between the various recorders which can be used, we will not be able to give detailed instructions for all cases. Fig. 4, however, shows a representative arrangement.

This is typical of a recorder which has the remote switch in the positive supply line of the motor, and has one side of the speaker connected to the negative supply line. A 2.5mm plug and switching socket is used to remotely control the motor, while a 3.5mm plug and switching socket is used to select either the internal speaker or an external one.

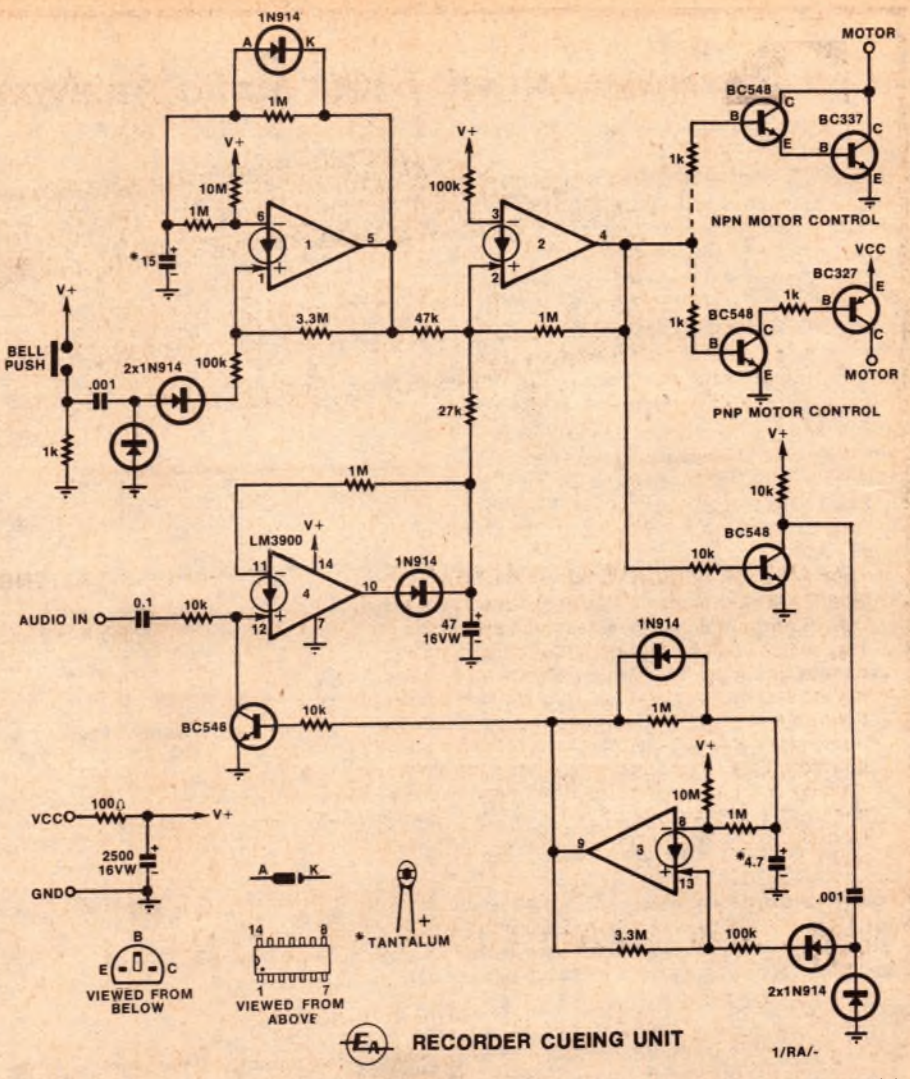
This configuration requires the PNP motor control circuit, and allows the cueing unit to be powered from the recorder. The positive supply line is obtained from the sleeve of the 2.5mm plug, while the negative supply line is obtained from the sleeve of the 3.5mm plug.

An external speaker is connected between the tip and sleeve of the 3.5mm plug, and can be placed in any convenient position. The internal recorder speaker will be disabled when the plug is inserted.

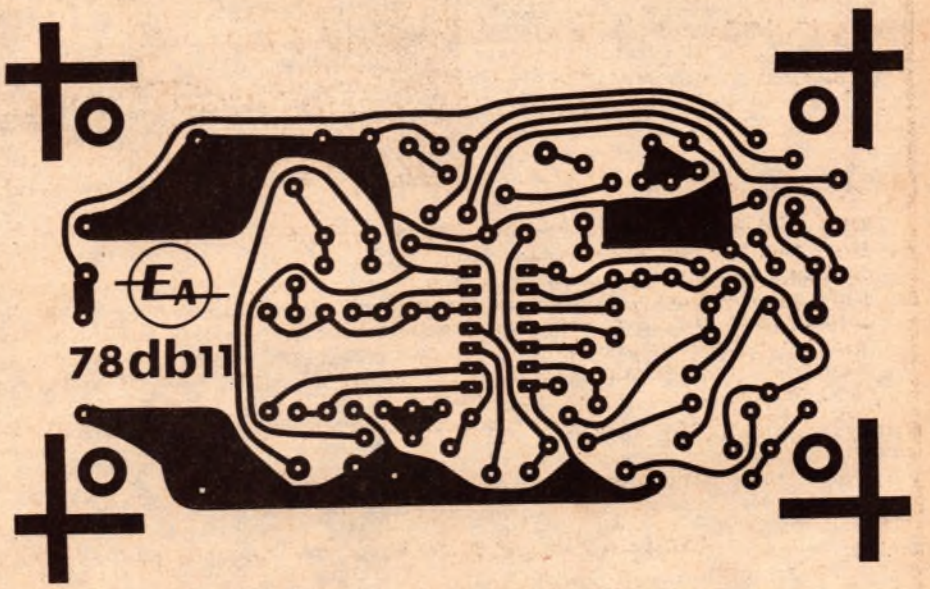
The tip of the 3.5mm plug is connected also to the audio input of the cueing unit, while the tip of the 2.5mm plug goes to the motor control output. Check that the supply voltage of the recorder is less than 16V before connecting up the cueing unit. If it is higher, you will need to increase the voltage ratings of the electrolytic capacitors. (The ultimate limit is the 36V rating of the LM3900.)

The NPN motor control circuit is used on those recorders having the remote switch in the negative supply line of the recorder. On these recorders it may not be possible to obtain the positive supply voltage from the recorder without modifications. If this is the case, fit an extra socket to some convenient area of the recorder case, and connect it directly to the recorder power supply (across the main supply bypass electrolytic).

It is not necessary to use shielded cable for the connections between the recorder and the cueing unit, ordinary twisted pairs are quite OK. Nor is it essential to use the sockets we used on the case of the cueing unit. To reduce costs they can be eliminated, and the twisted pairs terminated directly to the PCB. The extension speaker could be mounted in the case of the cueing unit,



The complete circuit of the cueing unit is shown above. Note the two possible motor control circuits. The PCB pattern is shown actual size below.



Cueing unit

or it could be mounted near the bell push.

Once all the electrical connections have been sorted out, a test tape can be prepared. Record some selections of speech or music on the tape, with four second gaps between the selections. The selections can be of any length greater than about six seconds. You can time the gaps with a stop watch, or just by counting mentally.

Now rewind the tape (if it is an endless tape, you will have to wait for the duration of the tape), and then connect up the cueing unit. Switch the recorder into the play mode, and adjust the output level control to a fairly high level.

When you swtiched to the play mode, the tape may or may not have started moving. This is normal, and is a function of the recorder circuitry. If it stops of its own accord, all is well. If it does not, turn the output level control to a minimum. If the tape still does not stop, you have not got the connections to the remote socket wired correctly.

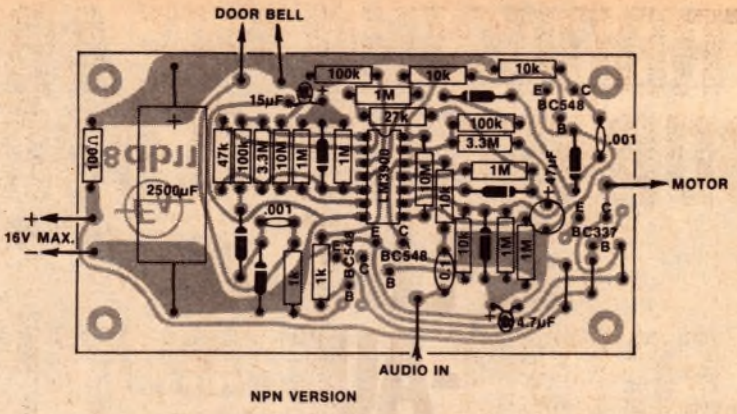
Once you have got the tape to stop, return the level control to a high setting, and depress the bell push. The tape should start moving, and a message should be heard. If the tape stops partway through the message, you will have to increase the output signal level from the recorder. The tape should continue for the duration of the message, and stop about two seconds after the gap has been reached.

Further depressions of the bell push should produce playback of the subsequent messages. If the tape does not stop when the gap is reached, it may be necessary to reduce the playback signal level slightly.

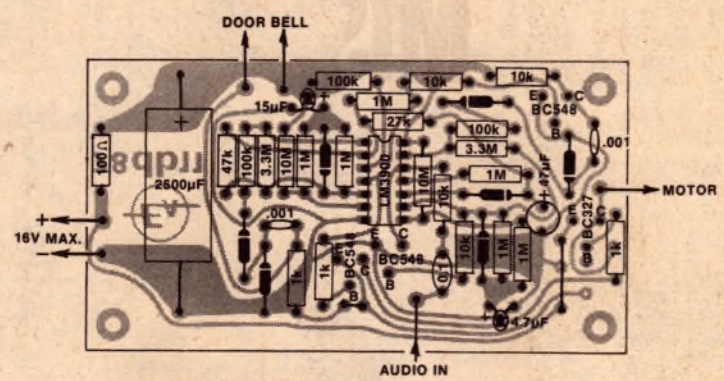
Assuming all is well, you can rerecord the tape with your favourite symphonies, hit records, Goon show excerpts, or messages designed to discourage travelling salesmen and the like.

Finally, a word of caution concerning the recorder. The unit should be used regularly (say once a day), to prevent the pinch roller from deforming, as in the play mode it is held permanently against the capstan. With regular usage, this should not cause problems.

In fact, at least some telephone answering systems do this also, and seem to operate for long periods of time without any noticeable effects.



NPN VERSION



PNP VERSION

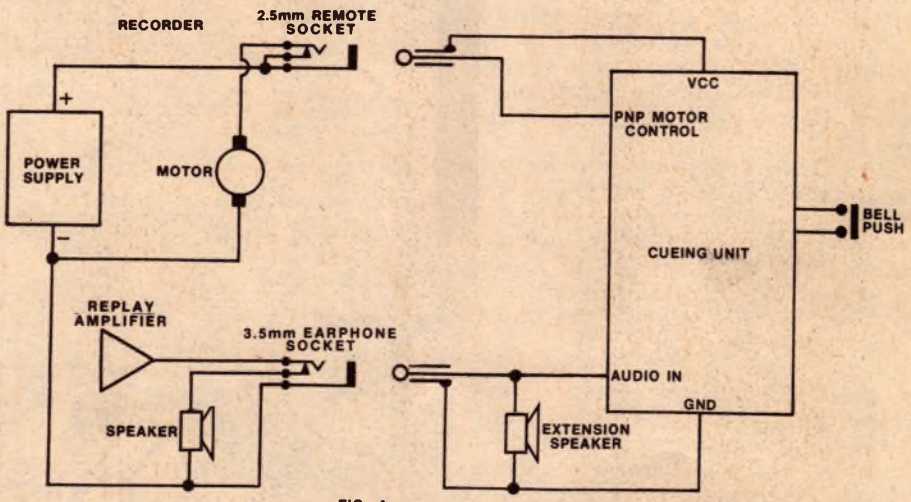
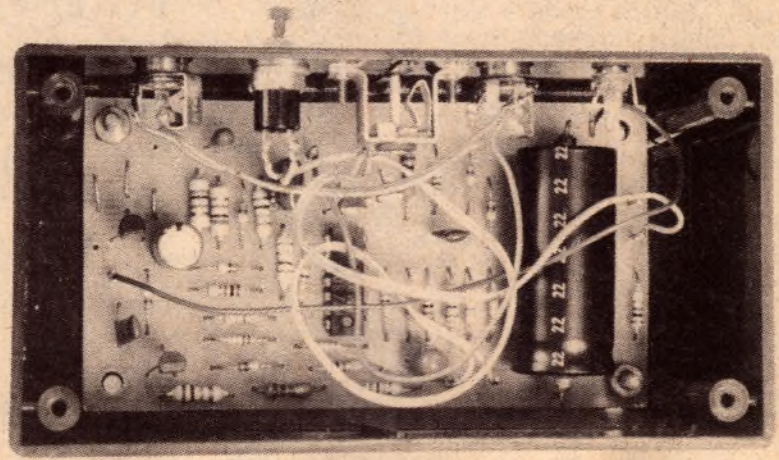


FIG. 4



At the top of the page are the two component overlay diagrams. Make sure that you use the appropriate one. In the middle of the page is the schematic connection diagram for a recorder with the motor remote control switch in the positive supply line to the motor. The bottom photo shows how the PCB and connection sockets are assembled into the plastic case.

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Playmaster AM-FM Stereo Tuner

To date, upwards of 10,000 Playmaster Twin 25 and 40/40 stereo amplifiers have been built. Now, to complement this very successful amplifier, we have produced a Playmaster FM/AM tuner which should really give those keen constructors something to rave about. Not only does it offer performance equivalent to tuners costing hundreds of dollars more, but it also offers a digital frequency readout and a 12-hour clock.

by LEO SIMPSON

Since we first published the very successful Playmaster Twin 25 and 40/40 stereo amplifiers we have had considerable demand for a matching FM/AM tuner from readers and kitset suppliers. However, we have been reluctant to publish such a tuner for the following reasons. First, any such tuner would normally require the use of alignment facilities not available to the majority of constructors.

Second, the necessary tuning gangs, coils, filters and other hardware are not available in large quantities at reasonably low prices — we expect the sales of this Playmaster tuner to run into the thousands. Third, and perhaps the most telling, styling and presentation were the greatest difficulties.

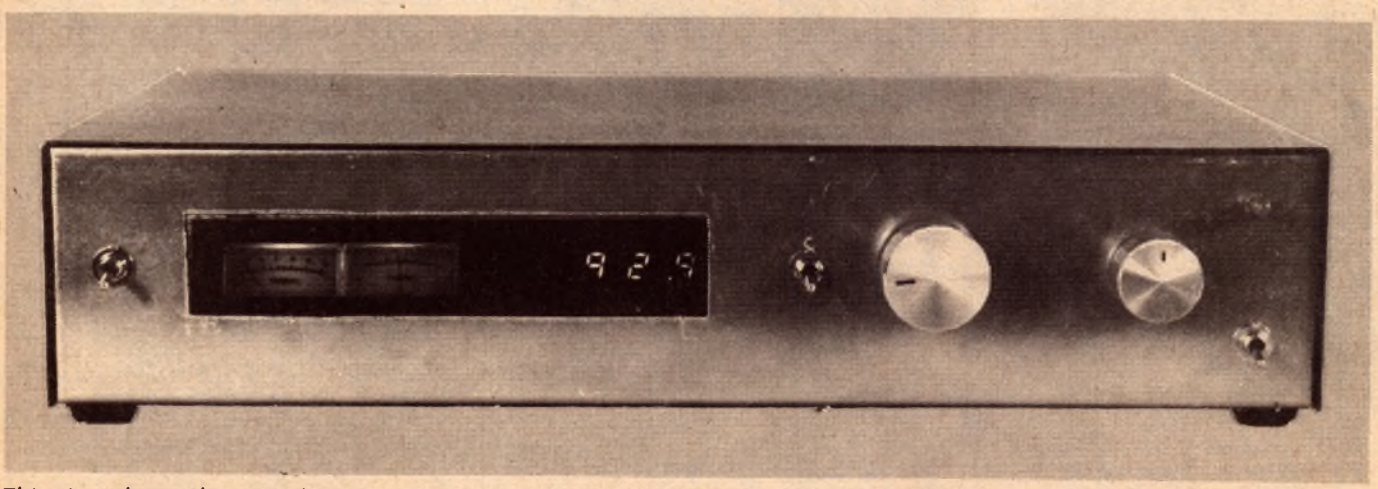
Even with the best will in the world, the home constructor cannot match the styling and presentation of commercial tuners and receivers produced in Japan. The Japanese manufacturers tool up for long production runs at a cost that can easily reach millions of dollars. So if we were to produce a successful tuner with "you beaut" styling, then the conventional "slide-rule" dial was out. Tooling was too expensive.

To solve these problems we adopted the approach that the prospective tuner must be based on a completely assembled and aligned module, and with digital readout of the frequency. Since one of the main kitset suppliers, namely Dick Smith Electronics, was particularly keen to see such a tuner published, we let them do the legwork. They scoured Japan, Hong Kong and South-East Asia for suitable modules.

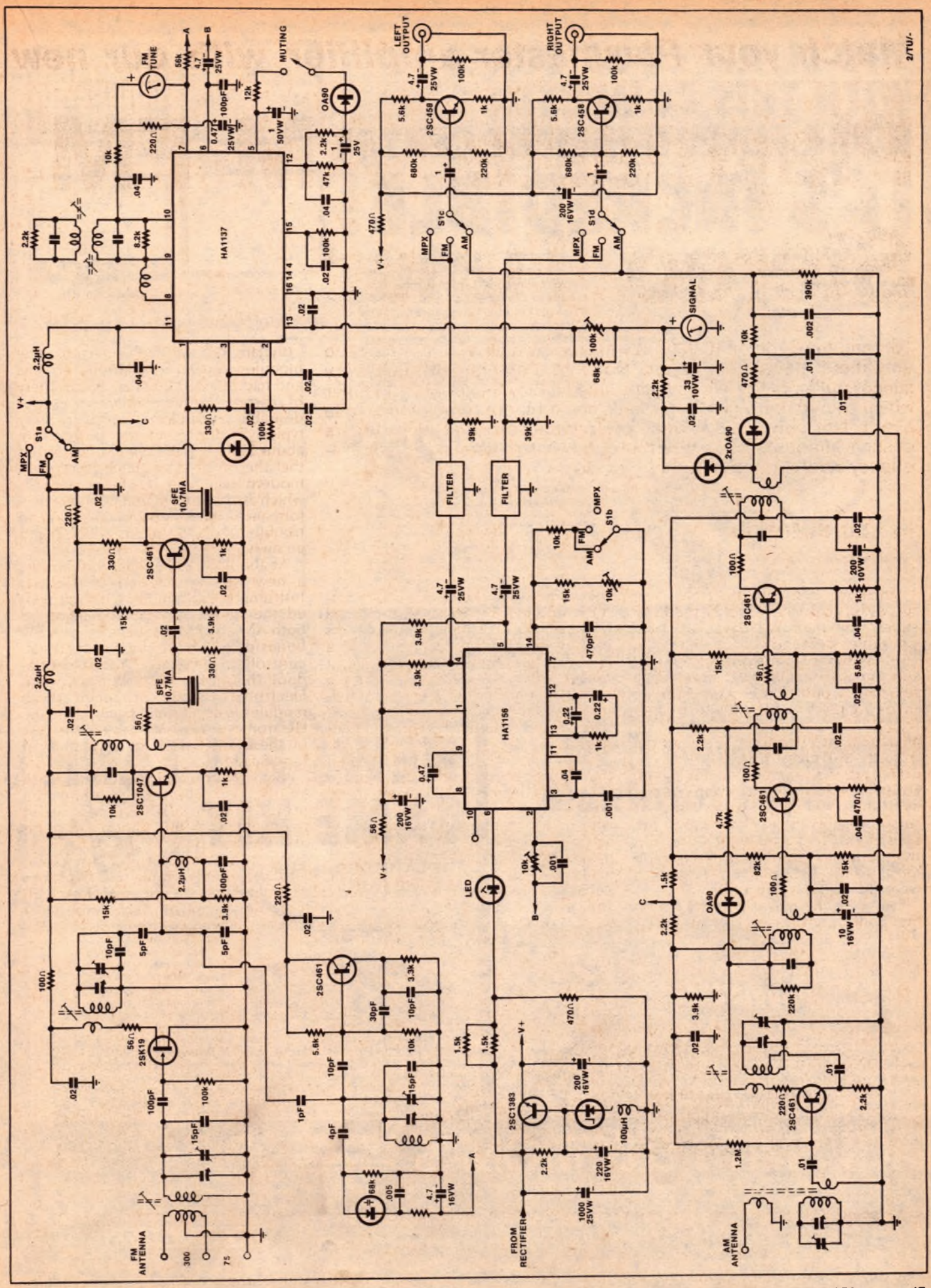
By late 1977 we had inspected many modules and overseas-produced kits and had rejected them all, for a variety of reasons. We then laid down a set of desirable specifications which are fairly typical of tuners in the range from about $200 to $400. We also stipulated that the prospective tuner must use a modern switching IC stereo decoder which assures part of that desirable performance noted above and has no troublesome adjustments which might go awry.

At about the same time, fortuitously, a new IC was released by General Instrument Corporation which provided the means for digital readout of both AM and FM frequencies, plus the bonus of a 12-hour clock with crystal-controlled timebase. Yabba-dabba-doo! Then, early this year, Dick Smith Electronics finally produced three modules from a firm in Japan, Wangine Electronics Co Ltd. We picked the best of these and asked for a number of modifications.

Many months and telexes later, Dick Smith Electronics finally had the module with all that we could reasonably wish for. All we had to do was interface it with the display circuitry and package it in a fancy case. That supposedly simple task has taken several months on our part. Now, with the co-operation of Dick Smith Electronics, General Electronic Services Pty



This view shows the new digital readout tuner in prototype form. At right is the circuit of the pre-aligned tuner module.


2/TU/-
FM TUNE
MUTING
OA90
LEFT OUTPUT
RIGHT OUTPUT
2SC458
HA1137
SIGNAL
2xOA90
FILTER
FILTER
OMPX
HA1156
SFE 10.7MA
SFE 10.7MA
2SC461
2SC1047
2SK19
2SC1383
LED
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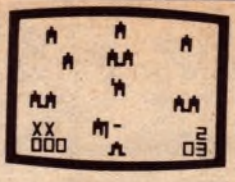

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BLACKJACK Cat. X-1201
Two games available - you play the TV (the bank) or two players can try and break the bank.

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Four games on this cartridge - Tic-Tac-Toe, Doodle, Shooting Gallery and Quadra Doodle - fun for all.

DESERT FOX Cat. X-1203
Two games - Desert Fox where you try and destroy the other tank without being destroyed and Shooting Gallery - the electronic rifle against dead ducks!

MAZE Cat. X-1204
Four great games - Maze, Jailbreak, Blind-man's-bluff, and Trailblazer - games that will test your skill.

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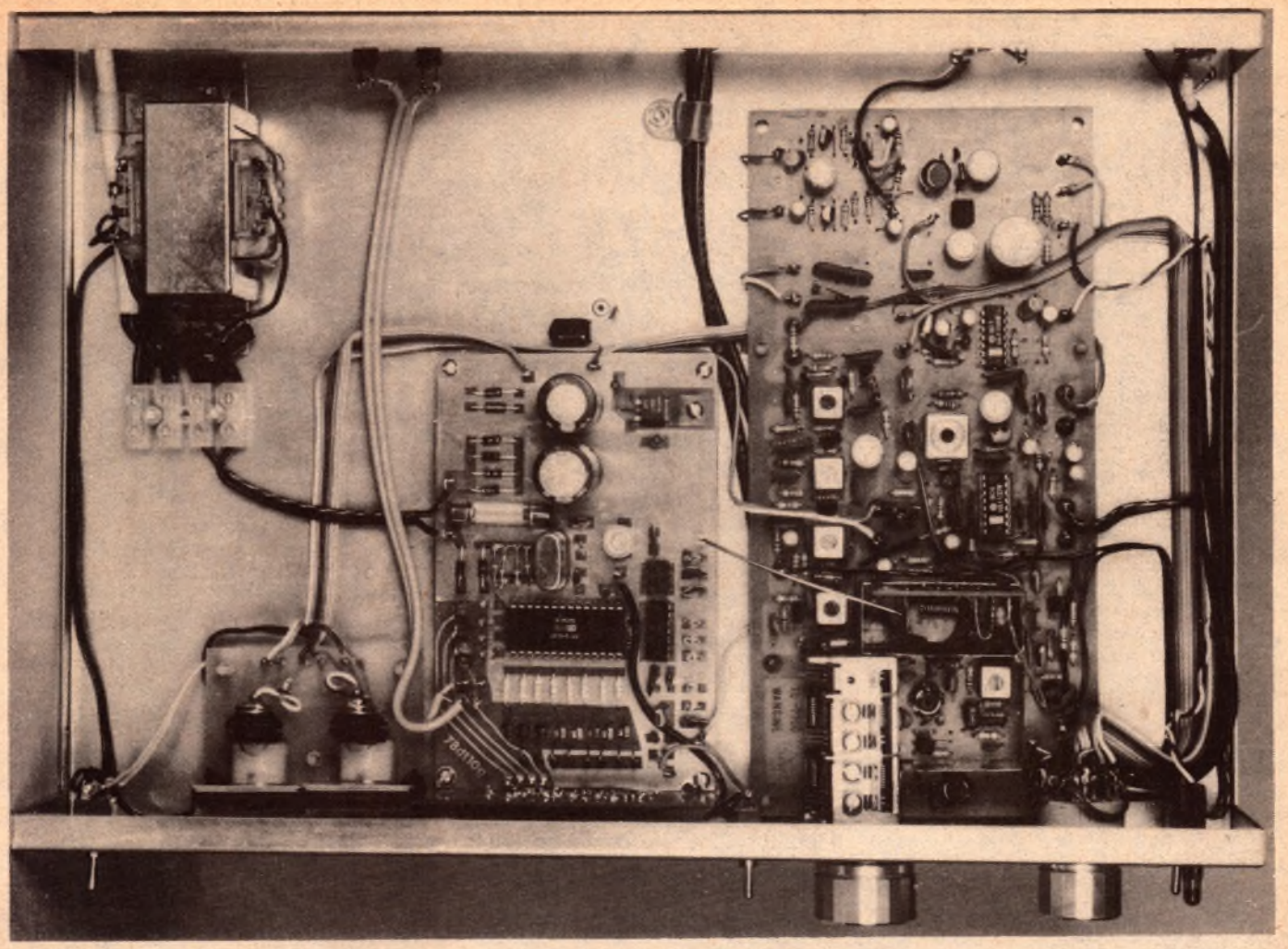


While it uses a lot of circuitry, the chassis layout of the tuner is relatively uncluttered.

Ltd, NS Distributors Pty Ltd and Bespoke Metalwork we are able to publish.

The new Playmaster tuner is styled to match the Playmaster amplifiers as closely as possible. It uses the same heavy-gauge gold-anodised aluminium front panel and matching knobs. The chassis dimensions are identical, so that it can use the same wrap-over cover or timber sleeve.

On the front panel, there are three toggle switches. The switch on the left hand side applies power to the tuner and lights up the two tuning meters, which are otherwise invisible behind the dark red perspex window. The clock circuitry is always powered — the only way to turn it off is to pull the plug from the wall socket.

The centre toggle switch selects time or frequency display. This means that you can listen to radio programmes while the time is displayed. If the broadcast (AM or FM) frequency is displayed, the readout automatically reverts to time display when the tuner is switched off.

The right-hand toggle switch is for switching out the FM interstation muting when tuning in very weak stations. Normally it is left in the "on" position.

The rotary selector has three positions: AM, FM mono and FM stereo. In the last mode, the adjacent LED will light when a stereo broadcast is received. As well as selecting the mode of reception, the selector sets the frequency display to FM (MHz) or AM (kHz).

The tuning knob is unconventional in action in that it only has 1.5 turns for full traverse and rotates anti-clockwise for an increase in tuned frequency. This would make tuning awkward in a conventional tuner, but the visual feedback provided by the digital display makes the task quick and accurate.

On the rear panel, there is a pair of RCA sockets which provide the audio outputs to a stereo amplifier. There is also a pair of screw terminals for connection of a 300-ohm ribbon antenna and a 75-ohm coax socket. An adjustable ferrite rod antenna picks up the AM broadcast signals.

Two push-buttons provide time-setting for the clock function. Pushing either the "hours" or "minutes" button causes the hours or minutes to advance at a rate of two per second. There is a one-second delay before the updating begins. This means that if you inadvertently press one of the buttons for a moment it will not change the clock display. However, momentarily pressing the "minutes" button resets the seconds count (not displayed) to zero and allows the time to be set exactly. This eliminates the need for a "hold" button which is usually found on digital clocks. Pushing both buttons simultaneously blanks the clock (or frequency) display. This is of no particular use to the user of the tuner but we mention it because otherwise people may think they have discovered a fault.

The tuner module is one that is very typical of those found in many middle-of-the-road Japanese tuners or receivers. As such it has provision for all the facilities normally found on FM/AM tuners. It has AFC (automatic frequency control), provision for two tuning meters, stereo blend switch (which we have elected not to use), switchable muting, and adjustable output level control (which we also have omitted).

All this is accommodated on a PCB measuring 220 x 106mm. There is a five-section tuning gang with 3:1 reduction gear incorporated. Both the tuned RF stage and local oscillator (for the FM portion) are shielded from the rest of

the circuitry.

The overall tuner circuit is very similar to that of the Playmaster 146 AM/FM tuner published in July to October 1975, at least as far as the FM portion is concerned. The main reason for this similarity and the similarity to many other commercial tuners lies in the IC's used for the IF amplifier, detector and stereo decoder functions.

Antenna input to the FM tuner circuitry is via a centre-tapped transformer which enables connection of 300-ohm ribbon or 75-ohm coaxial cable. The transformer has a tuned secondary winding which is coupled to the gate of a junction FET. This has a tuned output stage — that is, it is also affected by the tuning gang.

The local oscillator is of the Colpitts configuration with a grounded collector and parallel-tuned circuit in the base of the 2SC461 transistor. The oscillator runs at 10.7MHz higher than the incoming frequency. Automatic frequency control (AFC) to counter oscillator drift is applied by a varicap diode, which is biased from the quadrature detector.

The nature of the AFC is gentle. While it is effective in minimising oscillator drift it is not as strong as in some earlier FM tuners where you had to wind the pointer half-way across the dial before it would "let go" of the station.

With the present tuner, the AFC effect is so slight that it is almost unnoticeable. Consequently, we have not provided a switch to disable the AFC when tuning.

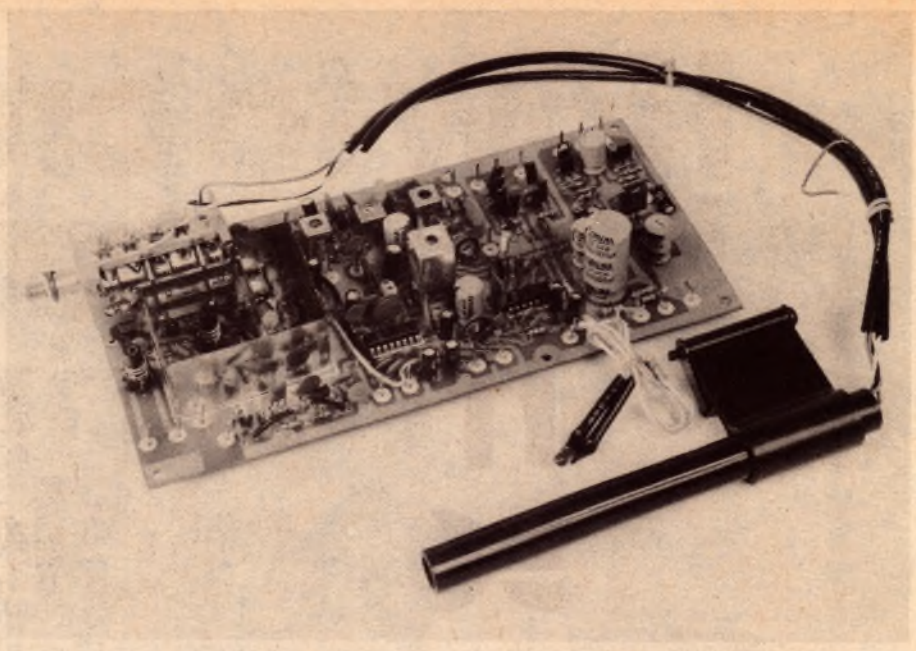
Output from the local oscillator is couled to the base of the 2SC1047 mixer stage via a 1 picofarad capacitor. That may seem like a very small capacitor but at the operating range of 98 to 119MHz (ie, the oscillator tuning range) the capacitor will have an impedance of approximately 1500 ohms.

10.7MHz is the output frequency of the mixer stage and this is coupled via an intermediate-frequency transformer to a Murata ceramic filter and thence to another transistor stage with an identical ceramic filter as its load.

Output of the last ceramic filter is coupled to the first integrated circuit which functions as a three-stage IF amplifier, quadrature detector and audio buffer. Made by Hitachi and designated HA1137, the IC looks to be a dead ringer for the CA3089E, which is the industry standard for this function.

At this stage we have not tried substituting a 3089 for the HA1137 but we are betting "London to a brick" that it will work with no modifications required.

Like the 3089E, the HA1137 provides outputs for the two tuning meters, AFC for the local oscillator and interstation muting. It has a double-tuned quadrature coil, which in the case of the 3089E, when adjusted critically, can result in harmonic distortion of less than 0.1% typical. Note that the overall harmonic distortion performance will depend on the rest of the circuit.



The Wangine WT-7700 tuner module is supplied fully aligned and complete with adjustable ferrite rod. Pictured is a pre-production sample.

Following the limiter and detector IC is the HA1156 multiplex decoder which is identical to the industry standard, the Motorola MC1310P. This IC is elegant in its function compared to its predecessors. It merely switches the composite stereo signal (obtained from the detector output) from left to right alternatively and synchronously at the rate of 38kHz.

An exact square wave at 38kHz is required for the above switching function. This is generated in the following way. An internal RC oscillator running at 76kHz is divided by a flip-flop to give 38kHz. Two further flip-flops produce two 19kHz square waves. One of these is used in a phase-lock loop comparator, to lock the loop to the 19kHz pilot tone; the other is used in a second comparator whose output is used for the automatic mono-stereo switching.

A 10k preset pot in series with a 15k resistor connected to pin 14 of the IC is used to set the 76kHz oscillator exactly to frequency. This is done by monitoring the 19kHz output waveform at pin 10. (On our pre-production prototype, the output was 19,002Hz.)

When the selector switch is set to AM or FM mono, the 76kHz oscillator is turned off by shunting a 10k resistor from pin 14 to ground. This avoids the possibility of higher harmonics of the 76kHz waveform producing audible beats with the AM mixer-oscillator and its 455kHz intermediate frequency output.

Because of the switching action of the decoding circuit, there is a considerable residual component of 38kHz remaining in the left and right outputs. This is attenuated by block filters (actually twin-T circuits centred on a nominal 38kHz) in series with the left and right outputs.

While the FM portion of the circuit is capable of very good performance, the AM section is quite modest — as is usually the case in FM/AM tuners and receivers. It uses only three transistors and a few diodes. The first transistor is a self-oscillating mixer with the ferrite rod providing a tuned input circuit.

Two intermediate-frequency stages follow the mixer. At the output of the second IF stage, two diodes function as signal detectors. One provides the audio output and applies AGC (automatic gain control) to the first IF stage while the other drives the signal strength meter. Another diode from the output of the first IF stage applies a second order AGC in the case of near over-load of the IF strip.

A diode connected to the AM positive supply line from the selector switch is used to latch up the HA1137 FM limiter/detector IC while the AM tuner is in use.

The tuner PCB requires a reasonably well filtered DC source of 14V or more. It has its own simple regulator circuit consisting of a zener-stabilised reference voltage (12V) and emitter-follower transistor. The 100-microhenry choke in series with the zener diode and the 220uF capacitor bypassing the series combination act to filter out zener-generated noise which might otherwise appear on the regulated supply line.

Next month we will publish the complete circuit of the clock and frequency readout section and present the constructional details.

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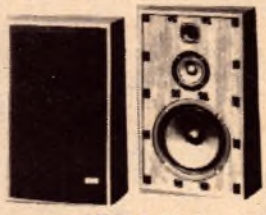

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An Electronic Thermometer

A very simple electronic thermometer capable of measuring absolute temperature directly in Kelvins may be made using the Analog Devices AD590 integrated circuit. This short article explains how the device is used.

by G. S. SHELL, M.Sc
PO Box 40, Yenda NSW 2680

The Analog Devices AD590 is an integrated circuit temperature transducer which produces an output current proportional to absolute temperature in Kelvins (K). (T in K = T in °C + 273.2)

It is suitable for measuring temperature over the range —55°C to +150°C, with an accuracy of about 1 degree. The accuracy is improved to 0.1 degree or better by calibration. For example it can be used to monitor wet/dry bulb air temperature, soil temperature, temperature distribution in a refrigerator, freezer or domestic oven (up to 150°C or 300°F).

The AD590 temperature sensor comes in a small TO-52 package (dimensions 5.6 mm diam. by 3.8 mm high), with two terminals ("+" and "—") for connection to the supply voltage and measuring instrument, and a third terminal connected to the case.

The integrated circuit uses the principle that if two identical transistors are operated at a constant ratio of collector current densities, then the difference in their base-emitter voltages is directly proportional to absolute temperature. In the AD590 this voltage difference is converted to a current which is amplified to give a sensitivity of 1uA/K. At room temperature (say, 27°C) the current will be 300uA. The device calibration is laser trimmed during manufacture so that only minor calibration is required by the user.

The AD590 sensor may be mounted by soldering the pins to a length of twin-conductor microphone cable (e.g., Dick Smith W-2034). The solder joints are kept electrically isolated with tape or fine spaghetti tubing. The cable shield is connected to the pin connected to the AD590 case. Reasonable water-proofing of the connections is obtained by cutting the tab off the AD590 case (adjacent to the "+" terminal) and slipping a length (say, 50-75 mm) of 6.3 mm heat-shrink tubing over the sensor and cable. The tubing will shrink over the cable and sensor with the heat from a hair dryer or soldering iron. The tubing-covering the sensor case can be either trimmed to expose about half the case (for short thermal response time) or crimped flat with pliers while the tubing is hot (for maximum water proofing).

The device will withstand a forward voltage of 44V and a reverse voltage of 20V. At a constant temperature, the current in the AD590 is comparatively insensitive to changes in supply voltage. The current changes by only 0.2uA/V for supply voltages in the range 5 to 15V. Thus power supply requirements are not critical.

The simplest circuit employing the AD590 uses a battery (e.g., 4.5, 6, or 9V) or a power supply and a 1k ohm resistor in series (Fig. 1). The voltage across the 1k ohm resistor is then proportional to absolute temperature (1mV/K, e.g., 0.3V at 300K or 27°C), and may be read on a high-impedance multimeter such as Dick Smith's Q1136 or Q1100 or (100K ohms/volt) or on a digital voltmeter. On the 0.5V multimeter range the resolution is 1 to 2 degrees. Using a 4-digit digital voltmeter the resolution is 0.1K. The calibration can be checked at one temperature, either in water against a thermometer, or at the ice-point (273.2K). The zero error can then be noted and applied as a correction to measured temperatures.

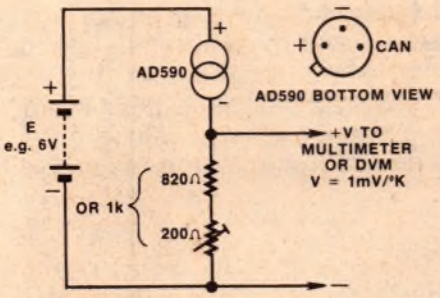


FIG. 1

Alternatively, an 820 ohm resistor and 200 ohm trimpot may be used in place of the 1k ohm resistor, in which case the voltage can be trimmed to 0.273V at the ice-point.

Absolute accuracy in temperature measurement (using the "J" version of the AD590) is then +/—2 degrees (maximum) over the range 218K (—55°C) to 423K (+150°C). The accuracy over a more limited temperature range (e.g., 273K to 323K) is better, typically +/—0.3 degrees. Furthermore, up to about 383K (110°C) the error varies nearly linearly with temperature; thus readings may be corrected simply by multiplying by a correction factor obtained from a calibration at two temperatures (e.g., the ice-point and the boiling point of water).

If an absolute accuracy of 0.1 degree or better is required, the sensor can be calibrated over the temperature span required, using a thermometer (such as mercury-in-glass) with a known calibration as a secondary standard.

When the temperature of the measured medium changes rapidly, or alternatively when the sensor is transferred from a medium at one temperature to one at a different temperature, the indicated temperature approaches the new temperature exponentially. The time taken for the difference between indicated temperature and true temperature to decrease to a certain value depends on the thermal contact of the sensor with the medium and on the heat capacity of the sensor. As an indication of this thermal lag, the time taken for the temperature difference to reach 1% of the initial value is 4½ minutes for still air, 1 minute for moving (0.27 m/sec) air and ¼ minute for a stirred liquid bath.

