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JUNE 1979 INTERNATIONAL

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When it comes to speaker design, JVC goes 2969 times further.

Traditionally, speaker systems have been designed by a tedious trial and error proccess, by which individual combinations of speaker, crossover and enclosure combinations are analyzed—one at a time—until the desired sonic results are achieved.

JVC has put an end to these time-consuming and archaic procedures, with a revolutionary new system called Phase Moire (Mor-ay) Propagation Technology, that uses a specially-constructed device to move a test microphone in a way that creates and preserves, via computers, video and high-speed filming, a field of nearly 3000 sound testing positions.

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The initial result of our unique Phase Moire Technology, combined with a great deal of human engineering, is the SK-1000. This unusually-efficient, extraordinary-sounding three-way speaker system delivers truly magnificent, rock-solid bass from its 12" free-edge woofer and heavy magnet structure. Capable of handling up to 170-watt peaks (85 watts RMS), the SK-1000 reproduces vocals and midrange with unusual smoothness, thanks to our specially-designed 5" midrange driver. Clear, crisp, brilliant highs are dispersed evenly within the listening area from a 1" soft-dome tweeter.

We also give you complete control over midrange and tweeter response with a pair of front-panel level controls.

But all the technology in the world can't fool two of the most sophisticated testing devices known: your ears. And all the words in the world can't tell you what the SK-1000 (and its two smaller companions, the SK-700 and SK-500) really sound like.

So we suggest that you hear what we've been talking about at a JVC dealer.

For details on all JVC Hi-Fi Equipment, write to JVC Advisory Service, P.O. Box 307, North Ryde, New South Wales 2113.

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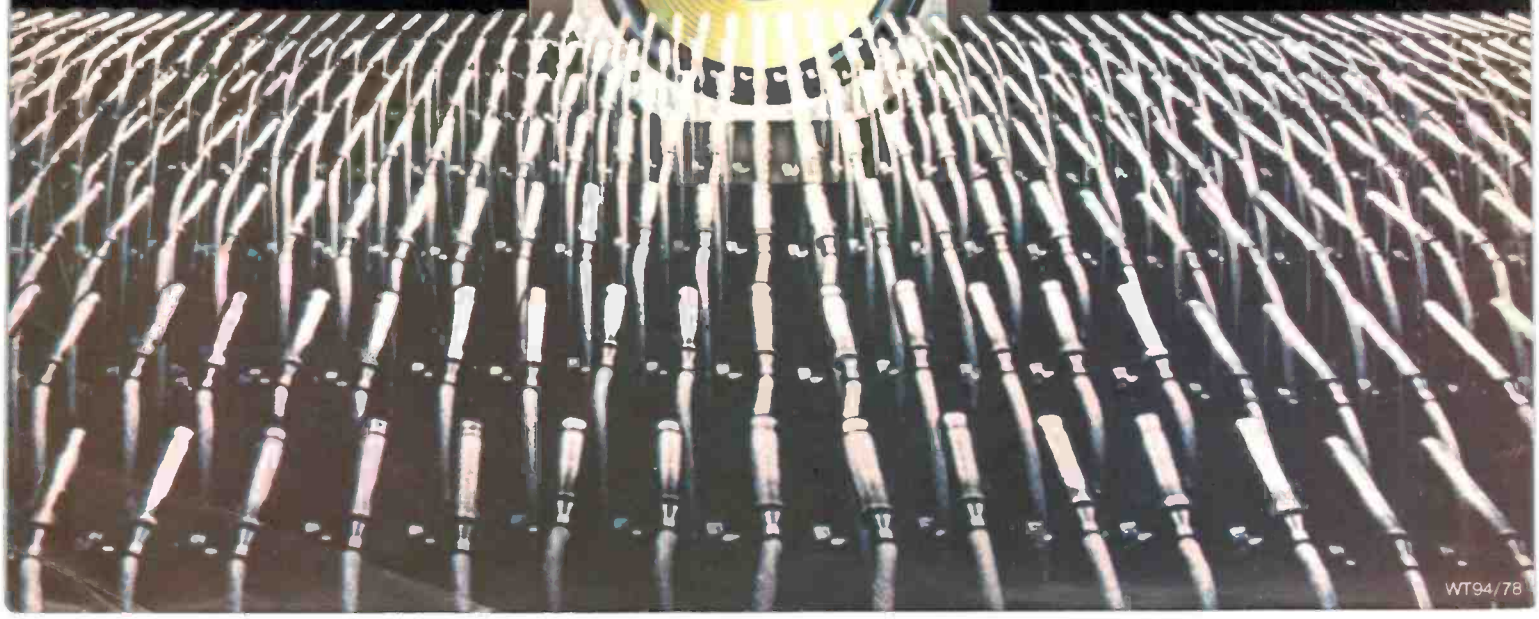


WT94/78

Registered for posting as a publication – Category B

ELECTRONICS TODAY INTERNATIONAL

WELCOME TO the 'new look' ETI. You will have already noticed some of the changes. This is no longer the 'contents' page, for one!

We're proud of our product and have often pondered how best to display our 'wares'. Over the page you'll find a double page spread telling you, briefly, about every item we have to offer you in this issue. We have included the advertisers' index too. After all, they form part of the magazine's contents. Also included is a short list of features we've planned for next month's issue.

As we foreshadowed last month, the magazine is undergoing a number of changes in style, typeface and layout . . . and size.

We're all enthusiastic about the 'new look' – we hope you like it too. We have some 'fine tuning' to do but we think you'll be as enthusiastic as we are about the final product.

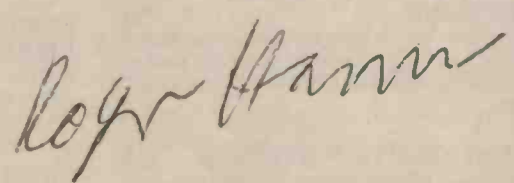
Along with these changes, we will be altering our 'banner'. So many readers refer to the magazine simply as "ETI" that it makes sense to use that as our title. Our new 'logo' is at the top of the page. Shortly you'll see it on the magazine's cover and our newsagents posters.

The staff are enthusiastic about what lies ahead, as the magazine approaches its tenth year of publication. The editorial and project staff are all ex-readers; electronics hobbyists, like yourselves. The notable exception is Managing Editor, Collyn Rivers (who prefers mechanical things) – but he started the magazine!. We manage to pursue our hobby as a vocation.

Through our news and features articles we will bring you what is interesting, informative and useful – to keep you abreast of what's happening both here and overseas. So much of interest is happening so rapidly in the fields of hi-fi and audio, personal computing and communications. With projects our philosophy is to present designs which are interesting or novel – but above all, practical. We make every attempt to ensure that components for our projects are available. We realise it's frustrating not being able to tackle an appealing project because critical components cannot be obtained.

Welcome to the new look ETI. We're **sure** you'll like it.

Roger Harrison, Editor



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eti

JUNE 1979 Vol.9, No.6.

ELECTRONICS TODAY INTERNATIONAL

Reviews

Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number.

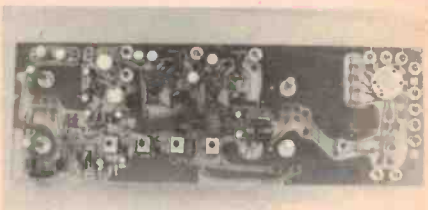
COVER

Spectacular picture of Io, a moon of Jupiter showing a volcanic explosion at upper right. The brightness of the plume has been increased by computer but its greenish-white colour has been preserved.