Self heating in the sensor gives rise to a small error in reading. For example, using a 6V battery with the sensor at 300K, and a 1k ohm series resistor, the sensor dissipation is (6 — 0.3) x 0.3mW = 1.7mW. This raises the sensor temperature by 0.8 degrees in still air, 0.2 degrees in moving air (0.27 m/sec) and less than 0.1 degree in a stirred liquid bath. For a given application, this error can be allowed for. Alternatively, power can be switched on for a few seconds only when measurements are required (e.g., using a push-on switch). In still air, the self-heating results in an error of 0.1 degrees after power has been applied to the sensor for about 10 seconds.

To obtain the ice-point accurately, a container of finely crushed ice should be used. Immerse the sensor and about 75mm of the connecting cable in the crushed ice. If crushed ice is not available, ice blocks in water may be used provided the sensor is kept in the upper region of the water near the ice blocks. (If the sensor is allowed to sit at the bottom of the container of ice blocks and water, an error of up to 4 degrees may result because water has its maximum density at 4°C.)

Because the AD590 converts temperature to current, switch and contact resistances are relatively unimportant (provided a voltage of at least 4V is maintained across the device), and it may be used with CMOS analog multiplexers in data-logging applications.

Finally, the AD590 is available from the Australian agents for Analog Devices, Parameters Pty Ltd (PO Box 480, Crows Nest 2065). Cost of the device in 1-off quantities is under $5.00, plus tax if applicable.

View at left shows the completed prototype, housed in a standard metal case. The amount of delay is variable from 10ms to 50ms.

by IAN POGSON

BBD audio delay and reverberation unit

. . . sound effects for your electronic organ

In the past we have had to depend upon such devices as springs, plates and endless tapes to provide delay and reverberation effects for music and musical instruments. More recently, a "bucket brigade device" in the form of a CMOS IC has been developed, which makes it possible to achieve similar effects with greater reliability and in less space. Here is an account of some recent experiments along this line.

Readers may recall that we presented a preliminary article on the then rather new BBD (Bucket Brigade Device) in the December 1975 issue; this from the viewpoit of a hobbyist. We were notably unenthusiastic at the time, probably because we were expecting too much, too soon, from too little circuitry. It's not surprising that we were disappointed.

Since then, it has become apparent that BBDs are indeed capable of rather interesting results — provided one is prepared to invest enough time and money in their application! And therein lies the real problem for the home constructor.

While still wary about getting too deeply involved, we did decide recently to have another look at BBDs for the hobbyist, but with a more modest objective: to see whether simple, practical circuitry had anything significant — even subtle — to offer the audio enthusiast, particularly one involved with electronic organs or other such instruments.

While we are still not wildly enthusiastic about the results, our observations did suggest a limited but interesting role for the kind of basic unit described in this article.

Before proceeding further, a short discussion on how the BBD works may be in order. A fairly detailed explanation was given in the article of December, 1975 and this may be referred to by readers wanting more than the abbreviated description which follows.

A number of BBDs are now available but they all function on the same general principle. The device which we used is a MOS integrated circuit, type MN3001. It is a dual 512-stage device in the form of an analog shift register. Each half may be considered as a line of 512 capacitors, so arranged with internal switching that each capacitor receives a charge from the one on the left, passing it on later to the capacitor on the right.

In practice, the first capacitor in the line receives a series of charges (or pulses) proportional to an audio input waveform; subsequently passed through the line, the charges emerge at the other end as a recognisable audio signal. The analogy with a bucket brigade is obvious.

In short, when an audio waveform is fed to the input of the system, a replica of the original will appear at the output, somewhat delayed in time. Ideally, there would be no losses in the chain and the output would be at the same level as the input. The device is remarkably efficient in this regard but there is a transmission loss of about 8.5 dB over each chain of 512 stages. This can be readily made up, as we will see later on.

The rate at which the charges are switched from one stage to the next controls the delay, or the time taken for the signal samples to travel from input to output. Switching is by means of an external square wave oscillator, or "clock". The delay time will thus depend upon the clock rate.

It will be obvious that no capacitor in the chain can receive a new charge until it has passed on the one that it already has. Thus, on a particular clock pulse, capacitor 1 may receive a charge

(or sample) from the input signal. On the next clock pulse, it will pass the charge to capacitor 2. On the third pulse, C2 will pass the charge to C3 and C1 will receive a new charge from the input signal. On the fourth pulse, C1 and C3 will pass their charges to C2 and C4 respectively, ready for what follows on pulse 5. And so on, all the way down the line.

In practice, two dissimilar clock signals are required to effect the alternate transfers. Fortunately, they can be provided by the one clock by simply having two outputs, with a phase difference of 180°. On this basis, the time delay in milliseconds is equal to the number of stages in the device, divided by twice the clock frequency in kHz. Thus, if we have 512 stages and the clock frequency is 20kHz, the delay will be 12.8ms.

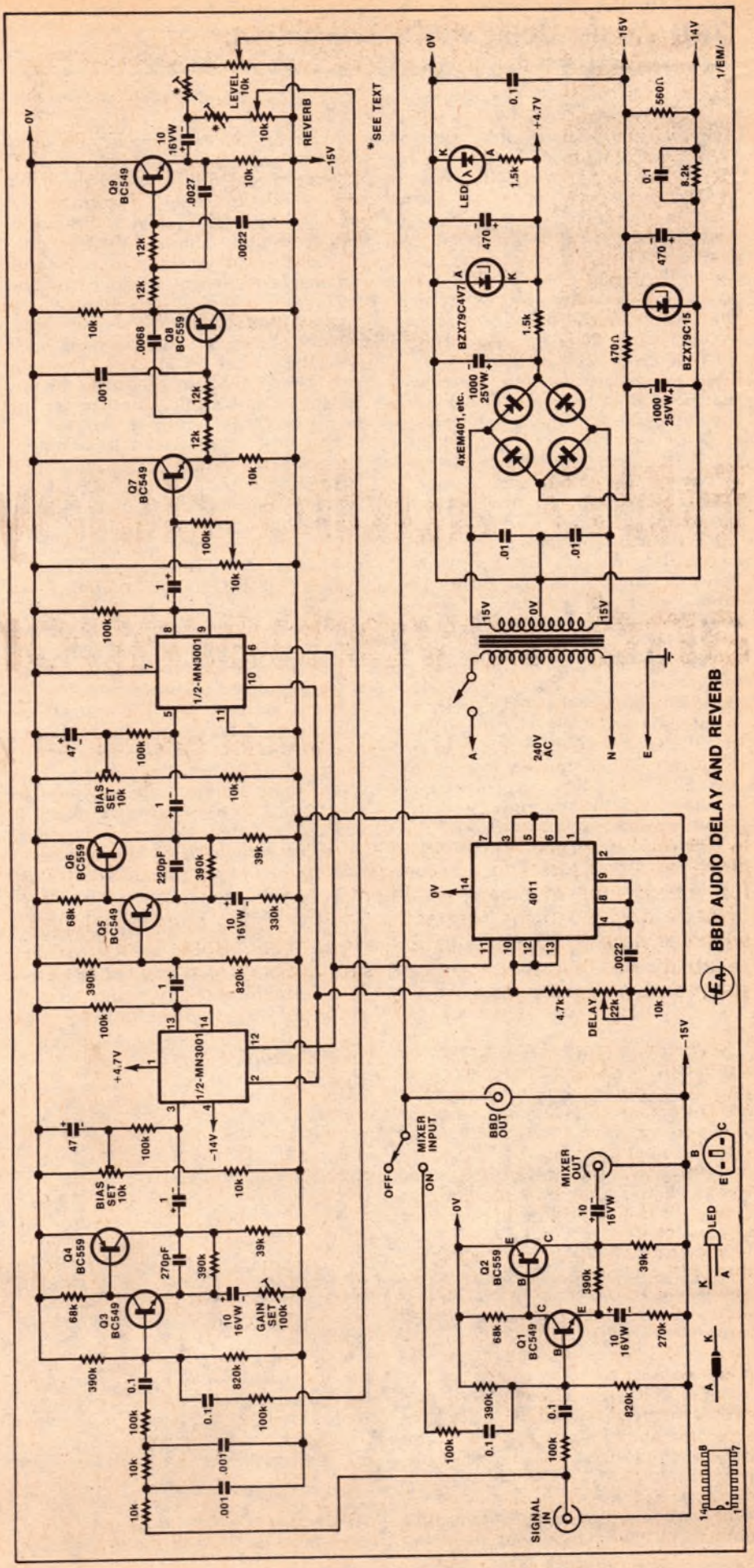
As a rule of thumb, the maximum audio signal frequency which can be handled by a pulse or sampling system is half the clock frequency. A more practical limit is one third the frequency. Thus, for a clock frequency of 20kHz, as mentioned above, the audio response would be limited to about 7kHz. If the clock rate was reduced, in an effort to obtain a longer delay, the audio bandwidth would be reduced in proportion.

Clearly, if the design requirement is for a long delay time plus a wide audio bandwidth, the only way to meet it is by substantially increasing the number of bucket brigade devices. This means more transmission loss through the system, more stages to make good that loss and greater vulnerability to distortion, noise, hum, instability and to penetration by external RF fields and pulses. Hence our wariness about diving in too deeply, or encouraging readers to do so, at this stage.

One other problem has to do with the clock frequency itself, which emerges from the BB chain along with the wanted audio signal. The MN3001 BBD, as specified, has an extra stage, so connected as to partially cancel the clock pulse at the output, but heavy filtering is still necessary to minimise the amplitude of the clock frequency fed to the subsequent amplifiers. Even if the clock frequency is not directly audible, it can make its presence felt in the way of spurious components and/or an increase in the perceived background noise.

Possible applications for the BBD are many and varied. Some which come to mind include adding spatial effects to electronic organs and other electronic musical instruments, or to recordings which lack ambience; adding an extra dimension to monaural recordings; and minimising the "sound in the head" effect when listening to headphones.

With some additional circuitry, a BBD can give a reverberation effect in addi-



tion to simple delay. Again, if the clock is frequency modulated, slow and fast vibrato can be achieved, which has obvious application in electronic organs.

Let us now look at the circuit and see how the foregoing has been put into practice. The signal to be processed is fed to the input, where it divides, one part going to a mixer and the other to the BBD channel. The mixer is an optional facility the role of which will become clear later on.

An immediate problem arises with that portion of the input signal fed to the BBD system. As the higher frequency signal components approach half the clock frequency, difference frequencies — the lower sideband — tend to appear as a spurious component in the recovered audio signal. To combat this, some form of low-pass audio filter is desirable and, as a compromise between simplicity and a really sharp filter, we have specified a passive network involving two 10k resistors and two .001uF capacitors.

As a further and important provision, the gain of the first BBD driver stage is made variable by means of a preset pot in the emitter circuit. The intention is that the gain should be preset so that the driver will adequately load up the first BBD with the particular signal available; this in the interest of optimum signal-to-noise ratio.

From the first section of the MN3001 BBD, the signal passes to a second amplifier, the gain of which is set to make up for the approximate 8.5dB lost in the BBD. The respective amplifiers have capacitors of 270pF and 220pF shunted across the 390k feedback resistors. The capacitors restrict the high frequency response of the amplifiers and supplement the input filter already described.

From the second amplifier the signal is fed into the second section of the MN3001 BBD. The signal at the output of the second section of the BBD consists of the wanted signal together with an unacceptable level of clock hash and this must be filtered out. This accounts for the fourth order low pass filter which follows, the values having been selected to cut off at 5kHz. The fully processed signal emerges from the low pass filter and is split, one part serving as the direct BBD output.

The other part is fed to a potentiometer and thence back to the input of the first amplifier. Part of the delayed signal is therefore re-routed through the BBD chain, delayed again, fed back again until it finally — and hopefully — diminishes to virtual zero. What is available at the output is therefore not just a delayed signal but one with a pattern of diminishing delays rather similar to what was obtained with a spring or an endless tape loop system. In short, simulated reverberation.

It may be seen that there are three 10k preset trimpots, one for each section of the BBD and one for the first transistor of the fourth order low pass filter. These trimpots are provided to set the bias to the respective stages. It will also be noted that there is a trimpot in series with each of the two level potentiometers at the output of the system. These have been provided to set the range of adjustment for the external "Level" and "Reverb" controls.

The clock uses a CMOS type 4011 quad 2-input NAND gate. Three of the gates form the oscillator proper, its output being used to drive the respective BBD sections. The oscillator output is also fed into the fourth gate and used as an inverter, thereby providing the second driving component which is 180° out of phase with the other one. Its frequency is adjustable over the range of approximately 10kHz and 90kHz with the 22k potentiometer, giving a delay between about 50ms and 5.5ms.

The power supply has been designed to provide three different voltages for the overall system. The secondary winding of the power transformer is rated at 15V AC each side of the centre tap and two pairs of silicon diodes are connected to give a positive and a negative DC output.

The positive DC output is filtered with a 1000uF electrolytic capacitor, the voltage being stabilised to 4.7V with a 1.5k resistor and a zener diode. The negative DC output is also filtered with a 1000uF capacitor and stabilised to —15V with a 470 ohm resistor and a second zener diode. In addition, —14V is required for the BBD chip and this should bear a constant relationship to the —15V. Therefore, the —14V is obtained by connecting a voltage divider consisting of an 8.2k and a 560 ohm resistor in series across the —15V supply.

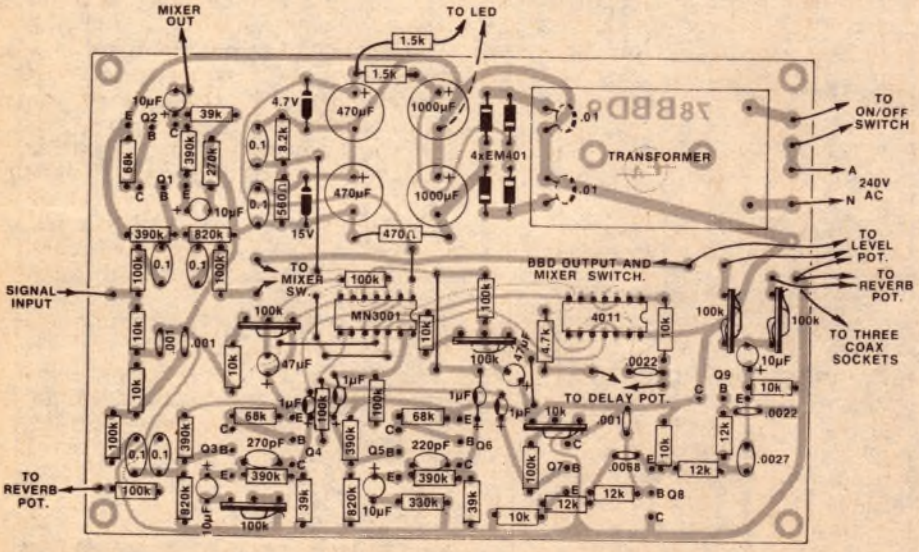
A LED is connected across the 4.7V supply and in series with a 1.5k resistor to serve as an indicator.

It may also be seen that we have bypassed each side of the transformer secondary with .01uF ceramic capacitors. These capacitors actually saved the project from disaster! After making preliminary tests in our laboratory, two staff members took the unit home to test it under more realistic conditions. While it seemed to do the things it was supposed to do, we were plagued with heterodyne whistles which were quite intolerable.

Both of the addresses concerned were within a few km of broadcasting station 2CH's transmitter, with a number of others somewhat further away. It was found that the whistles persisted even when no input lead was connected, indicating that the trouble was due to RF from broadcast transmitters being fed into the system via the mains supply. Presumably, the RF was beating with harmonics from the clock inside the unit. The two .01uF ceramic bypasses virtually eliminated the trouble.

This may be a hint worth keeping in mind. Years ago, mains transformers were fitted, almost as a matter of course, with an earthed electrostatic shield between primary and secondary. Modern mains transformers rarely include such a provision, which means that they are much more prone to transmit mains-borne RF to the internal circuitry.

Construction of the unit will normally start with assembly of the PCB. Care should be taken, when soldering components in place, to ensure that no



The component overlay diagram shows the PC board as viewed from the component side. Follow the usual precautions when inserting the CMOS ICs.

damage is caused by overheating. A small, clean, hot iron is needed and soldered joints should be made so as to have a good flow of solder and with no more heat applied than necessary to achieve this. Make sure also that polarity requirements of components are observed, where such apply.

It is a good idea to start with the smallest components and gradually move to the large ones. In short, start with the links, then proceed to the resistors and finally to the power transformer. Note that the two .01uF ceramic capacitors on the secondary of the transformer are mounted underneath the board, right at the points where the transformer secondary pins are soldered to the copper track.

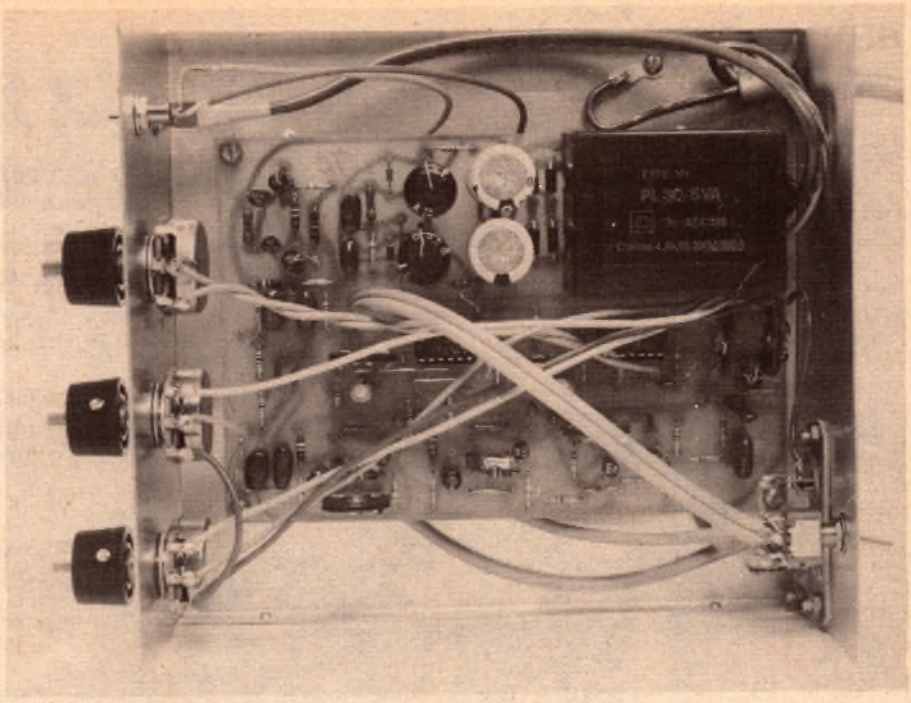
The two 100k trimpots in series with the reverb and output level controls are provided at least temporarily to allow for adjustments to suit the levels involved for any particular application. Once this has been done, the trimpots could be replaced with fixed resistors, or they may be left as they are. However, it should be noted that there are only two holes on the printed board and, in order to mount the trimpots, the centre pin must be bent over and soldered to one of the end pins above the board.

Two CMOS ICs are specified and, for readers not familiar with these devices, it should be stressed that they must be handled so as not to destroy them, even before they are fitted to the board. Accidental electrostatic discharges can be disastrous to CMOS devices if they are treated carelessly. DO NOT take them from their protective packing until they are actually going to be fitted in place.

As a further precaution against damaging CMOS ICs, I favour using sockets for them. However, if you wish to solder the ICs directly to the board, it is essential to take special precautions. The barrel of the soldering iron should be connected electrically, by a clip lead, to the 0V copper of the board while soldering. It is also wise to make the —15V and 0V supply connections before proceeding with the others.

With the board assembled, it should be checked to make sure that there are no errors or omissions. Satisfied that all is well, leads may be added from the appropriate points on the board to run to the various pots, sockets, etc. Hookup wire is used to the three pots and the LED indicator. The 1.5k resistor is soldered directly to the lead on the LED. A common —15V lead serves both the output and reverb level pots. Another —15V lead from the same point on the board runs to the three sockets. A short length of figure 8 mains cord is run from the appropriate points on the board to the on/off switch.

Leads to the three sockets are run in light shielded coax cable with the outer braid connected to the —15V line at the socket end only. Stereo shielded lead is run to the mixer input switch and the braid is also connected to the —15V line only at the switch end.



Shielded cable is used for the mixer input switch and socket connections.

The unit is housed in a deluxe metal cabinet, 160mm x 70mm x 184mm, listed in the Dick Smith catalog under No H-2744. The board is held in place with four ½in brass spacers. All the necessary holes will have to be drilled but the metal is easy to drill and there are not many holes required. The general location of the holes may be obtained from the picture.

The mains cord is run through a grommeted hole in the back panel and firmly clamped. The active and neutral leads are terminated on the board, while the earth lead is terminated at a solder lug screwed to the bottom of the cabinet.

With the unit completely assembled, we are now ready to adjust it before putting it to use. As a first step, it is a good idea to set all the trimpots to the centre of their travel. Switch on and check that the main voltages are correct, measured in respect of the 0V line. The voltages of interest should be approximately +4.7V, —14V and —15V. Assuming that these are correct, check that the LED lights; if not, more than likely the connections to it have been reversed.

The 10k trimpot at the input to the final filter should be adjusted to give —7.5V at the junction of emitter and 10k resistor at the output of the filter. The other two 10k trimpots should be adjusted to give bias levels of between —3.3V and —4.9V at pins 3 and 5 of the MN3001. We suggest that you set the voltages at about the mid point, say 4.1V, measured most easily at the rotors of the respective trimpots.

If you have an audio generator and a CRO (preferably twin trace) you are in a position to test and observe the effects obtainable from the system. Just how you go about your investigations will be a matter of choice for each individual. However, it cannot be emphasised too strongly that the right audio levels must be observed. This applies particularly to the signal level being fed into pin 3 of the MN3001, and compensated in part by the 100k Gain Set pot.

If the signal level is too low the signal-to-noise ratio will suffer. If the level is too high, the device will clip the signal peaks with obvious distortion being the result.

Whether or not you use the input mixer stage will depend on circumstances and requirements.

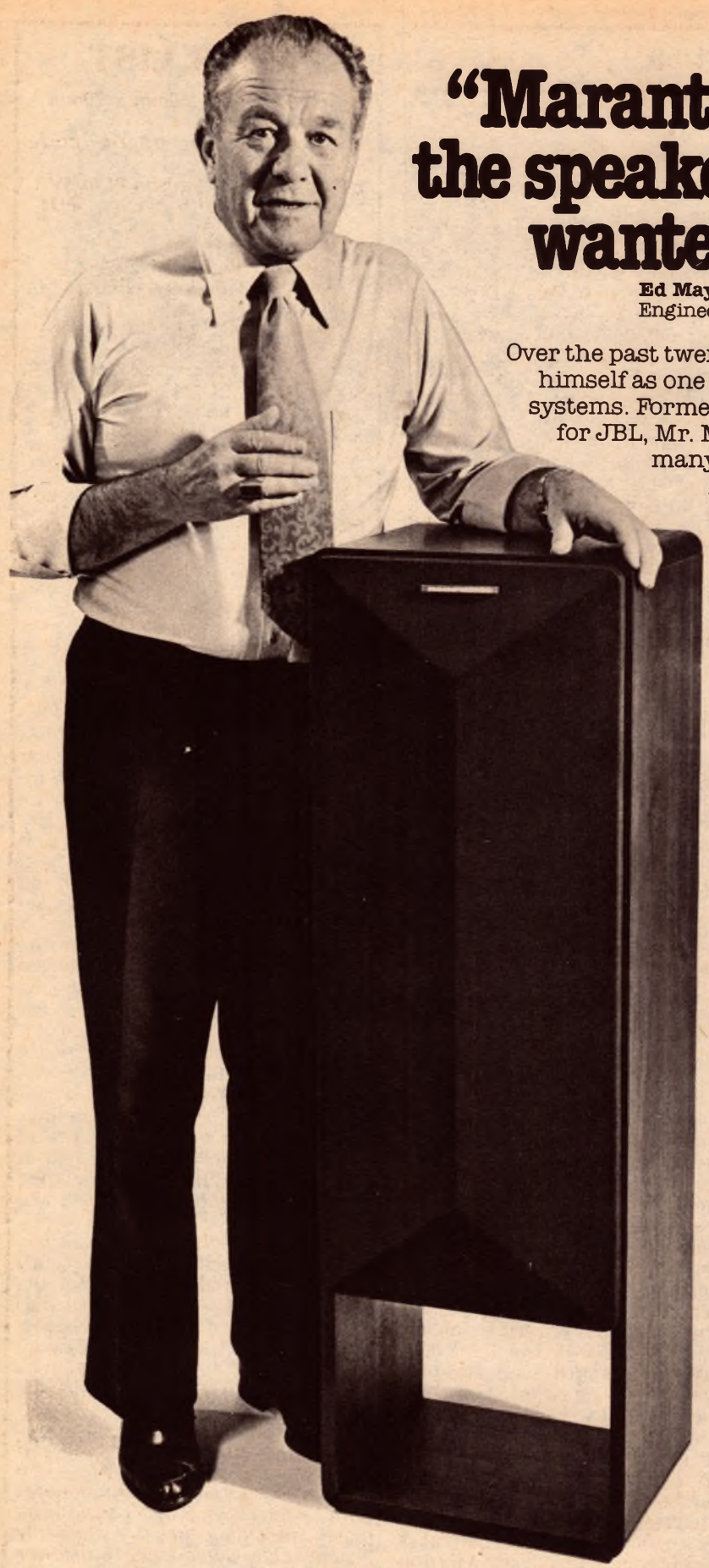
If you have only one amplifier channel available, it would be logical to feed it via the mixer, blending in as much processed signal as deemed desirable, using the Level, Reverb and Delay controls.

If you have two channels available, one could be used for the direct signal via the mixer, and the other for the processed signal from "Optional BBD Output", with the mixer switch open. The mix would then be acoustic rather than electronic.

Subjectively, there is a considerable difference between the two.

Electronic mixing of a delayed signal suffers from the so-called "comb" effect — a serrated frequency response curve caused when frequencies across the spectrum tend either to add or to cancel, as an accident of phase.

With two channels and two loudspeakers spatially separated, the comb effect produces less obvious cancellation or reinforcement, tending



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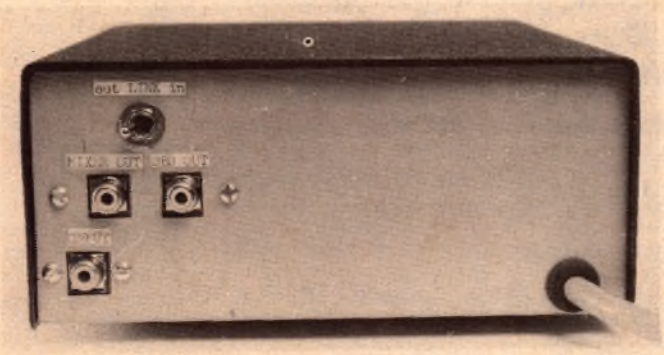
rather to broaden and disperse the source of sound.

The mixer does not need to be involved when the BBD is used to process the signal passing through one side of a stereo amplifier system (the other side being left as is). This application lends itself most obviously to achieving some spatial effect from AM radio stations, or when listening to, or copying old mono records on to tape. Used sparingly, it may also do something for not-very-ambient stereo records, particularly when heard through headphones.

The BBD system would need to be cut into the system between the preamplifier and main amplifier, at the point commonly provided for such access or for the introduction of a tape deck. Hopefully, the job will require only a couple of audio patch cords, no longer than necessary, one to divert the signal to the BBD system and the other to return its processed equivalent to the main amplifier channel.

If no ready access is provided, the enthusiast may have to take more drastic measures!



This rear panel view shows the various input/output sockets and the mixer input switch.

Having connected it up as described, the unit may be plugged into a power point but, before switching everything on, turn the output level and reverb controls right off. Turn the gain trimpot on the amplifier feeding the input of the MN3001 to minimum gain, with the full resistance in circuit. Now switch on and play a record or other program material through the system. You should hear program only through the channel which does not include the BBD unit.

With the volume set to a suitable listening level, this channel should now be disabled, possibly by adjustment of the balance control. Now advance the BBD output level control slightly and processed sound should be heard at low level. With the level kept low, increase the gain of the amplifier feeding the MN3001 until clipping is heard and then back off until the signal is clean again. Note that this setting may need to be readjusted later on, possibly when some louder program material is involved.

The other channel should be enabled again and the level of the processed channel adjusted with the output level control to give a suitable balance. At this point, you are in a position to experiment with the various controls. The delay can be varied so that its effect may be observed. You will find that the most noticeable effect is on speech, where the available delay is enough to produce, not just an echo, but a second voice a syllable behind the original! On music, the delay is much less apparent.

When turning attention next to the Reverb control, it must be kept in mind that advancing it too far will lift the loop gain above unity, leading to instability and a coarse, howling noise. Just short of this setting is the position for maximum available reverb. The 100k series trimpot should be adjusted so that the panel Reverb control is limited to the useable range.

Whether or not you will consider the results interesting or worthwhile is strictly an individual response. Our objective here is purely to give you something to think about or play with!

One thought we had in mind from the outset was the possibility of the BBD unit adding a spatial effect to a home electronic organ. Accordingly, some initial observations were made with the writer's own instrument. It is fitted with an external tone cabinet and it was easy to break into the main audio line feeding the associated amplifier. The signal was passed through the mixer as previously discussed and the processed signal mixed in. The results were interesting but not startling, having in mind that the organ already had in-built spring reverb. At the time of writing, I have not tried a separate amplifier with acoustic mixing.

Fortunately, another member of our staff has an electronic organ of a different type and he gave the BBD unit a rather more extensive trial. This organ does not have an external tone cabinet.

One method of breaking into the

PARTS LIST

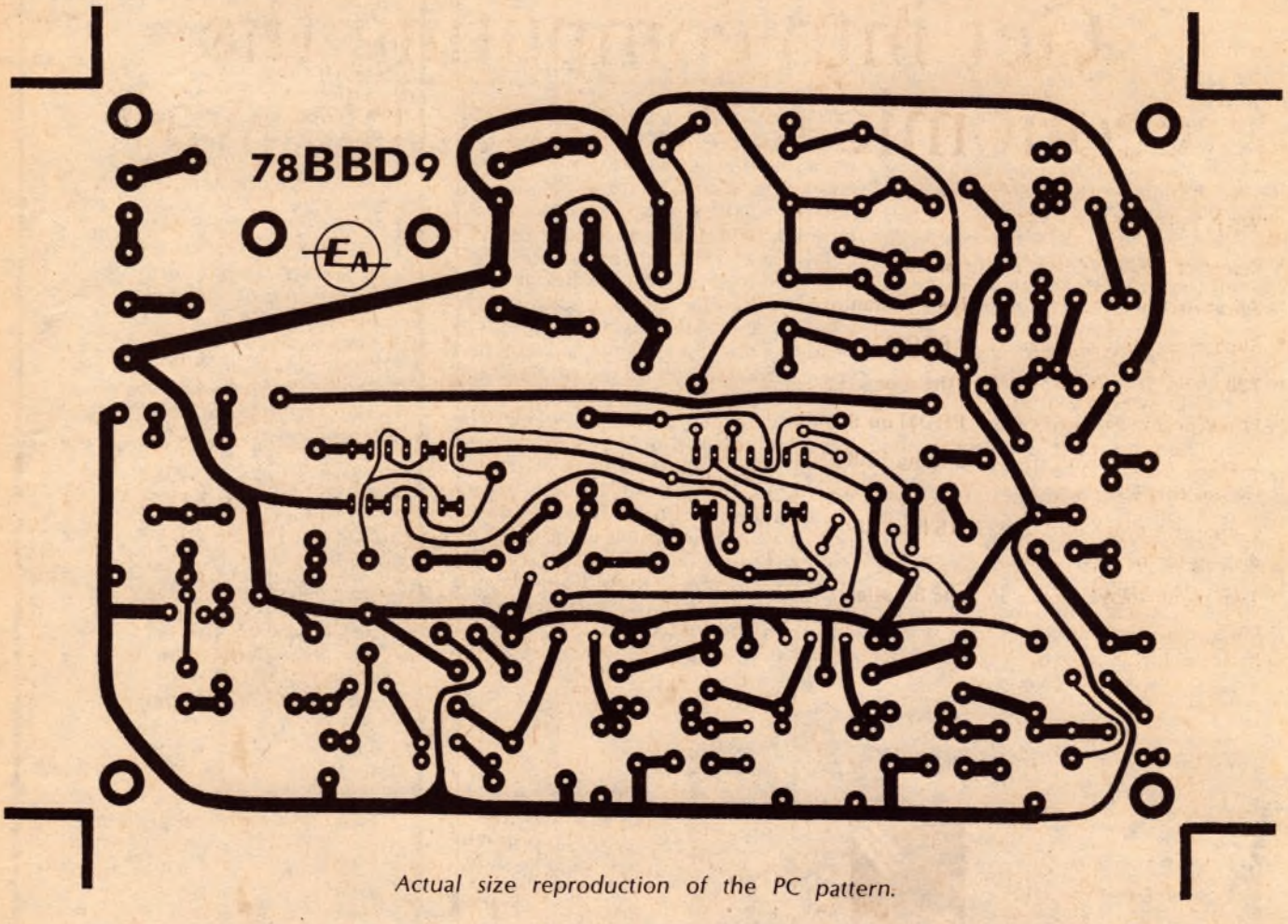
1 Metal cabinet, 160mm x 70mm x 184mm
1 Printed circuit board, code 78BBD9
1 Transformer, Ferguson PL30/5VA
2 Miniature toggle switches, SPDT
1 RCA socket, stereo pair
1 RCA socket, single
3 Knobs
4 Spacers, ½in long tapped ⅛in Whitworth
1 IC, MN3001 14-pin DIL
1 IC, 4011 14-pin DIL
2 IC sockets 14-pin DIL
5 Transistors, BC549 etc
4 Transistors, BC559 etc
4 Silicon diodes, EM401 etc
1 Zener diode, BZX79C4V7
1 Zener diode, BZX79C15
1 Light emitting diode with bezel

RESISTORS (all ½W unless stated otherwise)
1 470 ohms
1 560 ohms
2 1.5k
1 4.7k
1 8.2k
8 10k
3 10k Philips trimpot (large)
2 10k linear potentiometer
4 12k
1 22k linear potentiometer
3 39k
3 68k
9 100k
1 100k Philips trimpot (large)
2 100k Philips trimpot (large, see text)
1 270k
1 330k
5 390k
3 820k

CAPACITORS
1 220pF polystyrene
1 270pF polystyrene
3 .001uF greencap
2 .0022uF greencap
1 .0027uF greencap
1 .0068uF greencap
2 .01uF disc ceramic
6 0.1uF greencap
4 1uF 35VW tantalum
5 10uF 16VW electrolytic
2 47uF 6.3VW electrolytic
2 470uF 25VW electrolytic
2 1000uF 25VW electrolytic

SUNDRIES
Hookup wire, single coax cable, shielded stereo cable, figure 8 flex, 3-core flex, 3-pin plug, rubber grommet, solder, solder lug, screws, nuts.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used on the prototype. Components with higher ratings may generally be used, providing they are physically compatible. Components with lower ratings may generally be used, providing ratings are not exceeded.



Actual size reproduction of the PC pattern.

main audio line was at the input to the main amplifier, which also happens to be the point where the swell pedal control is shunted across the line. However, it transpired that the signal level at this point was quite low, implying high gain in the following power amplifier. As a result, introduction of the BBD device at this point led to hum problems and a poor signal-to-noise ratio, irrespective of whether the BBD was used to feed the organ's own amplifier or a separate system.

So another method was tried and this proved more successful. It involved taking the signal from across the main loudspeaker terminals. So as to avoid DC problems as well as earth loops, an isolating transformer was added between the speaker and the line to the BBD unit.

The output of the BBD unit was fed into the "AUX" input of a separate stereo amplifier and, after having made level adjustments, the overall results obtained were encouraging.

The simple fact that some of the sound is coming from a couple of speakers from another part of the room can, of course, be an improvement in itself. But when the sound from these speakers has been delayed by say 50ms, it can further enhance the spatial effect. With some reverberation added as well, a further improvement was observed. In short, the somewhat confined sound which is normally experienced with an electronic organ in the average lounge room had been improved to a worthwhile extent.

The audio voltage across an organ speaker system will depend on its impedance and the power level fed to it but one can expect something of the order 5V to 20V RMS. The maximum input voltage which the BBD unit will accept is about 1V RMS, so that a convenient transformer would be a type, preferably shielded, which offered a step-down ratio of somewhere between 10:1 and 20:1. The impedance of the larger winding is not critical, provided it is much higher than that of the voice coil circuit across which it is being connected.

A resourceful enthusiast may be able to locate an oddment transformer that will do the job, even to pressing into service a small oddment power transformer or a not-too-miniscule transistor driver or output transformer. High frequency response is not critical, because of the limited response of the BBD system, but the low frequency response will determine how much bass reaches the BBD system and the supplementary amplifier.

With a transformer installed, so that a fine adjustment can be made to suit the input of the BBD unit, a potentiometer of say 1k should be connected across the transformer secondary winding. The output will then be taken between the pot rotor and the earthy side. With this setup, it would be a good idea to set the amplifier gain in the BBD unit to its minimum and then adjust the level short of clipping with the pot across the transformer. The gain of the supplementary amplifier can then be preset to a convenient level, leaving the overall loudness to be controlled by the expression pedal.

We would like to be able to say that the simple BBD unit can replace the spring system in your organ but it is no more true now than it was in December 1975! What we can say is that it can provide another option or supplement which you may consider well worth having, particularly for more formal organ music played in the restricted ambience of a domestic lounge room.

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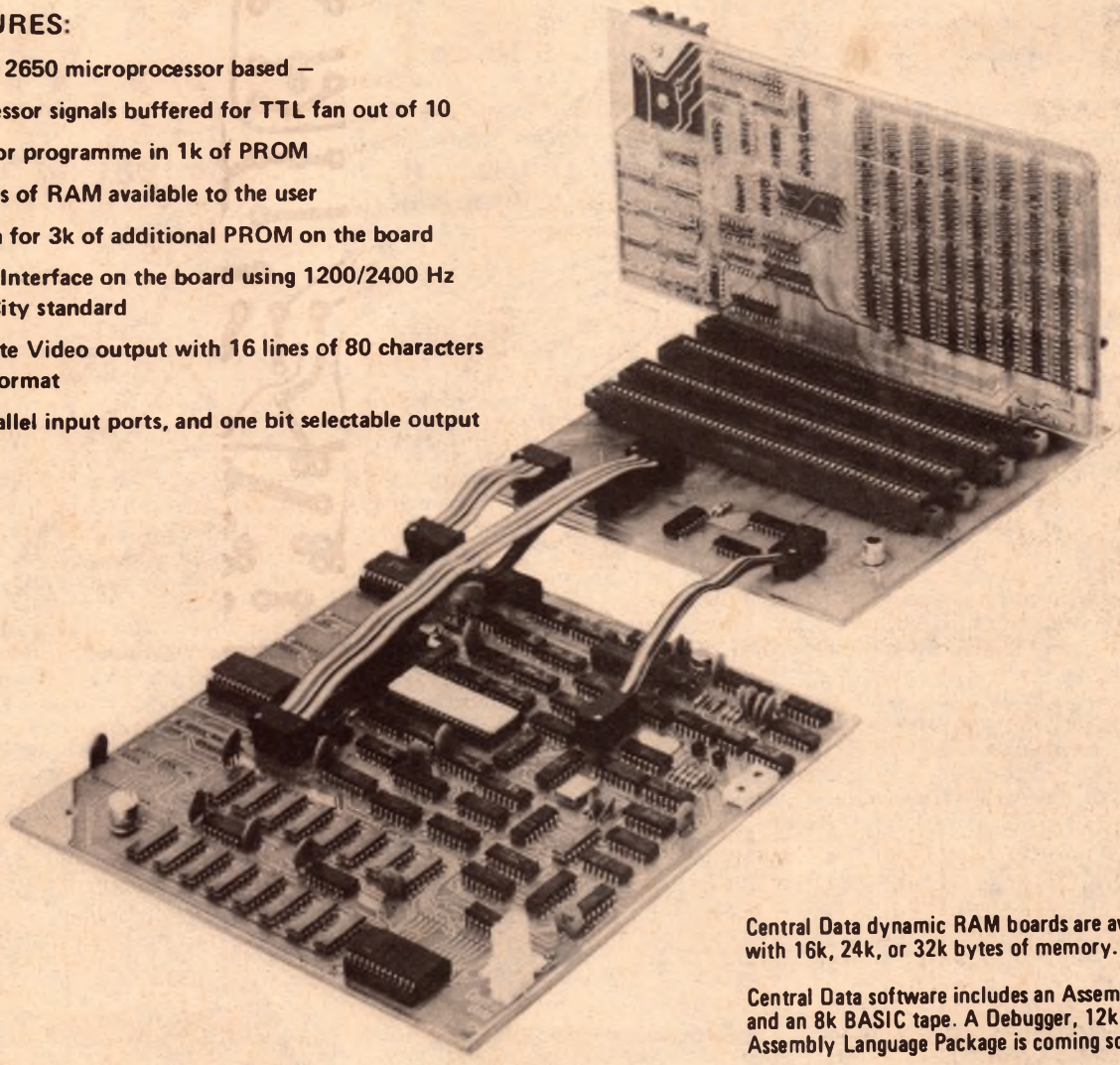

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Add extra features to your

Digital Photo Timer

Since the publication of our new Digital Photo Timer in the April 1978 issue, we have had many enquiries from readers interested in increasing the maximum time period, or in adding a hold facility. In this article, we provide details of how to add either of these features to the basic design.

by DAVID EDWARDS

The maximum exposure time available with the unit as described in the April 1978 issue is 99 seconds. While this is adequate for enlarger timing, which was the main intended use of the unit, it does limit the usefulness of the device in other roles.