News

Features

Projects



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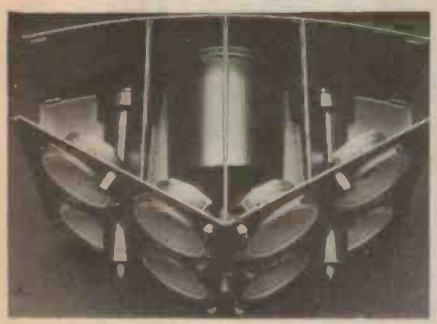
Sound



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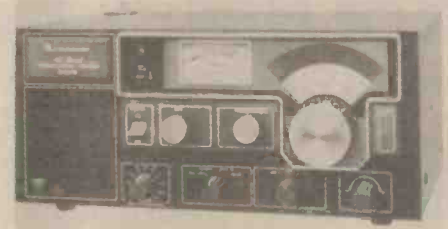


NEXT MONTH

*OUR ANNUAL CE SHOW ISSUE

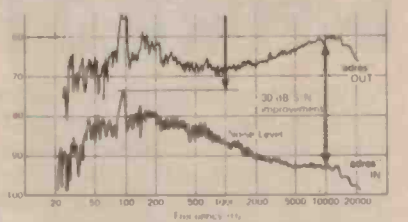
News on the latest consumer electronic equipment released here this year and details on the Show — we'll be there too!

"Series 4000" stereo amplifier

Build a superb stereo amplifier from two of our ETI 470 60 watt modules and the high performance preamp (ETI 471) described in this issue.

Nakamichi 582 cassette deck

We review this sophisticated cassette deck designed for the new Metafine tapes and incorporating a 'diffused resonance' transport for low noise and improved performance. See how it measures up.