Applications in which longer times are required include the developing of negatives and prints, as well as exposure timing for printed circuit board resists, and photosensitive materials used in the production of front panels and labels. In fact, the modified prototype is now in daily use in our office, timing dyline exposures and "Scotchcal" exposures.

Refering now to the circuit diagram on page 40 of the April 1978 issue, we can see how the unit is modified. As many readers pointed out, all that is needed to increase the timed interval is to insert a divide-by-60 circuit into the clock line between terminal 1 of S2a and pin 6 of IC3b. A second switch can then be used to insert or remove this divider, as desired.

When the divider is in circuit, the timer functions normally in all respects, except that the displays represent minutes instead of seconds. This allows timed intervals up to 99 minutes to be achieved. The rate control remains in operation, so that a total of four ranges are provided: 0 to 9.9 seconds, 0 to 99 seconds, 0 to 9.9 minutes, and 0 to 99 minutes.

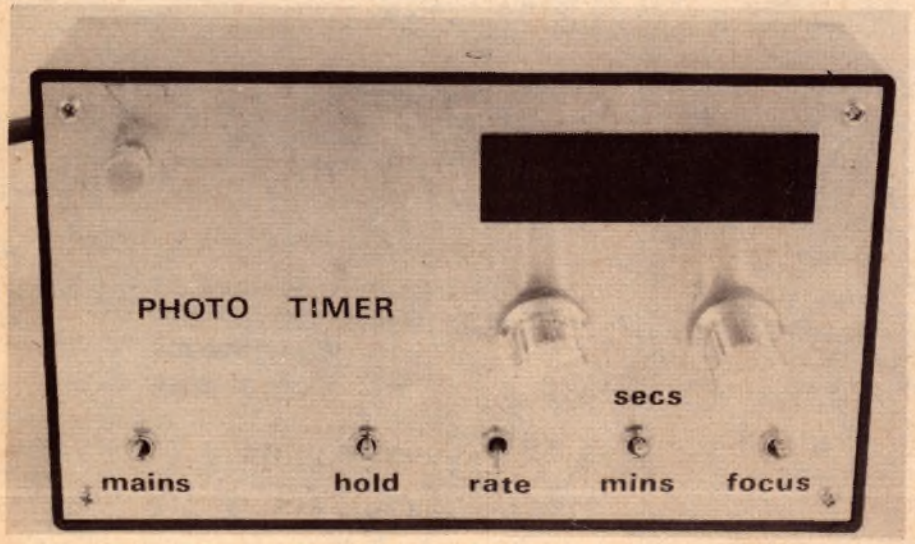
The circuitry to implement the additional divider requires only two CMOS ICs — a 4518 dual decade counter and a 4011 quad nand gate. We have designed a small printed circuit board, coded 78t9 and measuring 46 x 33mm, which is small enough to fit inside the case of the Phototimer without modifications.

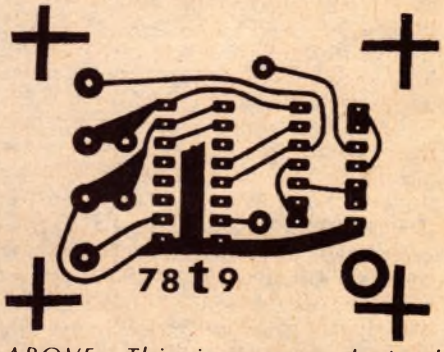
The only other components required are the previously mentioned switch (a SPDT miniature toggle type), and a 0.1uF polyester bypass capacitor. The PCB assembly is secured to the end of the case remote from the transformer, using a single machine screw.

A four-way cable is used to connect between the new PCB and the existing circuitry. These connections can be made without removing the main PCB from the case, as will be detailed soon. First, however, mount the additional switch on the front panel. As you can see in the photographs, we mounted it midway between the rate and focus switches.

Disconnect the wire connected to S2a-1, and connect it instead to the centre terminal of the new minutes/seconds switch. The output wire from the new divider board is connected to one side of the new switch, while the input wire is connected to the other side of this switch, and also to S2a-1.

A ground connection is available at S1-1, while +5V is available at S3-2. That completes the wiring, so the modification can now be tested. Note that with the 0 to 99 minute range, a delay of up to one minute can occur





ABOVE: This is an actual sized reproduction of the PCB, and can be traced or copied if desired.

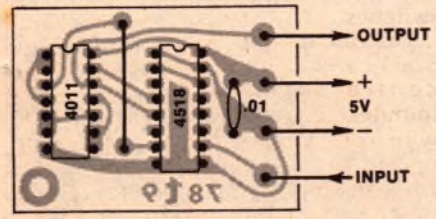
LEFT: Compare this photograph with the one published in the April 1978 issue to work out the additional switch locations.

between when the start button is operated and the commencement of the timing cycle. This reduces to 1/10th of a minute on the 0 to 9.9 minute range, and to one second and 1/10th second on the two second ranges respectively. This delay is an inherent characteristic (drawback!) of the circuit.

The second modification involves the provision of a hold control. This requires only the addition of a DPDT miniature toggle switch. A hold is achieved by stopping the clock pulses to the main counter chain, while simultaneously disabling the relay used to control the enlarger lamp.

A hold facility is a useful addition to an enlarger timer, and allows "dodging" to be carried out during the printing process. As you can see in the photographs, we mounted the hold switch at the left hand side of the rate switch, and used a toggle switch so that it could be differentiated by feel from the start switch. (Incidentally, once a timing cycle has commenced, the start switch has no further effect on the circuit.)

The counter clock is disabled by shorting out the .01uF capacitor used to remove glitches from the 100Hz clock line (just before the 1N914 diode). This capacitor also provides adequate debouncing of the hold switch. The relay is disabled, without resetting the output flipflop, by shorting the base-emitter junction of the BC337 output transistor.

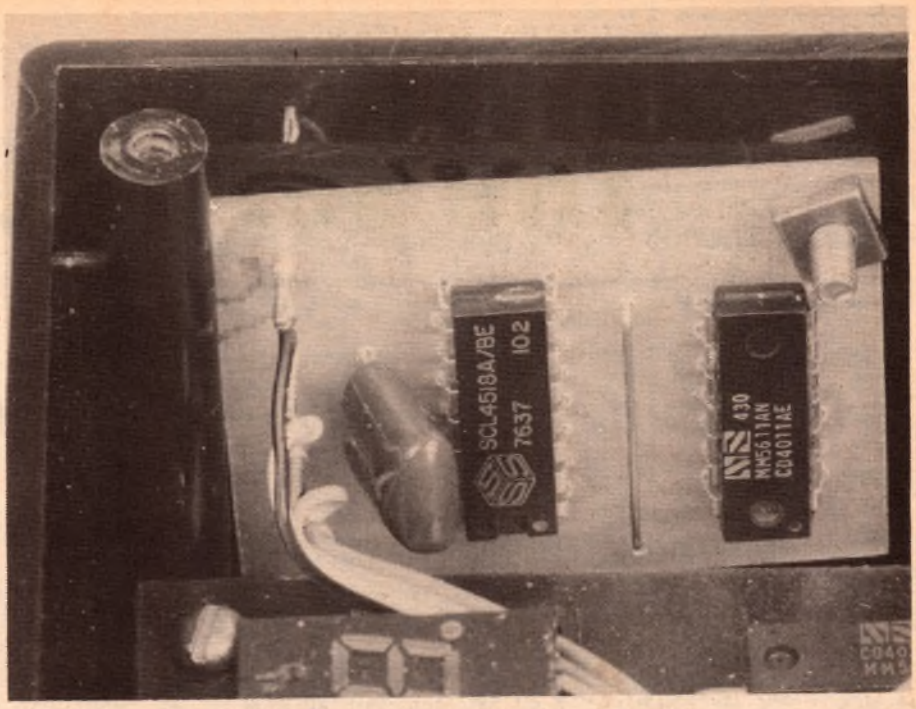


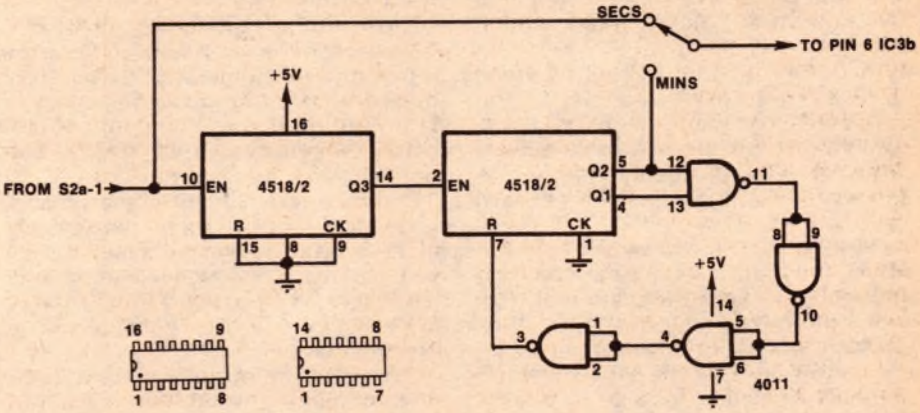
Use this overlay diagram as a guide when mounting the components onto the printed circuit board.

Only three wires are required to the hold switch. Earth the two centre poles of the switch by connecting them to S1-1. The two normally open poles are then connected to the appropriate points on the main PCB. This can be done without removing the PCB from the case.

The base of the BC337 is available at one end of the 4.7k resistor used to limit the base current; simply solder the wire to the base end of the resistor. Similarly, solder the other wire to the "diode" end of the 10k resistor used to limit the base current into the BC548 transistor.

To complete the modifications, simply add the appropriate lettering to the front panel, and then spray it with a clear protective lacquer.





EA SECONDS TO MINUTES CONVERTER 2/PT/-

The circuit diagram of the divider unit is shown above. This should be read in conjunction with the diagram on page 40 of the April 1978 issue. The photograph at the top of the page shows how the completed PCB is mounted in the Phototimer case.

The Serviceman

You're never too old to learn — even about valves

To say that some faults — and their solutions — are unbelievable may sound like an exaggeration, but this was literally true of one job recently. Among other things it emphasises that it doesn't matter how long you have been in the game; there's always a curly one sitting on the shelf waiting to throw you.

It is bad enough when either the symptoms, or the cure, are hard to believe, but when both occur in the one set it really makes you wonder. So take note of this one, it could happen to you.

The set was a portable, monochrome, valve TV set, AWA model P4. The customer's complaint seemed simple enough; the picture had progressively shrunk over the preceding months, until it was now only about half its normal size.

I tipped that it was most likely the 6CM5 line output valve, a common enough cause of these symptoms, so I promptly took a new one from stock and substituted it. This seemed to be the answer because the set came good immediately with a full size picture.

However, the picture appeared to be running at full brightness and contrast, presumably due to the weak, as well as small, picture which had resulted from the sick valve. No doubt this had prompted the customer to turn both controls full up.

So what? All I had to do was turn these controls down. Except that that was where the trouble started. As soon as I retarded either control, the picture was cut to pieces horizontally. And I use that "cut to pieces" phrase deliberately; it wasn't the more conventional loss of horizontal sync, where the picture simply tips over and may even remain faintly recognisable.

Rather, the whole horizontal system seemed to go mad, as though it was being forced to work at some completely foreign frequency. Even the faint sound from the EHT transformer seemed wrong somehow.

At this point I had a horrible feeling that what had started out as a routine "this-one-will-only-take-a-few-minutes" job had suddenly become a monster. Quite frankly, I hadn't the faintest idea what would be the cause. Granted, it would be easy enough to name half a dozen likely causes of lost sync, but not one that was dependent on the setting of the brightness or contrast controls.

The first thing I did was to put the old valve back in the set. It behaved exactly as before, but seemed to be quite immune to the setting of either control. At any setting where I could still see the picture, it remained rock steady. But the new valve was hopeless.

I fished out the circuit of the set and began looking for some part which might provide unwanted coupling, in the event that a decoupling component had failed. This provided little inspiration and I found myself going round in mental circles.

I decided to make a few voltage measurements around the offending controls to see whether that would provide a clue. In fact, I didn't get very far with this exercise, because just then the phone rang. It turned out to be a colleague who was trying to track down a hard-to-get component, and wanted to know if I could help.

I could, as it happened, and having done him a favour I was not above asking one in return. I nominated the set, described the symptoms, and asked him if he had ever experienced anything like it.

He laughed. "I'll bet," he said, "that you've fitted a Mullard or a Philips valve".

I glanced over to the workbench where the empty carton lay.

"It's a Mullard," I replied, "but what's that got to do with the price of fish?"

"Try an AWV brand."

"Eh? Aw, don't be uncle Willie."

My colleague snorted. "I am not, as you rather rudely put it being 'uncle Willie'. I am trying to help you. Have you got an AWV 6CM5?"

"Yes, I think so."

"Well try it. I'll bet you any money you like it'll fix it. I'll even wait on while you try it."

It was obvious that the poor fellow had blown a fuse in his main computer. After all, everyone knows that a 6CM5 is a 6CM5 — regardless of the brand. In fact there was a time when they all came out of the same factory.

Best to humour him. All I had to do was fit the AWV valve, confirm that it behaved the same, then gently suggest that he take a holiday — and perhaps see a doctor at the same time.

I found a couple of AWV 6CM5s, fitted one to the set, and switched it on. The set came on at full brightness and contrast (as I had left the controls) and fully locked as before. Now came the moment of truth. I turned down the brightness. The picture stayed locked. I turned down the contrast. It still stayed locked. I tried every combination setting of the controls I could think of, and the picture remained rock steady.

I went back to the phone. My colleague heard me pick up the handset and didn't wait for me to speak.

"Well, are you convinced now?"

It's moments like this that I wish I was one of those blokes with a rapier wit who, with all the odds against him, can come up with a devastating reply which makes the other fellow feel about half size. Unfortunately I'm not and, even if I was, I doubt whether I could have coped with this situation. As it was, all I could manage was "You seem to have been lucky this time".

The tone of my colleague's reply was suddenly rather more serious.

"It wasn't really luck you know. The same set caught me, and I found out the hard way. I don't know why it is, but those sets won't work with Philips or Mullard brand valves. Check it with the rest of your stock if you like, but I'm sure the results will be the same."

Which rather put an end to any argument I may have felt inclined to offer. But it didn't answer the obvious question: exactly what was the nature of the malfunction and why was it caused by valves of a particular brand?

(I did, in fact, check my stocks later, and confirmed that what he said was true.)

We both agreed that it was almost certainly a case of the valve going into some form of spurious oscillation — hence the "cut to pieces" effect I had noted — but what really puzzled us was why it seemed to be tied in with the brightness and contrast control settings.

We finally evolved a theory which, for the want of something better, will have to do for the moment. When the picture tube is running at full brightness it is drawing maximum current from the EHT supply and, therefore, would be producing the maximum damping effect on this supply. In these circumstances, the valve was probably too heavily loaded to enable it to take off. But once the brightness was turned down . . .

But why did the valve take off anyway? There seems little doubt that the two brands are not identical, but which one is "wrong" — if that is a correct term — is another matter. Also, it is inevitable that the AWA TV set was designed around AWV valves with whatever minor differences they contained, relative to the Philips or Mullard versions.

Unfortunately, whatever these differences were, they were sufficient to tip the scale between stable and unstable operation. Which seems to suggest, in turn, that the set did not have a very great safety margin of stability, even though it may have appeared adequate in the original design.

All of which involves a fair amount of speculation, but that is probably as close as we shall ever get to the real story. In any case, with the valve scene rapidly running down, the precise details become largely academic.

On the other hand, from a practical point of view, servicemen will have to try to keep these sets going as long as they can, using what valves they can get, from rapidly dwindling sources. Hopefully, my experience will at least alert others to the nature of the fault. After that, you're on your own.

My next story comes from a colleague and I felt it was worth passing on in the hope that it might save someone else some head scratching.

The set was a Kriesler colour set with a 59-3 series chassis, and the symptoms were that the switched-mode power supply had sensed an overload and gone into the "hiccough" mode.

My colleague established that the fault was in the line output stage but, at that point, ran into a blank wall. All the likely components in this section — line output transistor, tripler, etc were checked and cleared.

One possible fault in such cases is a breakdown of the insulating washer between the line output transistor case and chassis, there being quite high voltages between these two items (1.5kV in this case).

This model chassis uses a rather

THE SERVICEMAN

different arrangement. The transistor is mounted directly on an aluminium plate, about 50mm square, which is bolted to, but insulated from, the chassis. Furthermore, the transistor can be removed, as for testing, without disturbing the plate or its mounting.

At this point the insulator between the plate and chassis was suspected, and an ohmmeter check made between the two. This revealed no evidence of a breakdown. Nevertheless, the plate was removed and the insulator examined for signs of a flashover with, once again, negative results.

The whole thing was reassembled and the set switched on again. This produced another surprise, because the fault had vanished. At this point my colleague realised that he had not fully tightened the screws holding the plate and, when he did tighten them, the fault returned.

Convinced now that it was a breakdown across the insulator, he deliberately disabled the power supply protection circuit for a few seconds, then examined the insulator again. This time he found clear evidence of a flashover, fairly obviously due to a pin hole in the insulator.

It is, of course, always easy to be wise with the benefit of hindsight, but it would seem that two factors combined to confuse my colleague. One was the failure of the breakdown to show up on an ohmmeter test and the other was simply the unfamiliarity of the transistor mounting arrangement, this being the first time that he had needed to consider it in detail.

The point is that not all breakdowns create a permanent condition, particularly where high voltages are concerned and where the power supply is protected. A hole in an insulator is sufficient to allow a flashover, on the simple basis that air is more easily broken down than is the insulator material. And, with the power supply protected, the breakdown left little evidence.

So, next time you suspect a breakdown, don't dismiss the possibility simply because there is no visible evidence.

On a somewhat different theme, a recent experience prompts me to comment on the number of coincidences which seem to crop up in one's daily work.

In one day, recently, I had two calls from housewives who both described an identical set of circumstances which had caused their TV sets to fail; circumstances which, superficially, would seem to have little likelihood of being responsible.

Both ladies had been using a vacuum cleaner in the vicinity of the TV set, and had switched the vacuum cleaner off. At that point, when the first one rang me, I was all prepared for her to say," . . . and now the screen has patches of colour all over it".

Fortunately, I kept quiet, because she went on to say that the set had failed completely. And, forestalling any likely suggestion that it was the power point that had failed, she explained that she had tried several other appliances in the point, and that they all functioned.

The set turned out to be a Kriesler model 59/1 and the immediate cause of failure was a blown 2A fuse in the chopper power supply. This set is fitted with a pair of 4A delay fuses, one in each 240V line where it comes into the chassis, from which the lines go through filter chokes into a bridge rectifier. The output of the bridge goes to the chopper transistor, via the 2A fuse.

It was the chopper transistor which was the real culprit, having broken down completely. Fitting a new transistor put the set back in business.

In itself, the story wasn't particularly interesting. I assumed that the particular vacuum cleaner, switched off at a critical moment, had generated a spike which was beyond the filter chokes' ability to suppress. This had taken out the chopper transistor and the fuse had done its job.

What really intrigued me was a second call, a few hours later, from the second housewife, describing exactly the same set of circumstances and, again, a complete failure of the set.

This time it was a Sharp colour set; a model which uses a conventional power transformer rather than a chopper system. Once again it was a fuse problem. This set has two 2A fuses in the incoming mains line, where it feeds the transformer primary. Both fuses were blown, although vapourised would be a more accurate term, the inside of the glass being coated with a film of metal.

With that kind of symptom I expected something pretty drastic in the way of a fault. I went over the set looking for likely causes, but drew a blank, and was finally forced to fit a new set of fuses, stand clear, and switch on.

The result was an anti-climax. No smoke, no flames, and no explosion. What was more, the sound came up immediately, followed by a perfect picture a few seconds later. Puzzled, I let the set run for the rest of the day, fully expecting it to repeat the performance.

In fact, it ran perfectly and nothing I could do would make it misbehave. Eventually, I had no option but to return it to the owner, with the cause of the fault a complete mystery. Since that was a couple of weeks ago, and there has been no kick-back, it appears to have been a one-off situation. But why the vacuum cleaner? And why was the reaction so violent?

I'm afraid I must pass on that one. If anyone has any ideas I'd be happy to hear them.

AUDIO INDICATORS

DATA SHEETS — (see following pages)

What Kind of Sound Is Available?

The range of Audio Indicators is comprised of three basic types in relation to kind of sound:

(1) ELECTRONIC/MECHANICAL AUDIO INDICATORS.
This type consists of a mechanically tuned reed driven by an electronic oscillator. These audio indicators emit a buzzing sound, high in harmonic content.

(2) SPEAKER AND OSCILLATOR AUDIO INDICATORS.
This type can be specified in a wide variety of frequency and voltage ranges, in an almost unlimited number of sounds.

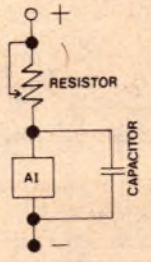
(3) PIEZO TRANSDUCER TYPES
These types feature a lower rate of power consumption, higher SPL outputs, and longer operational life. Made of a thin ceramic element bonded to a brass disc, they are electrically attached to an oscillator circuit. This circuit causes the brass disc to flex, thus generating sound waves.

Volume Control

Reduction of audio indicator SPL output is desirable in some applications. With some audio indicators, this can be done by adding a series resistor between the audio indicator and the power supply. This procedure is ***not recommended*** for use on electronic/mechanical units.

For extra operation reliability, a capacitor should be connected across the audio indicator.

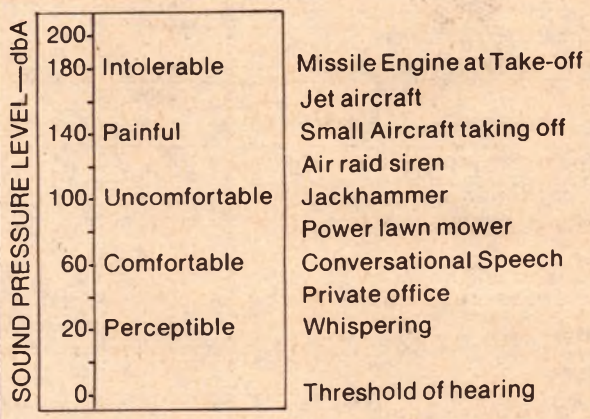
The value of Resistor and Capacitor will depend on the audio indicator being used and on the volume reduction required.



What Kind of Sound Is Required?

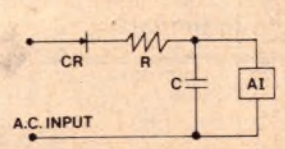
Research has shown that sound levels in the 700 to 900 Hz frequency range are most pleasing to the ear, while those in the 2KHz to 4KHz range are most attention-getting.

Additionally, a pulsing sound will demand more attention than a continuous tone.

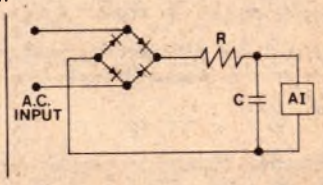


Power Supplies

Shown are two typical circuit diagrams to permit the operation of a DC audio indicator from AC voltage. Be sure to match resistor, diode, and capacitor values to the appropriate level for the voltage and current levels of the audio indicator used.



Half Wave Rectification



Full Wave Rectification

PRICES FOR 100 to 249. (For one off prices see your local electronics distributor.)

AI 120/1/2/3 .....$1.53	X51 series $12.80	OTHER MODELS available to manufacturers specifications upon request.
AI 124/6/7/8 .....$1.61	X53 series $15.75	
AI 250/4 .....$3.60	X70 series $6.36	
X50 series $11.20	X71 series $9.65	
X50W12A $12.90	X73 series $9.98	NOTE: All prices plus 15% sales tax if applicable.
X51W12A $13.85		

INSTRUMENT TECHNICS

Importer-Manufacturer of Advanced Technology Products.

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Components Division
Box 224 Doncaster 3108
Victoria, Australia

Cable address:
INTECHNICS,
Melbourne.

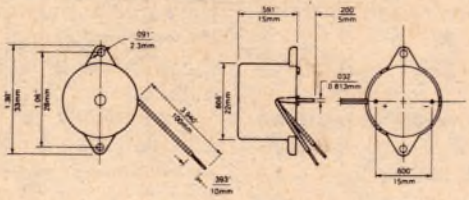
Series AI-250

Miniature Piezo Audio Indicator

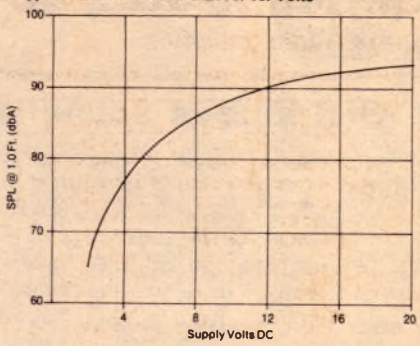
FEATURES: Piezo transducer • 3 to 16 vdc • P.C. Pin or Flange Mounted • 4 KHz frequency (low in harmonics) • Continuous tone.

MODEL NO.	PART NO.	D.C. VOLTS	ELECTRICAL CONNECTION
AI-250	06250	3 to 16	Wires
AI-254	06254	3 to 16	P.C. Pins

Dimensions—Series AI-250



Typical Sound Pressure Level vs. Volts

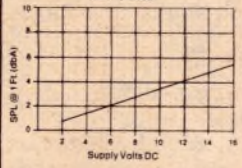


Electrical Specifications

All data at 25°C unless otherwise specified.

PARAMETER	CONDITION	LIMITS MIN.	LIMITS TYP.	LIMITS MAX.	UNITS
SUPPLY VOLTAGE (Vcc)		3	12	16	Volts DC
SUPPLY CURRENT (Average)	Vcc = 12v		4	6	mA
SUPPLY CURRENT (Peak)	Vcc = 12v		40	70	mA
FUNDAMENTAL FREQUENCY	Vcc = 12v	3	4	5	KHz
SOUND PRESSURE LEVEL	Vcc = 12v	75	89		dbA
TEMPERATURE					
Operating		−40		+60	°C
Storage		−50		+60	°C
DESIGN LIFE	Max. Rated Voltage	1000			Hours

Typical Average Current vs. Volts



All data is preliminary and subject to change on production units.

Specifications subject to change without notice.

Series AI-120

Economical Solid State Audio Indicator

Electrical Specifications

All data at 25°C unless otherwise specified.

PARAMETER	CONDITIONS	AI-120/126 MIN.	AI-120/126 TYP.	AI-120/126 MAX.	AI-121/AI-127 MIN.	AI-121/AI-127 TYP.	AI-121/AI-127 MAX.	AI-122/AI-128 MIN.	AI-122/AI-128 TYP.	AI-122/AI-128 MAX.	AI-123 MIN.	AI-123 TYP.	AI-123 MAX.	AI-124 MIN.	AI-124 TYP.	AI-124 MAX.	UNITS
SUPPLY VOLTAGE (Vcc)		1.5	2.5	3.0	3	5	7	8	12	16	20	24	28	3	5	7	Vdc
SUPPLY CURRENT (Average)	Vcc = 1.5v		4.5	6													mA
	3.0v		8.5	11		16	21								16	21	mA
	7v					34	45								34	45	mA
	8v								11	13							mA
	16v								23	28							mA
	20v											17	20				mA
	28v											23	27				mA
SUPPLY CURRENT (Peak)	Vcc = 1.5v		28	33													mA
	3.0v		57	66		43	50								43	50	mA
	7v					95	110								95	110	mA
	8v								24	28							mA
	16v								47	55							mA
	20v											38	46				mA
	28v											50	56				mA
FUNDAMENTAL FREQUENCY	Vcc = 2.5v	270	375	550													Hz
	5v				270	375	550							270	375	550	Hz
	12v							270	375	550							Hz
	24v										270	375	550				Hz
SOUND PRESSURE LEVEL	Vcc = 1.5v	66	75														dbA
	3.0v	68	79		67	80								67	80		dbA
	7v				72	83								72	83		dbA
	8v							71	81								dbA
	16v							74	85								dbA
	20v										70	83					dbA
	28v										72	85					dbA
CONTROL CURRENT (Min.)	Vcc = 3v													0.07	0.13	0.22	mA
	7v													0.09	0.15	0.22	mA
CONTROL CURRENT (Avg.)	Vcc = 3v													0.58	0.67	0.80	mA
	7v													1.5	1.8	2.0	mA
TEMPERATURE																	
Operating		−50		+40	−50		+40	−50		+40	−50		+40	−50		+40	°C
Storage		−55		+70	−55		+70	−55		+70	−55		+70	−55		+70	°C

VCLO for AI-124, maximum, is 0.5 volts. (VCLO = Control Line to "−" Lead Voltage for No Sound Output)
VCLI for AI-124, maximum, is 1.0 volts. (VCLI = Control Line to "+" Lead Voltage Required for Minimum Sound Output)

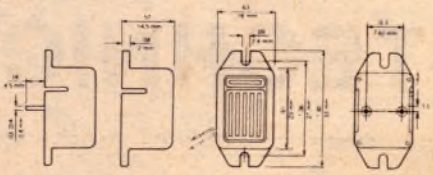
FEATURES: Electronic/Mechanical transducer • No contact arcing or R.F. • P.C. mount or wires • ABS plastic case • 375 Hz frequency • High quality at a low cost.

MODEL NO.	PART NO.	CASE	DC VOLTS	TONE	TERMINATION
AI-120	06120	Plastic	1.5to3	Continuous	wires
AI-121	06121	Plastic	3to7	Continuous	wires
AI-122	06122	Plastic	8to16	Continuous	wires
AI-123	06123	Plastic	20to28	Continuous	wires
AI-124	06124	Plastic	3to7	Continuous	3 wires
AI-126	06126	Plastic	1.5to3	Continuous	P.C. pins
AI-127	06127	Plastic	3to7	Continuous	P.C. pins
AI-128	06128	Plastic	8to16	Continuous	P.C. pins

Application Notes

1. For voltages higher than rated, see application notes.
2. Power supply impedance must not exceed 50 ohms.
3. AI-124 allows gating directly from C-MOS logic with no need for external drive transistor.
4. For additional information see application notes, pages 2 and 3 and mounting notes, page 5.

Dimensions—Series AI-120



Wire Color Code: Red +, Black −, White + Switch (AI-124 only) Wire #24 AWG. P.C. Pins Tinned Brass

Series X-50

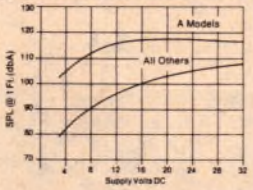
Piezo Audio Indicator

FEATURES: Piezo transducer • Rated to 110 dbA • 2.7 KHz frequency • Excellent mechanical protection for most environments • Strong, strident tone • UL component recognized • ABS plastic case.

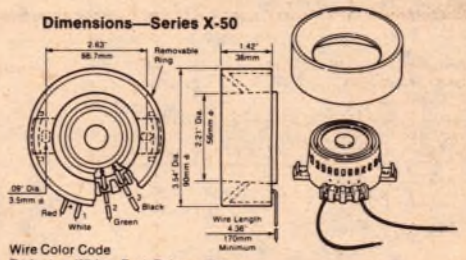
MODEL NO.	PART NO.	DC VOLTS*	TONE
X50W12	06630	6 to 20	Continuous
X50W12A	06631	6 to 20	Continuous 105 dbA
X50W24	06632	15 to 32	Continuous
X51W12	06635	6 to 20	Slow pulsing
X51W24	06636	15 to 32	Slow pulsing
X51W12A	06637	6 to 20	Slow pulsing 105 dbA
X53W12	06645	6 to 20	Cont. and slow pulsing
X53W24	06646	15 to 32	Cont. and pulsing
X55W12	06655	6 to 20	Continuous and fast/slow pulsing
X55W24	06656	15 to 32	Continuous and fast/slow pulsing

*Consult your local representative for availability of AC Models.

Typical Sound Pressure Level vs. Volts



Dimensions—Series X-50



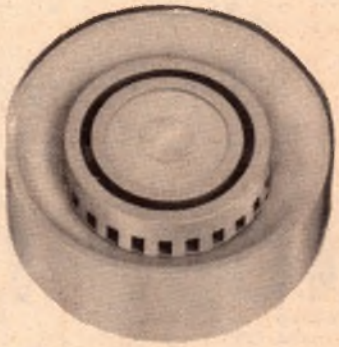
Wire Color Code
Red: + • White: Fast Pulse • Green: Slow Pulse • Black: Continuous •
Wire: AWG No. 17 Gage

Removable outside ring for easy mounting.

Electrical Specifications All data at 25°C unless otherwise specified.

PARAMETER	CONDITIONS	X50, X51, X53, X55 W12 MIN.	W12 TYP.	W12 MAX.	X50, X51 W12A MIN.	W12A TYP.	W12A MAX.	X50, X51, X53, X55 W24 MIN.	W24 TYP.	W24 MAX.	UNITS
SUPPLY VOLTAGE (Vcc)		6	12	20	6	12	20	15	24	32	Volts DC
SUPPLY CURRENT (Avg.)	Vcc = 6v		1.5	4		10	13		2	4	mA
	20v		7	9		47	55			X	mA
	32v								11	14	mA
SUPPLY CURRENT (Peak)	6v		5	7		43	53		6	9	mA
	20v		17	21		130	150				mA
	32v								35	42	mA
FUNDAMENTAL FREQUENCY	12v	2.3	2.7	3.1	2.3	2.7	3.1				KHz
	24v							2.3	2.7	3.1	KHz
SOUND PRESSURE LEVEL	6v	76	86		100	110		80	90		dbA
(at 1 meter)	20v	90	102		105	116		X			dbA
	32v							95	107		dbA
PULSE RATE (Fast) X55	12v	1.4	2	2.6	1.4	2	2.6				Hz
	24v							1.4	2	2.6	Hz
PULSE RATE (Slow) X51, X55	12v	7	10	13							Hz
	24v							7	10	13	Hz
TEMPERATURE—Operating		−20		+60	−20		+60	−20		+60	°C
Storage		−20		+60	−20		+60	−20		+60	°C
DESIGN LIFE	Max. Rated Voltage	1000			1000			1000			Hours

Specifications subject to change without notice.

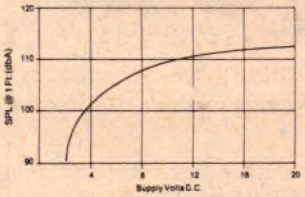


Series X-70

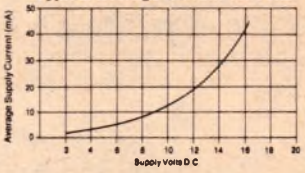
Piezo Audio Indicator

FEATURES: 85 dbA AT 10 FEET • Piezo transducer • P.C. mount or panel mount with wire leads • 2.8 KHz frequency • Strong, strident tone.

Typical Sound Pressure Level vs. Volts



Typical Average Current vs. Volts



Model No.	Part No.	dc Volts	Tone/ Termination
X70W06	06670	3 to 12	Continuous wires
X70P06	06671	3 to 12	Continuous PC pins
X71W06	—	3 to 12	Pulsed wires
X71P06	—	3 to 12	Pulsed PC pins
X73W06	—	3 to 12	Pulsed and continuous
X73P06	—	3 to 12	Pulsed and continuous

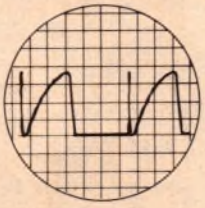
Electrical Specifications All data at 25°C unless otherwise specified.

PARAMETER	CONDITIONS	X70 MIN.	X70 TYP.	X70 MAX.	UNITS
SUPPLY VOLTAGE (Vcc)		3	6	12	Volts DC
SUPPLY CURRENT (Average)	Vcc = 6v		8	12	mA
SUPPLY CURRENT (Peak)	Vcc = 6v		60	100	mA
FUNDAMENTAL FREQUENCY	Vcc = 6v	2.8	3.2	3.6	KHz
SOUND PRESSURE LEVEL	Vcc = 6v	100	105		dBA
TEMPERATURE					
Operating		−20		+60	°C
Storage		−30		+80	°C
DESIGN LIFE	Max. Rated Voltage	1000			Hours

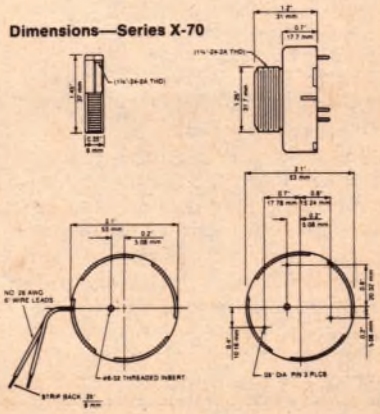
All data is preliminary and subject to change on production units.

Specifications subject to change without notice.

Typical Current Waveform



Dimensions—Series X-70



Add full buffering and parallel IO ports:

How to expand your 2650 system

Since the publication of our 2650 mini computer design in the May 1978 issue, we have had many requests for information on expanding this system. Here is the first of two articles in response to these requests. It tells how to add full address and data bus buffering, memory page decoding and four parallel input-output ports.

by DAVID EDWARDS

Before discussing how the 2650 Mini Computer can be expanded, let us first spend some time discussing the reasons for expansion. The basic design, as presented in the May 1978 issue, is limited in memory size to 5K total (1K ROM and 4K RAM), due to the bus driving capacity of the processor.

Of course, this is quite a respectable amount of RAM, and allows quite large machine language programs to be run. However, when one considers handling large amounts of data or text, or running a BASIC interpreter, one finds that it is not quite enough. TCT BASIC, for instance, which was reviewed in the September 1978 issue, requires 4K of RAM for the interpreter, another 1K for use as scratchpad memory, plus whatever RAM is required for user program storage.

Thus, a definite need for extra RAM exists. The 2650 CPU can address a maximum of 32K of RAM, and now that 2114 RAM chips are more readily available, a memory of this size is quite feasible. In fact, to implement an 8k RAM board requires only 16 2114 chips, and these can easily be accommodated on a single board.

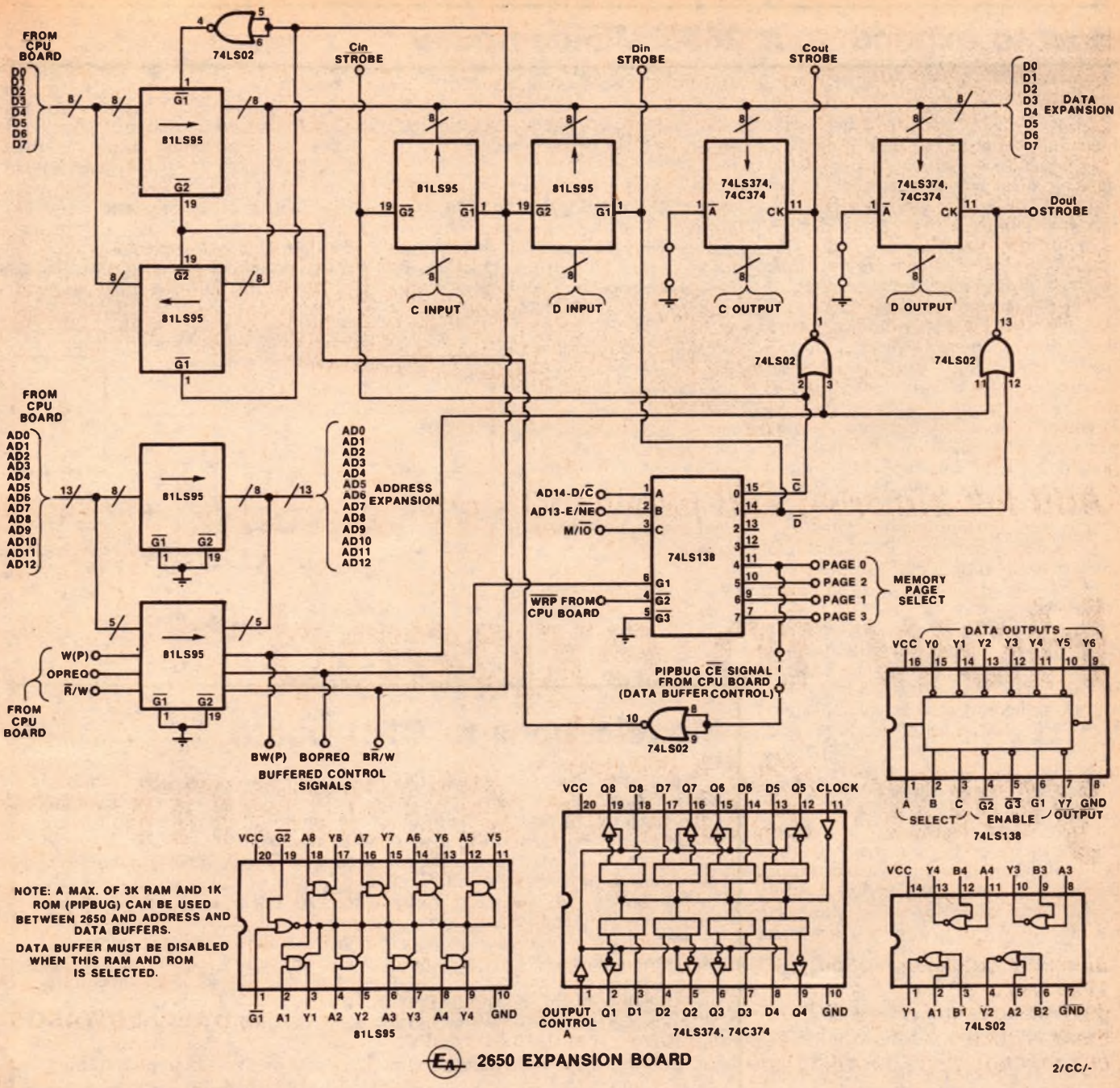
The second main limitation of the original design is that the only external communication with the CPU is via the 20mA teleprinter interface. This limits not only the data transfer rate, but the number of devices which can be connected to the computer.