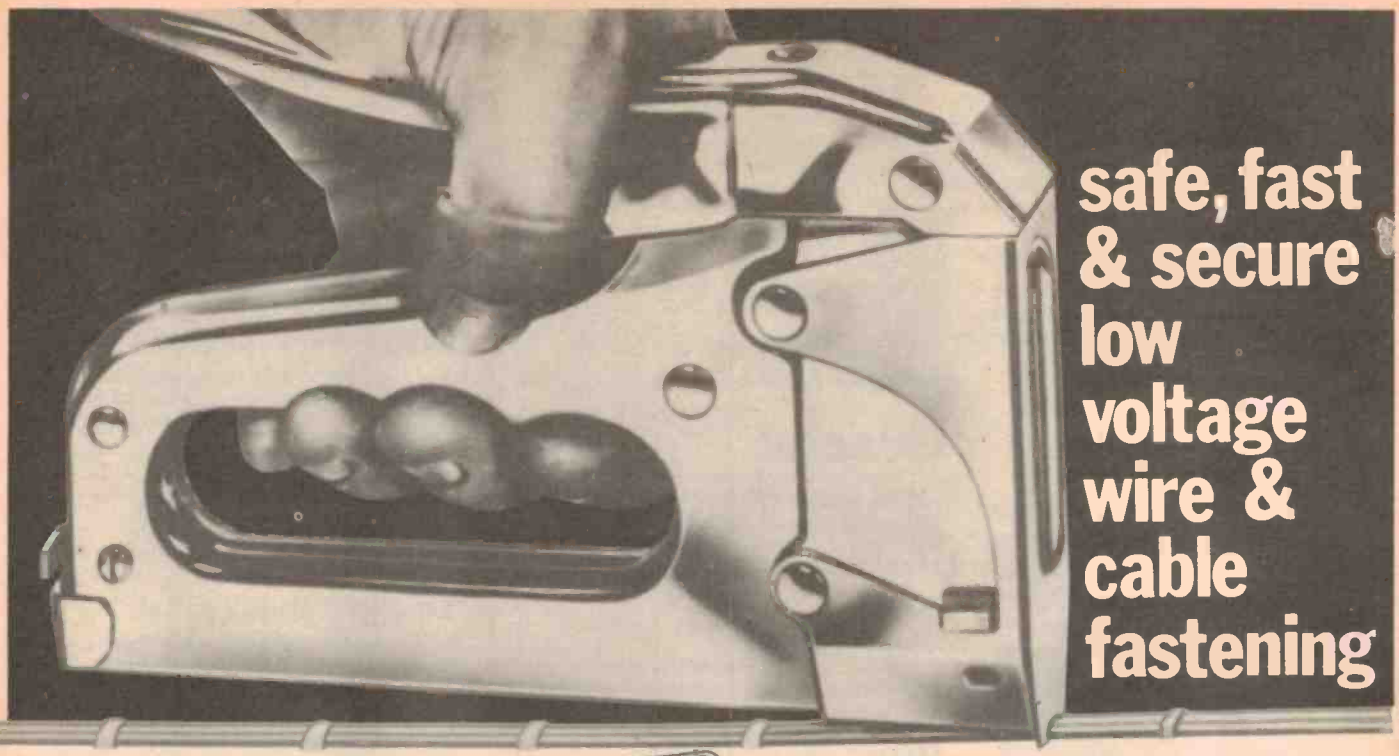
The 'Adres' noise reduction system

Claimed to rival the Dolby system — we examine the technique in depth.

Microwave oven leak detector

A simple project of topical interest. It is inexpensive to build and has features we've not seen on commercially available models.

Although these articles are in an advanced stage of preparation circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.



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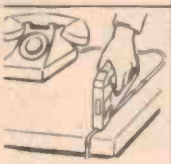
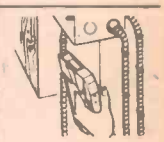


Telephone Wiring

Intercom Wiring



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That is why two heads are better than one. It gives your customers the choice of two exceptional systems in design technology.

Philips N6325 Electret Headphone (Above)
The electret principle embodies all the advantages of electrostatic sound reproduction, yet manages this without cumbersome weight or expensive power supplies. There is no reduction in performance, but there is a significant fall in cost.

Philips N6330 Electrodynamic Headphone (Below)
Although N6330 (Philips' range leader) is a conventional electrodynamic headphone, there is nothing conventional about the revolutionary design concepts that ranks these phones with any competitor in the world today. And **not** as expensive as you would expect.

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ETI May

Lexicon sued by rival translator designer

Three weeks before Lexicon released their handheld translator in Australia through Hanimex, Friends Amis Inc, the designer and manufacturer of the rival Craig M-100, filed a US $5 million antitrust suit against Lexicon.

Charging Lexicon with lying to potential customers and violation of antitrust laws in marketing a competing device, Friends Amis stated in court papers filed in San Francisco that Lexicon, Barco Business Machines and a distributor, amongst others, falsely told distributors and actual or potential customers that Friends Amis could not meet its commitments or orders; that it was experiencing manufacturing difficulties; that Lexicon held patents covering Friends Amis' translator and that it had filed a suit that would prevent Friends Amis from making or marketing its products.

The Friends Amis suit also charged that Lexicon had falsely stated that it had existing injunctions preventing Friends Amis from shipping translators and that Friends Amis was experiencing substantial patent difficulties. The suit charged Lexicon with violation of the US Sherman Act for attempting to restrain and monopolise interstate and foreign commerce.

Ron Gordon, owner of Friends Amis, said that his firm and Lexicon had both requested patents for their translators, but that "there is a huge difference between patents pending and patents issued".

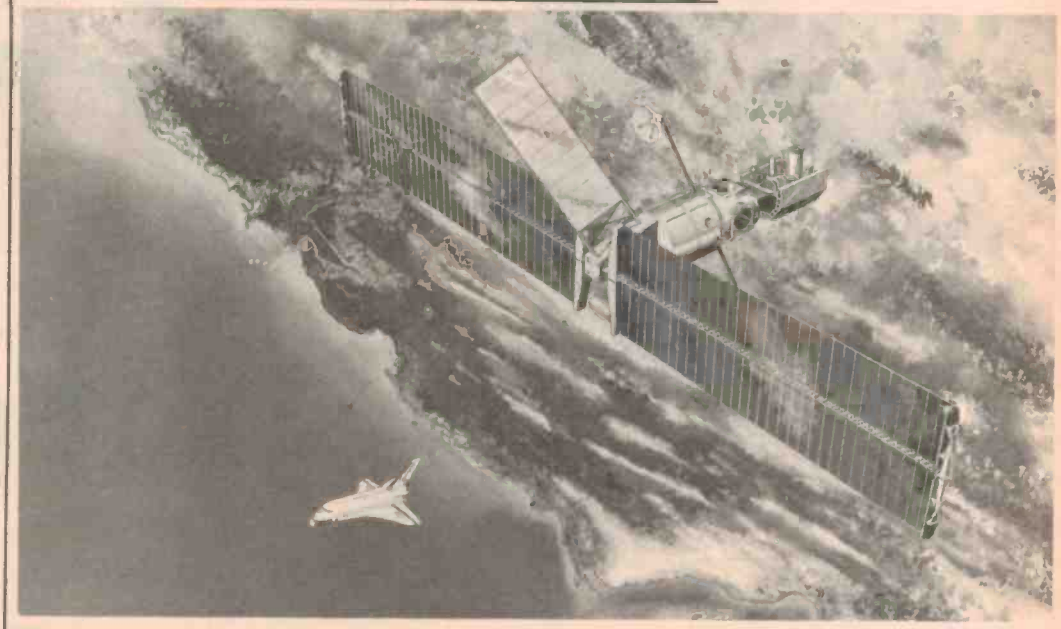
Questioned at the Lexicon/Hanimex press release function at the Sydney Hilton early in May, a Lexicon spokesman told ETI that it is a common practise in the US for companies to file such suits "merely to gain publicity".

He said that Lexicon had applied to the US patent office some time before Friends Amis. Lexicon had received a letter from the patent office and that "the US patent office has never given a patent to anyone who was second".

The hobby computer boom

This year, the hobby computer market in Australia will have an estimated turnover around three million dollars. rising to five million by 1980 and over fifteen million dollars by 1982, according to predictions based on US and European market projections, it seems a full-scale consumer boom has set its course.

The home computer fills the same needs as any other hobby — with one exception. While other pastimes give a great deal of pleasure to the lone hobbyist and also afford the possibility of club activities and contests, the hobby computer gives something more — education. Anyone who has ever had occasion to work with a large computer — be it for wage calculation, engineering design or any other use — will realise just how complex the subject is. In order to



This is an artist's concept of a 25 kW power module that may be among the first long-life devices to generate large amounts of solar power in space.

Under contract to NASA's Marshall Space Flight Center in Huntsville, Alabama, Lockheed Missiles & Space Company, of Sunnyvale, California, conducted a study to assess the feasibility of using existing hardware in the module's development, to project future payload requirements and to identify ways to increase power output from 25 kW to as much as 250 kW.

The power module concept makes use of solar arrays developed by Lockheed for the Solar Electric Propulsion Stage. The instrument would support shuttle and spacelab operations for at least five years before being returned to earth for refurbishment and re-launch.

fully understand the machine, it **has** to be played with. Play is essentially a learning process and the opportunities for play offered by large machines is limited — so the obvious answer is to buy your own.

This carries its own problems for the hobby computer industry. It has been said in the past that what caused the recent boom and slump in CB equipment was the fact that the units were sold as toys. They came into fashion and the market grew apace. They went out of fashion as people ran into the limitations of their rigs and the market dropped dramatically.

Will the same happen to the home computer market? We don't think so, because none of the major retailers in this country is selling their machines purely as toys. All of them have to some extent retained the respectability of image which the word "educational" gives to their advertising.

Meanwhile the market is growing steadily. We will continue to support it fully and assist our readers to **learn** from what they read in this magazine — not just build it, play with it and throw it out.

Transistor confusion reduced

There are so many equivalents to the common NPN and PNP small-signal transistors specified for projects and circuits, all having the maximum possible permutations of base-collector-emitter lead orientation, that it's a wonder many enthusasists ever successfully complete projects.