Of course, peripheral devices can be configured as memory, but this is not the approach which was taken by the designers of the 2650 CPU chip. Instead, they chose to implement peripheral communications via dedicated input/output ports.

Of particular interest to a small system, such as we are interested in, are the "non-extended" I/O ports. These are accessed via four special instructions, REDD, REDC, WRTD and WRTC, which are all singlebyte instructions.

The non-extended I/O ports can be implemented as either two bi-directional ports, or as two separate input ports and two separate output ports. We have chosen the latter approach, as we felt it to be more flexible for a small system.

Provision of these output ports will enable the computer to communicate with high speed devices in parallel



2650 EXPANSION BOARD

2/CC/-

rather than serial format. Other uses include digital-to-analog and analog-to-digital conversion, as well as control of devices such as motors and lights, and the input of the system data.

Expansion of the 2650 Mini Computer thus involves the provision of I/O ports, and additional RAM. In order to provide these, it is necessary to buffer the address and data lines, so that overloading does not occur. We have designed two new circuit boards, one concerned with buffering the address and data lines, and providing the I/O ports, and the other concerned only with the provision of extra RAM.

Each board has the same dimensions and mounting holes as the main CPU board and is intended to mount in the case in the same way as the CPU board. No power supply components are included on either board, and connections between the boards are made using rainbow cable.

The expansion-board, coded 78up9, contains the address and data bus buffering, the I/O ports, and memory "page" decoding. The RAM board, coded 78up10, contains 16 2114 RAM chips, as well as optional address and data buffers.

The expansion board may be powered from the existing power supply, while the RAM board requires an additional power supply. Details of the RAM board, and the required power supply will be given in the following article. In this article we will give full constructional details of the expansion board.

Turning now to the circuit diagram, we can discuss the expansion board in more detail. National Semiconductor 81LS95 octal Tri-state buffers have been used to implement the data and address buffers, as well as the two input ports. The output ports are implemented with 74LS374 or 74C374 Tri-state octal latches. Page selection and I/O port selection is achieved using a 74LS138 one of eight decoder.

The 81LS95 device is most probably unfamiliar to most readers, so a brief digression concerning it will no doubt clear up a few doubts. This device is packaged in a 20 pin DIL package, and has eight non-inverting buffers. Two control inputs are provided, G1-bar and G2-bar. If either or both of these inputs is at a logic 1 (high) level, the

outputs of the buffers are placed in a high impedance or Tri-state mode.

This facility is used to enable several devices to be wired in parallel on the one bus. Only one device drives the bus at any time, with all other devices switched into the Tri-state mode. This should become clearer if we now turn to Fig. 1, a simplified representation of the bi-directional data bus.

When the CPU is transmitting data to the RAM or the I/O device, the R-bar/W line is high. This disables the output of buffer B, and places it in the high impedance state. Buffer A, however, is enabled, because it's output enable signal is low. So the data placed on the bus by the CPU is transmitted to the RAM. The output of buffer B does not load the bus, because it is in the high impedance state.

Similarly, when the RAM or I/O device is sending data to the CPU, buffer A is disabled, and buffer B transmits the information.

Returning to the main circuit diagram, we can now discuss the address and I/O decoding. The control signals for the non-extended I/O ports are multiplexed together with the two high order 2650 address lines, AD13 and AD14. A control signal, M/IO-bar, is provided to enable them to be separated. These three signals are applied to the A, B and C inputs of the 74LS138.

Control input G1 is driven by the buffered OPREQ signal, while input G2-bar is driven by the inverted WRP signal. This latter signal is obtained from the CPU board after the modifications detailed in the box accompanying this article have been carried out.

The "O" output from the 74LS138 then becomes the C port select line, while the "2" output becomes the D port select line. These signals are used to enable the output buffers of the 81LS95s used for the input ports, so that information at the port inputs can be transmitted to the CPU.

The same signals are also gated with the buffered W (P) line, and are used to clock the two output port latches. This clocks the valid output data on the data bus into the appropriate output latch. The data is then available for peripheral devices until fresh data is clocked in. The output enable lines of the latches have been earthed via links, so that they can be strobed externally if necessary.

We have specified two pin-compatible ICs for the output port latches. The low power Schottky devices (74LS374) were our first choice, but there may be supply problems with these. However, the CMOS devices can be used, and are available.

The four high-order outputs of the 74LS138 decoder form the page-select lines. These go low whenever an address within the relevant page is selected, and are used to select the appropriate 8k block of memory.

A spare gate from the 74LS02 used for decoding the output port control

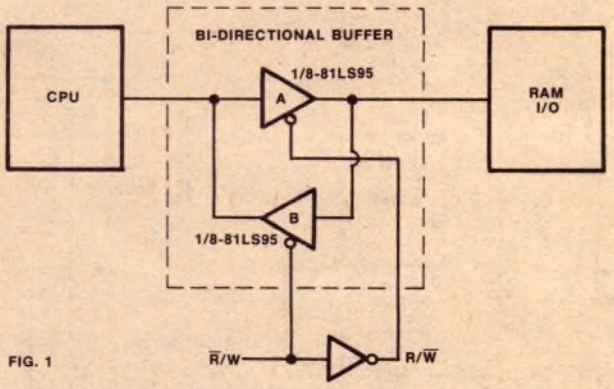


FIG. 1

This diagram shows the way in which the bidirectional data buffer operates. Only one of the eight separate buffers is shown.

Modifications to CPU board

A possible timing conflict exists in the data bus of the 2650 Mini Computer System, described in the May 1978 issue. We have had no reports of this conflict causing operating faults, but recommend that the following modifications be carried out to eliminate this possibility.

The modifications require the use of an extra logic inversion, so this is provided by utilising the gate previously used as the interrupt request buffer. This avoids the need for an extra gate package, although it does mean that buffered interrupts are not available.

The alterations involve re-routing the WRP signal from the 2650 so that it is not gated with the R-bar/W signal, but instead is used to gate the 74LS138 address decoder. An inverter is required to do this, as only active low inputs are available as unused inputs on the 74LS138.

The modifications required, and the order in which they are best carried out, are listed below:

1. remove the links earthing pins 12 and 13 of the 74LS38 quad buffer.
2. remove the 10k resistor connected to pin 12 of the 74LS38.
3. remove the link earthing pin 4 of the 74LS138 address decoder.
4. cut the track leading to pin 9 of the 74LS38, and join pins 9 and 10 of the 74LS38 together with a small piece of tinned copper wire (used component lead).
5. cut the track leading to pin 11 of the 74LS38 at pin 11.
6. add a 1k resistor on the copper side of the board between pin 11 and pin 14 of the 74LS38.
7. connect pin 11 of the 74LS38 to pin 4 of the 74LS138.
8. connect pin 12 of the 74LS38 and pin 22 of the 2650. Pin 22 is available near pin 9 of the 74LS38.
9. check that steps 1 to 8 have been carried out correctly, and that there are no short circuits or solder bridges between IC pins.

We have also had a small number of reports of ringing on the clock input to the 2650, causing faulty operation. This ringing, if present, can be eliminated by connecting a 22pF ceramic capacitor between pins 5 and 8 of the 74123 device.

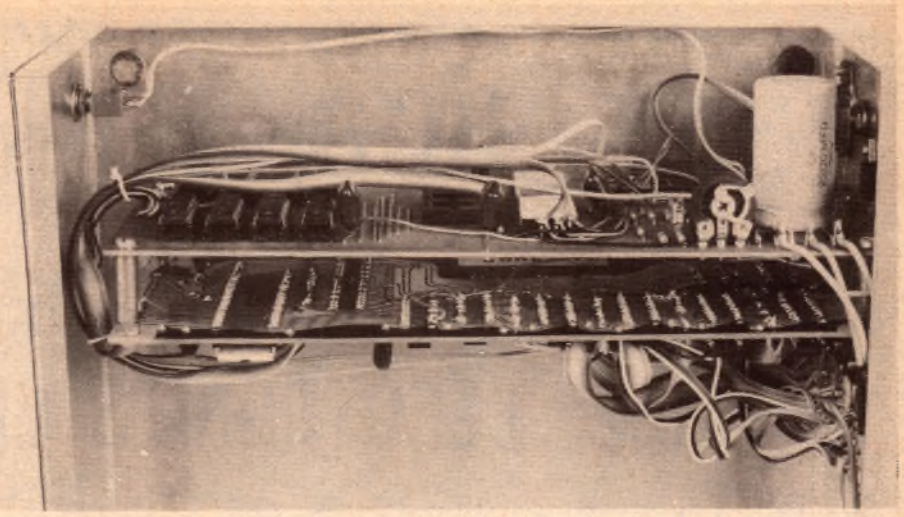
Finally, we would like to note that in theory both of the problems mentioned above may occur with the "baby" 2650 system described in the March 1977 issue, although there have been no reports of trouble.

Note also that the 1.5uF capacitor in the sense line should be reduced to 0.47uF for operation at 300 baud.

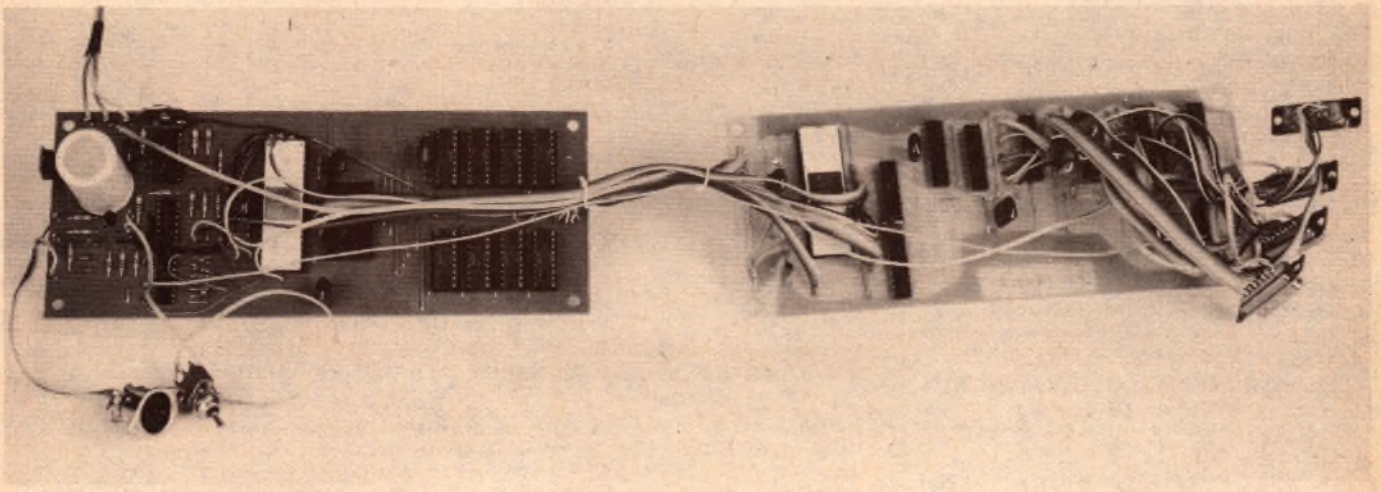
PARTS LIST

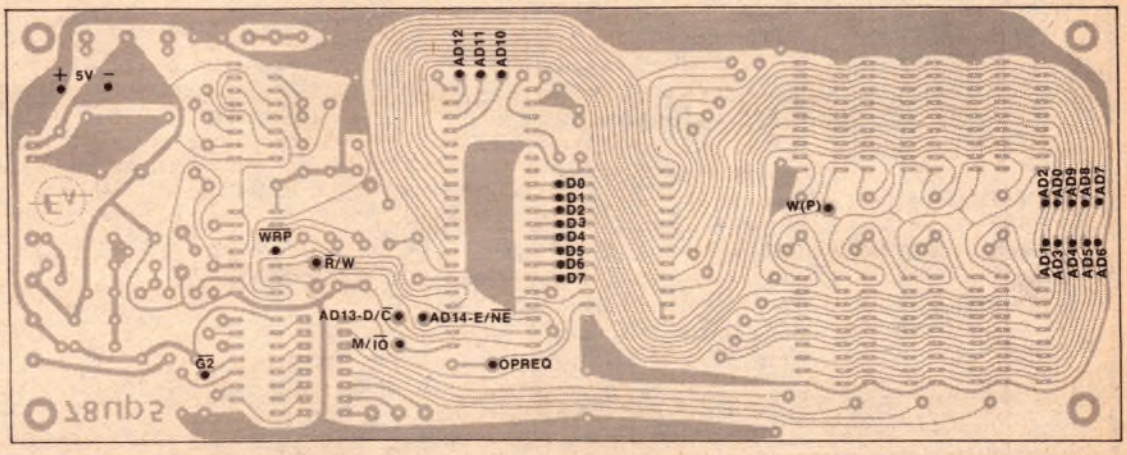
6 81LS95 octal Tri-state buffers
2 74LS374 or 74C374 octal Tri-state latches
1 74LS138 decoder
1 74LS02 quad NOR gate
1 PCB, coded 78up9, 218 x 81mm
8 0.1uF polyester capacitors
4 15-way chassis mounting sockets and plugs to suit
Solder, tinned copper wire, rainbow cable, machine screws and nuts, tapped spacers, PCB pins

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



These two photographs show how the two boards are assembled in the case, and how they appear when removed. Arrange the boards as shown in the lower photograph while completing the interconnections.





RIGHT: Use this overlay diagram of the CPU board to find the appropriate connection points. You may also need to refer to the overlay diagram on page 57 of the May 1978 issue.

signals is used as an inverter so that the data buffer can be disabled whenever page O is selected. This is required to prevent a conflict, as the Pipbug ROM and existing RAMs are on the CPU side of the buffer. Without this disabling, the data buffer and RAM or ROM would both try to drive the data bus whenever a read operation in page 0 was performed.

The page 0 signal is coupled via a link, so that a different configuration can be achieved if desired. The reasons for this will become clearer in the next article.

Note that strictly only 3K of RAM can be inserted on the CPU board when the expansion board is connected, due to bus loading limitations. This presumes that all devices present their maximum specified load. However in practice we found it possible to insert the fourth pair of RAMs, and still have correct operation.

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How to expand your 2650 Minicomputer

Before commencing construction, we recommend that you carry out the modifications detailed in the box. The following constructional hints assume that this has been done.

The circuitry is all contained on a single-sided board, coded 78up9, measuring 218 x 81mm. Note that the board has provision for a 40-pin IC (a possible future addition), but this is not used at present.

As you can see in the photographs, the new board mounts parallel to the CPU board. To do this, we removed the nylon standoffs used initially, and replaced them with tapped spacers screwed either side of the existing mounting bracket using a short length of threaded rod.

By arranging the cabling between the two boards in a suitable way, it is possible to remove both boards as a unit from the case, with a minimum of unsoldering. This is made easier if the TTY socket and the I/O sockets are mounted from the inside of the case, so they can be removed by simply unscrewing them, without unsoldering.

While this mounting method is a little awkward, and not conducive to extended servicing, it does leave enough space for at least two additional boards, and it is economical (motherboard systems have a high initial cost).

The existing transformer and power supply on the CPU board have enough reserve capacity to run the additional board as well, so no mods are required in this area. The power supply rails from the new board are simply connected in parallel with those on the CPU board.

Commence construction by fitting the I/O sockets, and by arranging the mechanical supports for the board. Make sure that the support pillars do not short to any of the tracks on the board (use insulated pillars if necessary). Then remove the board from the case, and commence to fit the components.

A low wattage, chisel pointed iron will be required, as well as some fine resin filled solder. A good light will also be necessary.

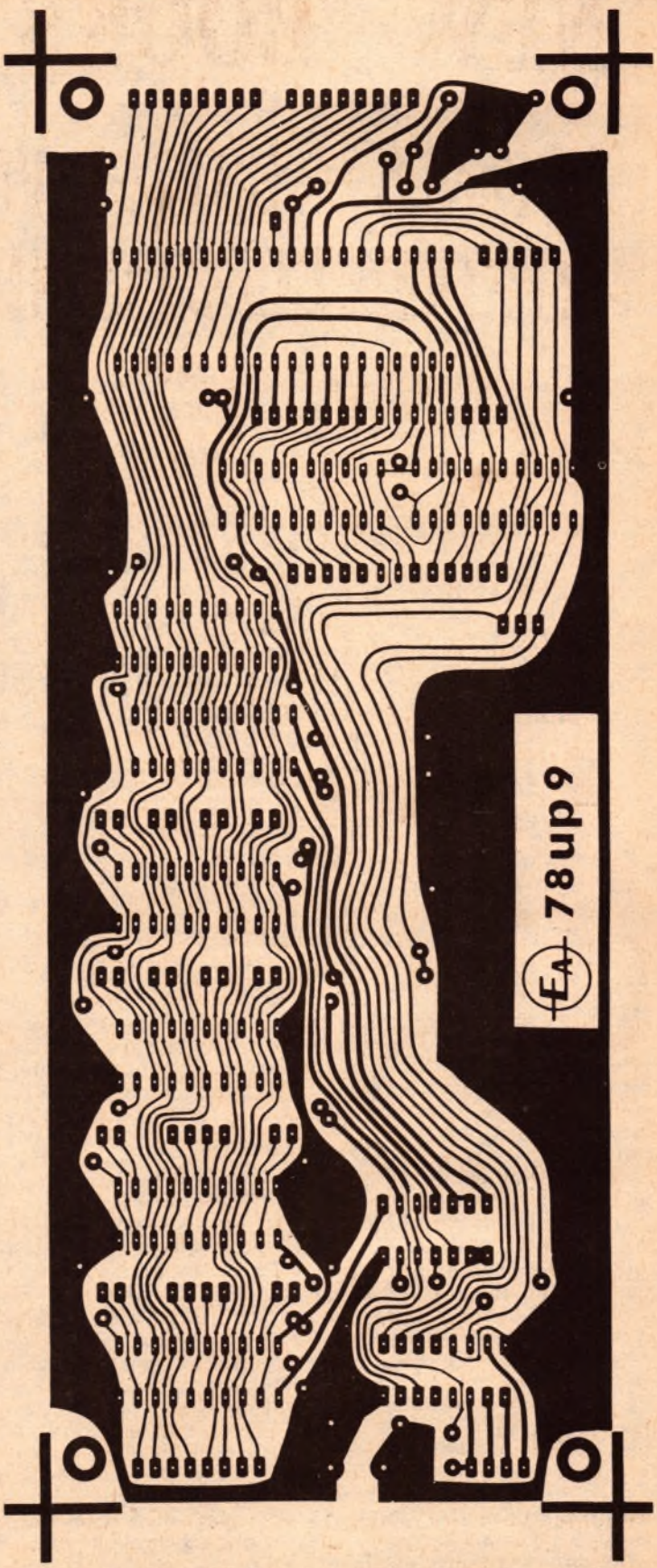
Fit all the passive components and links first. Leave the bypass capacitor between the 81LS95 address buffers out at this stage, and fit it only after the ICs have been inserted. Sockets are not required for the TTL ICs (ie, all but the 74C374's, if used) provided you are careful with your soldering iron.

Once all components have been fitted to the board, inspect it very carefully to check for solder bridges, wrongly oriented ICs or other similar faults. We do not recommend PCB pins for most of the inputs and outputs to the board, as there is not sufficient room for them.

Now remove the CPU board from the case, and place it in position on your work bench next to the expansion board, with the two "front ends" adjacent to each other. Using suitable lengths of rainbow cable, and using the two overlay diagrams as a guide, make the required interconnections. Remember to leave enough length so that the two boards can be folded copper side to copper side, and then assembled in the case.

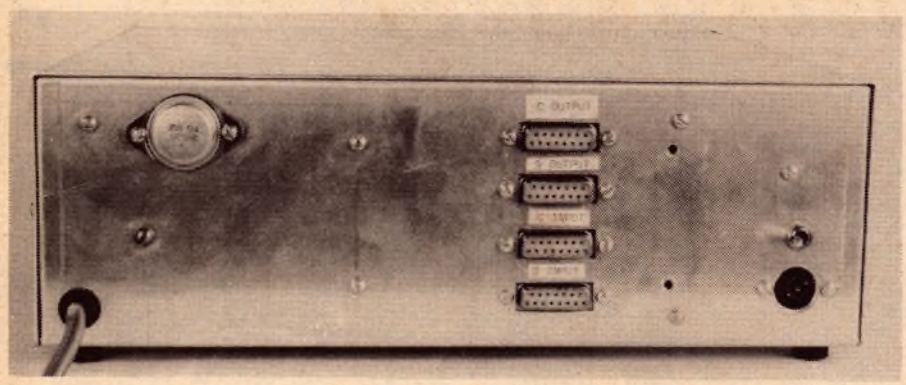
Take your time when making the interconnections, as any mistakes will be difficult to correct later, as well as being difficult to trace. It will be easier if you make use of the colour code of the rainbow cable, and make say the DO line back, the D1 line brown and so on.

Insert the link to disable the data buffer whenever page 0 is selected, and connect the page 0 line to the G2-bar input of the 74LS138 on the CPU board.

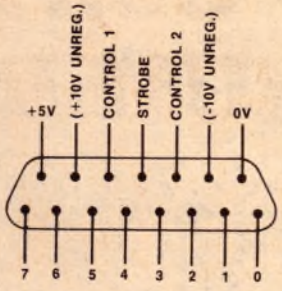


Here is a full sized reproduction of the PCB artwork. Commercial boards should be also available.

How to expand your 2650 Minicomputer



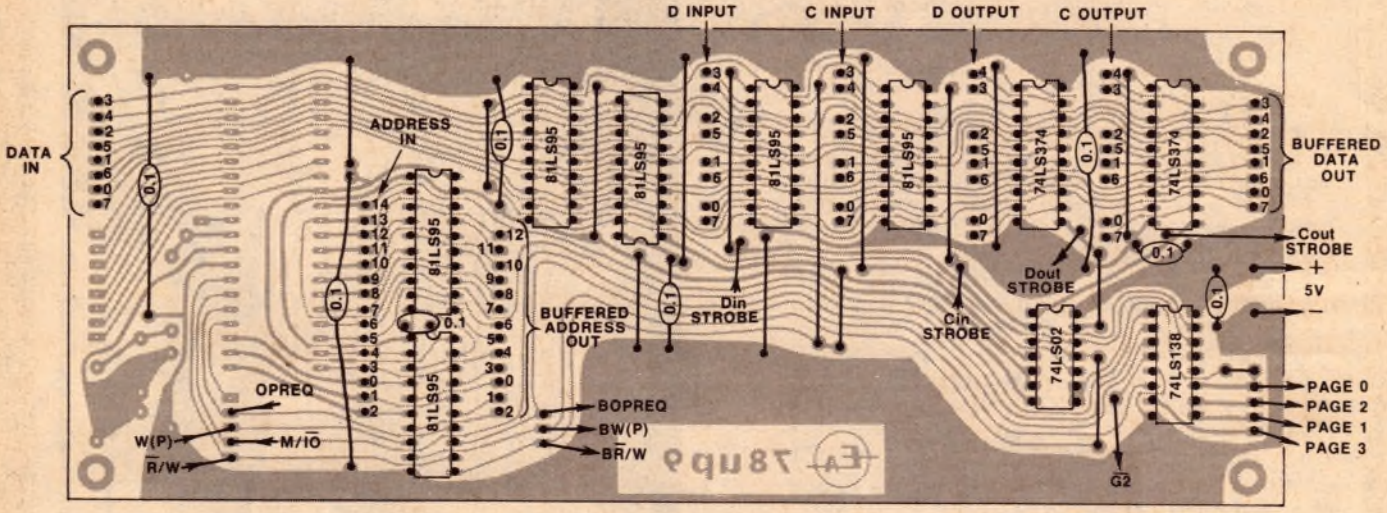
ABOVE: The position of the IO sockets can be scaled from this photograph. Mount them from the inside of the chassis.



FEMALE 15-WAY CANNON CONNECTOR ON CPU CHASSIS VIEWED ON WIRING SIDE

ABOVE: This is the suggested wiring diagram for the 15way Cannon connectors we used for the IO sockets.

BELOW: The overlay diagram is used both to place the components on the PCB, and to make the connections between the PCBs.



The wire leading from pin 11 of the 74LS38 (the WRP-bar signal), must be extended to the G2-bar input of the 74LS138 on the expansion board.

The two power supply rails are available near the three terminal regulator. Make sure that you do not get the polarity wrong.

Once you have finished and checked all the interconnections between the two boards, you can wire up the I/O sockets. We used 15-way Cannon D Subminiature plugs and sockets. The connection scheme we used is shown in the accompanying diagram.

The eight pins in a row are used for the data connection, with the remaining seven pins used for control and power supply signals. The +5V and OV signals are the main supply rails, while the +10V and —10V signals can be derived from the power transformer using a bridge rectifier and two electrolytic capacitors.

The strobe signal is obtained from the expansion board, while the control signals can be selected from the other ports as desired. For example, to run the OP-80A paper tape reader, a ninth data input is required, so this can become one of the control signals.

Once all the wiring is completed, and has been checked thoroughly, testing can commence. This can be done before the board assembly is replaced in the case. Fit a heatsink to the regulator tab, and reconnect the three wires from the transformer

Monitor the +5V rail, and switch on. If it does not rise immediately to the correct value, switch off and trace and rectify the fault. Assuming all this is well, connect up your terminal, and check that Pipbug and whatever RAM is fitted is working correctly.

The output ports can be tested by using a small routine of instructions to write data to them and checking that it appears on the appropriate output pin with a multimeter. You can use the Pipbug BIN routine to get data bytes from your terminal, the BOUT routine to echo them, and the WRTC or WRTD instructions to transfer them to the output ports.

Similarly the input ports can be tested by reading them via REDC and REDD instructions, and using the BOUT routine to print the byte obtained on the terminal. With nothing connected to the inputs, you should get hexadecimal FF from both ports.

Now use a clip lead to ground one input pin at a time, and check that the appropriate byte is displayed. For instance, shorting the bit O data input should change the display from FF to FE.

Once you are satisfied that all facets of the unit are operating correctly, the board assembly can be fitted to the case. Use of a magnetised long blade screwdriver will be found helpful in this operation, if you are using steel screws.

In the next article, we will give details of the 8K RAM board and the additional power supply components required with it. This additional supply will also provide the +10V and —10V unregulated voltages mentioned previously.

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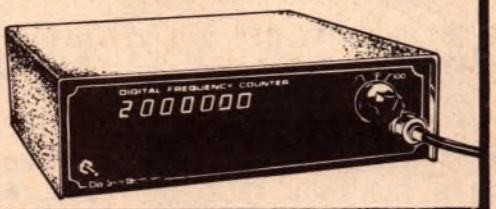

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2650 MINI COMPUTER (E.A. May '78)
ALL parts, case, front panel, power supply, etc. – not a 'part' kit. Ik of memory – a powerful mini system.
Cat. K-3447 .. .. $115.00

LOW COST VIDEO DISPLAY UNIT
(E.A. February '78)
Mates with above. Communicate with a computer!
Cat. K-3460 .. .. $97.50

VIDEO MODULATOR for use with VDU
(E.A. April '78)
Allows above VDU to be used with any TV set.
Cat. K-3462 .. .. $4.50

ASCII KEYBOARD ENCODER
(E.A. April '78)
Uses our standard keyboard (Cat. X-1180)
Cat. K-3464 .. .. $39.50

CASSETTE INTERFACE (E.A. April '77)
Use any cassette player to communicate with computer.
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Another fascinating aspect of computer technology.
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Outstanding value for a valuable service aid.
Cat. K-3469 .. .. $25.00

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TANK BATTLE GAME KIT
(E.T.I. October '78)
Experience the excitement of commanding your own tank as you navigate through a minefield to destroy the enemy's tank.
Cat. K-3475 .. .. $39.50

10-GAME VIDEO GAME
(L.A. July '78)
Features 4-way bat control, many combinations of bat sizes, ball speeds, angles, etc.
Cat. K-3491 .. .. $49.50

STUNT MOTORCYCLE GAME KIT
(E.T.I. June '78)
Play 4 different games, motorcross, enduro, drag and stunt, easy to build!
Cat. K-3474 .. .. $29.50

AMATEUR CB, ETC.

MORSE KEYER (E.A. April '78)
Perfect Morse code – electronically generated. Inc. paddle.
Cat. K-3470 .. .. $37.50

VK POWERMATE (E.A. May '78)
Short form kit – no metalwork, mains wiring etc.
Cat. K-3449 .. .. $32.00

CB POWER SUPPLY
13.8 volts at 2A continuous (4A peak) complete kit.
Cat. K-3448 .. .. $29.50

45 WATT VHF AMPLIFIER
F'glass PCB, 13.8V operation. Req. 8 – 12W of drive.
Cat. K-3132 .. .. $27.50

30 WATT 80 METRE AMPLIFIER
Ideal for the novice. 13.8V. Adaptable to 50W output.
Cat. K-3133 .. .. $34.95

MISCELLANEOUS

6 DIGIT 240V CLOCK KIT
Hours, minutes & seconds display. Short form w/o case:
Cat. K-3364 .. .. $19.75
Handsome case to suit.
Cat. H-3192 .. .. $5.00

CAPACITOR DISCHARGE IGNITION
(E.A. July '75)
Save on petrol; end ignition troubles. Prewound coil.
Cat. K-3280 .. .. $25.75

DRILL SPEED CONTROL Mk2
(E.A. July '76)
Suits 240V 'universal' motors (not electronically switched or controlled types). A must for the home handyman.
Cat. K-3080 .. .. $11.50

HIGH POWER STROBE (E.T.I. August '71)
A real blast – ideal for parties, discos, etc. Dazzler!
Cat. K-3150 .. .. $27.95

TV MASTHEAD AMPLIFIER
(E.T.I. August '71)
Can turn an unwatchable mess into a brilliant picture.
Cat. K-3230 .. .. $29.95

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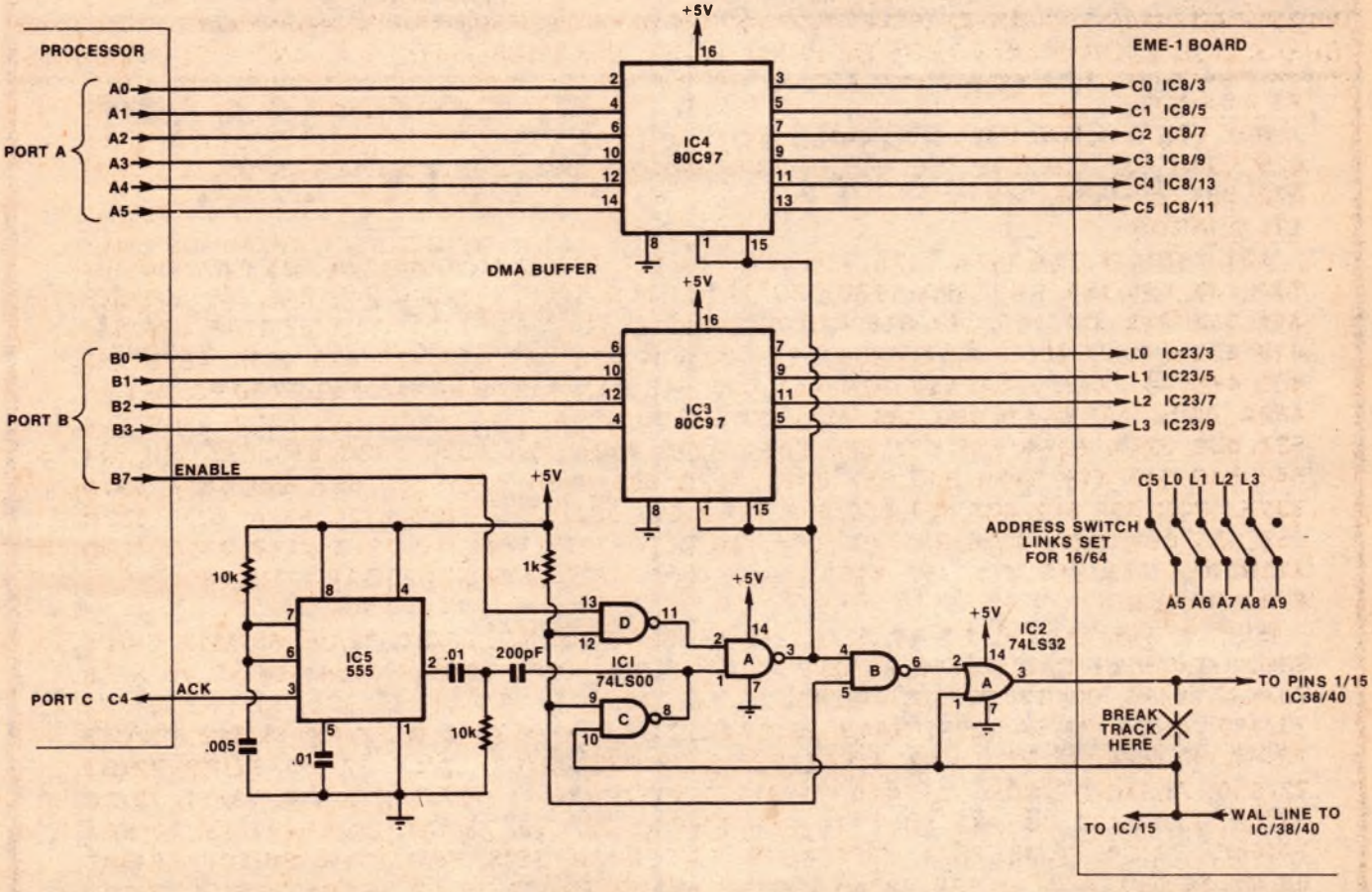
DICK SMITH ELECTRONICS

Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Suggested modifications to the VDU



The current trend with VDU design is to provide direct memory access to the VDU RAM (if not part of the processor) thus allowing characters to be written into RAM without sequentially stepping through each location in turn. Those like myself who constructed the EA VDU described in February 1977 will have found a limitation with the standard teletype format. A very simple modification is possible to the original EME 1 board that requires breaking one track and making 10 connections to the board. If the cursor modification has already been fitted then the 10 address lines be wired to the cursor board.

The two tri-state outputs (IC3,4) are wired in parallel with the existing read/write address counter buffers. The WAL line that selects either the read or write counter is used to control the DMA buffers when the enable line is taken low. The WAL line provides a short negative pulse on receipt of data (via the serial input) and this pulse momentarily enables the write address buffer, thus loading data into the VDU RAM. When the enable line is taken low the WAL pulse will disable both read and write buffers and enable the DMA buffers, thus loading the data at the address set on the inputs of IC3,4.

In order for the processor to establish that data has been loaded, the WAL pulse is stretched after inverter 1/C by IC5 to approximately 60us, thus allowing time for a program loop to test for the pulse.

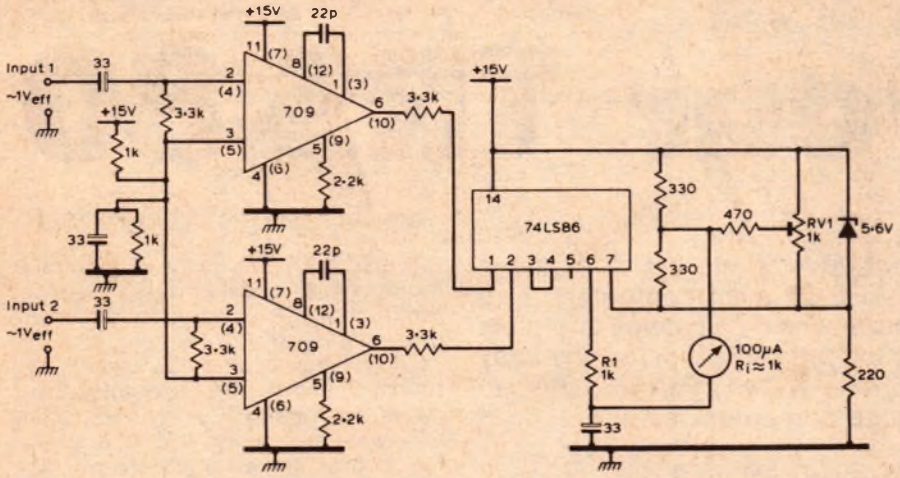
The modification described assumes that the EME 1 is set for 16 x 64 character format as this is the most likely configuration that will be used in the DMA mode. The prototype also used standard TTL NAND/OR gates quite successfully as these were all that were available at the time.

Finally, when fitting the modification it was found that the schematic supplied with the EME 1 shows the address switch wiring incorrectly. The corrected version is shown on the diagram.

(By Mr I. C. Butterworth, Flat 98 Block 1, Carriwan Street, Woomera, SA 5720.)

Audio phase meter to adjust 90° phase-shift networks

Here is a novel test unit for the accurate adjustment of 90° broadband audio phase-shift networks, such as those used in phasing type SSB generators or demodulators. Developed by Anjo Eenhoorn, PAOZR, it allows you to adjust an audio phase-shift network for optimum results on the basis of direct measurements,



rather than the conventional indirect technique of trying to check the accuracy of the network by measuring the sideband suppression.

The network is fed from an audio generator with tones of variable frequency, and the outputs from the two branches of the network are fed to inputs 1 and 2, respectively, of the instrument. The sine wave input signals are converted into square waves by means of type 709 op-amps. Frequency compensation in the op-amp feedback is selected so that the zero crossings of the square waves coincide as nearly as possible with those of the original sine waves.

The two square wave signals are fed to a type 74LS86 exclusive-OR gate. When the square waves are in phase the output (pin 6) remains "low" all the time. When they are in exact antiphase, pin 6 remains "high". In intermediate situations a square wave signal appears at the output (pin 6). Should the two square wave signals have a phase difference of exactly 90°, then the square wave output signal would be symmetrical, or exactly 50% duty cycle.

The circuit arrangement is such that the meter can be made to deflect to exactly half scale for a symmetrical output signal. With the component values shown (total resistance in the meter circuit about 2k and a 100uA FSD meter) a deviation of plus or minus 5° from 90° causes the meter to indicate either zero or full deflection.

After construction, the preset potentiometer RV1 requires adjustment. With only one sine wave input signal it is adjusted so that the pointer of the meter is at mid scale.

It should be noted that harmonic content in the signal from the audio generator will falsify the result. It was found that 1% harmonic distortion in the generator output will cause an error of about 1° in the measurements made with the test instrument. However, it is relatively simple to determine whether the harmonic distortion is excessive.

With only one input signal connected, as when adjusting RV1, the generator is varied over the frequency range of interest, say 250 to 3500Hz. If during this procedure the meter deviates from mid scale, then it indicates the presence of harmonics and also indicates, by the magnitude of the deviations, the approximate degree of accuracy that can be expected from the instrument.

(From "Radio Communication".)

Silicone prevents iron bits from sticking

The standard types of small soldering iron bits soon become oxidised with use and it is not long before they are so firmly embedded in the bit holder that they can never be removed, unless one drills out the copper material of the bit. This can cause great inconvenience when one tries to renew a bit and can lead to damage of the iron.

This problem can be easily avoided if one coats the parts of the bit which fit into the bit holder with a thick coating of silicone grease before the bit is first used. After the bit has been heated a few times, the silicone grease is converted into a hard coating which prevents rapid erosion of the bit inside the holder.

Bits which have been coated with silicone grease in this way can easily be removed from the holder at any time and bit renewal is very easy. The hard coating is very thin and it seems likely that there is better heat transfer to the bit from the holder.

(By J. Brian Dance, 8 Birmingham Road, Alcester, Warwickshire, UK.)

Calibrating the 7 Digit Frequency Meter

After building the 7 Digit Frequency Meter as described in March 1977, I was faced with the problem of calibrating the unit. A highly accurate signal is present in many lounge rooms. The chrominance section of a colour TV receiver contains an oscillator running at 4.43361875MHz, which is kept in step with a precision frequency source at the TV station.

If you have a Philips colour TV receiver, a 4.43MHz signal is available from test point 16 on the U270 module. The test lead should be kept short and unshielded and a resistor of about 680 ohms should be placed in series to reduce loading on the circuit. On the x10 range the frequency meter should be adjusted to read varying between 4.433618-9. Care must be taken not to short any connection around the stage, otherwise some damage may be caused.