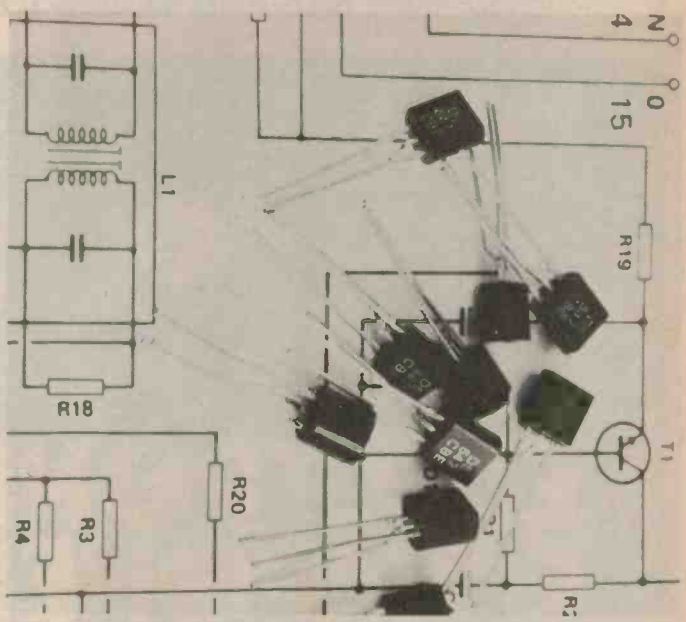
What has been needed for a very long time is a limited series of the most common small-signal transistors with **one standard base lead arrangement.** This would allow a constructor to insert a transistor into a pc board, knowing **with complete confidence,** that the lead orientation was correct.

Dick Smith has done just that. With the introduction of his 'DS' series he intends to rationalise his line of small-signal transistors, reducing the confusion that occurs with so many equivalent types.

There are five types in the DS series; three NPN — DS547, DS548 and DS549, and two PNP — DS557 and DS558.

Each has the same standard base lead arrangement — c-b-e and what's more, **the lead connections are marked on the base.**

The DS series come in T092 plastic packs, manufactured for Dick Smith Electronics according to the pro-electron series. Comparable types are:



DS547 . . BC107, BC207, BC147, BC182, BC547.
DS548 . . BC108, BC208, BC148, BC183, BC548
DS549 . . BC109, BC209, BC149, BC184, BC549
DS557 . . BC177, BC307, BC212, BC157, BC557
DS558 . . BC178, BC308, BC213, BC158, BC558.

Australian director for Mt Stromlo

Two British and two US scientists have held the directorship of Australia's Mt Stromlo observatory since it was established in 1924.

Now, after 55 years, an Australian, Professor Donald Mathewson, has been appointed to the post.

An important observatory since its opening, the Mt Stromlo facility added a field observatory at Siding Springs, in the Warrumbungle Ranges near Coonabarabran in NSW, in 1964. The joint Anglo-Australian telescope project at Siding Springs has pushed the observatory to world prominence and it is now a key establishment in international astronomy.

Prof. Mathewson put himself through night school and university paying his fees by working as a laboratory assistant in a Brisbane hospital. He joined the CSIRO in 1955 as a researcher, moving to Jodrell Bank in the UK in 1958 at the invitation of Sir Bernard Lovell. He was appointed acting director of our observatories 18 months ago.

It is expected Prof. Mathewson will lead a drive for Australian universities to turn out more PhD graduates in astronomy and to press for greater use of the NASA airborne observatory.

The Oddie dome pictured at left was the first construction at Mt Stromlo.

Pioneer to reduce prices

Due to the strengthening of the Australian dollar against the Japanese yen, Pioneer will be reducing their prices by about 10 percent.

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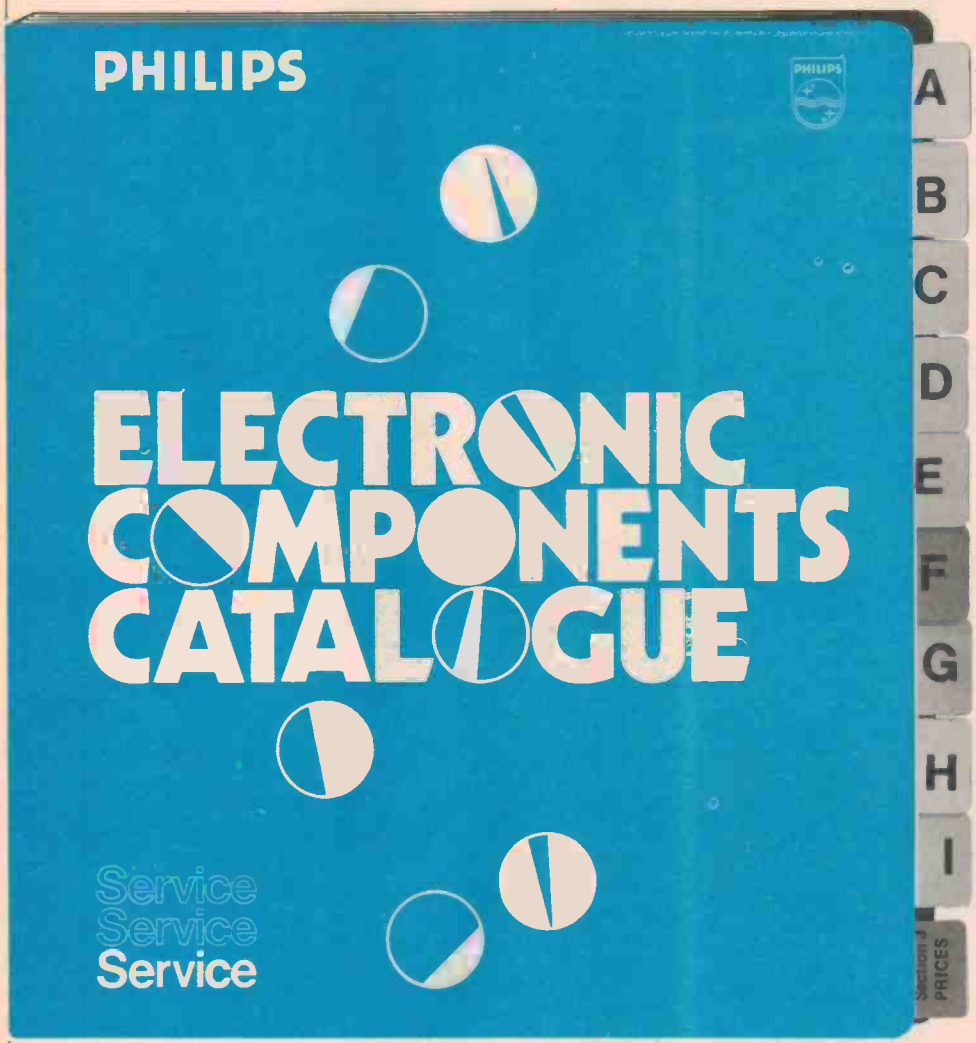

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Lie detectors under fire in US

A forthcoming Presidential report on the need to safeguard individual privacy is expected to add fresh fuel to the campaign against the use of the 'polygraph' — better known as a lie detector — in employee interviews and internal pilfering investigations.

Many people think that not only are lie detectors tests unreliable, they also represent an invasion of personal fundamental rights.

For example, people being interviewed for jobs might be asked to state their sexual and political preferences.

The polygraph monitors the subject's breathing rate, blood pressure and skin resistance while questions are being asked. From an analysis of the results, polygraph operators claim to be able to detect stress associated with giving a false answer.

Even though the polygraph may not be infallible, the fact that many of the general public believe that it is infallible leads them to tell the truth while being monitored. In 1971, when President Nixon proposed that 1500 Executive Branch employees be polygraphed after press leaks, he said:

"I don't know anything about polygraphs and I don't know how accurate they are, but I know they'll scare hell out of people".

Americans question voiceprints

Voiceprint analysis, in which a recording of a human voice is analysed for its spectral content and compared with known samples to prove identity, is questioned in a report by the National Academy of Science.

Voiceprint evidence, which has been allowed in US courts since 1966, is used in cases where, for instance, a ransom message is recorded from a telephone call. It has been used over a hundred times since its introduction.