(By Mr S. McIntosh)

Plot biorhythms with your TRS-80

Here's an article which should be of special interest to all those proud owners of shiny new Tandy TRS-80 microcomputers. In it the author describes a novelty program which calculates and plots biorhythms, at the same time informing the subject of the weekday on which they were born. The program is written in BASIC, and can be adapted for other BASIC-language computers as well.

by GIL SPENCER, VK2JK Box 300, Spit Junction NSW 2088

Those of us with hobby computers are probably all familiar with that frustrating feeling which arises when interested but uninformed friends want to know just what your computer can do.

It's useless to try and explain some of the personal but arcane jobs you've found for it. They think you're a spendthrift madman if you try and buy out by saying simply that it's fun to work (play) with.

It's a tough public relations exercise. Games generally provoke a ho-hum response because everybody remembers last Christmas's TV game present that's now gathering dust in a forgotten closet.

What to do to enlighten the unwashed?

Tell your computer that it's a Biorhythm Clock. Then you can show people something they don't know about themselves. It's a guaranteed hook!

WHAT ARE BIORHYTHMS?

Believers suggest that at the moment of birth, 3 different clocks start ticking inside your body. Together, they control your destiny forever. Each of the 3 clocks measures one of your essential functions. They are:

1. Your Physical Clock, with a 23-day cycle ("P")
2. Your Emotional Clock, with a 28-day cycle ("S")
3. Your Intellectual Clock, with a 33-day cycle ("I")

While the 3 clocks start together at birth, the different cycle lengths result in an out-of-phase relationship almost immediately. From birth on every day is slightly different from yesterday.

Biorhythm cycles are usually represented by sine curves moving above and below the x-axis of time. See Fig. 1. When a curve is above the line its "active" or "high". When a curve is below the line its "passive" or "low".

When the curve "switches" from active to passive (or vice versa) a critical day for that function is said to occur. When 2 or 3 curves become critical simultaneously . . . watch out!

So much for the basic thinking behind biorhythms. Considerable additional detail can be found at your library. Presently, it's a "hot" subject.

BIORHYTHM PROGRAMMING

It takes only a little reflection to conclude that biorhythms must have been invented with the digital computer in mind. What a delightful, yet exotic programming challenge for the computer hobbyist!

TRS-80 microcomputer owners can squeeze a Biorhythm Clock into a basic 4K/4K machine. It's a tight fit, calling for some ingenuity and that always makes program writing more fun. The listing is shown in Fig. 2, but let's discuss the approach it uses to do what it does.

Let's say that you want to establish your own biorhythms for today. The question that must be answered is "how many days have you been alive?". It's best to divide the question into 3 parts:

K = No. of days from birth to end of birth year
L = No. of days in complete years between birth and today
M = No. of days from first of this year until today.

How Bob converted the sceptics . . .

ACT 1 — SCENE 1

It's late Sunday afternoon in the study of Bob Bionic's home. On a desk at centre stage is a Tandy TRS-80 microcomputer with its screen illuminated. From the door at stage left a small but animated group of people enter, Bob included.

First Guest (the glad-hander): Show us what's new in here, Bob, before you carve the roast."

Bob: "Well, since you were here last, I've bought a home computer. It's there on the desk."

Second Guest (an enthusiastic girl named Mary): "Isn't that something! It's a TV, a cassette player and a typewriter connected together. Bob, what's a home computer for?"

Bob: (answering carefully, his years of fielding well-meant questions about his ham equipment help him): "It's simply another household applicance, Mary. Just like a clock or a calculator. It's more versatile, though . . . extremely quick, and a lot of fun."

Third Guest (the sceptic): "I thought you said it was a computer. How can it be like a clock?"

Bob (smiles, knowing the trap worked): "That's easy . . . because a clock really IS a computer."

Third Guest: "Come on, now, Bob. A clock is a clock!"

Bob: "That's true. And a clock has no value unless it was set on the right time in the first place, is still going, and running at the proper speed. A clock is a single-purpose computer, that can only do its job if it's given the correct instructions in the first place. As a matter of fact, I could tell my computer that it's a clock and it would keep time for us. But let's make it do something more interesting. Who knows what day of the week they were born on?"

First Guest: "Not me."

Others mumble negatively.

Bob: "OK, Mary. What's your birthday . . ."

The curtain falls as Bob Bionic saunters to the keyboard. The others crowd in behind him.

```
                    BIORHYTHM CLOCK

I WILL NEED SOME DATES FROM YOU.  ENTER THEM BY
NUMBERS.  ALWAYS ENTER THE COMPLETE 4-DIGIT YEAR.
EACH INPUT ELEMENT SHOULD BE SEPARATED FROM THE NEXT
BY A COMMA (,).  DON'T CHEAT 'CUZ I'M WATCHING!

ENTER DAY OF WEEK (1=SUN, 3=TUES, 6=FRI, ETC.)  ?6
ENTER TODAY'S DATE (DD,MM,YYYY)  ?30,06,1978

ENTER YESTERDAY'S DATE (DD,MM,YYYY)  ?29,06,1978

ENTER YOUR BIRTHDATE (DD,MM,YYYY)  ?10,02,1950
ENTER YOUR NAME, PLEASE  ?KEN
```

```
              KEN'S BIORHYTHM CHART FOR THE NEXT 35 DAYS

TODAY      +7      +14      +21      +28      +35 DAYS
30- 6                       BIRTHDATE = 10  2  1950
PHYSICAL (SOLID) CURVE LASTS 23 DAYS.  TODAY, IT'S AT DAY # 17
EMOTION (BROKEN) CURVE LASTS 28 DAYS.  TODAY, IT'S = DAY # 7
MIND (LAST) CURVE LASTS 33 DAYS.  TODAY, IT'S AT DAY # 5
DID YOU KNOW, KEN, YOU WERE BORN ON A FRIDAY?_
```

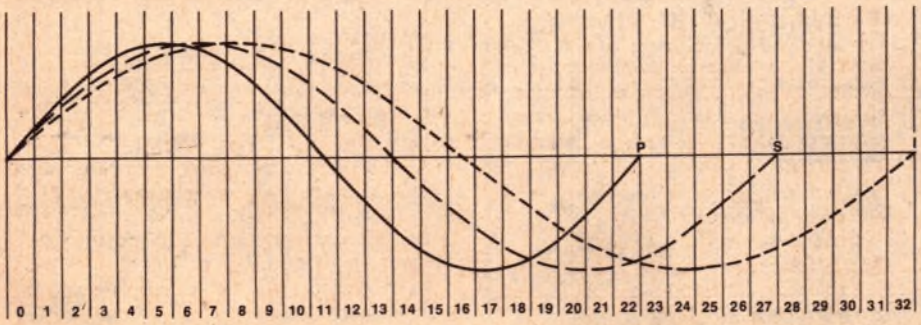


Fig. 1: The three basic biorhythms and their lengths in days.

PLOT BIORHYTHMS ...

Then N = K + L + M where N = how many days you have been alive.

We know that the Gregorian calendar is an imperfect tool at best. Calendar years (365 or 366 days) and astronomical years (about 365D, 5H, 48M, 46S) do not match. Consequently, a certain amount of fiddling is necessary.

Here are the rules:

a. If year not divisible by 4, then year = 365 days.
b. If year divisible by 4, then year = 366 days, EXCEPT:
c. If year divisible by 100, then year = 365 days, EXCEPT:
d. If year divisible by 400, then year = 366 days.

Therefore:

1978 has 365 days by Rule a.
1976 has 366 days by Rule b
1900 has 365 days by Rules b and c
2000 has 366 days by Rules b and d

The leap year anomaly results in quite a few program statements. Don't forget that you must test every year from the birth year to the "today" year to see if it's a leap year, and in the K year and the M year you have to position the extra day at February 29th.

Let's say that, counting today, you've been alive for 11,000 days (a bit over 30 years). First, we divide 11,000 (N) by the lengths of the 3 Biorhythm cycles (in days):

11,000/23 = 478.261 Physical cycles so far
11,000/28 = 392.857 Emotional cycles
11,000/33 = 333.333 Intellectual cycles

Then, in each case we subtract the Integer (numbers to the left of the decimal point) part of the result from the whole result. The remainder (numbers to the right of the decimal point) is then multiplied by the original divisor:

(478.261 - 478)*23 = 6.0 Physical
(392.857 - 392)*28 = 24.0 Emotional
(333.333 - 333)*33 = 11.0 Intellectual

The result is the day number of each biorhythmic cycle for today.

With a TRS-80 (or other device with graphics capabilities) it is possible to display the interrelation of the 3 Biorhythm curves. The program shown starts with "today" and goes forward in time for 5 weeks, or 35 days.

The TRS-80 will graph based on x, y rectangular coordinates. We establish the x-axis as time (that's the horizontal axis, if you've forgotten your math). To find y, all we need in the sine wave formula, y = sine x. But TRS-80 Level 1 BASIC doesn't have this on call, so the program uses the sine subroutine that appears on page 218 of the manual.

In order to make the curves snake above and below the x-axis (which is represented with a dashed horizontal

line), the program tests the value of x. If x is less than half of the cycle length, then y is made positive . . . otherwise y is negative. When the value of x reaches the end of a cycle it repeats.

The final thing the program does is work out the day of the week that the subject was born on. Very few people know the week-day of their birth. They'll love your machine when it reports this piece of personal data.

Finding the week-day of birth is simple enough. When the program initially asks the subject for his birthdate, today's date and yesterday's date (for checking) it also asks which day of the week it is "today" (line 165). Then after it has calculated the total number of days between the subject's birth and today (line 440), it is able to calculate the week-day of birth — first as a number from 1 to 7 (line 475) and then as a character string B$ corresponding to the correct day name. This last step is done by the sequence in lines 480—490, neatly designed to get around the severely limited string capabilities of the TRS-80's Level 1 BASIC.

You might care to run through the sequence for yourself, as the approach used can come in handy for other applications.

The Biorhythm program has a few limitations, as a result of its being written for the 4K/4K TRS-80. They're minor, and perhaps you'll work out how to overcome them. Then you can tell me!

1. The programming complexities of a birthdate too close to "today" are large. I didn't try to solve them, so the program simply refuses to work them out (line 260).
2. People born more than 600 years ago are a potential problem. First, they're generally dull company! Second, the INT function of the TRS-80 fails with numbers bigger than 32,-767. 600+ year number-crunching develops numbers bigger than this, so the program opts out (lines 710-720).
3. Trying to superimpose 3 curves on the same graph leaves something to be desired for clarity. Colour TV is definitely the answer here.

Incidentally, you can draw Biorhythm curves for different points in time other than "today". Fool your computer by inputting your wedding day, the day you broke your leg, etc. as "today", and see what truths you'll discover.

There's plenty of room for logic statements (review Chapter 24 of the Level 1 Manual) between the input statements and the calculations. These will prevent wise guys from pretending they were born after "today" . . . or in the 13th month or the 32nd day of a month, etc.

You'll find that Biorhythms are a real crowd-pleaser. People get very interested because they're personal and because they seem more "scientific" than horoscopes or astrology charts.

```
LIST
1  REM BIORHYTHM CHART & WEEKDAY OF BIRTH PICKER -VK2JK-780331
100  CLS :P.T.(20),"BIORHYTHM CLOCK" :P.
110  P."I WILL NEED SOME DATES FROM YOU.  ENTER THEM BY"
120  P."NUMBERS.  ALWAYS ENTER THE COMPLETE 4-DIGIT YEAR."
150  P."EACH INPUT ELEMENT SHOULD BE SEPARATED FROM THE NEXT"
160  P."BY A COMMA (,).  DON'T CHEAT 'CUZ I'M WATCHING!":P.
165  IN."ENTER DAY OF WEEK (1=SUN, 3=TUES, 6=FRI, ETC.)   ";I
170  IN."ENTER TODAY'S DATE (DD,MM,YYYY)   ";A,B,C
190  P. :IN."ENTER YESTERDAY'S DATE (DD,MM,YYYY)   ";D,E,F
200  P. :IN."ENTER YOUR BIRTHDATE (DD,MM,YYYY)   ";G,H,J
205  IN."ENTER YOUR NAME, PLEASE   ";A$
210  IF (B=E)*(A<>D+1)+(J>C)+(J>F)+(A>31)+(D>31)+(G>31) T. 250
220  IF (I>7)+(B>12)+(E>12)+(H>12)+(B<>E)*(A<>1) T. 250
230  G. 260
250  P.T.(10),"INPUT ERROR.  TRY AGAIN!" :G.  165
260  IF F-J<2T.P."BIRTH TOO CLOSE TO TODAY FOR ACCURACY":G.170
270  IF F-J>600 T. GOS. 710 : G. 170
300  REM - Y =# DAYS IN FULL YEARS BETW BIRTH & YESTERDAY
310  Q=(F-1)-(J+1) :GOS. 2000 :Y=((Q+1)*365)+Z :IF Y<0 T. Y=0
350  R=0 :S=E-1 :T=1 :IF S=0 T. Q=0 :G. 370
360  GOS. 900 :IF (F/4=INT(F/4))*(E>2) T. Q=Q+1
370  W=Q+D :REM W=# DAYS FROM BEGIN THIS YR TO YESTERDAY
400  Y=0 :R=H :S=12 :T=H+1 :IF T=13 T. 430
410  GOS. 900 :V=Q :IF(J/4=INT(J/4))*(H<3) T. V=V+1
430  R=H-1 :S=1 :T=1 :GOS. 900
435  V=V+(Q-G) :REM V=# DAYS FROM BIRTHDATE TO END BIRTH YR
440  U=V+W+Y :REM U=# DAYS FROM BIRTH TO YESTERDAY
450  Q=U/23 :K=INT(((Q-INT(Q))*23)+.5)
460  Q=U/28 :L=INT(((Q-INT(Q))*28)+.5)
470  Q=U/33 :M=INT(((Q-INT(Q))*33)+.5)
475  Q=(U+1)/7:Q=INT(((Q-INT(Q))*7)+.5):Q=I+(7-Q):IFQ>7T.Q=Q-7
480  F. N= 1 TO Q :READ B$
485  DATA SUNDAY, MONDAY, TUESDAY, WEDNESDAY
486  DATA THURSDAY, FRIDAY, SATURDAY
490  N. N :RESTORE
497  CLS :P.A$;", YOU'VE BEEN AROUND FOR";U+1;"DAYS."
498 P."THAT'S ABOUT";(U+1)*24;"HOURS OR";(U+1)*1440;"MINUTES"
499 P.TS(10),"HERE COME YOUR BIORHYTHMS!":F. N=1TO4500 :N. N
500  CLS :P.T.(8),A$;"'S BIORHYTHM CHART FOR THE NEXT 35 DAYS"
510  F. X=10 TO 115 S.21 :F. Y=5 TO 27 :S.(X,Y) :N. Y :N. X
520  F.AX=325 to 377 S.2 :P.A.X,"-" :N. X
530  P.A.642,"TODAY":P.A.654,"+7":P.A.664,"+14":P.A.675,"+21"
540  P.A.685,"+28" :P.A.696,"+35 DAYS" :P.A.705,A :P.A.708,"-"
545  P.A.709,B :P.A.739,"BIRTHDATE =";G:H:J :GOS. 800
550  O=11.5 :P=K :R=1/3 :S=1 :T=23 :GOS. 3000
600  O=54 :P=L-1 :R=1 :S=3 :T=28 :GOS. 3000
650  O=16.5 :P=M-3 :R=3 :S=9 :T=33 :GOS. 3000
700  G. 700
710  P.:P."MORE THAN 600 YEARS BETWEEN BIRTH & TODAY.  PLEASE"
720  P."BREAK YOUR INPUT INTO 2 OR MORE PARTS." :P. :RET.
800  P.A.768,"PHYSICAL (SOLID) CURVE LASTS 23 DAYS.  TODAY, ";
801  P."IT'S AT DAY #";K+1
810  P.A.832,"EMOTION (BROKEN) CURVE LASTS 28 DAYS.  TODAY, ";
811  P."IT'S = DAY #";L+1
820  P.A.896,"MIND (LAST) CURVE LASTS 33 DAYS.  TODAY, IT'S";
821  P." AT DAY #";M+1
822  P.A.960,"DID YOU KNOW, ";A$;", YOU WERE BORN ON A ";B$;
850  P."?"; :RET.
900  REM CALC DAYS IN INCOMPLETE YEAR SUBR
910  Q=0 :F. N=T TO S :R=R+1
920  ON R G.931,928,931,930,931,930,931,931,930,931,930,931
925  N. N :RET.
928  Q=Q+28 :G. 925
930  Q=Q+30 :G. 925
931  Q=Q+31 :G. 925
2000  REM ADJUST FOR LEAP YEARS SUBR
2010  Z=INT((Q+3)/4) :IF J+1>1900 T. RET.
2020  R=INT((J+1)/100) :F. N=19 TO 0 S.-1 :IF R=N T. 2050
2030  N. N
2050  IF R*100=J+1 T. R=R-1
2060  IF J+1>1600 T. Z=Z-(19-R) :RET.
2070  IF J+1>1200 T. Z=Z+1-(19-R) :RET.
2080  IF J+1>800 T. Z=Z+2-(19-R) :RET.
2090  IF J+1>400 T. Z=Z+3-(19-R) :RET.
2095  Z=Z+4-(19-R) :RET.
3000  REM CALC & DRAW SUBROUTINE
3100  F. N=11 to 114 S.S :P=P+R :IF P>T T. P=1
3200  X=(P*180)/D :X=INT(X+.5)
3201  IF X>=180 T. X=X-180 :X=-X
3400  X=X/57.29578
3440  Y=X-X*X*X/6+X*X*X*X*X/120-X*X*X*X*X*X*X/5040
3450  Y=Y+X*X*X*X*X*X*X*X*X/362880
3460  X=N :Y=INT((Y*(-10))+.5)+16 :S.(X,Y) :N. N :RET.
```

Fig. 2: A complete listing of the author's biorhythm program.

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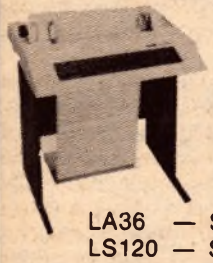

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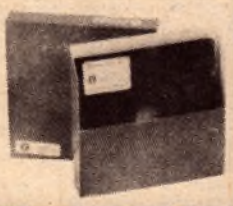

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Hard copy for your Motorola D2 kit

by MICHAEL MOTE

Those who have the Motorola MEK6800D2 evaluation kit should find this article of great interest. Written by an applications engineer at Daneva Control Pty Ltd, it tells how that company's "Duoprint" miniature printer may be used with the D2 kit to provide hard copy facilities. Details are also given for a hex dumping routine to suit the Duoprint.

There's nothing quite like hard copy. You can touch it, hold it, store it, scribble changes on it and even tear it to shreds if things are getting you down. If you've worked on a computer system with hard copy facilities, no doubt you wonder how you could get along without it. And if you are currently struggling along without it, hopefully you aren't fully aware of what you're missing.

Admittedly the main thing which has prevented many microcomputer users from adding hard copy facilities to their systems has been cost. The price of printers has fallen over the last few years, but the cost of microcomputers themselves has plummeted. It is only in the last year or so that small printers have appeared at a price which makes them attractive enough for use with microcomputers which themselves cost only a few hundred dollars.

A miniature printer designated the Duoprint has been developed and is being marketed by a Melbourne company, Daneva Control Pty Ltd. The Duoprint is a combination of an overseas mechanical unit with a locally-designed electronics module, and has a price tag of $275 plus tax where applicable. It uses 60mm-wide metallised paper, and is capable of printing the full 64 characters of the 6-bit ASCII subset. Either 20 or 40 characters per line may be printed, selected by logic, at a speed of two lines per second.

Duoprint is capable of interfacing to a microcomputer or microcontroller system via either an asynchronous serial line or a parallel port with "handshaking". However, the easiest way to connect it to the Motorola MEK6800D2 evaluation kit is to use parallel interfacing, via the user-defined PIA device already provided on the D2 kit PC board. The interfacing required is quite simple, as shown in Fig. 1.

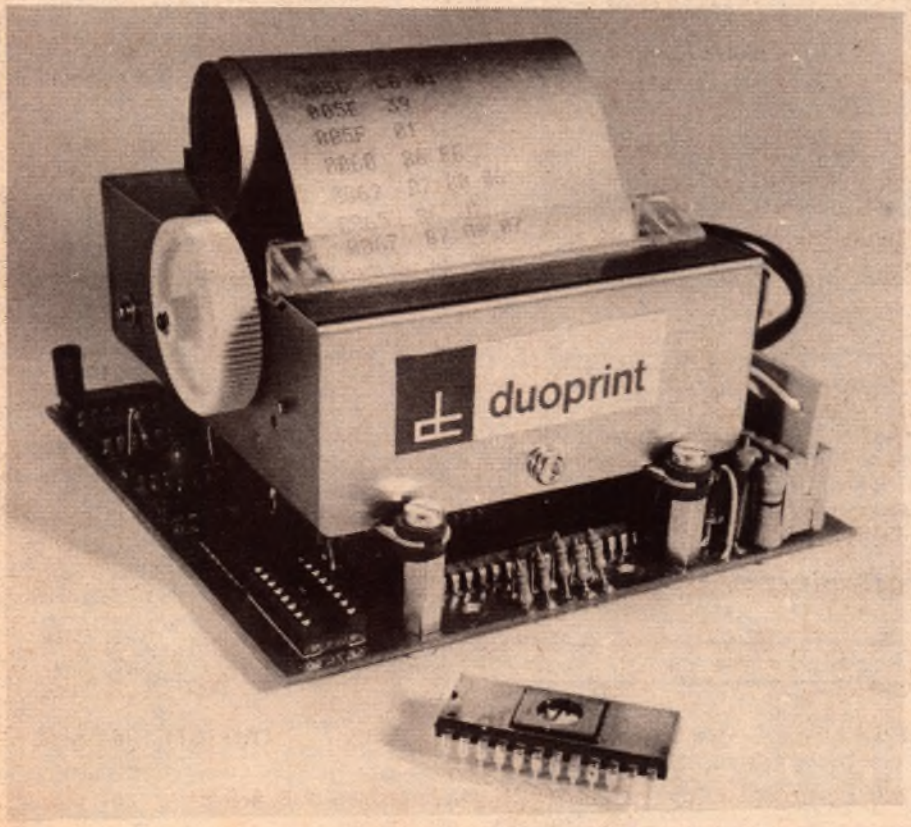
Power requirements for the Duoprint are +5V at 210mA and —24V at 1A. The —24V supply is for the printer head, and should be provided with a 1000uF bypass capacitor to ensure a high peak current capability. An internal regulator on the Duoprint PCB makes available a —12V supply capable of supplying up to 25mA, which may be used by external logic.

Daneva Control offers a firmware package designed to facilitate use of the Duoprint/D2 kit combination. Called PRINTBUG, the firmware normally sells for $29.95, and comes in a 2708 EPROM which plugs into the IC socket "U10" on the PC board of the D2 kit. This is shown in Fig. 1, together with the links required on the PCB to suit the 2708.

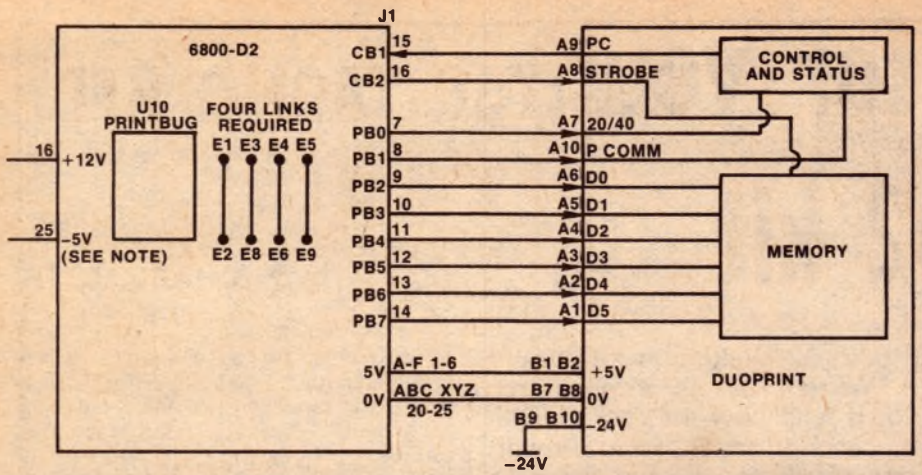
As the 2708 requires both +12V and —5V supplies in addition to the +5V provided on the D2 kit, these additional supplies must be provided. Luckily the —5V may be derived from the —12V output on the Duoprint, using a series resistor and 5V zener diode. These can be added to the D2 PCB in locations provided for this purpose — see the D2 kit manual.

PRINTBUG allows Duoprint to print any data accessible to the 6800 processor, whether the data is in RAM, ROM or the registers of interface adapters. The data can be printed in block format, with "N" bytes per line (where N is programmable). Alternatively when a program is being dumped, PRINTBUG may be arranged for partial disassembly. This causes each instruction to be printed on a separate line, as a group of one, two or three bytes (in hexadecimal) as appropriate.

The program for PRINTBUG was developed jointly by the author and Mr G. Foley, Lecturer at Box Hill Technical College. Mr Foley acted both as a software consultant and as an experienced microprocessor user who



At left is Daneva Control's Duoprint module, with an EPROM containing the PRINTBUG routine in front.



NOTE: THE –5V SUPPLY MAY BE DELETED BY USING THE –12V SUPPLY IN DUOPRINT AND ADDING THE ZENER/RESISTOR IN THE LOCATIONS PROVIDED ON BOARD

Fig 1: Here is the interfacing required to connect the Duoprint to the Motorola MEK6800D2 evaluation kit. The links shown in the D2 kit PCB are for the 2708 PRINTBUG EPROM.

helped set the PRINTBUG goals. His help is greatly appreciated.

For those who would like to either run PRINTBUG in RAM or blow it into their own EPROM or fusible-link PROMs, a complete hex listing is shown in Fig. 2. As you can see it occupies only 261 bytes, being currently located in the hex address range C000-C105.

PRINTBUG uses a few spare locations in the JBUG-dedicated RAM of the D2 kit, for its own scratchpad and control parameter storage. There are seven control parameter storage locations, from A050 to A056 inclusive, storing five control parameters as shown in Table 1. Each of the five parameters shown must be specified before PRINTBUG is called.

The first two locations store the starting address of the block to be printed, with the more significant byte in A050 and the less significant byte in A051, ie. to start listing at location 03F7, store 03 in A050 and F7 in A051.

The next two locations store the end address of the block to be printed, with the more significant byte in A052 and the less significant in A053. But note that the contents of the end address given are not actually printed, so that the address given should be of the location one higher than the last location to be printed.

The format control parameter stored in location A054 determines whether PRINTBUG prints in data block mode, or in program mode. To produce printing in program mode, where the bytes for each instruction are printed on a separate line, load hex "00" into A054. Note that any data encountered by PRINTBUG in this mode will be interpreted as instruction codes, and "disassembled" accordingly.

To print out in data block mode, the control parameter stored in location A054 should be "0N", where N is the number of bytes to be printed per line. Needless to say the maximum number of bytes per line depends upon the character size; with 20 characters per line you can only print 5 bytes per line, while with 40 characters per line you can print up to 11 bytes per line.

For convenience I suggest you specify 4 bytes per line (code 04) if you are using 20 characters per line, and 8 bytes per line (code 08) if you are using 40 characters per line. This fits in neatly with the hexadecimal addresses.

The characters per line control parameter is stored in location A055. To make PRINTBUG print 20 characters per line, store "81" in this location; to make it print 40 characters per line, store "80".

The final control parameter is the exit control code, stored in location A056. This must be set to suit the way in which PRINTBUG is used. If it is called as a subroutine, the stored exit code must be "39", corresponding to an RTS instruction. On the other hand if you are running PRINTBUG as a free-standing program, use the code "3F", corresponding to an SWI instruction. Or if PRINTBUG is going to be accessed as the result of an interrupt, you should use the code "3B", corresponding to an RTI instruction. One of these three codes should be stored in location A056.

Once the five control parameters have been stored, PRINTBUG may be called for execution. Its starting address is C05D.

Note that the PCB jumpers shown in Fig. 1 are for the 2708 version of PRINTBUG and may not be appropriate for other PROMs, including the single-supply equivalents to the 2708. The links shown are suitable for the MC68708, but for the MCM7641 you need only three links, joining E3-E9, E4-E7 and E5-E7. Similarly for the MCM68317 you again need only three links, joining in this case E0-E4, E1-E2 and E5-E9.

You can get some idea of the results possible with the Duoprint and D2 kit combination from the PRINTBUG listing, which was itself produced by such a combination working in the data block mode. As you can see the characters are well formed and easy to read.

Well, there it is: a simple way of adding hard copy facilities to a low cost D2 evaluation kit. Once you've tried it, you'll wonder how you got along without it!

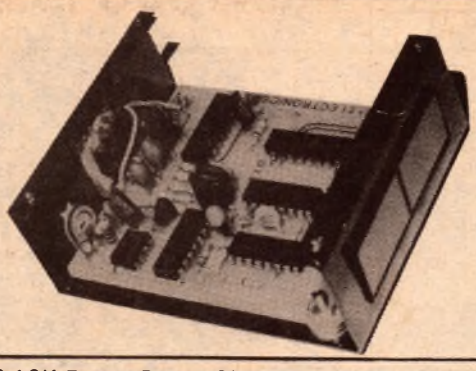
PRINTBUG listing:

```
C000  49 25 09 46  C088  8D D1 B6 A0
C004  46 46 84 3C  C08C  58 48 48 48
C008  8B C2 20 12  C090  48 8D C8 86
C00C  2B 07 49 2B  C094  83 B7 80 06
C010  03 46 20 EF  C098  37 80 06 F6
C014  46 46 8B 70  C09C  A0 54 26 02
C018  46 46 84 3C  C0A0  8D 80 A6 00
C01C  8B 02 B7 80  C0A4  8D B5 A6 00
C020  06 39 A6 00  C0A8  48 48 48 48
C024  81 8C 27 2D  C0AC  8D AD 86 83
C028  81 8F 27 29  C0B0  B7 80 06 08
C02C  81 CE 27 25  C0B4  8C A0 52 27
C030  84 F0 81 70  C0B8  16 5A 26 E6
C034  27 1F 81 B0  C0BC  B6 A0 55 B7
C038  27 1B 81 F0  C0C0  80 06 FF A0
C03C  27 17 81 00  C0C4  57 B6 80 07
C040  27 16 81 10  C0C8  2A FB F6 80
C044  27 12 81 30  C0CC  06 26 A8 B6
C048  27 0E 81 40  C0D0  A0 55 B7 80
C04C  27 0A 81 50  C0D4  06 B6 80 07
C050  27 06 C6 02  C0D8  2A FB F6 80
C054  39 C6 03 39  C0DC  06 CE C0 F1
C058  C6 01 39 20  C0E0  A6 00 B7 80
C05C  A3 7F 80 07  C0E4  06 08 8C C1
C060  FE A0 50 FF  C0E8  05 26 F5 F7
C064  A0 57 01 86  C0EC  80 06 7E A0
C068  FF B7 80 06  C0F0  56 83 83 12
C06C  86 2C B7 80  C0F4  56 3E 42 4A
C070  07 B6 80 06  C0F8  26 3A 51 83
C074  FE A0 57 36  C0FC  0E 3E 36 42
C078  A0 57 8D 84  C100  32 16 51 16
C07C  B6 A0 57 48  C104  83 83
C080  48 48 48 8D     DUOPRINT COMPLETE
C084  D6 B6 A0 58
```

A full hex listing of PRINTBUG, printed out by the program itself driving a Duoprint. This is an example of the data block mode, with the program set for 4 bytes per line. (The listing has been cut in two, with the halves pasted side by side).

TABLE 1: PRINTBUG CONTROL PARAMETERS

Parameter	Location in scratchpad (Hex.)
Start Address	A050/A051 (high & low bytes respectively)
Stop Address	A052/A053 (high & low bytes respectively)
Format Control	A054 (00 for program print, 0N for data)
Character Control	A055 (80 for 40 chars, 81 for 20 chars)
Exit Control	A056 (39, 3F or 3B)



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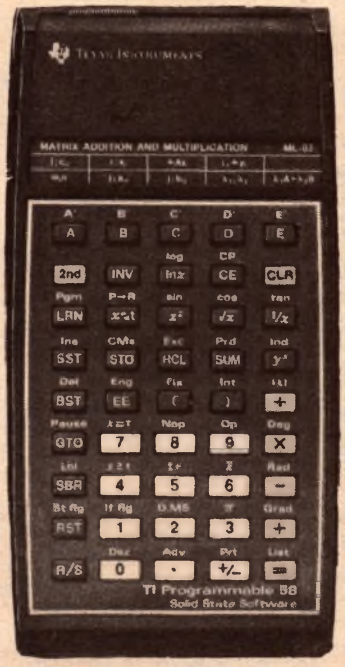

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Melbourne's First Home Computer Show

Melbourne's first Home Computer Show is being held on the 9th and 10th of December at the Box Hill Town Hall. Designed to allow small business owners, educators, hobby enthusiasts and the general public to see for themselves the potential of the latest low cost computer systems, it will have a wide range of equipment on display.

DSE's Edixy "Sorcerer"

Judging by present indications, Melbourne's first Home Computer Show could be one of the biggest yet held outside the USA. The organisers had signed up a dozen exhibitors less than a week after sending out the promotional brochure, and many others seem likely to commit themselves. This combined with intensive promotion in the popular media seems likely to make the show an outstanding success.

Organisers of the show are Australian Seminar Services Pty Ltd, a Melbourne-based company well established in the area of conferences, exhibitions and other methods of information dissemination. Over the past three years the company has conducted more than 40 conferences, seminars and lectures in all major capital cities.

Australian Seminar Services points to the success of computer shows in the USA and that of the recent ACS-8 in Canberra, suggesting that these show the tremendous interest in this area by educators, business people, hobbyists and the general public alike. Also in view of the potential of microcomputer products to transform a wide range of products and services in our society, there is a need for consumer and public education.

The Home Computer Show is designed to satisfy both these requirements. New equipment will be both displayed and demonstrated, information supplied, and there will even be direct sales to the public. Prizes, raffles and attractions such as "computer portraits" are also planned, to give a festive and friendly atmosphere to the show.

The show will be held at the Box Hill Town Hall in Whitehorse Road, Box Hill on Saturday the 9th and Sunday the 10th of December, 1978. It will be open from 10am to 10pm on the Saturday and from 10am to 6pm on the Sunday. An admission fee of $2 will be charged for adults, or 50 cents for children and pensioners.

Here are some of the firms exhibiting at the show, and an idea of some of the products they are planning to display:

Texas Instruments will be displaying its full range of microprocessor-related products, including both calculators and computers. In the calculator product area this is likely to include the DataMan, a hand-held maths learning aid with functions and styling making it appeal to children. Also the Data-Chron pocket calculator/alarm clock/stopwatch, featuring LCD display and typical battery life of 12 months.

In the more elaborate calculator area, TI is planning to have its hand-held programmable SR-58 and SR-59 calculators with "solid state software" modules. Also the new SR-60A desk-top personal computer/calculator, with inbuilt thermal printer, 20-character alphanumeric display, magnetic card program storage and programming in alphanumeric language.

We understand there is also a chance that TI may be launching its new personal computer, although TI at present isn't committing itself. According to overseas reports, the new computer is designed to operate with a standard home TV set, and is mooted to cost between $300 and $400 — well below

existing units. Apparently TI is calling it a "home information centre", presumably to give it greater appeal to non-technical consumers.

Dick Smith Electronics is planning to have the Edixy Sorcerer home computer on display. This is based on the Z-80 microcomputer, and comes with 8K bytes of RAM and 4K bytes of ROM with a monitor. A plug-in 8K ROM cartridge provides an extended BASIC interpreter offering high resolution graphics, powerful string handling and PEEK and POKE capabilities.

DSE will also be displaying its kits for the EA 2650 Mini Computer system, designed to appeal to the hobby enthusiast in particular. The firm will also be displaying the Fairchild Channel-F programmable video game units, with their very wide range of fascinating colour video games in plug-in cartridges.

Abacus EDP Services is planning to demonstrate the new Sord M100 personal computer, from Sord Computer Systems in Japan. Based also on the Z80 microprocessor, the M100 comes with

Sontron's Sol System IV

either 16K or 32K bytes of dynamic RAM, in addition to 4K bytes of ROM containing a monitor. It runs extended-BASIC, which is supplied on a cassette and loads in about two minutes.

The M100 has two cassette interface ports, which are capable of operating at either 300 or 1200 baud. It also has a full monochrome TV interface inbuilt, with 2K refresh memory and graphics capability. Other features include a standard RS-232 serial interface, parallel input and output ports, a Centronics printer interface, two 8-bit analog-to-digital converter input channels, a 2-octave music generator output with speaker, and an S-100 bus connector.

Abacus is also likely to be showing the larger Sord models, including the new Mark-II model M223 and the M203. These are intended for small business use. The M203 comes with 64K bytes of memory, single or double mini floppy disc drives, and monitor. The M223 is virtually an expandable version of the M203, with the potential of driving up to eight I/O channels and four floppy disc drives.

Futuretronics Pty Ltd is planning to display a wide range of consumer products based on microprocessors and related technology, including games, toys and a personal alarm. The firm distributes the Chess Challenger, Checker Challenger and Gammon Master games, also the video games from Atari. It is also offering the games Megapolis, Marinattack and Tankattack, board games played using an electronic strategy "computer".

South West Electronics is planning to display the new MSI 6800 computer system, from Midwest Scientific Instruments. This is described as an improved system based on the Motorola 6800 microprocessor, with a wide range of functional modules and support software.

Hardware modules in the MSI 6800 system include a CPU board, power supply, 8K byte RAM and EPROM memory boards, PROM programmer and verifier, floppy disc interface, parallel interface, and a variety of peripherals. Software includes an extended BASIC in both interpreter and compiler versions, floppy disc operating system, interpretive debug, mini assembler and disassembler.

Sontron Instruments and the Byte Shop are planning to demonstrate the Sol range of small computers, produced by Processor Technology Corporation. The range on display may include the new Sol System IV, a powerful system offering four full size floppy discs, 50,176 bytes of RAM, a disc operating system, extended disc BASIC, video monitor and full documentation.

The same firm is also planning demonstrations of speech recognition

Abacus EDP's Sord M100

and synthesis, and systems with particular emphasis on business and educational applications.

Caldor Corporation is planning to have the new Unitrex chess computer on display, along with its range of calculators, the Bally video arcade machine and a microwave burglar alarm system.

Warburton Franki is planning to display the Heathkit computer systems, including the H-8 and H-11 computers and the matching range of peripherals.

Computerland will be displaying the Apple-II home computer system, whose colour graphics will no doubt attract plenty of attention.

Other exhibitors currently signed up for the Home Computer Show are Rod Irving Electronics, Pennywise Peripherals, and Delta Scientific Products.

All in all, the Home Computer Show seems likely to be an impressive event, and one which should really give the public an insight into the way computer technology is coming into their lives.

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Microcomputer News & Products

Intel's 16-bit micro

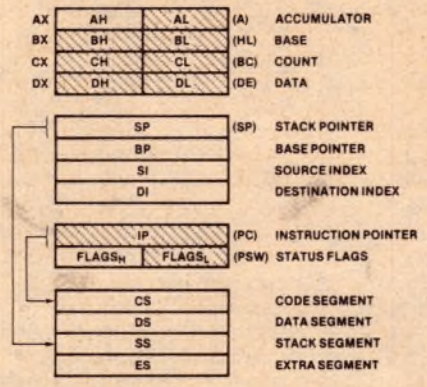
The new 8086 16-bit microprocessor from Intel Corporation has been designed to extend the existing 8080 family into the high performance 16-bit area. It has attributes of both 8 and 16-bit processors. For example it executes the full set of 8080A/8085 8-bit instructions, and is therefore software compatible with the 8-bit processors, while offering a powerful set of 16-bit instructions as well.

The added features include 8-bit and 16-bit arithmetic, both signed and unsigned, including multiply and divide, efficient interruptible byte-string operations, and improved bit manipulation. There are also mechanisms for re-entrant code, position independent code and dynamically relocatable programs.

An important feature of the 8086 is its ability to directly address up to one megabyte of memory — 1,048,576 bytes, using 20-bit addresses. The addressing scheme used can allocate within this memory space four functional segments, each of up to 64 kilobytes, and each associated with a separate indexing register. The segments are designated for code, stack, data and alternate data.

16-bit operands can be located on both even and odd byte — address boundaries, and are not constrained as in some other 16-bit processors.

The 8086 has 24 operand addressing modes. It has 14 internal 16-bit registers, including the four segment index registers.



Here are the 8086's internal registers, with those shared by the 8080 shaded.

The device is in a standard 40-pin DIL package, with data and address information multiplexed on a common 16-bit bus. However execution speed and memory utilisation are kept high by an instruction stream queuing mechanism, whereby instruction fetching effectively occurs simultaneously with execution.

In effect, the 8086 consists of two processors, one performing instruction execution and the other bus interfacing and instruction fetching. Whenever the execution processor is not communicating with the memory bus, the bus interfacing processor is able to fetch instruction bytes and place them into a 6-byte "queue" in an on-board FIFO (first-in first-out buffer). The bus interfacing processor thus keeps the execution processor continuously "stoked up" with instructions, and does this by making use of normally unutilised bus periods.

Intel claims that this gives the 8086 a potential 10-fold increase in performance over the 8080.

Further information on the 8086 is available from Intel agents Warburton Franki, who have offices in most states.

Display/keybd chip

A new single-chip controller for display and keyboard interfacing has been announced by Matrox Electronic Systems. The MTXA1 is described as a general purpose programmable alphanumeric display and keyboard interface device, suitable for use with any 8-bit microprocessor. It will drive up to 32 5 x 7 dot matrix alphanumeric LED displays, and also scan up to 64 keys.

The MTXA1 comes in a 40-pin DIL package and operates from a single +5V power supply, drawing only 60mA. It includes a character generator for the 64 character set of 6-bit ASCII, and also has its own internal 32 x 8 refresh RAM. All timing for the display refresh and keyboard scanning is controlled by an on-chip clock oscillator, using an external crystal or LC tuned circuit.

The controller can execute a total of 22 instructions for display and keyboard manipulation. The commands have a

fixed 8-bit word length. Functions include clear display, rotate display left or right, shift left or right, move cursor left or right, read display memory, get display length, get key address, load display memory, and load keyboard status.

Price of the MTXA1 in one-off quantities is $55. Further information is available from Measuring and Control Equipment Co Pty Ltd, PO Box 78, Epping, NSW 2121. Telephone (02) 86 4060.

Reservoir capacitors

Those building their own microcomputer power supplies and looking for reservoir capacitors should be interested to learn that ACE Radio has 22,000uF/40VW units available at only $8 each plus packing and postage if applicable. Further details from ACE Radio, 136 Victoria Road, Marrickville, NSW 2204.

Zilog distributor

Zap Systems Pty Ltd has advised that it has recently taken on the responsibility of distributing Zilog systems and components for Australia.

Among the new range of Z80 support devices is the Z80-SIO dual-channel serial I/O chip, which provides two independent full duplex serial I/O ports with full software control. The device operates up to 550k bits/second, and operates in asynchronous, bisynchronous and SDLC/HDLC communication modes.

It is compatible with many processors, including the Z80/Z80A, 8080A, 8085A, 6800, 6500 and 9900.

Further details from Zap Systems Pty Ltd, 3 Smail Street, Broadway, NSW 2007. Telephone (02) 211 1066.

Computer party

Computerland Australia held its second birthday party at the Sydney showroom on Saturday, September 23, and over 250 people took part in the celebration. All who attended were kept busy with computer colour graphics competitions, hardware and software demonstrations and lively discussions with old and new friends sharing the common interest in microcomputers.

Michelle, the four-year-old daughter of Computerland's managing director Rudi Hoess, cut a multi-tiered birthday cake and the guests toasted the success of Computerland in champagne. Helium filled balloons were released, carrying discount vouchers entitling the finder to a 10% discount on any purchase made before October 23.

At the party Mr Hoess announced the formation of the Apple II Computer Users Club, designed to bring those using the Apple machines together for mutual help and co-operation.

Further details of the Apple II Users Club are available from Computerland Australia Pty Ltd, 55 Clarence St, Sydney.

Classical Recordings

Reviewed by Julian Russell

Szymanowski — Violin Concertos Nos. 1 & 2: recommended

SZYMANOWSKI — Violin Concertos Nos. 1 and 2. No. 1 with violinist Wanda Wilkomirska, the second with Charles Treger. The Warsaw National Philharmonic Symphony Orchestra, the first with Witold Rowicki, the second with Robert Satanowski. World Record Club Stereo R 02941.

Until I was sent this record to review, just about all I had ever heard of the Polish composer Szymanowski (1882-1937) was a brilliant violin solo called the Fountain of Arethusa, recorded about the middle 1930s by Szigety — on a 78, of course.

When the great pianist Artur Schnabel visited Australia about 1940 he lived near me in Elizabeth Bay and I got to know him well — socially I mean, for he was a very complex and perceptive person. He often told me — remember in 1940 — that in his opinion (Schnabel's) Szymanowski was one of the greatest composers of his age.

Schnabel himself was a spare time composer, but mostly in the 12-tone style. I was therefore more than usually curious to hear what might be on this disc.

Szymanowski came from an upper class environment. He studied in Warsaw where one of this best friends was Arthur Rubinstein. In those days Warsaw was a conservative stronghold where outside influences were ignored in favour of such composers as Mendelssohn and other stalwarts of the classical and romantic style. But by 1913 Szymanowski had asserted a strong individual style and founded, in Berlin, an association of young Polish composers.

All this is borne out by the difference between the first and second concertos recorded here. The first was written about 1916, the second about 20 years later. Szymanowski's development during the intervening period is strongly evident.

There is, however, nothing immature about the first concerto. It has a very complex orchestral accompaniment rightly described in the sleeve notes as showing Debussy and Scriabin influences. Over this accompaniment soars a very long and ecstatically floating melodic line. It offers beautiful sound. Underneath it the harmonies change kaleidoscopically, a characteristic in which the influence of Richard Strauss can be detected.

The formidably difficult solo part is played expressively with great authority by Wanda Wilkomirska. The orchestra glitters under Ritold Rowicki while, to repeat, the violin soars over it like a lark in full song giving an effect of continuing ecstasy.

The writing everywhere is very free but sure-footed, and I listened to the whole work with delight.

The second concerto is much more spare, as is the habit of most notable composers as they approach the end of their life. Like the first concerto it is one long movement, but in the second everything is treated with much more economy. Gone is the rich ornamentation and brilliant colouring of the first.

It is, however, unmistakably from the same pen. The juiciness of most of the harmonies is dispensed with. But the soaring solo line remains, though rather more impersonally than that in the first.

The same density of scoring is carried over from the first though without the former's glitter. It lacks the immediate appeal of No. 1 though it well repays repetition.

The equally difficult solo part is this time played, also in masterly fashion, by Charles Treger with the same orchestra conducted by Robert Satanowski. To those seeking the unusual I can recommend this disc with the greatest enthusiasm.

Bax — Symphonic Poems: "beautifully played"

BAX — Symphonic Poems. Tintage-1. The Garden of Fand. Mediterranean, and Northern Ballad, No. 1. London Philharmonic Orchestra conducted by Sir Adrian Boult. World Record Club Stereo R 02171.

Here is a disc full of some of the most picturesque music produced in England during the late 20s and early 30s of this century. It is music to warm the heart and set the imagination racing.

The two major poems are both sea pieces. Lusciously scored Tintagel starts with a low swell at sea and, as it approaches the land, turns into waves crashing on to the rocks of the Cornish coast. And above all the turmoil, the ruins of King Arthur's legendary castle still challenge the ocean after many centuries of defiance.

It is graphic music — unfashionable nowadays — and although it sometimes advertises the composer's admiration of Debussy and Ravel, it still retains its own strong individuality. It is a realisation in music of a great legend, hinting at a dim past but drawing in bold strokes its present haunting spectacle.

Boult's conducting of it — and of the other pieces on this disc — is obviously a labour of love.

It has often been dismissed in some quarters as "film" music. But so has Vaughan Williams' "Antarctic" Symphony, with perhaps more justice. But what is wrong with film music if both the film and the music are good? Few will not find Tintagel moving, beautifully played as it is here.

The sleeve notes include an abbreviated form of the program that prefaces the score of The Garden of Fand and which some listeners may find interesting. I quote: "The Garden of Fand is the Sea . . . In the earlier portion of the work the composer seeks to create the atmosphere of an enchanted Atlantic . . . Upon its surface floats a small ship . . . The little craft is borne on beneath a sky of pearl and amethyst until on the crest of an immense slowly surging wave it is tossed on to the shore of Fand's miraculous island. Here is human revelry, and the voyagers are caught away, unresisting, into the maze of the dance. A pause comes, and Fand sings her song of immortal love . . . the dancing and the feasting begin again and, finally, the sea suddenly

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29-3636.

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In fact, BASF's chromium dioxide tape set the Hi-Fi standard to which most manufacturers still refer.

Where this improvement has taken place is mostly in the magnetic surfaces used to coat the tape. And, this is where another controversy reared its ugly head; the chrome controversy.

BASF have a straightforward position on chromium dioxide; it's the best.

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By today's high standards of cassette technology, this is the ultimate cassette.

On the surface of things chromium dioxide is better.

Chromium dioxide is man-made and the individual particles are 'grown' in much the same way as crystals are 'grown'. Ferric oxide on the other hand, has to be ground down to a suitable particle size. Whereas each chromium dioxide particle is a long, thin crystal, a ferric oxide particle is usually made up of a number of shorter crystals that have irregular off-shooting branches.

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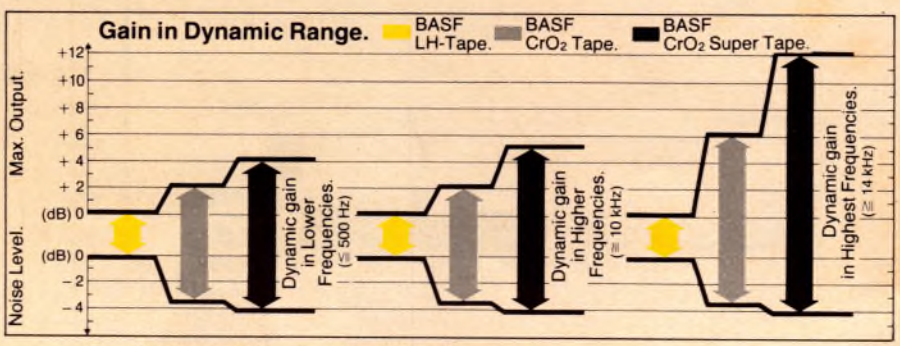
Each CrO_2 particle is one, individual non-porous crystal with one magnetic 'domain'. Because a ferric oxide particle is made up of a number of crystals each capable of holding their own signal, de-magnetization can occur, lowering the tape's recording efficiency.



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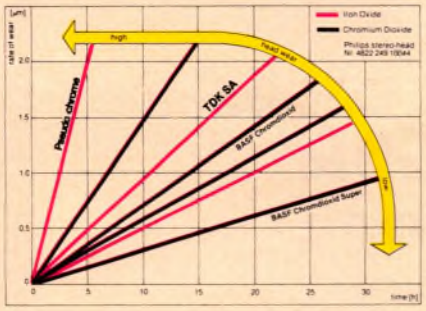

Du Pont, the giant American chemical company wrote: "Our tests showed CrO_2 to be fully competitive in headwear characteristics with non oxide tapes, and in many cases superior." The choice of the oxide formula is not a significant factor in headwear. The main cause of contention over this issue results from a confusion between chrome, which is a hard material, and chromium dioxide, which is a different material with completely different properties. The hard chrome is not inserted into the highly sensitive tape surface.

One tape is as good as the next.

Chromium dioxide is a uniform surface for the tape, which means that the quality and performance is uniform.

One BASF chromdioxid cassette bought one day, will perform as well as another BASF chromdioxid cassette, bought another day. And, the Security Mechanism, SM, which is patented to BASF, ensures the smooth running of the mechanics inside the cassette making sure the tape is transferred smoothly and accurately from one spool onto another.

SM Special Mechanism
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overwhelms the whole island . . . The twilight falls, the sea subsides, and Fand's garden fades out of sight."

Fanciful, perhaps, but it's all there in the music. It is, on the whole, more lightly scored than Tintagel but conveys the same sense of enchantment, especially in passages of almost unbelievable delicacy.

If these two call up legends of a Celtic past, Mediterranean is a sunny trifle, unique in its invocation of Spanish music without actual quotation of that idiom. It is a perfect holiday "recollected in tranquility". Don't expect too much of it except its exquisite lightness of touch and not too seriously considered melodies.

Northern Ballad No. 1 is different again. In it, Bax pictures the Scottish Highlands as they were before Butcher Cumberland's shameful massacre in 1845. Every man always stands ready with his claymore and dirk ready for bloody-handed conflict between clans and families. And all in a country of unique beauty. Even the manly lament beginning on the oboe calls up a vision of a stern people mourning their dead.

It has a true Scottish flavour throughout and makes a fitting conclusion to this glamorous disc.

☆ ☆ ☆

SWINGLE II — Part Songs by English and French composers. RCA Red Seal Stereo. LRL1 5112.

I was unable to hear Swingle II live in Sydney during their recent Australian tour for Musica Viva. Having listened to this recording, I now realise how much enjoyment I missed. The combination consists of a double vocal quartet.

On one side of this disc the songs are English, on the reverse, French. Side 1 starts with three Vaughan Williams settings of Shakespeare songs. These are, like most of the other Swingle offerings, unaccompanied and in them VW shows his genius for winning countless differing sonorities from the group.

The first, Full Fathom Five, features the singers with bell like sounds, quite extraordinarily lifelike. One bone from a soprano is almost fairylike. The music swells up into a clash of voices miraculously like that you might hear when passing a cathedral.

The second, the Cloud-capp'd Towers, features a slow moving melody resonantly harmonised with the most sensitive imaginable control of nuance — and breath. In the wisplike Over Hill, Over Dale VW uses his characteristic modal style in a manner that seems to recreate a true Tudor atmosphere.

Stanford's The Bluebird comes next. I am of the generation which, during the early years, disparaged the music of Stanford as being much too conventional. We adored, instead, Elgar, Holst and Delius. Indeed I fear I have neglected Stanford's music ever since. Well, any critic is entitled to his prejudices, but this part song is a really delightful miniature. On hearing it sung by this unique combination I was quite captivated.

The next piece, Ode to St Cecilia by Britten, is too well known to concert audiences and churchgoers to need any description from me. Like all the other items on this disc it is deliciously presented with generally more solid tone than you hear in the previous items. But this treatment does not exclude sensitive inflections and sudden passages of great weight. Fast bars are attacked with the crisp accuracy of a first class orchestral woodwind choir. An exquisite Elgarian trifle, The Shower, brings the English part of the recital to an end.

The reverse side starts with Debussy settings of three poems by Charles of Orleans who, it may be recalled, owing to the fortunes of war, spent most of his life in an English prison. They are typical Debussy, making much use of his innovative idiom of parallel motion and open fifths which somehow, despite their "modernism", emphasise the atmosphere of Charles' period. I choose to mention the third specially because there you hear the troupe's suberb accuracy at speed, including impeccable staccatos.

Athough Debussy and Saint-Saens were contemporaries the latter was no innovator, though his contribution here — two short chansons — has much charm in a conventional way.

Ravel is represented by Three Songs which, to my knowledge, has not been recorded since they were first issued, sung by a Lyons choir back in 78 days. They are so delightful that I have long been waiting for a more modern recording of them since the 1930s. The Swingles do not use all the same tempos as did the Lyons choir but their differences are always logical if not quite as subtle. Again in the third, a Rondo, you will find another example of the Swingles' astonishing accuracy at speed. An enchanting re-encounter.

A group of four songs by Poulenc is something of a surprise. The composer here is in a more serious mood — except in his religious music — than is usual and discards his customary flippancy. Particularly lovely is the third song, in the manner of a lament, which evokes a picture of a winter-stripped wood.

The fourth makes its point in a mood of night, cold and loneliness in a challenging manner different from all that has gone before. It makes a fine ending to a ravishing disc.

Beethoven: Piano Sonatas Nos. 30 and 32

BEETHOVEN — Piano Sonatas No. 30 in E and No. 32 in C Minor. Artur Schnabel (piano). RCA Victrola Mono AVM1 1410.

Beethoven Piano Sonatas played by Schnabel were re-issued in the early days of LP in a series called Great Recordings of the Century. Now a remastered version of Op. 109 and 111 are available on an RCA-Victrola disc which has much improved sound. Though the piano tone is still a little dull it is surprisingly lifelike. (The originals, by the way, were recorded in 1942.)

Schnabel, during his lifetime, was regarded as the world's greatest exponent of these works. He was a "strict score" man going back to Beethoven's original manuscript to study the composer's intentions. To these, in performance, he applied an intensity of perception that earned him his world wide reputation. He has indeed provided models for some of today's best interpreters of the master's works.

Now despite the work Schnabel put into his studies and performances he was not always note perfect. Indeed there were times when he omitted some passages altogether, particularly here and there in the bass. It was this that earned him the flippant nickname of a "biblical pianist" — never let your right hand know what your left hand is doing.

This, however, didn't seem to matter when one was under his very potent spell. His command of sonorities was infinite. His phrasing, however slightly it might differ from his competitors, revelatory. And all this was aided by a mind of very great culture, not only musically but seemingly in every branch of knowledge he discussed.

These two greatly improved engineering products present Schnabel at his best. Both are works which, in addition to their beauty, demand great insight into the mind of the composer as well as his interpreter. That we still have them is a great stroke of good fortune. They possess virtues that would be idle for me to repeat here, so often have they been expressed before. I therefore recommend them to all students of the works and to all those for whom the name "Schnabel" is legendary.

Lighter Side

Reviews of other recordings

Devotional Records

O HOW HE LOVES YOU AND ME. The Celebration. Stereo, Singcord ZLP-3005S. (From S. John Bacon Pty Ltd, 13 Windsor Ave, Mt Waverley 3149. $7.95).

"The Celebration" are introduced in the jacket notes as a group of four male and four female gospel singers from the Taylor University in Indiana, USA. The vocal arrangements and two featured solos are by their conductor Ben Markley and backing orchestrations by Bob Krogstad.

While many modern gospel groups rely on a driving rock style for their appeal, The Celebration have as their forte more traditional vocal blend and discipline, with the interplay of voices having an almost orchestral quality. They are superbly complemented by the orchestral arrangements of Bob Krogstad, as they present:

The Saviour Is Waiting — When I Remember — Wonderful Peace — When The Saints; Oil In My Lamp; Just A Little Talk — Another Day, Another Song — Near To The Heart Of God — Healing Love — Together We Can All Be Free — Jesus Loves Me — Oh How He Loves You And Me.

A performance like this, by eight college singers, conceding nothing to professionals from the popular music field, emphasises the technical standard which Gospel music has reached in the USA. Recommended for family listening. (W.N.W.)

☆ ☆ ☆

HYMNS WE LOVE. The Magic Organ Plays. Stereo, Harlequin (Festival) L-25152.

The "Magic Organ" — a modern electronic played strict tempo in the manner of a continental fairground instrument — has built up quite an array of albums in the popular field. I wondered what the almost anonymous organist Jerry Smith would do with "Hymns We Love".

I have a feeling that Jerry Smith wasn't too sure himself! Even the brighter hymns don't lend themselves to the "Magic Organ" formula, with the result that they come churning out

to background of strict tempo synthetic percussion, with the melody carried by anything from a simulated harmonium to a simulated whatnot! Certainly the hymns are well known:

Do Lord — I'll Fly Away — In The Garden — When The Roll Is Called Up Yonder — The Old Rugged Cross — Standing On The Promises — He Keeps Me Singing — He Set Me Free — What A Friend We Have In Jesus — Bringing In The Sheaves — Sweet Hour Of Prayer — Little Brown Church In The Vale — Amazing Grace.

Somehow I feel that this one will fall awkwardly between two stools — appealing neither to the "Magic Organ" audience nor to collectors of Gospel albums. (W.N.W.)

☆ ☆ ☆

HE WALKS BESIDE ME. Favourite Songs of Faith and Inspiration. Elvis Presley. Stereo, RCA Victor APL1-2772.

According to the jacket notes, this is a recent re-issue of tracks heard on earlier albums plus, I gather, at least two "live" performances not previously released: "The Impossible Dream" and "If I Can Dream".

The other track titles, variously backed by the Jordonaires and the Imperials Quartet include: He Is My Everything — Miracle Of The Rosary — Where Did They Go Lord — Somebody Bigger Than You And I — An Evening Prayer — Padre — Known Only To Him — Who Am I — How Great Thou Art.

There is a tremendous difference between the polish of some of the older tracks and others apparently recorded at a less propitious stage in his career. I doubt that the album will do much to enhance his memory.

Devotional? I wonder whether many other than dedicated Elvis fans will take it seriously as such. Over to you! (W.N.W.)

Instrumental, Vocal and Humour

ANNAPOLIS SOUNDS. Stereo, Richardson RRS-3-2 (27941). (From M.R. Acoustics, PO Box 110, Albion, Qld 4010.)

In a way, this is a sampler for Richardson Records which, as readers of this column may recall, attempt to capture sound with a minimum of electronic manipulation. It is also a sampler for the kind of music available in Annapolis, USA.

Side 1 opens with a performance by the US Naval Academy Glee Club presenting: The Star Spangled Banner — Cantate Domino — Alleluia, The Lord Is King — A-Roving — Shenandoah — Old Man Noah — America The Beautiful. A fine, unaccompanied choir.

This follows a brief segment by the Singers Madrigale, with six madrigals dating back to as early as "circa 1300". Beautifully sung.

The Annapolis Brass Quintet open side 2 with five brief excerpts which demonstrate their complete mastery of the instrument.

Then the Aeolian Woodwind Quintet offer a beautifully smooth "Divertimento No. 1 in B-Flat Major" by Haydn.

Last but not least is a performance of Buxtehude's Prelude and Fugue in A-minor" on the newly built Freiburger organ at St Anne's Church. Expertly played by John Cooper, the church organist, it is an arresting sound, epitomising the sheer sonic brilliance of a modern pipe instrument.

All told, it is a varied and most entertaining album, superbly recorded. One that I can certainly recommend. (W.N.W.)

☆ ☆ ☆

STAR WARS. Ferrante & Teicher. United Artists stereo L 36548.

Duo-pianists Ferrante & Teicher must be short of ideas. If ever a record was arranged around a tenuous theme, this must be it. They have taken the main title theme from the film "Star Trek", added a bunch of other numbers of a celestial nomenclature and presto, another F&T album just like any other.

As far as the orchestral arrangements are concerned, I would rather not have them. Ferrante & Teicher can certainly play piano. Well, let 'em play. Get rid of

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

LIGHTER SIDE — Cont.

the orchestra.

Twelve tracks make up this astronomical selection: Theme from "Star Trek" — Swinging On a Star — Claire Disco Lune — You Are My Lucky Star — Star Eyes — Moonshine Sonata — Stairway To The Stars — Stardust — Moon Beams — Stars Fell On Alabama — When You Wish Upon A Star — Theme from "Star Wars".

Recording quality is okay but not out of this world! (L.D.S.)

☆ ☆ ☆

DANCING IN THE DARK. Carmen Cavallaro. Mono, MCA Records, MCA-532. (Astor rleease). Also available on cassette.

I am not sure about the age of this recording but I have another by the same artist "Waltzing In The Dark" dated 1963. This one is in the style which made Carmen Cavallaro so popular at the time: gentle basic rhythm, rippling fingers and a rarely matched ability to ornament the basic melody. And the melodies themselves will represent a trip down memory lane:

Dancing In The Dark — The Very Thought Of You — If I Had You — Smoke Gets In Your Eyes — Falling In Love With You — Stairway To The Stars — Cocktails For Two — Lover — Alone Together — You're Mine You — September Song — Always In The Heart.

The recording is clean and quiet and one can overlook the mono on quietly played cocktail piano; in fact, I didn't even notice it for a while. But what I did notice immediately was a vague uncertainty in the pitch of the piano, denoting wow in the recording. Some may not worry about it but, if you have any doubt, listen to the sustained opening note on "Lover". (W.N.W.)

Famous Australian pianist "lives" again

PERCY GRAINGER. Percy Grainger, piano, and the Sydney Symphony Orchestra conducted by John Hopkins: Concerto in A minor Op. 16 by Grieg. Leopold Stokowski and his Symphony Orchestra conducts Percy Grainger favourites. RCA VRL1 0168.

If you read the story in our October issue on Denis Condon and Peter Phillips and their reproducing vorsetzer, you'll probably find this record of great interest. Side 1 features a recording of the Grieg Piano Concerto in A minor, as performed at the Sydney Opera House earlier this year and recently televised on national television, featuring the "ghost" of Percy Grainger playing with the Sydney Symphony via a Duo-Art reproducing roll and Denis and Peter's vorsetzer.

The roll used for the performance was actually three rolls combined, which were released by Duo-Art in 1921. As the rolls had been a piano solo arrangement of the entire concerto, they were painstakingly corrected to remove the orchestral parts — quite an achievement, apart from the development of the vorsetzer itself.

And the end result? Well, to my ear it is simply superb. The re-creation of Grainger's lyrical playing is entirely convincing, and the SSO under John Hopkins seems to achieve virtually perfect assimilation with it. The recording itself is also very clean, making the entire performance an outstanding achievement and a credit to all concerned.

Side 2 contains seven of Percy Grainger's best-known pieces, played by Leopold Stokowski and his orchestra and recorded in 1950. The pieces include "Handel in the Strand", with Grainger himself as the piano soloist, also "Country Gardens" and "Early One Morning". The arrangements are Grainger's own. The recording is a little dated, as one might expect, but still of a high standard. (J.R.)

DIRECT-TO-DISC

CROSSFIRE. Direct to Disc. Trafalgar Records D2D001. (Distributed by RCA.)

In strong contrast to the earlier direct-to-disc album, recorded by Astor in Melbourne and reviewed in these columns the producers of this new Trafalgar album have been remarkably self-effacing. They list the track titles, the members of the "Crossfire" group, and the main items of recording equipment. They add a few acknowledgements and that is that.

But there is certainly no need to be modest about the end result. The sound emerges from complete silence, notably free any hint of distortion or any sense of system stress. The frequency response is wide and the stereo definition excellent.

Crossfire uses Wurlitzer piano, flugelhorn, drums, percussion, saxophones, flute, bass and guitar to play five tracks: It Coitanly Was — On The Wings Of An Alabatrocity — Oddball — Satie-ated — Fahannakookin.

Don't worry if the titles are unfamiliar; the music might be described as restrained jazz, using the word to describe the sound as heard rather than the musicianship required to produce it. The whole point is that, if you are interested in an excellent, locally produced example of direct-todisc recording, even a jazz non-enthusiast will be well able to adjust to the program content.

Well worth a hearing. (W.N.W.)

☆ ☆ ☆

THE WORLD OF BURT BACHARACH. The International Pops Orchestra Stereo, Image (Astor) ILP-4961.

If you like the music of Burt Bacharach, you'll be a sitting shot for

this album by the International Pops Orchestra. With a smooth, happy sound they ran through a dozen well known numbers: Raindrops Keep Falling — Do You Know The Way To San Jose? — What The World Needs Now — Walk On Love — The Look Of Love — Wives and Lovers — Alfie — Let Me Go To Him — I Say A Little Prayer — Everybody's Out Of Town — I'll Never Fall In Love Again — This Guy's In Love With You.

The sound, balance and spread is all good and, if you have a place in your collection for some more Bacharach music, this should fill the bill, for either featured sound or mood background. (W.N.W.)

☆ ☆ ☆

GOLDEN HARP. Gonzalez and his Ensemble. Stereo, World Record Club W.R.C. S/5631.

The jacket notes introduce Argentine harpist Ricardo Gonzalez as "the poet of the harp". Whatever the term may mean, this recording leaves no shadow of doubt as to his ability and style which the notes aptly describe as "crystalline". The combination of harp and backing percussion strings, Gonzalez and Argentinian music makes for a different and infectious sound.

I guess that I could list all 14 of the tracks but I doubt that the indigenous names would mean any more to you than they did to me. It may be more meaningful to say that their basic rhythms, reflecting both South American and European influences, include polka, cancion, waltz, samba, chamane, guarania, tango and galop.

Whether those terms are all meaningful matters little either. You'll enjoy them anyway, the more so because the balance, the stereo spread, the transients and everything about the recording is excellent. Recommended. (W.N.W.)

☆ ☆ ☆

BOB CROSBY, THE BOB CATS. Their Greatest Hits. Re-processed mono MCA Records MCA-253. Astor Release. Also on cassette.

Those who remember Bing's brother Bob for his brief venture as a night show compere on Sydney TV may have only a vague impression of his previous reputation as a well known and successful Dixieland band leader. This album offers an excellent opportunity make good the lack and to enjoy an excellent program of 1938 style jazz.

There are a dozen numbers on the two sides, together with jacket notes backgrounding the titles and the featured musicians: March Of The Bobcats — What's New — Yancey Special — My Inspiration — Gin Mill Blues — I'm Prayin- Humble — South Rampart St Parade — Honky Tonk Train Blues — The Big Noise from Winnetka — Boogie Woogie Maxixe — Summertime — Little Rock Getaway.

Said to be recorded in 1938, at the height of the Bobcat's popularity, the quality is nevertheless surprisingly good, with normal bass and treble and very little in the way of noise and distortion. Reverberation has apparently been added during the re-processing which lends a convincing spatial effect. Well worth a hearing if you're interested in the material. (W.N.W.)

☆ ☆ ☆

WEEKEND RENDEZVOUS. Racing Cars. Chrysalis L36345 Festival release.

This is Racing Cars third album, and they are developing into an exciting rock group. Tight harmonies are backed by clean, crisp guitar work and strong, driving percussion. The overall sound is delightfully balanced and pleasing to the ear.

Graham Hedley Williams stands out, especially on "Ticking Over" and "Clever Girl", with spirited lead guitar work. Overall, the album is a pleasure to listen to. It has variety, skill and is superbly engineered. Other tracks include Down By The River — Didn't I Tell You — Weekend Rendezvous — Take Me From The City — Standing In The Rain — Backwater Road — High And Dry — Nobody's Business. (D.W.E.).

☆ ☆ ☆

BUDDY MERRILL TODAY. Buddy Merrill. Interfusion L35769. Festival release.

Buddy Merrill is a skilled guitarist who has many credits to his name. He played for many years as a featured guitarist with Lawrence Welk, and this is his seventeenth album.

It consists of about 12 tracks, five composed by Buddy himself, and the remainder recent hit parade standouts. The music is always a skilful blend of rhythm and melody, with Buddy's guitar work the feature.

Tracks are: Space Monkey — Could It Be Magic — Happy — (Hey Won't You Play) Another Somebody Done Somebody Wrong Song — Wildfire — Blue Midnight — Space Boogie — Song Of Sirocco — Solitaire — Big Red Apple — Ain't No Way To Treat A Lady — Please Mr Postman — A Dream Ago — Blue Rain. (D.W.E.)

CLOSE UP THE HONKY-TONKS. The Flying Burrito Brothers. A&M L45816/6. Festival release.

This two-record set covers the history of the Burritos from 1968 to 1972. Comprehensive cover notes are included on both the tracks and the musicians. The latter include Gram Parsons, Chris Hillman, Sneeky Pete Keinow, Michael Clarke, Chris Ethridge and Bernie Leadon, while the former includes tracks previously unreleased.

The tracks are too varied to list or even categorise. All that can be said is that they cover the full spectrum of country rock, and then some! I found the album most interesting, and would recommend it for those interested in early country rock from one of the best known groups in this field. Technically, the records were good, with minimal surface noise, and a good clean sound. (D.W.E.)

☆ ☆ ☆

NATURAL FORCE. Bonnie Tyler. RCA Victor VPL17165. RCA release.

Bonnie Tyler has made a mark for herself of late on the charts with the single "It's A Heartache", and this is included on this record. She has a very expressive, gravelly type voice, and offers a range of songs.

The record was produced by Ronnie Scott and Steve Wolfe, who are also given credits for composing about half the tracks. Other composers featured include Stevie Wonder, Brian Cadd and Carole King. Overall, I found the record most enjoyable, although it may not appeal to all tastes. Recording quality is good, but not exceptional. (D.W.E.)

☆ ☆ ☆

TINA RAINFORD, SILVER ANGEL EPIC ELPS-3869. CBS release.

Eleven tracks with a solid, rocking disco sound would be the best description of this album from Tina Rainford. The titles are: Big Silver Angel — Be My Baby — Dance — To Have To Hold & Let Go — Come Softly To Me — Silver Bird — Lovely Daughter — San Francisco Bay — Tell Me A Lie — Guitar Man — Leave Me The Way You Found Me.

Technically, the quality is good, except when Ms Rainford is drowned by the backing group,which includes such people as "Rockin' Rudi", "The Buck", "Flying Fingers", "The Birdman", "Le Rock", "The Hammer", "Bongo. For your further enlightenment, the mastering was carried out by Ted "Mr Clean" Jensen. (N.J.M.)

World Record Club recordings reviewed in these columns can be obtained only through the Club, membership of which involves purchasing not less than one record per year. For details: World Record Club Pty Ltd, 605 Camberwell Road, Hartwell 3124. Tel. (03) 29-3636.

Special quality album

COLLABORATION. Kunihiko Meets Eiji. Stereo, Audio Lab ALJ-1007. (From M.R. Acoustics, P.O. Box 110, Albion, Qld 4010.)

This is another in the series of special quality albums produced by Audio Lab in Japan. It is extremely well packaged in a double fold album, with jacket notes covering the inside faces. Unfortunately for Australian buyers, the jacket notes are in Japanese and all I can tell you about the two "collaborators" is that one is a top-line pianist, as at home with the "cocktail lounge" kind of playing as he is with free wheeling jazz. The other has skills to match on clarinet. Add an accomplished but unnamed player on double bass and a drummer to match, and you have as much as I can discover about the group.

There are six numbers on the two sides adding up to about 38 minutes of playing time:

Perdido — These Foolish Things Remind Me Of You — Autumn Leaves — Gone With The Wind — My Funny Valentine — Blues.

Two of the numbers are in sentimental mood, the other four in predominantly jazz style but all highly listenable. As you would expect of this label, and of the price in Japan as well as Australia, the quality is outstanding. (W.N.W.)

THE SENSUOUS SOUNDS OF SILVETTI, Spring Rain, Hispavox L36469 Festival release.

Hispavox engineers have done it again, with another "pop" type record, displaying technical skills that put the record in the demo class. The bass is very tight and clean and being a "Disco" release there's plenty of bass and percussion to prove it.

The eight tracks are: Spring Rain — Primitive Man — A Smile At Dawn — Two Cups Of Coffee — Voyage Of No Return — Coconut Rain — Fortune Teller — Contigo. The wordless chorus doesn't add much but if you're "into" the "Disco" scene, give the record a hearing; you will most likely buy it. (N.J.M.)

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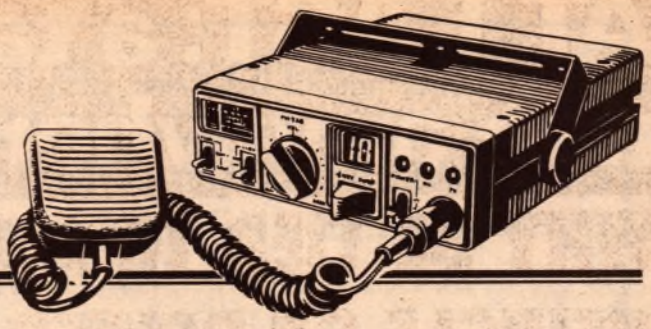


THE IONOSPHERE, SUNSPOTS AND LONG DISTANCE CONTACTS

From time to time, reference is made in books and magazines to the Ionosphere, to sunspots, and the effect that they have on the transmission and reception of radio signals. What's behind these terms and, in particular, how significant are they to operation on the 27MHz CB band?

by NEVILLE WILLIAMS

In seeking an answer to such questions, it is very easy to get rapidly lost in a maze of technical terms, and to end up nowhere in particular! Let's try to keep it simple, for a change, and save you any special feats of memory.

Fortunately for our well being, the earth is surrounded by a layer of air, comfortably dense at ground level but becoming rarefied at increasingly higher altitudes.

Normally we regard the air as being transparent to radio waves and, at the altitudes at which human beings normally live and travel, this is substantially true. Radio waves travel through it without being greatly affected, from radio and television stations to receivers in the surrounding area; between CB transceivers 20 or 30km apart; and so on.

It should be noted, however, that we referred in the foregoing paragraph to air "at the altitudes at which human beings normally live and travel". Above this, at altitudes of about 50km and beyond, the air may become "ionised", and likely to influence the behaviour of radio waves reaching it from terrestrial radio transmitters of one kind and another.

What happens is that intense radiation from the Sun, in particular ultraviolet radiation, dislodges electrons from individual gas molecules in the upper atmosphere. As a result, the otherwise neutral air becomes an electrically significant layer containing negatively charged free electrons, and positively charged ions. Hence the term "ionised".

This layer of rarefied air, prone to ionisation, lies between about 50km and 500km above the Earth's surface, and is referred to as the "Ionosphere". In practice, it has a quite profound effect on radio transmission and reception.

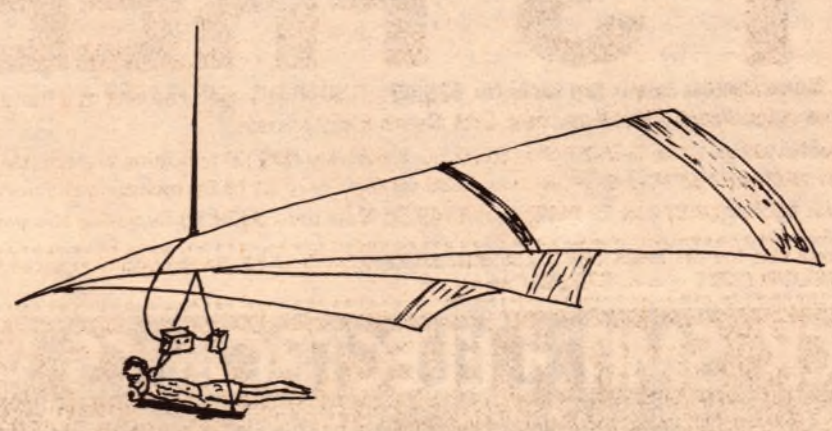
To quote the most familiar example, the transmitting towers of modern medium-wave broadcast stations are so designed that they radiate as much of their energy as possible substantially parallel with the terrain; engineers refer to it as "a low angle of radiation", or "the ground wave". The signal so transmitted typically serves a region of radius 50 to 150km, depending on circumstances.

However, some of the energy from the transmitter is inevitably radiated obliquely upwards — "high angle radiation" or "the sky wave" — so that it reaches the Ionosphere. From here it may be reflected (or deflected) back to earth, with the Ionosphere acting as a kind of radio mirror. Thus, a broadcast station may be received clearly hundreds, or even thousands, of kilometres beyond the range of its normal ground-wave signal. This is commonly referred to as "skip" reception.

In the early days of broadcasting, station operators used to relish reports of long-distance or "DX" reception, as an indication of the potential coverage of their transmitters. Nowadays, however, they use transmitting antennas designed to minimise high angle radiation for at least two reasons:

- They prefer to concentrate as much of the available energy as possible in the ground wave, so as to provide the strongest possible signal to their target audience — the audience that keeps them in business!
- The broadcasting control authorities are keen to minimise sky-wave transmission, since it greatly aggravates mutual interference between stations throughout the continent, attempting to provide a broadcast service to specific local audiences.

On the short-wave bands, the position is rather different. Here the intention may be to broadcast to areas deliberately remote from the transmitting site, for ethnic, political or propaganda reasons. Such stations exploit sky wave transmission to circle the globe, bouncing the signal off the Ionosphere back to earth, then back to



"I don't know what the regulations say, but it certainly works!"
(From W. F. Harrison, 68 Rickard Rd, Narrabeen 2101)

the Ionosphere and so on, in a multiple-skip path.

It so happens that the 27MHz CB band lies within the short-wave or HF (high frequency) portion of the spectrum where skip transmission and reception can readily occur. It is for this reason that there are occasional DX breakthroughs to countries such as New Zealand, USA and Japan.

If the Ionosphere was a stable layer of upper air, always ionised uniformly between the same altitudes and to the same degree, it would not have been necessary to use the word "occasional" in the preceding paragraph. The fact is that the Ionosphere is far from stable.

Being a function of rays from the Sun, the nature of atmospheric ionisation varies around the world according to whether it is night or day in that particular region. This will be evident from the fact that skip transmission and reception of broadcast band stations is prevalent at night, but rare during the day. Long distance short-wave reception also follows a 24-hour pattern, depending on the night/day situation along the transmission path.

Again, there is a seasonal factor in pattern of ionisation above different parts of the globe, depending on whether it is summer, winter or a transitional period.

Just to complicate things even further, the nature of the ionisation determines that part of the radio spectrum which will be effectively reflected. For different times and seasons and over different paths there will be an "LUF" (Lowest Useable Frequency) and an "MUF" (Maximum Useable Frequency). Above the MUF, radio waves simply go straight through the Ionosphere, to be lost in outer space.

Nowadays, a good deal is known about the behaviour of the Ionosphere and out of this has come terms which are both confusing and forgettable, unless one applies oneself to understand and memorise their significance: the D Layer, the E Layer, and others known as F, F1 and F2. Those concerned with such matters observe the height of the respective layers, the degree of ionisation, the frequency segment which they will reflect, skip distances and so on.

They can predict the frequencies most appropriate for given transmission paths around the Earth for various dates and times. Short-wave stations base their time and frequency schedules on such predictions, while they are also used by amateur operators keen on DX working. In fact, an Ionospheric prediction chart for amateurs appears in each issue of this journal.

Even so, Ionospheric predictions are

The Australian

CB SCENE

rather like weather forecasts, and for somewhat related reasons: they can predict major behavioural trends and probabilities but they can be inadequate in terms of detail. Just as the weatherman may be surprised by local sunshine or the local storm which can make or break an outing, so the Ionosphere can turn on local highly reflective zones which may earn the title "sporadic E" (layer).

As we said earlier, the CB band on 27MHz is in that part of the spectrum which is subject to Ionospheric reflection but only occasionally, when the MUF (Maximum Useable Frequency) happens to rise above 27MHz. Without trying to get any more deeply involved, at least you will know the reason for those occasional DX breakthroughs.

Now for the subject of Sunspots.

As we explained earlier, the prime source of ionisation of the Earth's upper atmosphere is radiation from the Sun and this, itself, is a highly variable quantity.

While one can soon get lost in the physics of the Sun, one of the phenomena which greatly influences the amount of radiation affecting the Ionosphere is that of Sunspots — darker areas which occur on the Sun's surface. When the Sun is "quiet" — no Sunspots visible — ionisation is at its lowest and reflection of the top end of the HF spectrum (including 27MHz) is minimal. When the Sunspot count is high, the reverse is the case.

While there is a good deal of argument about detail, it appears that the number of Sunspots goes through a minimum/maximum cycle about every 11 years. The important consideration, right now, is that the Sunspot activity is increasing towards a predicted peak around 1981-2. That means increasing ionisation, a more intense Ionosphere, and more frequent DX breakthroughs on 27MHz.

For those CBers interested in international DX (illegal, by the way) it may sound like good news, but it may as easily mean utter confusion. At various times, the CB bands in a major city are already cluttered and if they are suddenly inundated with signals pouring in quite unintentionally from other cities or other countries, it may become quite impossible to work anything but strong local stations.

The real sufferers will be those operators who use their CB for deliberate 2-way local communication of a personal or business nature, as distinct from chance encounters. Instead of having to compete merely with local contacts, they will find the channel cluttered with interstate or international chatter. In America, the FCC has predicted that clutter on the channels during DX breakthrough may reduce the effective range for customary local contacts by between 20% and 50%.

It has already increased the pressure on the FCC to announce a new CB allocation in the UHF spectrum, which will not suffer from skip effects, irrespective of the Sunspot count.

In Australia, it can only boost interest in the now accessable UHF CB band on the part of those who want reliable point to point contact.

On the lookout for recruits, the Eastern Suburbs (Sydney) VKCB Club holds a kerbside exhibition in a shopping centre, displaying the call sign VK2BVS and an invitation to "Talk to the World by Amateur Radio". Ten club members passed the recent Novice Licence examination.

DSE CASE TURNS CB TRANSCEIVER INTO A PORTABLE

With the introduction of their new "Porta Pack" accessory, Dick Smith Electronics have overcome one of the familiar bugbears of ordinary CB transceivers — their lack of portability, once away from the car or the operating table.

The "Porta Pack" is a tough and serviceable carrying case which will house any of the Dick Smith or Midland AM transceivers. It is made of a tough, leather-look fibre material, which resists scratching and which will effectively protect the equipment inside. Its wide shoulder strap is fully adjustable, allowing the Porta Pack to be worn in any likely position, even around the waist.

The optional antenna, a 5ft centre loaded whip, mounts either vertically for normal carrying, or across the case when it is being used on a horizontal surface, eg as a temporary base station.

At the bottom of the case is an optional battery compartment, which will accommodate 10 nicads or 8 dry cells (2 dummy batteries are supplied). The pack is pre-wired to a plug which connects to the tranceiver's power socket. The pack can be removed easily from the case, to facilitate charging or changing batteries.

Internal measurements of the Porta Pack case are approximately 165mm wide and 58mm front-to-back, with a clearance of about 210mm above the battery pack. Price of the Porta Pack is $25, plus the optional battery container at $6.50 and the optional centre-loaded telescopic antenna at $14.50.

Alternatively, the Porta Pack case itself is available free with future purchases of a Dick Smith "Wasp" transceiver at $99.50, a Midland 857 at $119.50, or a Midland 882C at $129.50. The antenna and battery pack must be purchased separately, however.

DSE claim that any one of the abovementioned tranceivers, combined with the newly available accessories, add up to outstanding value in terms of true all-purpose CB equipment.

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SP820 Matching for TS820S	$65.00

rotators

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5Y/2M Jaybeam, 7.8 dBd, length 1.6M, 5el	$39.00
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Canberra	82.3581	Melbourne	836.8635

AMATEUR RADIO

by Pierce Healy, VK2APQ

Increasing 28MHz activity, ITU news, RTTY contests &c

Australian novice licensees and good propagation conditions have increased world wide activity on the 10 metre band, sparking off an increase in the number of awards to be gained by keen operators.

The introduction of the Australian novice licence has seen a very marked increase of activity on 28MHz. In fact, rare DX stations can be heard calling only VK novice stations. It has also resulted in a growth of the "Ten-Ten" international net.

The "Ten-Ten" movement began some years ago in Southern California when some amateurs feared that the band might be lost to commercial or other interests, the main aim being to populate the band. Since then the movement has grown and there are now well over 20,000 members throughout the world.

To become a member it is necessary to work five DX or 10 local members, and obtain details of their membership numbers.

Within the Ten-Ten organisation many chapters have been formed, each having a series of awards. These are obtained by acquiring a required number of points through contacts on 10 metres with members of the Ten-Ten organisation and members of the particular chapter. A membership fee is charged.

The regional representative of Ten-Ten International is Peter Williams, ZL1BEB, Kaihere R.D., Ngatea, New Zealand, from whom full details are obtainable.

To assist members to qualify for awards, chapters conduct nets on various frequencies. Here are details of some.

Australia: VK4 Gold Coast Chapter — Saturday 2200GMT, 28.505MHz; Flagstaff 10/10 Chapter (VK3) — Sunday 0100GMT, 28.545MHz; Welcome Stranger Ten-Ten Chapter (VK3) — Sunday 0100GMT, 28.530MHz.

New Zealand: Down Under Ten-Ten Chapter (ZL1) — Wednesday 0800GMT 29.005MHz; Canterbury Ten-Ten Chapter (ZL3) — no details received.

USA: Central Florida Cyprus Chapter — Wednesday 0100GMT, 28.665MHz; New Orleans Chapter — Thursday 0130GMT 28.715MHz.

ITU NEWS

At the present time, October 23 to November 17, 1978, a most important International Telecommunication Union meeting is in progress in Geneva in preparation for the World Administrative Radio Conference in September, 1979.

This is a meeting of the International Radio Consultative Committee (CCIR) technical experts who, by recommending various technical parameters, will enable decisions made at WARC 79 to be based upon the latest agreed-to technical and operational advice.

Mr R. E. Butler, from Telecom Australia, Deputy Secretary-General of the ITU.

One of the personalities responsible for ITU organisation and activities is an Australian, Mr Richard E. Butler, Deputy Secretary-General ITU.

Mr Butler, seconded from Telecom, is the most senior ranking Australian in the United Nations system of specialised agencies. Elected in 1968, he was re-elected for a further term in 1973.

During this term of office Mr Butler has addressed many international forums on telecommunications and its many facets, from systems to economic aspects and benefits to mankind, including the amateur radio service.

On September 11, 1978, he addressed the inaugural seminar meeting in New Delhi, India, of the United Nations Development Program on Rural Telecommunications.

The purpose of the seminar was to study the problems of providing effective telecommunication services to rural areas and possible technical, economic and administrative solutions. In the course of his address, Mr Butler referred to recent advances in technology making it possible to provide and operate services for remote areas at far less cost than in the past.

More than 30 countries were represented at the seminar, with Australia among those presenting special discussion papers.

Even with his international ITU committments, Richard Butler has found time to attend functions and address members of the amateur service. In fact, he formally opened the 11th triennial conference of the Region I division of the International Amateur Radio Union held at Miskolc-Tapolca in northern Hungary, April 24-28, 1978.

In his address, Mr Butler referred to the encouragement Hungarian authorities were giving in providing means for practical training and help to radio amateurs. The importance of the self-training aspect of the amateur service was also mentioned.

"This is a fundamental aspect in telecommunication development seen with its capital intensive and manpower orientations in order to produce efficient services at the lowest practical costs. It is a corner-stone of the ITU technical co-operation program in favour of developing countries; indeed, more than two-thirds of such expenditure is devoted to projects concerned with telecommunication training. The existence of a strong national radio amateur service can be an invaluable help in such objectives."

Mr Butler had also visited the amateur satellite station HG5BME at the Technical University of Budapest and was impressed by the demonstration of an OSCAR orbit. His appreciation of

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR RADIO

the work being performed by amateurs associated with the AMSAT-OSCAR programs included this comment "... it is the duty of radio amateurs to see that the enormous possibilities of space communication reach the general public."

Responding to those comments Noel Eaton, VE3CJ, president of the IARU, expressed the appreciation of the amateur service for the many years of co-operation it had received from the ITU and the advice and encouragement amateur radio had received from Mr Richard Butler.

AMATEUR TELEPRINTER SOCIETY

For the past year, an RTTY news broadcast has been made each Sunday on behalf of society members and is the only official broadcast of its type in Australia. The international amateur standards of 45.5 bauds and a 170Hz shift is used for all transmissions. The broadcasts are made from authorised stations in Sydney.

These broadcasts are made on the international amateur RTTY frequencies of 7045kHz and 14090kHz at 0030GMT Sunday morning and on 3545kHz at 0930GMT Sunday evenings. Transmissions are also made on 146.6MHz at the same times.

The high frequencies appear to give complete coverage of Australia. It is possible that, soon, arrangements can be made for rebroadcasts in each capital city.

The WAEDC European RTTY contest will be held over the weekend November 11-12, 1978. The operating times are 0000GMT Saturday to 2400GMT Sunday. All bands 3.5MHz to 28MHz may be used. Although the contest period is 48 hours only 36 hours operation is permitted. The 12 hour break may be taken over one but not more than three periods. All rest periods must be shown in logs. The exchange of contest numbers is the usual RST report plus three numbers commencing at 001 and progressing one for each contact. Additional points can be gained for reporting previous QSO's to a European station (QTC).

In NSW two RTTY VHF repeaters are in the process of being activated. One to be in Sydney and the other in Maitland.

The society has kits of demodulators, modulators, filters, etc, for RTTY work. If you wish to join the society and receive its newsletter send $2 to the Secretary, ANARTS, 14 Atchison Street, Crows Nest, NSW 2065.

RADIO CLUB NEWS

PROSPECT COUNTY AMATEUR RADIO GROUP:

The main objectives of the group are:

1. To provide a common meeting place for western district amateurs.
2. To train interested persons to become amateurs.
3. To promote and improve the standing of amateur radio in the area.
4. To provide a community service, via amateur radio communication, in times of need.

Meetings are held on the fourth Tuesday of each month in the Soldiers Memorial Hall, Artillery Crescent, Seven Hills, (near the Seven Hills railway station), at 7.30pm. All interested persons are invited to attend and there is no obligation to join the group.

An informal on-air meeting is held each Monday evening at 7.30pm on or near 28.485MHz.

The postal address is PO Box 109, Toongabbie, NSW 2146.

GEELONG AMATEUR RADIO-TV CLUB: The talk for November 10, 1978, is to be by Ian McDonald, VK3AXH, the radio inspector for the Ballarat area, of which Geelong is a part. A section of Ian's talk will deal specifically with interference problems.

GARC meetings are held in the club rooms Storrer Street, East Geelong. Visitors are welcome.

ORANGE AND DISTRICT AMATEUR RADIO SOCIETY: From the September issue of "Tuned-In", the monthly newsletter of ODARS, comes this report; A rather remarkable breakthrough on two metres occurred during the evening of September 10, 1978. Ian Cousins, VK5IK, at Eudunda, near Adelaide was heard loud and clear through channel 2 FM repeater VK2RAO.

Bruce Thomas, VK2FD, at Guyong made the first contact and later worked VK5IK direct on 146.00MHz with good signals each way.

Other stations VK5IK worked were VK2ZSX, Gosford; VK2ZDY and VK2BXT Moree; VK2TK and VK2ASY Orange; VK2ASM, VK2AXB, VK2BTE, VK2BGA and VK2WR Sydney; VK2APP Young; VK2ZAY Gunnedah; VK2AOH Mittagong; VK2ADZ Griffith and VK1RC Canberra.

Andrew VK5ZCP located south east of Adelaide was also worked by Peter Carter, VK2TK Orange.

The Central West Net may be heard at 8.00pm Tuesday evenings on 3572MHz. Join in and meet the ODARS members.

FAR SOUTH COAST RADIO CLUB (NSW): Formed in March, 1978, the club has a membership of 20, most being visitors on holidays. The main object of the club is to install a channel 3 FM repeater. It will be situated north of Bega and is expected to cover the south coast from Nowra to the Victorian boarder. Call sign will be VK2RFS.

The secretary is Ken Kelly, VK2MJ, 9 Hill Street, Merimbula, NSW 2548. Telephone (0649) 51624.

SOUTH EAST RADIO GROUP: In 1960, a small group of short-wave listeners in Mount Gambier, Sth Aust., formed the South East VHF Radio Group. Membership grew and two years later the present title was adopted.

In 1976, the club obtained a licence to operate a two metre FM repeater to close the communication gap for mobile operation between Adelaide and Melbourne. The repeater station was designed and built by local amateurs and operates under the call sign VK5RMG on channel 6.

For the past two years, the group has conducted very successful technical courses.

At present, the group meetings are held in the South East Community College but hope to purchase a suitable

CPU-2500R — 2 meter FM transceiver

Yaesu brings a Central Processing unit to VHF communications

Computer technology is brought to bear in the revolutionary CPU-2500R 2 meter FM transceiver from YAESU. Sophisticated circuit design and renowned YAESU quality workmanship are yours today with this exciting new transceiver from YAESU — where performance comes first!

Features

■ Heart of the CPU-2500R, a central processing unit (CPU), performs complex control operations while you just flick a switch.

■ 800 PLL synthesized channels are available in 5 kHz steps over the entire 2 meter band. A photo-interrupter frequency selection technique is used, and full 6 digit frequency display is provided.

■ The CPU scanner moves you instantly up or down the band, and will search for a busy or clear channel, as desired.

■ Four memory channels available for simplex or repeater operation, and additional memory channel may be used for split of up to 4 MHz. The CPU will scan just the four memory channels, if you wish.

■ Choice of standard microphone, with up/down scanner controls, or the keyboard microphone. The keyboard mike allows up/down scanner control, remote selection of dial or memory frequencies, and contains a two-tone encoder for autopatch or control purposes.

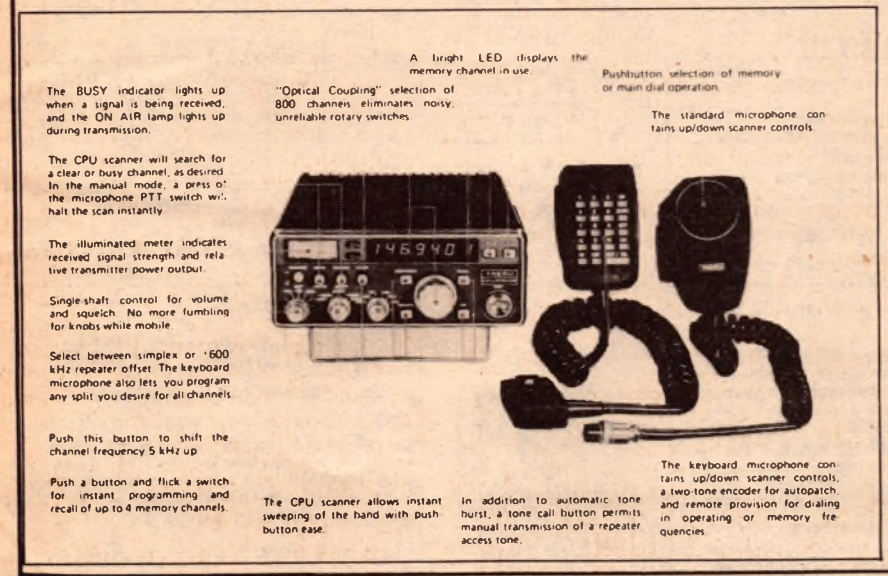
■ A subaudible tone guarded squelch encoder/decoder is an available option, for silent monitoring of busy channels.

■ A dual gate FET front end lets you pull in weak signals, while the transmitter puts out a solid 25 watts.

■ Convenience features include "busy channel" and "on the air" lamps, a memory backup feature, and manual or automatic tone burst selection. Your CPU-2500R is protected against high VSWR and reversed power supply polarity.

■ Ease of operation is ensured by careful selection of positions for controls and switches. Engineered for performance, using the latest technology, the CPU-2500R is truly a first-class set. YAESU promises you nothing less!

For a leaflet containing all specifications and full-color illustrations, contact Bail Electronic Services.



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A precision automatic and manual record-playing unit fitted with Garrard Synchro-Lab4 pole shielded motor to provide constant speed conditions for the 10½ inch aluminium turntable.

The low resonance tubular pickup arm is counter-balanced with a resiliently mounted weight to permit light sensitive tracking, and the slide-in cartridge carrier enables styles inspection and the interchange or replacement of cartridges to be carried out simply and quickly.

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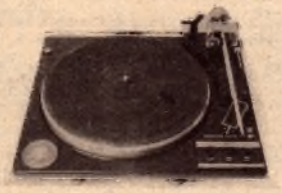

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building in the near future.

To assist in this project the Group have organised a lottery to be drawn on December 22, 1978. The first prize is a Kenwood TS520S transceiver; second prize a Kenwood R300 receiver; third prize a Kenwood desk microphone and fourth prize a Kenwood world clock. The total value of prizes is $1141.00. The first prize has been donated by Trio Kenwood Aust. and International Communications Systems of Port Adelaide.

Tickets at $1.00 each may be obtained from: Lottery Committee SERG, PO Box 1103 Mount Gambier SA 5290. There are 6000 tickets available.

Opposition to any extension of TV channel 5A service is very strong in the Mount Gambier area. Over 60 letters of protest have been fully endorsed by their state member of parliament who forwarded them to the member of federal parliament.

For details of SERG classes and activities write to the secretary, PO Box 1103, Mount Gambier, SA 5290.

WESTLAKES RADIO CLUB: The club is to conduct a contest for novice or full call amateurs from 0800GMT December 9, 1978 to 0759GMT December 10, 1978.

The object is to encourage contact between amateur stations in Australia, New Zealand and New Guinea during a 24 hour period, with special emphasis on contacts with novice and club stations.

Full details are available from the Contest Manager, Westlakes ARC, PO Box 1, Teralba, NSW 2284.

Meetings and classes for WIA Youth Radio Scheme certificates and PMG examinations for amateur licences are held each Saturday afternoon and Wednesday evening at the club rooms York Street, Teralba. Telephone (049) 58 1588.

MEDIUM FREQUENCY DX

From December 12, 1978, Charlie Shaw, VK9NI will again be operating on 160 metres from Norfolk Island from 0800GMT. He will be operating CW on 1803kHz every other day and looking for ZL's on 1810kHz and VK's on 1825kHz. Charlie's postal address is PO Box 27, Norfolk Island.

REPEATER NEWS

Increasing interest in 25kHz channel separation has emphasised the inadequacy of the present numbering systems, for both simplex and repeater channels, which is based on 50kHz separation. This has prompted the NSW Repeater Committee to suggest a new numbering system, which it is currently publicising in order to invite comment.

For repeaters, the new system would use a four digit number based on the last four digits of the repeater output frequency, ie, the present channel 1 (repeater input 146.050/output 146.650) would be designated channel 6650. The next channel, between the present channels 1 and 2 would be 6675.

The scheme has been designed to be compatible with modern digital readout displays, which are gaining in popularity. As well as being directly related to frequency, and therefore unlikely to become redundant, the system has the advantage that (with one exception) the first digit indicates whether the offset required is up or down. Where the first digit is six the offset is down; where it is seven the offset is up. The exception is the current channel 8 which would become 7000 but with the offset down.

Simplex channels would use a three digit figure, by omitting the last digit. This is to permit differentiation between repeater and simplex channels.

ETHNIC TV PROGRAMS

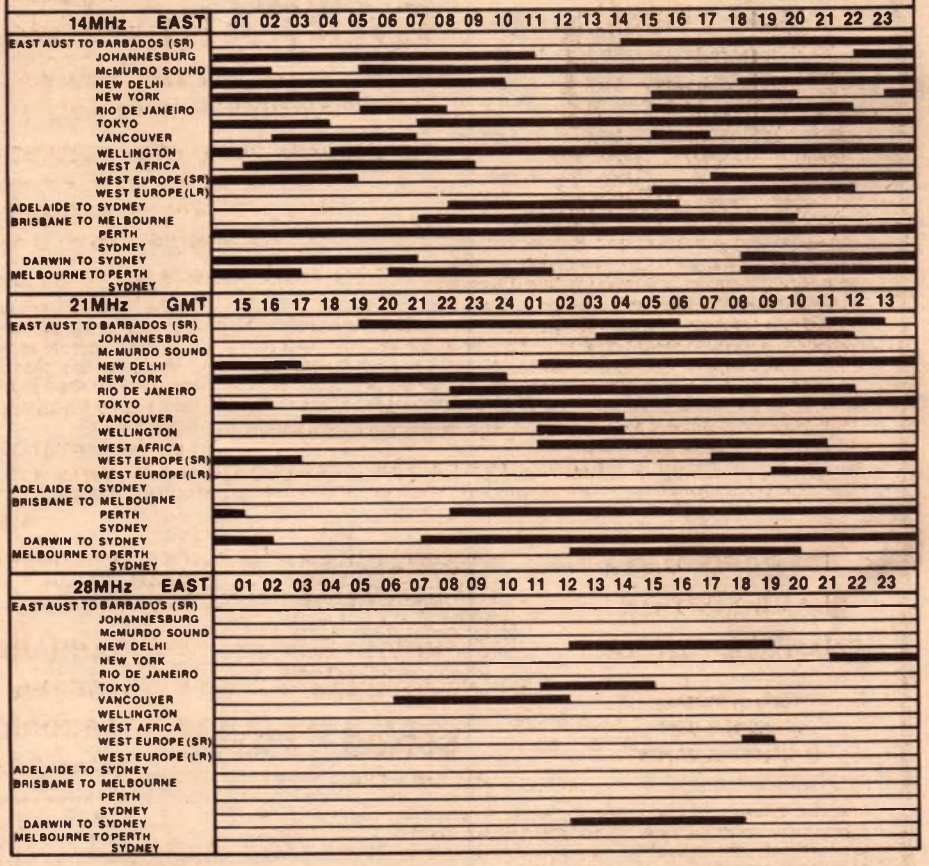
Just before these notes went to press it was announced that the federal government intends to introduce ethnic TV programs early in 1980. Initially these will be pilot programs, on existing ABC channels, as time permits. Ultimately, the programs are to have their own transmitters in the UHF band.

While this will not provide any immediate benefit to amateurs or viewers in channel 5A areas, the acceptance of the UHF concept by the government is a step in the right direction.

Thus encouraged, amateurs should continue their pressure to have all "odd" channels eventually phased out and, more importantly, to halt the expansion of channel 5A. There is still no cause for complacency.

IONOSPHERIC PREDICTIONS FOR NOVEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 11.78



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ARRL Handbook Cat. B-2218 **$12.75**
Radio Handbook Cat. B-1106 **$23.95**
mini log book Cat. B-2235 **$2.00**
SSB for the radio amateur Cat. B-2212 **$6.75**
Amateur operating manual Cat. B-2208 **$6.90**
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Great circle map Cat. 4502 **$3.00**
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Yaesu FTV250 Transverter extends HF to 2 metres

Amateurs anxious to extend from HF into VHF, using the popular HF modes — SSB, CW, and AM — may well consider the Yaesu Musen FTV250 Transverter, in conjunction with their existing HF transceiver, as one approach.

The FTV 250 is designed for 144-148MHz operation in conjunction with the Yaesu Musen FT series of HF transceivers. It is capable of handling all amateur transmission modes; AM, SSB, CW, and FM, assuming these are available in the HF transceiver. However, for reasons we will explain, its role in the modern FM scene is restricted.

It is best regarded as a means of putting the other modes on two metres and its value for money assessed on this basis. If it passes this test the FM capability may be regarded simply as a gift horse.

As well as its own transverter function, it provides the means to connect a second (6-metre) transverter to the HF transceiver at the same time and to select any one of the three combinations.

Coverage of the 144MHz — 148MHz band is achieved by tuning the four segments of the 28MHz — 30MHz band of the HF transceiver. The four segments are used for each 2MHz coverage ie, 144MHz — 146MHz or 146MHz — 148MHz, dependent on the position of a transverter switch.

On transmit the 28MHz output from the HF transceiver is heterodyned with the output of crystal oscillators multiplied to 116MHz or 118MHz (a crystal for each 2MHz segment), amplified and fed to a 2N5591 final stage, giving an RF output, through a two stage RF filter, of around 10 watts.

The receiver uses a dual gate MOS FET RF amplifier. The output heterodynes with the crystal oscillators (116MHz or 118Mhz) to a 28MHz IF signal. This passes through a buffer amplifier to the HF transceiver, and is processed as a normal 28MHz signal.

A switch on the front panel allows either exciter drive level or relative power output to be indicated on a meter. Other controls are; a three position switch — off, and the two band segments, 144MHz — 146MHz or 146MHz — 148MHz; a tune control for optimum signal circuit performance of receiver and transmitter; a gain control for the RF amplifier stage; and three LED indicators to show which unit — HF, 6-metres, or 2-metres — is being used.

The transceiver is well constructed with each section adequately shielded. No spurious signals or "birdies" were observed. The stability of both transmitter and receiver was very good and reports on audio quality were very complimentary, indicating that the audio from the HF transverter is not affected by processing to 2 metres.

The tune control operates via varactor diodes to tune the appropriate transmitter and receiver tuned circuits. It is very effective and there was no noticeable drop in receiver performance or transmitter power between 144 and 148MHz.

On-air checks were made over a

period of ten days using an FT901D HF transceiver fitted with a memory unit. The antenna was a home made half wave vertical at heights varying from one metre to seven metres above ground at a good VHF location.

We found that the method of frequency selection can sometimes be confusing and inconvenient. One cause of confusion is the fact that the 2MHz in the HF band — 28 to 30MHz — is used twice to provide the total 4MHz VHF coverage. This means that the one HF reading on the transceiver can indicate either one of two possible 2-metre frequencies. Unless the operator takes due account of the transverter switch position, he may listen or transmit on the wrong frequency.

Some inconvenience is experienced when frequency changes involve crossing the boundary between one 500kHz segment and another, with the need to reset the HF transceiver dial at each boundary. These problems can be at lease minimised by preparing a frequency conversion chart.

Performance on SSB was very good, although there was only a limited amount of traffic available during the test period. Tuning into an existing signal automatically puts the transmitter on the same frequency, as in the HF mode, and no mental frequency conversion is involved. Initiating a call requires a little more effort in this regard, assuming the need to use a specified frequency.

As stated earlier, FM operation, involving fixed channels, repeaters, etc, tends to be restricted, one of the limitations being the frequency selection system already discussed.

But it is repeater operation, requiring a 600kHz frequency split, that suffers most. It is possible only if the HF transceiver is fitted with a memory. Even then, having entered the appropriate frequencies in the memory system, it is still necessary to switch from one band segment to another, as well as operate the memory button, for each send or receive operation.

Using a repeater as a calling frequency to establish contact, and then transfering to a simplex channel, can become an involved switching and tuning procedure.

The foregoing comments apply purely to the physical operation of the unit. Their importance may vary, according to the dexterity of the operator, and they do not detract from its electrical performance.

In all modes both transmitter power output and receiver sensitivity appeared to be well up to the maker's specifications. On FM, contacts were made both through repeaters (4, 5 and 8) and direct on simplex channels. Good strength signals were also received from the beacons at Dural and High Range, near Bowral.

At the same time, an RF power output of 10W seems rather low, particularly compared with more conventional SSB equipment, and considering the total cost of the equipment used to generate it.

Also, the incorporation of a 600kHz offset frequency oscillator, for repeater operation, would greatly improve the versatility of the unit.

While all units are factory aligned, the instruction manual gives setting-up procedures, photographs showing component location, parts list, circuit diagram and alignment instructions for each section, should that become necessary.

The FTV 250 under review, and the FT901D with memory unit, were supplied by Dick Smith Electronics, Sydney. The FTV 250 has an advertised price of $329. (PJH VK2APQ)

SHORTWAVE SCENE

by Arthur Cushen, MBE

Australia moves into new frequency plan

The new frequency plan which takes effect on November 23 covers medium wave stations in Europe, Africa, Asia and the Pacific. Under the new plan, stations will be 9kHz apart instead of 10kHz as at present, resulting in 120 frequencies being available on medium wave as against 106 at present.

Australian medium wave stations are making only minor adjustments, for the most part, and will move to the nearest 9kHz frequency. When frequencies in the old and new plans coincide, such as on 630, 720, 810, 900, 990, &c, stations using these frequencies will normally be unaffected. Sydney station 2CH is one such. Other Sydney commercials will be adjusted as follows: 2GB 870 to 873kHz; 2UE 950 to 954kHz; 2KY 1020 to 1017kHz; 2UW 1110 to 1107kHz; 2SM 1270 to 1269kHz.

In New Zealand, several stations will make major moves, generally to a lower frequency.

With the changes, opportunity is being taken to minimise the co-channel interference which exists at present and to give stations a better operating frequency.

Of special interest to DX hunters is the fact that North and South America remain on the present 10kHz separation, and it should be possibe to hear many stations from North America during early evening on split frequencies between the Australian broadcasters.

SPECIAL UN PROGRAM

Some months ago it was announced by the United Nations radio in New York that they would be supplying transcribed programs to be broadcast from stations in Europe and Africa and beamed towards Southern Africa with the anti-racism theme. We have heard Radio Budapest, Hungary, on Mondays at 0300GMT on 11910kHz with one of these transcribed programs which was recorded in New York. According to the BBC, Cairo Radio has also been noted with an English program at 1600-1645GMT on 17785kHz. The announcement heard at the end of the broadcast was "This is the United Nations Radio and this program is one in a series specially prepared at the United Nations Headquarters in New York".

CHILEAN PROGRAM CHANGE

The Voice of Chile has for some months operated a schedule which rotated the languages throughout the day, and it was very difficult to find a standard time to listen to a given language. The station has adjusted this type of schedule and is now broadcasting 14 English sessions each day.

A new frequency of 11765kHz has been heard with English transmission from 0230 to 0300GMT and signals are good, although there is some sideband interference from Havana, Cuba on 11760kHz. The times of the English broadcasts are now as follows: 0100, 0230, 0400, 0530, 1100, 1200, 1300, 1530, 1830, 2000, 2200 and 2330GMT.

Another new channel for the Voice of Chile is 15125kHz, and this frequency has been heard opening at 1100GMT and causing some interference to Radio Sweden which is broadcasting to Australia and New Zealand in English at that time. At 1130GMT Sweden leaves 15125, but the Voice of America is heard opening a transmission from Greenville on that channel.

The Voice of Chile has verified reception reports after one year and, as well as a card, a new schedule of broadcasts has been included. This shows that there are 14 English broadcasts each day. The best received in this area is at 2200GMT, carried on 11715, 15140, 15150, 17715, 17780 and 17800kHz.

DAYLIGHT TIME

Most of the Australian states as well as New Zealand have now moved to daylight time, one hour ahead of standard time. This means that overseas shortwave broadcasts will be heard an hour later in these countries. The main change will of course affect late evening listening, when during the summer months, reception during the hours of darkness will peak, and particularly so on the higher frequencies. It should be pointed out that Radio New Zealand's shortwave service does not stay with GMT, in other words, the broadcasts from New Zealand are carried from the domestic network and therefore are heard one hour earlier. The DX World program on the first Sunday of the month and Mail Bag on the third Sunday of the month will be heard at 0915GMT until February, and in March they will revert to their old time of 1015GMT.

AUSTRIA USING 13M

The Austrian Radio at Vienna is using four 13 metre band frequencies, three of which are providing good reception in this area. The frequency of 21470kHz is used 0600-0700GMT; 21500kHz 1400-1500; 21555kHz 0600-0900 and 21715kHz 0900-1300. English is broadcast 0830-0900 and can be heard on 21555kHz. At 0600GMT both 21470kHz and 21555kHz open at good strength, while at 0900 21715kHz is also providing listeners in this area with a good signal.

NEW BBC FREQUENCIES

The BBC is using new frequencies and relay outlets for its transmissions to this part of the world. These include the Masira transmissions from the island in the Persian Gulf mentioned in the last issue, and also increasing use of the Antigua station in the Caribbean, which is used for the relays of the World Service. The Masira transmitters are now heard 0900GMT opening on 15310 and 17770kHz. The frequency of 15310 is used between 0900 and 1515GMT, while 17770kHz is used from 0900 to 1130GMT. Another new frequency, this one from Singapore, is heard in the

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

SHORTWAVE SCENE

Asian languages program operating on 11895kHz. From 1330 through to 1415GMT the program is in Burmese, 1415-1445GMT in Vietnamese; this last transmission is broadcast from the Far East Relay station. As well, another new channel 9580kHz replaces 9725kHz and broadcasts in Japanese at 2200GMT. Mandarin is at 2230 and Cantonese at 2245.

The Antigua relay base in the Caribbean is noted on 17840kHz from 2000 to 2115GMT with the World Service, with some interference evident from Prague. 9510kHz carries the World Service 0445-0915GMT; 6195kHz 0900-0915; and 11775kHz from 1100-1330GMT.

RELAYS DISCONTINUED

The use of relay stations to rebroadcast transmissions on shortwave is widely used, and relay bases have been established in all continents mainly by European broadcasters, Radio Canada and the Voice of America. Recently we reported that Radio Japan had carried out tests through the Trans Europe station at Sines in Portugal for reception in Europe in order to improve its signals in that area.

Since 1969, the broadcasts of Radio Peking have been relayed in Europe through Radio Albania at Tirana, but the recent break in relations between China and Albania has resulted in the ending of the agreement. According to the BBC, some 41 hours of programs were relayed by the Albanian station for reception in Europe and Africa, and these broadcasts were in English, Spanish, Portuguese, Serbo-Croat and Hausa. Radio Peking is now carrying these broadcasts to these areas direct from its transmitters in China.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time it is necessary to add a further hour.

UGANDA VERIFIES

The Uganda broadcasting Corporation has confirmed reception of their recent test broadcasts in a letter from C. A. Kizzakizito, according to Arthur Demaine of Auckland reporting in the New Zealand DX Times. The present schedules of broadcasts from Kampala is 0300-0400GMT daily to USA, Canada and New Zealand on 15325kHz; 1350-1600 daily to East and Central Africa with English at 1445 on 6030; 1615-1750 daily to Southern Africa on 9515; 1800 on Tuesday, Thursday, Saturday and Sunday to Western Africa in English on 15325kHz.

CHOOSING A RECEIVER

From time-to-time readers ask about the best type of receiver for shortwave listening and there are several points which should be adhered to before making the purchase. The coverage of the receiver is the first thing to look for. It should cover both medium and shortwave continuously from 520 to 26,000 or 30,000kHz. This gives a coverage of the 13 and 11 metre bands which are now becoming active with the higher sun spot count and also reception of the 27MHz Citizens Band. Another modern adjunct to the receiver is its facilities to listen to single side-band and as several stations are already transmitting in this mode, it enables the listener to tune to this type of transmission which is unintelligible on a normal receiver. Another aspect to look for is the portability of the receiver. If you plan to take the receiver to areas where there is no electricity, a set with both power and battery operation is essential. The dial calibration makes listening more interesting for the newcomer to the hobby, and a set with read-out facilities showing the exact frequency the receiver is tuned to is of great advantage and much more accurate than the slide-rule type of dial, which often is very poorly calibrated. Readers should also use an aerial and an earth with their receiver to give it maximum performance and the installation of a lightning arrestor at the aerial lead-in safeguards your valuable radio from damage in a thunder storm.

AMERICAN CHANGES

The three American Gospel stations have all been observed on new frequencies over the past few weeks. KGEI in San Francisco is using 9685kHz for its broadcast in English at 1000GMT, but this frequency suffers interference from the American Forces Radio operating on the same channel.

WYFR Oakland, California has been using 21610kHz from 1605-2100GMT to Europe. Another frequency 15440kHz is used 2300-0200 in Spanish to South America while 11855kHz has been heard also with Spanish at 0200GMT.

Station WINB, Red Lion P.A., is using 15185kHz at 2200GMT, but this frequency is also used by the Voice of America Philippines in an English transmission to South East Asia.

VOA USES NEW FREQUENCIES

New frequencies have been used by the Voice of America in their transmission to Australia and New Zealand for our morning reception. The broadcast from 2200 until 2400GMT is now carried in the 11 metre band for the first time at a frequency of 26095kHz from a transmitter at Dixon, California. The transmission from this site continues to be carried on 21610kHz. Two frequencies in the 16 metre band are now used from the Philippines for Australia and New Zealand, namely 17740 and 17820kHz.

LISTENING BRIEFS

EUROPE

FINLAND: Helsinki, recently made a frequency change for its service to Australia and New Zealand 0930-1000GMT and John Mainland of Wellington reports 21495kHz now carries this broadcast, this frequency replaces 17840kHz. The Sunday transmission from Helsinki on 21495kHz 0800-0925GMT is noted by John Lewry of Newport, Victoria, as being received at good strength.

MALTA: The Broadcast of Malta Calling has been observed in English on Saturdays 2045-2115GMT. This frequency of 5980kHz gives good reception and is a replacement for the former 5990kHz.

AFRICA

TANZANIA: Mike Willis of Perth advises that Radio Tanzania has been heard at 1530GMT on 6105 with English identification and that there is no sign of 9750kHz and it is presumed to be a possible frequency change.

CAMEROONS: Yaounde has been heard by Mike Willis of Perth reporting in DX Post using the frequency of 7205kHz. The broadcast was in a French dialect and the station is noted in parallel with 9745kHz at 1520GMT.

KENYA: The BBC Monitoring Service report that two 250kW shortwave transmitters are to be installed in the Nairobi area, to provide better regional coverage of the English and Swahili Domestic Services and would also form the nucleus of an External Service.

ASIA

MALAYSIA: According to the DX Digest of India the Voice of Malaysia's latest schedule includes Indonesian 2200-2400GMT and 0900-1600 on 9750kHz, 6175; English 0625-0855 on 15295, 9750, 6175, Mandarin 1100-1300 on 11900; Arabic 1530-1700 on 15295.

PAKISTAN: Radio Pakistan in its world service is using the frequency of 21625kHz from around 0700-1100GMT in Urdu with slow speed news in English from 1100-1115. The same program is carried on 17665kHz and the frequency of 21625 replaces the old channel of 15115kHz.

KUWAIT: Radio Kuwait with its English broadcasts 0500-0800GMT is now using 17740kHz and has been heard with news at 0530GMT. According to the announcement, the broadcast is also carried on 9650kHz. The second English broadcast is heard 1800-2100GMT on 12085kHz and this is for evening reception in the Middle East Area.

PHILIPPINES: Radio Veritas Asia is using 17710kHz for an English broadcast 0100-0200GMT. News is noted at 0130GMT and the same program is transmitted on 15275, but this frequency is blocked by Radio Japan. The station is requesting reports on the reception of this transmission, and they should be sent to Radio Veritas, Asia, PO Box 939, Manila, Philippines.

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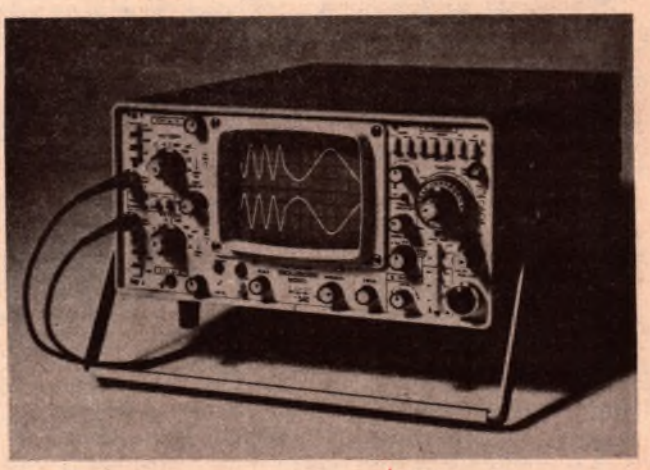
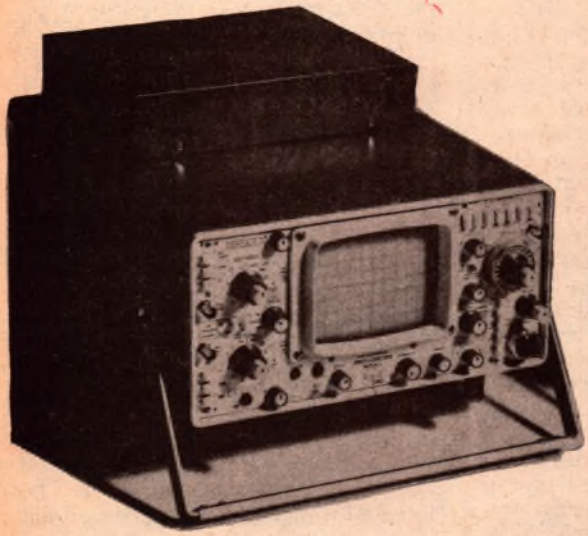
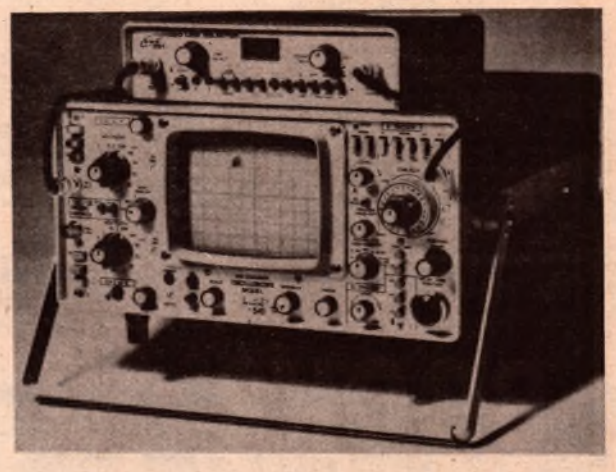
The BWD 540 is a versatile 100MHz DUAL TRACE Computer-Communications Oscilloscope. It has a 5mV to 20V/div. sensitivity range plus 1mV at 25 MHz on Ch. 1.
5nSec max sweep speed with delayed trigger or sweep and it operates on 117 or 235V AC 48 to 440Hz or 24V DC power.





Add a BWD BP3 BATTERY PACK and you have Complete Portability.
Of special interest for communications is the phase corrected X-Y facility enabling trapezoidal modulation patterns for linearity and phase to be made with carriers to 100MHz and modulation to 0.5MHz.

A BWD 701 VIDEO LINE SELECTOR adds Precision Video Monitoring with a sensitivity range from 25mV to >100V, a flat response to 10MHz within 5% (40MHz-3db) 10 turn line selector with digital read-out, 2 or 4 field selection, sync tip or back porch clamping, chrominance filter, variable line trigger delay, two preset lines, a video monitor output: and it consumes only 1.5 watts.



Add BOTH Options and the BWD/540 becomes a completely Portable, Computer-Video-Communications oscilloscope of unprecedented versatility.
For measurement on land, at sea, or in the air, you will find the performance, compactness and light weight of the BWD 540 and its options a most economical answer to your measurement problems.

BWD ***Oscilloscopes AUSTRALIAN Made to Measure***

ELECTRONICS PTY. LTD.
Miles Street, Mulgrave, Victoria. 3170.
P.O. Box 325 Springvale, 3171.
Telephone 561 2888 Telex 35115

W12/A

N.S.W.	Amalgamated Wireless (A'asia) Ltd., Sydney. Ph. 888 8111
QLD.	Warburton Franki (Brisbane) Pty. Ltd., Phone 52 7255
S.A.	Protronics Pty. Ltd., Adelaide. Phone 212 3111
	Rogers Electronics, Adelaide. Phone 42 6666
W.A.	Cairns Instrument Services, Perth. Phone 325 3144
TAS.	Associated Agencies Pty. Ltd., Hobart. Phone 23 1843

New Products

BWD 540 100MHz Dual Trace Oscilloscope

The BWD 540 dual channel 100MHz oscilloscope provides high performance and accuracy in a lightweight field portable form. The unit can be operated from either AC or DC supplies, with an optional rechargeable battery pack also available. A delayed time base facility is also provided.

The BWD 540 model oscilloscope is a compact lightweight instrument, designed for both laboratory and field use. Overall dimensions are 175mm high x 345mm wide x 470mm deep. Net weight is only 9.3kg.

An 800mm x 100mm rectangular CRT tube is featured, which has an internal parallax-free graticule with variable illumination. A tilting bail is provided to enable a convenient viewing angle, as well as bottom and rear feet.

Two independent vertical amplifiers are provided, each with 12 calibrated sensitivities ranging from 5mV to 20V per division. In addition, a x5 range is provided on channel 1, increasing the sensitivity to 1mV per division.

Uncalibrated vernier controls extend the range of each channel to 50V per division, and also allow interpolation between the selected ranges. Pushbutton switches are provided to enable the inputs to be AC or DC coupled, or grounded.

The timebase can be triggered off either channel 1 or channel 2, or a mixture of both. Switch selection is also provided for the vertical display mode, and allows either channel 1, channel 2, channel 1 and channel 2 in either chopped or alternate mode, and channel 1 + channel 2 to be displayed.

Input loading is nominally 1M and 26pF, and the maximum allowable input voltage is 500V (DC + peak AC). Bandwidth is from DC to 100MHz, with respect to a 6cm trace. The rise time for a 6cm step input is 4ns.

The main timebase covers sweep rates from 50ns/div to 1s/div in 23 steps. Maximum sweep speed is 5ns/div at x10 magnification. A vernier control covers the ranges between steps, and extends the sweep speed to below 5s/div.

The delayed timebase has a similar performance, but with only 21 steps. Minimum sweep speed is below 1s/div.

Versatile trigger circuitry is provided. Response extends from DC to 125MHz, and independent source, polarity and level selections for the main and delayed timebase are provided. Trigger coupling not only includes high, low and power line frequency selection, but TV video also, with line or frame lock.

A 10 turn calibrated delay time multiplier is provided in the bottom right hand corner of the front panel. This provides a delay range from 100ns to 10s.

Rear panel facilities include a battery socket and companion Use/Charge switch (the charger is incorporated), DC input terminals, a channel-1 signal output, intensity modulation input, a main timebase output, and main and delayed timebase gating signals.

Accessories supplied with the model 540 Oscilloscope include a comprehensive instruction manual, which also contains sections detailing how the various circuits operate, and two probe kits.

The probe kits, model P32, incorporate a three position slide switch, giving x1, x10 and Ref positions. They come with 1.2 metre leads. Also included are an insulating tip, a sprung hook, a trimmer tool, a BNC adaptor and an IC tip.

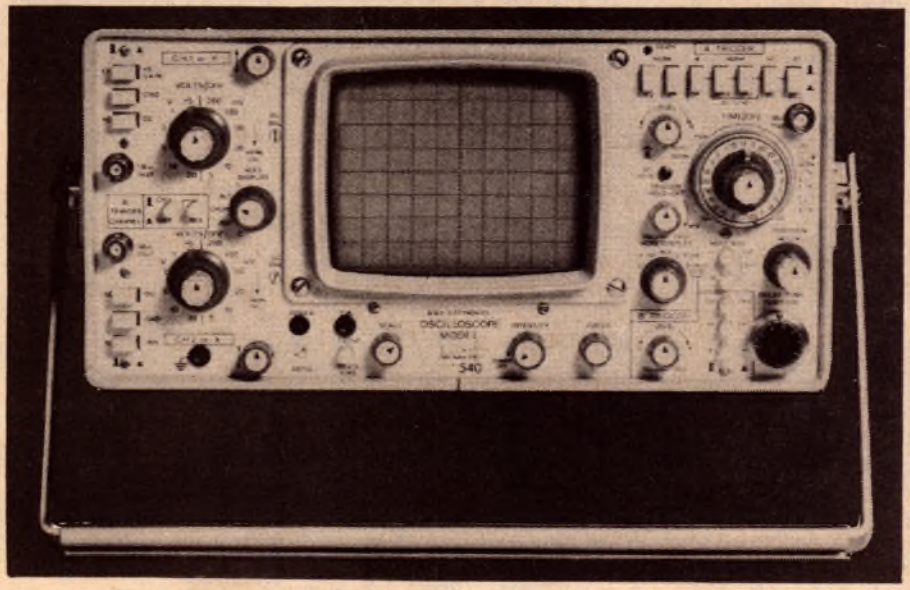
In the x1 position, input impedance is 1M in parallel with 68pF, and the bandwidth is from DC to 10MHz. In the x10 position, input impedance is 10M in parallel with 10.8pF. The bandwidth is from DC to 100MHz. On both ranges, peak input voltage is 600V.

In the reference position, the probe tip is grounded via a 9M resistor, and the oscilloscope input is grounded directly.

Our overall impression of the model 540 Oscilloscope was one of a versatile and useful test instrument, which would be at home in either laboratory or field conditions. Operation of the controls was quite simple, considering the complex nature of the instrument.

We found the switchable probes to be quite convenient in use, and allowed rapid selection of the attenuation during measurements.

Price of the model 540 Oscilloscope is $1995, plus sales tax if required. The optional battery pack is listed as $335 plus tax. Further inquiries should be directed to BWD Electronics Pty Ltd, Miles Street, Mulgrave, Victoria 3170. (D.W.E.).



A 6-GAME KIT FROM ACE RADIO

What must be one of the cheapest TV games ever is currently being offered by ACE Radio for $11.95. Supplied in the form of a knock-down kit, ready for final assembly, it offers a choice of six games: handball, squash, tennis, soccer and two shooting games involving a hand "pistol".

It would appear that the kit is a carryover from the original Telesports "Super Six" TV game which was manufactured and sold locally some years ago. In consequence, the main games chip would now be regarded as a dated design but, for all that, it offers the choice of the games listed above, plus on-screen scoring, sound effects, and options for ball speed, bat size, bat angle, and manual/auto operation.

The game operates from a 9-volt 276-P battery and draws about 60 milliamps. In the original model, a miniature jack was provided, allowing it to operate from an external mains-powered 9V supply. Connection to the TV set is by a coaxial cable to the antenna socket.

The kits that we handled contained the fully wired circuit board, to which was attached the antenna cable, battery lead and the cable running to the pistol. There were the two halves of the plastic case, a battery compartment lid, panel transfer and a small package containing sundry knobs and screws.

Being the left-overs from a factory production run, the components were not presented and packaged with the finesse of a regular do-it-yourself kit but simply supplied in a plastic bag in a cardboard box, together with three or four roneoed sheets giving a few hints relative to adjustment and troubleshooting.

Superficially, assembly would appear to be simplicity itself: Strip the back off the panel label and stick it in place, at the same time pushing out the pre-punched segments corresponding to the holes in the panel. Then fit the pre-assembled circuit board under the top of the case, hold it in place with the pot and switch nuts, bring the leads out the back, fit the bottom of the case and the knobs and the job is done!

However, the only way it would have worked that way for us would have been if we had been prepared to settle for a rough job. Here's what we found it desirable to do:

- Thoroughly check the wiring board. One we had was neatly soldered, the other was fairly rough. In both cases one of the small inductors had been dislodged and needed to be re-cemented in place.
- The threads on the games selector switch did not come through the top of the case sufficiently for the nut to grip. We unsoldered the switch and filed the hole in the board sufficiently to let the body of the switch come hard against the board. We also cut some burr from the underside of the lid.
- The flat on the switch shaft did not match up with the indicator knob supplied. Rather than settle for a paint spot on the knob, we re-located the switch about 20-30 degrees further round, so that the knob would index correctly.
- One of the bat control pots would not mount snugly because a couple of wiring components tended to foul the underside of the pot recess in the lid. Rather than shift the components, we pared away a little of the soft plastic with an Exacto knife. It was also necessary to nip a small corner off the wiring board.

There is nothing very difficult or time consuming in matters like this for anyone familiar with electronic gadgetry but we make the point in order to stress that the components are factory over-runs and constructors have to be prepared to impose their own "quality control".

The sound effects, incidentally, involve the provision of a small loudspeaker inside the case. It would appear that almost any small unit will work, of 75mm diameter or less as, for example, a speaker salvaged from a discarded transistor portable. It can simply be slipped down between the front of the case and the edge of the wiring board and held in place, if necessary, by a couple of scraps of foam plastic. Leads to the voice coil can be run from two points on the board identified by the letters "LS".

Remember, by the way, that this game, like most others uses MOS chips and any soldering on the board should preferably be done with a small low voltage iron, with the body connected by clip lead to the "earthy" pattern.

We understand that ACE will be supplying oddment small speakers as part of the kit, for at least the initial batches, and that they are also having a full circuit diagram prepared to accompany each kit. For further information: ACE Radio, 136 Victoria Road, Marrickville, NSW 2204. Phone (02) 51 3845.

Why be without a radio?

As a pre-Christmas special, Classic Radio are currently offering a 6-transistor superhet portable receiver for $4.90, complete in carton with carrying strap, earphone and batteries. For mail order customers, package and posting is free.

The same model receiver was announced and reviewed in our December 1974 issue but the price then was $6.95 plus 90c P&P — one of those rare cases where selling price has come down rather than escalated!

Under the name "Genesonic", the receiver measures 1100mm x 70mm x 33mm, small enough to be packed or carried easily.

The receivers currently being offered are identical with those offered previously and our report published on that occasion, still applies:

"A couple of receivers checked by E.A. staff performed well in typical Sydney suburban areas, with ample selectivity to separate all the local stations, no obvious AGC problems and sensitivity to bring in a fair selection of country and interstate transmitters at night.

"Performance, in short, is up to the usual expectations of a miniature 6-transistor superhet and adequate for personal listening in all ordinary urban and provincial areas."

Better than that, one of those original receivers still lives in this reviewer's office and is hauled out every now and again . . . err . . . sorry . . . at lunchtime, to capture the latest cricket, football or tennis scores!

From Classic Radio, 245 Parramatta Rd, Haberfield, NSW 2045. (W.N.W.)

GENUINE AIRCRAFT CLOCKS 8-DAY EX RAAF

$27.50

P & P A$1.60 B$2.50
C$2.70 D$2.70

GENUINE EX ARMY WRIST WATCHES

Complete with nylon band **$19.50**
Post **$1.10**

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00
(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

RECEIVER No. 210

2-16 M/cs **$65.**
Transmitter No. 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones, Mic. Morse Key, Antenna **$110.**

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY

5" x 600' **$1.50**
7" x 1200' **$2.75**
P + P $1.30
10½" x 2400' $7.95
P + P A.$1.65 B.$2.75 C.$3.10

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75

Fully synthesised transceiver with am, upper, lower and independent sideband operation. 1KHz steps from 2MHz to 29.999MHz. 1 microvolt sensitivity. 2.5KHz bandwidth ssb. 6KHz bandwidth AM. 1 RW. PEP max output. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc. 400Hz supply

Ideal for amateur use.

PRICE $750

COLLINS SYNTHESISED 1 SB RECEIVER

TRC/75 receiver section of transceiver specification as above.

PRICE $400

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don. 8 perfection condition $35 per drum. $2.00 cartage to rail freight payable at destination.

RCA 77DX MICROPHONES

PROFESSIONAL QUALITY $75
P&P A. $1.80, B. $3.50, C. $4.55, D. $4.55.

20X to 60X ZOOM TELESCOPE

With Tripod. **$115.50.**
Post **A$2.25, B$4.10, C$6.10.**

SIEMENS Typing Perforator

240 Volt Type with Keyboard **$57.50**

SELSYN MOTORS MAGSLIP

RECEIVERS 2" MK2 $5.50
TRANSMITTER 3" MK2 $15.00

Post Packing A. $1.75, B. $2.75, C. $2.75, D. $3.65
P+P: A. $1.75, B. $3.00, C. $3.10

SOLENOIDS

200 MA 24 volt, ½in push movement.
$2.50 P+P 80c

NIFE CELLS

1.2 volt, fully charged, 4in x 3in x 1in 4 AH.

$1.50 each. P&P 80c.

CENTRE DRILLS 15"/64 x 5/64
Carbon Steel, **$3 dozen**
Post 60c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360? 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L. 10" with cross hairs, eyepiece, ½" right angle prism — height 10" — weight 3½kgs. With leather carrying case. Original cost $300.
Our Special only **$27.50**
P&P A.$2.25 B.$4.00 C.$6.00

POSTAGE KEY:

A: NSW
B: Vic, Qld, SA
C: NT, Tas.
D: WA

VALVES

BRAND NEW

6SN7	**$1.95**	6BN8	**$1.95**
5U4	**$1.95**	6GV8	**$1.95**
EF50	**$1.50**	6AK5	**$1.95**
5Y3	**$2.95**	1H6	**$1.50**
2x2	**$1.50**	832	**$5.00**

P+P 80c

THEODOLITES

Made by Wilds Microptic, with tripod Model T1, reads down to one minute of ARC **$750.**
(Usual Price **$1750**).
Model T2 reads down to one second of ARC **$1000** (Usual Price **$3200**).
Freight payable at nearest attended R'way Stn.

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb
$32.50

45 x 40
Length: 16in
Height: 10in
Weight: 2lb
$49.50

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.
POST: A. $1.75, B. $3.00, C. $3.60

TELESCOPES
25 x 30 $13.50
P&P A. $1.30

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only **$7.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new Complete with case.

		P&P	
8 x 30	**$32.50**	A	**$1.75**
7 x 50	**$43.95**	B	**$3.00**
10 x 50	**$44.95**	C	**$3.10**
12 x 50	**$46.00**		
20 x 50	**$47.50**		

SMALL CLIP-ON POCKET TELESCOPE

15X **$6.50**, P+P 80c

3" ASTRONOMICAL REFLECTOR TELESCOPE

117X magnification FL 700mm with 5x24mm finder scope and two section hardwood tripod. **$169.25.**
Post **A$2.25, B$4.10, C$6.10.**

3000 TYPE RELAYS

P.M.G. 200 ohms — 1,500 ohm Coils **$2.50** each P+P 80c

AIRCRAFT INSTRUMENTS

Directional Gyros.
AN5735-1 Air Operated.
$35
Sperry Artificial Horizon.
AN5736-1 Air Operated.
$45.
Slip and Turn Indicators
$17.50
P&P
A. $1.65, B. $2.75, C. $3.10

TV WAVEFORM MONITOR

Tektronix type 525
$175.00.

P.M.G. TYPE KEY SWITCHES.
75c P+P 80c

CONDENSER LENS

1½" diam. 4½" F.L. 75c. 2½" diam 2" F.L. **$1.50** each or **$2.50** per pair. P&P 80c

IMPELLER PUMPS

New gunmetal body. Stainless Steel Shaft. Neoprene Impeller. Up to 15ft Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx. size 8" x 5"
⅜" **$30.35**, ½" **$43.30**, ¾" **$47.60**
P+P: A. $1.95, B. $3.50, C. $4.60

Liquid filled compass

With magnified lens sight and degree reader.
Only **$7.95** each. Post $1.30

WHIP ANTENNAS

8ft in 6 tapered sections, copper plated steel no base **$9.50.**
P+P $1.30

MORSE KEY AND BUZZER

$4.25
Post 60c

MAGNESIUM DRY CELL BATTERIES

Suits PRC 25 and dozens of other uses. 15 volts long life only **$1.50** ea.
P+P: A. $1.35, B. $2.75, C. $3.60

PLESSEY PRODUCERMATIC STANDARD NAB STEREO CARTRIDGE REPLAY UNITS

600 ohm line balance outputs up to +30dbm. 240 volts, 50Hz operation.
$150.00

ROLA 66 MK 2 TAPE RECORDERS

Good condition
$275.00

BYER 77 MK 1 TAPE RECORDERS

Good condition
$175.00

6x4 ..... **$1.95**
VR65 ..... **$1.50**

TRANSCEIVERS Ex Army

No C45 set. 23 to 38MHz with headphones, mic. 24V power supply, etc. **$95.00**

$2.00 cartage to rail, freight payable at nearest railway station.

EX-ARMY TWO-WAY FM RADIOS

1.2 WATTS OUTPUT
SUPERHET
PRC9 AND 9A 27 to 39M/HZ
PRC10 AND 10A 38 to 55M/HZ
WITH HANDSET ANTENNA $25 EA.
UNTESTED
Battery $3.50 extra. Harnes $4.50 extra
$2 Cartage to Rail. Freight payable nearest attended Railway Station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated complete with Speaker and Amplifier.
RCA **$275**
BELL & HOWELL **$195.**
$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

CB RADIOS

PMG Approved Famous Pony Brand on 27 Meg.
7 transistor model **$55** per set of two (hand held).
11 transistor model 1 watt (hand held) **$72 ea.**
5 watt 6 channel **$89 ea.**
Post A. $1.75, B. $3.00, C. $3.60

COMMUNICATIONS RECEIVER

COLLINS R — 391/URR

Continuous tuning of range 500 Kills — 32MHz in 32 bands. Receive frequency indicated directly on digital counter type readout to within 300Hz. Selectivity adjustable in six steps. From 100Hz to 16KHz bandwidth. Sensitivity 1 microvolt or better 240 VAC operation — 10 inch rack mount — autotone on eight preset channels available complete with instructions and service manual and tested.
PRICE $500.

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C O D

4-digit DMM

True RMS, autoranging, 0.01% resolution and current range up to 10A are standard features of a new full 4-digit multimeter from Philips Test and Measuring Instruments. The PM2515 is available with LED or liquid crystal displays and is fully protected against overloading on all ranges.

As well as measuring voltage, current and resistance, the PM2517 can measure temperature from —60° to +200°C with an optional low cost probe. Other options include data hold which allows the display to be frozen by a switch on the probe. Only one input is required for AC or DC voltage from 100uV to 1kV, resistance from 0.1 ohm to 10M and current up to 100mA. A separate input is provided for the 10A current range. One switch allows selection of any measurement mode — including a special position for diode tests.

Other specifications include: a common mode rejection ratio of 80dB for AC, 100dB for DC; series mode rejection ratio of 60dB; long term drift of 0.05%/year; and a recalibration interval of one year — typical of laboratory-grade instruments.

Crystal oscillators

A new range of packaged crystal oscillators has been released by Clermont Electronics. Compact and economical, the units cover the range from .015Hz to 250MHz and are available with sinewave, TTL or CMOS outputs. Special packages, open PC board versions, temperature compensated (TCXO) and voltage controlled (VCXO) oscillators are also available.

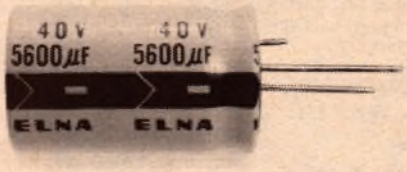
Further information from Clermont Electronics, P.O. Box 273, Mount Eliza 3830 Victoria. Telephone (03) 787-3091.

Diecast cases

A range of competitively priced diecast cases has been added to the products marketed by Australian Transistor Company. The cases come in three handy sizes, 100 x 50 x 25mm, 110 x 60 x 30mm and 120 x 65 x 40mm, with accurately fitting lids. The cases are slotted inside to support PC boards.

Enquiries to Australian Transistor Company Pty Ltd, 726 High Street East Kew, Victoria 3102. Telephone (03) 859-1372.

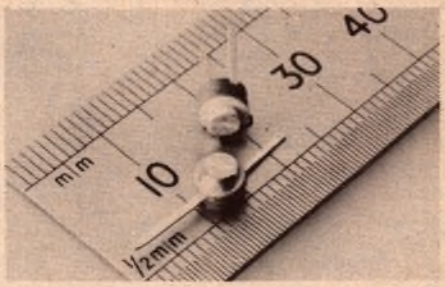
PC-mtg can electro



Soanar Electronics has introduced a new style of electrolytic capacitor which allows large capacitance values to be mounted directly on a PC board. Designated type RP, the style has a three-wire terminal configuration, with the third wire serving as an anchor. The initial range of values being stocked is 2500uF in 35V, 63V and 80V DC working and 5600uF in 40V DC working. Further values will follow.

Technical specifications and other details are available from Soanar Electronics Pty Ltd, 30 Lexton Road, Box Hill Victoria 3128. Telephone (03) 89 0661.

Ceramic trimmers



The CD5 range of miniature ceramic disc trimmer capacitors produced by Oxley Developments has been extended by the addition of a new unit having a range of 4-40pF. Like the other trimmers in the CD5 range the new unit is a BS 9000 approved product, and is available in either horizontal or back mounting configurations. Q at 1MHz exceeds 200, and self-resonant frequency is above 750MHz.

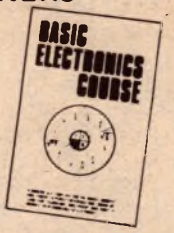
Further information on the CD5 range of trimmers is available from the distributors, IRH Components, Box 70, P.O. Kingsgrove NSW 2208. Telephone (02) 50 0111.

READ ALL ABOUT IT!

BOOKS from DICK

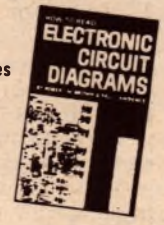
Dick has an enormous range of books for beginners, experts, professionals, hobbyists, amateurs. The titles listed here are just a small sample — call into a Dick Smith Store today and see the lot — or write to our Mail Order Centre for a detailed list!

BOOKS FOR BEGINNERS



Basic Electronics Course
Crowhurst — 361 pages.
A modern, self-study text for beginners, as well as a useful reference for trained technicians. Illustrated.
Cat. B-1689 .. .. .. $8.95

Electronics Self-Taught
Ashe — 285 pages.
Ten chapters crammed with everything the beginner in electronics needs to know.
Cat. B-1684 .. .. $7.50



How to Read Electronic Circuit Diagrams
Brown & Lawrence - 192 pages
Describes each circuit part and its function, gives clear pictures of components as well as circuit symbols.
Cat. B-1650 .. .. .. $6.50

Basic Electronics
E.A. Staff — 128 pages
An easy introduction to radio, hi-fi and electronics. 23 chapters profusely illustrated. Latest edition.
Cat. B-3620 .. .. $3.00

Basic Transistor Course
Kenian — 218 pages
Explains what transistors are, how they work and their relationships with other electronic components.
Cat. B-1567 .. .. .. $7.50

Fundamentals of Solid State
Rowe — 120 pages
An excellent introduction to semi-conductors and their applications. 17 chapters, many illustrations and drawings.
Cat. B-3621 .. .. $3.00

ANTENNA BOOKS

ABC's of Antennas
Lytel — 96 pages
Describes basic types of antennas, their radiation characteristics, uses and construction.
Cat. B-1000 .. .. $5.50

Wire Antennas for Radio Amateurs
192 pages
Gives construction details for many types of amateur band antennas including horizontal, vertical, multitrap and beam antennas, 2-160 metres.
Cat. B-2302 .. .. $9.90

All About Cubical Quad Antennas
112 pages
The world famous 'classic' on quads. Gives dimensions, data for many types of quad antennas.
Cat. B-2304 .. .. $7.90

Beam Antenna Handbook
200 pages
All information you need about construction of triband and compact beams including baluns, matching systems and test instruments.
Cat. B-2306 .. .. $9.90

BOOKS FOR AMATEURS (and aspiring amateurs)

Amateur Radio Techniques — RSGB
Hawker — 300 pages
Whatever branch of amateur radio you're interested in you'll find loads of information in this book's 300 pages with 700 illustrations. A bargain for the amateur enthusiast.
Cat. B-2040 .. .. $6.90

VHF-UHF Manual — RSGB
Evans and Jessop
This huge manual deals with techniques and equipment for operating above 30 Mhz. Valuable for amateur radio enthusiast.
Cat. B-2054 .. .. $15.00

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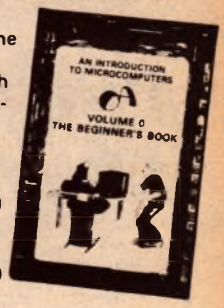

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Books & Literature

Servicing data

TAPE RECORDER SERVICING MANUAL, Volume Two, Second Edition, by John Gardner. Hard covers, 206 pages, 193mm x 252mm, illustrated by photographs, circuits and diagrams. Published 1977 by Butterworth & Co. Price in Australia $17.50.

Volume 1, reviewed in these columns in November last, was devoted to tape recorders popular in Britain during the years 1968-1970. It could have had only selective appeal in Australia.

The present volume may have somewhat wider interest covering, as it does, models released in the period 1971 to 1974. By this time, the preponderance of open-reelers and mono decks had given way to stereo cassette equipment.

Nevertheless, brands like Amerex, Elizabethan, Ferguson, ITT, Marconiphone, Saba and Teleton are rarely encountered in this country. That leaves the manufacturer's style service data on the remainder as the area of potential value: Akai, Grundig, Hitachi, National, Philips, Sanyo, Sharp, Sony and Tandberg; this, plus about 10 pages of general technical text, up front.

If you are in the business of servicing tape recorders, then the purchase price of this collection of servicing data may well be money well spent. Otherwise it would be little more than a collection of circuits, diagrams and related text.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067. (W.N.W.)

Small computers

AN INTRODUCTION TO PERSONAL AND BUSINESS COMPUTING. By Rodnay Zaks. Stiff paper covers, 245 pages 216mm x 140mm, illustrated by photographs and diagrams. Published by Sybex Inc., 2020 Milvia, Berkeley, CA 94704, USA.

According to the covering letter, this book, produced primarily as an educational text, has emerged as a "best seller" for Sybex. Whatever that means in precise terms, I can quite understand why it might be so. Given the feeling that one should know more about the subject, the immediate impact of the book is to generate the conviction that one should stop, and buy and read it!

It opens with a chapter "The Microcomputer Era" — a fanciful glimpse at the lifestyle of tomorrow's typical sales representative. But is it fanciful if it's only a decade away?

Then follow chapters which introduce the reader painlessly to microcomputer concepts: uses, definitions, operation and programs. This leads naturally into the computer language concept in particular, BASIC.

Chapter 7 comes to grips with computing in business, followed by other chapters explaining systems and peripherals, hints on selecting a microcomputer, the economic aspects, and reasons why things go wrong.

Following a final chapter "Tomorrow", the book closes with a series of appendices, giving details and information which would have bogged down the text, had they been included in the preceding chapters.

We haven't read it right through but we intend to! Our copy came direct from the publishers, with no price quoted. (W.N.W.)

Amateur radio

AMATEUR RADIO TECHNIQUES, by Pat Hawker, G3VA. Sixth Edition. Published by the Radio Society of Great Britain. Soft covers, 336 pages, 245mm x 183mm. Illustrated with over 750 diagrams. Price in the UK £3.20.

This latest edition of Amateur Radio Techniques follows on from the five preceding editions, the first of which appeared in 1965. During the intervening years the publication along with its author have become household names in the field of amateur radio, and well beyond. It is not a textbook in the ordinary sense of the word but more a compendium of many good and unusual ideas. As such, it is a very valuable reference for experimenters and others who wish to keep up with the more novel approach to electronics.

If you do not already have an earlier edition, then I suggest that you invest in this one.

Even if you have one, it is four years since the fifth edition and quite a bit of extra material has been added. This amounts to an extra 34 pages and these have been spread over the various chapters. For readers not already familiar with former editions, here is a list of the chapter headings.

1. Semiconductors; 2. Components and Construction; 3. Receiver Topics; 4. Oscillator Topics; 5. Transmitter Topics; 6. Audio and Modulation; 7. Power Supplies; 8. Aerial Topics; 9. Fault-finding and Test Units. These chapters are followed by an appendix which lists many IFs of receivers, etc. and a comprehensive index.

Although we do not have the local price at this stage. the UK price confirms that it is very good value. For readers who have the fifth edition, it would be still worthwhile to have a look and see whether you wish to update on the newly added material.

The review copy came direct from the publishers but copies are normally available from local technical booksellers. (ILP).

Satellites

SATELLITES FOR BROADCASTING. IBA Technical Review No. 11. By various authors, edited by Pat Hawker. Stiff paper covers, 71 pages 229mm x 199mm, illustrated by diagrams and photographs. Published by the Independant Broadcasting Authority.

This is not a regular textbook for general sale but is intended primarily for issue to technical libraries and to engineers directly involved in the broadcasting field. However, because of its very topical content, it is worth

Books & Literature

bringing to the notice of those who may not have been made aware of it.

The contents are as follows: Introduction — Development of communication and broadcasting satellites — The ITU plan for space broadcasting — Fundamentals of satellite broadcasting — Low-cost satellite receiving techniques — IBA earth station at Crawley Court — Satellite relays and distribution — Digital modulation for satellite systems.

A note on the title page indicates that copies of the IBA Technical Review No. 11 may be obtained by application to the Chief Accountant, IBA, Crawley Court, Winchester, Hants SO21 2QA. The charge is £1.50 per copy. Send crossed cheque with order, made payable to IBA. (W.N.W.)

Microprocessors

MICROPROCESSOR INTERFACING TECHNIQUES, by Autin Lesea and Rodnay Zaks. Second Edition, 1978. Sybex, Inc., Berkeley, California. Soft covers, 141 x 216mm, 412pp, many illustrations. Price in USA $9.95.

A book intended for those wanting to go a little further into the design of microprocessor systems than is covered in basic books like Zaks' "Microprocessors: From Chips to Systems", which was reviewed in these columns a couple of months ago. It starts with the processor, deals first with interfacing basic system elements like RAMs and ROMs, and then progresses to deal with I/O interfacing — simple things like keyboards and displays first, then teleprinters and VDUs, cassette tape, floppy discs and so on.

It covers a lot of ground, perhaps too much for a book of its modest size. Many of the more advanced tropics are treated very sketchily, the reader being given little more than a broad idea of the type of techniques employed. Still, this will probably give the newcomer a reasonable grounding, sufficient to build upon with further reading.

The processors discussed are the 8080, the 8085, the Z-80 and the 6800, with many of their associated devices.

The diagrams used to illustrate many aspects of the text are of variable quality. Quite a few appear to be reproduced from manufacturers' data, and some are either so small or so poorly reproduced as to be of very limited value.

All in all, though, I think many will find it a valuable book in helping them to delve deeper into micro systems, despite its limitations.

The review copy came direct from the publisher, but I believe copies are available from Computerland. (J.R.)

INFORMATION CENTRE

TACHO FOR CDI: About 2½ years ago I built the Capacitor Discharge Ignition described in "Electronics Australia" in July 1975. The unit has worked in a four cylinder Japanese car to my complete satisfaction and never caused any problem. However now that I have transferred the CDI to a six cylinder Datsun Skyline I found that I cannot use the tacho. I believe this is a common occurrence with CDI.

I wonder whether you can suggest any remedy for this problem, as I would like to use CDI in preference to a transistor assisted ignition. (J. H., West Pymble, NSW.)

● We suggest you refer to the article entitled "Impulse Tachometers and Capacitor Discharge Ignition" published in the April 1978 issue (File No 3/TM/14). You might also wish to try adapting the circuit of the "Tune-up Tachometer" published in October 1975 (File No 3/TM/11).

PLAYMASTER TWIN 25: I have built the Playmaster Twin 25 and it has been giving faultless performance until recently when it started giving a very loud crack in the speakers at the moment of switchoff. The amplifier is fitted with the speaker protector kit, but the noise appears before the relay can disconnect the speakers. I moved the suppressor capacitor from the terminal block to the terminals on the switch, but this has not cured the problem. Could you please advise me what could possibly be wrong? This noise is definitely out of place in such a noiseless amplifier. (K.C., Northgate, Qld.)

● Replace that capacitor. It is almost certainly open circuit. The replacement should have a rating of at least 250VAC or 630VDC.

PROGRAMMABLE LOGIC ARRAYS: I am an avid reader of your magazine and find your articles most informative. At present I am very interested in learning about programmable logic arrays. However information about their use is not easily obtainable and I am unable to understand their operation and application. Would you consider presenting an article on these devices, beginning perhaps with "discrete" circuits for experimentation, then on to ICs? (W.H.S., Footscray Vic.)

● You'll find a small amount of material on PLAs on pages 22 and 23 of our handbook "An Introduction To Digital Electronics". We'll have a look at the idea of publishing more information on these devices, although they're still rather specialised in their applications. You may be able to obtain further information from firms who market or distribute PLA devices, in the meantime.

SCRAMBLERS: Lots of books dealing with the war years refer to scramblers. I often wondered about them — concluded they were probably pulse transmissions with noise added. You may have printed something already but, if so, I missed it. Perhaps you could base an article on it one day.

My congratulations on the high quality of the magazine. (D.K., Waverley, NSW).

● As we recall we have not dealt with this subject. However, we can tell you that they were in use long before the war, mainly on the overseas telephone circuits, to prevent eavesdropping by short-wave listeners.

The early systems were simple speech inverters. The audio signals were heterodyned with a higher audio signal, outside the audio passband of the sytem, so that the high frequencies became low frequencies and the low frequencies, high frequencies.

This was a fairly easy system to crack, once the principle was known, and a later system was developed to overcome this. This changed the heterodyne frequency every 20 seconds, synchronously at both ends of the link, in a random pattern.

Other, much more elaborate, systems have been developed, but little information is available about these.

Thank you for your kind remarks about the magazine.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Steam loco . . . from p23

overhead wires and catenary masts would be avoided.

The locomotive we are now studying is a 2.5MW (3350 horse-power) express freight and semi-fast passenger locomotive. It would be ideally suited to such duties, particularly on the sort of long hauls found in India, Australia, Russia, China, Africa and the Americas, where electrification is unlikely to be worthwhile. It might have applications in Europe, too.

Reprinted in abridged form from "Spectrum", journal of the Science Unit of the Central Office of Information, London.

NOTES & ERRATA

LOW COST VDU (August-September 1978, File No. 2/CC/28-29): The PCB wiring diagram shows the wrong polarity for C18. Also the positive side of C18 should be linked across to the +5V supply line, present on PCB edge connector pads ABC-123 adjacent.

ALTERNATIVE KEYBOARD FOR LOW COST VDU. (September 1978, File No. 2/CC/30): The PCB number quoted in the article should be 78ut4, and not 78up4.

MINI SCAMP REACTION TIME (May 1978, File No. 8/M/29): The instruction at hex location 0004 should be changed to LDI 31 (hex C4 31) for correct operation.

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AUSTRALIAN RADIO DX CLUB, the national group for people interested in long distance (DX) radio reception and monitoring as a hobby. The monthly bulletin "Australian DX News" is a primary source of DX information for Electronics Australia's "Shortwave Scene" and covers shortwave broadcast, medium wave and utility listening. Write for details, enclosing a 30c stamp to ARDXC, PO Box 67 Highett, Victoria 3190 or PO Box 79 Narrabeen, NSW 2101.

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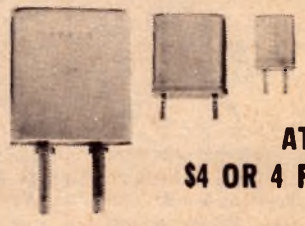

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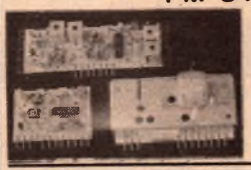

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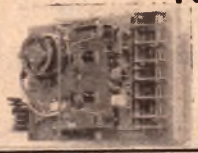

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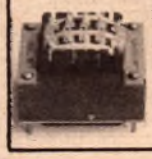

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ADVERTISING INDEX

A & R Sonar	80
ASP Microcomputers	95
Abacus Computer Store	86
Ace Radio	114
Acme Engineering	35
Acoustic Research Australia	30, 45
Agfa-Gevaert Ltd	In colour section
All Electronic Components	78
Astro-Optical Supplies Pty Ltd	66
Audio Telex Communications Pty Ltd	83
Australian Government Recruiting	51
Australian Seminar Services	93
BASF (Aust.) Pty Ltd	In colour section
BWD Electronics Pty Ltd	117
Bail Electronic Services	109
Bright Star Crystals	100
Butterworth Pty Ltd	74
Cema (Distributors) Pty Ltd	27
Chapman L. E.	127
Chirnside Electronics	108
Classic Radio	110
Clock Disposal Co.	126
Convoy International Pty Ltd	42
Deitch Bros	120
Dick Smith Electronic Group	21, 38, 39, 48, 77, 102, 112, 122
Diggerman Electronics	126
E. D. & E. Sales Pty Ltd	78
EMI (Australia) Limited	128
Electrocraft Pty Ltd	80
Electronic Calculator Discounts	89
Elmeasco Instruments Pty Ltd	28
Enfield Radio Service	126
Ferguson Transformers Pty Ltd	15
Hagemeyer (Aust.)	In colour section & OBC
Harmonix Acoustix	52
Honeywell Pty Ltd	26
Hurtle Webster Pty Ltd	126
Instrument Technics	67, 68, 69
John Burnett & Steven Penning	101
Lanthur Electronics	66
Latrobe University	21
Leroya Industries Pty Ltd	29
Linear Electronics	128
M.R. Acoustics	84
McGills Newsagency Pty Ltd	124
Moysten Enterprises	123
National Panasonic (Australia) Pty Ltd	IBC
Non-Linear Systems (Australia) Pty Ltd	23
Paris Radio Electronics	92
Pennywise Peripherals	91
Philips	2
Plessey Australia Pty Ltd	34
RCS Radio	25
Radio Despatch Service	99
Radio Parts Group	104
Rod Irving Electronics	90
Royston Electronics	63
S.M. Electronics	89
Sabtronics International	In colour section
Sontron Instruments	95
Sony Australia Pty Ltd	IFC
Stewart Electronics	94
Stotts Technical College	65
Superscope (A'asia) Pty Ltd	36, 58
Tandy International Electronics	22
Tasman Electronics	101
Technico Electronics	61
Tektronix	9
Television Replacement Service Pty Ltd	121
Vanfi Pty Ltd	In colour section
Vicom International	106
Video Technics	84
Vneshtorgreklama Elorg	In colour section
Warburton Franki Ltd	6
Wireless Institute of Australia	111

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The first and foremost function of an amplifier is to amplify. To amplify all the incoming signals as accurately as possible. Technics terms this "waveform fidelity" which simply means that the music that's put in will be the music that comes out, neither adding nor subtracting from the original.
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National Technics hi-fi

T78.18

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Every day people all over the country go into hi fi dealers with complaints about their tape recorders.

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