The FBI commissioned the report, which took two years to prepare.

The conclusions were that voiceprints were often ambiguous and should be used 'with great caution'.

The FBI does not use voiceprints as evidence.

Microprocessor Controlled DVM

The AUTOCAL 1071 is a seven and a half digit DVM with an input impedance of 10 000 M.

As the name suggests, the unit has automatic calibration — on all ranges — and can be calibrated via an IEEE 488 bus (the connection standard used by the Commodore PET — see ETI May 79, p 73). Another interesting feature is the 'error' readout (in ppm or percent). When the 'error' key is pressed, the machine takes all the factors influencing the error into account and gives the maximum possible error for the measurement it is making at the time.

The addition of a microprocessor makes it possible to perform arithmetic operations on the measured figures — such as averaging, finding maxima and minima and computing ratios.

The Dindima Group Pty. Ltd., PO Box 106, Vermont, VIC 3133.

Dick Smith introduces Sorcerer accessories

We heard several weeks ago that Dick Smith Electronics was having trouble with supplies of the Exidy Sorcerer home computer (see review in ETI April 79, p.63). The grapevine now tells us that those problems have been solved with the replacement of one of the Exidy export staff.

The Sorcerer is unique in having the option of plug-in ROM (read-only memory) which make it possible to change the high-level language in which the machine operates. At present, only BASIC is available but Exidy have for some time been promising APL (a much more powerful language, but not for beginners) and a word processing system as plug-ins as well as an assembler/editor package.

While none of these has as yet reached this country, we hear that they are on their way. Dick Smith is also offering a faster printer (120 cps at $1298), an S-100 expansion board and a dual-drive floppy (630 K).

For full details, contact **Duncan Craven at Dick Smith Electronics, 24 Carlotta St, Artarmon, NSW 2064. Phone: (02) 439-5311.**

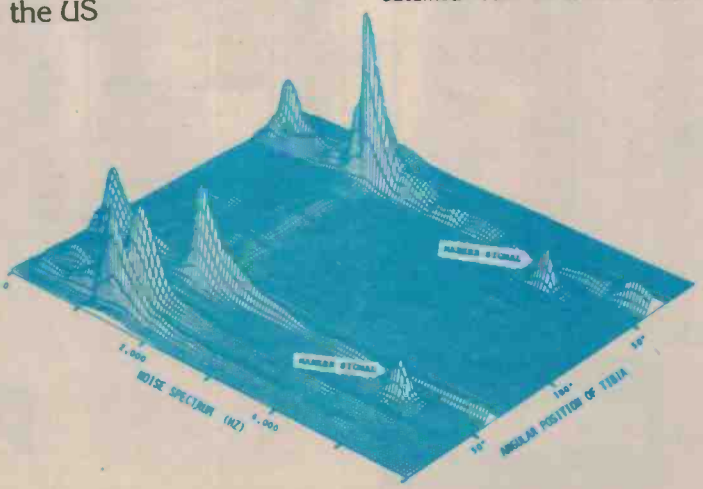
Computer Looks At Creaking Knees

A computer technique for diagnosing knee trouble by measuring the sounds a joint makes as it bends is under development in the US

A microphone assembly is held against the patient's knee "in a quiet room" and the joint is bent and unbent in time to a pendulum (for repeatability). A marker signal is generated when the leg reaches its full travel. The sound information is then digitised and drawn by the computer for further study.

It is hoped that the method will allow not only the nature of the disorder to be diagnosed but also the improvement or worsening with time and the position in the joint itself.

University of Akron, Ohio researchers have been investigating the technique.



A computer plot of the signal obtained from an arthritic knee.

ETI Unitrex calculator contest

The result of April's contest was as follows: The tuna salesman needs two weighings to determine which is the heaviest can.

He will, of course, be able to tell at a glance which pan of the scales is the one biased with the extra weight — it will sit lower than the other with no cans on the scales.

The winner was **Martin Elgner** of Greystanes.

New SLIM series of rectifier bridges to reduce PCB size.

Electronic Components and Materials

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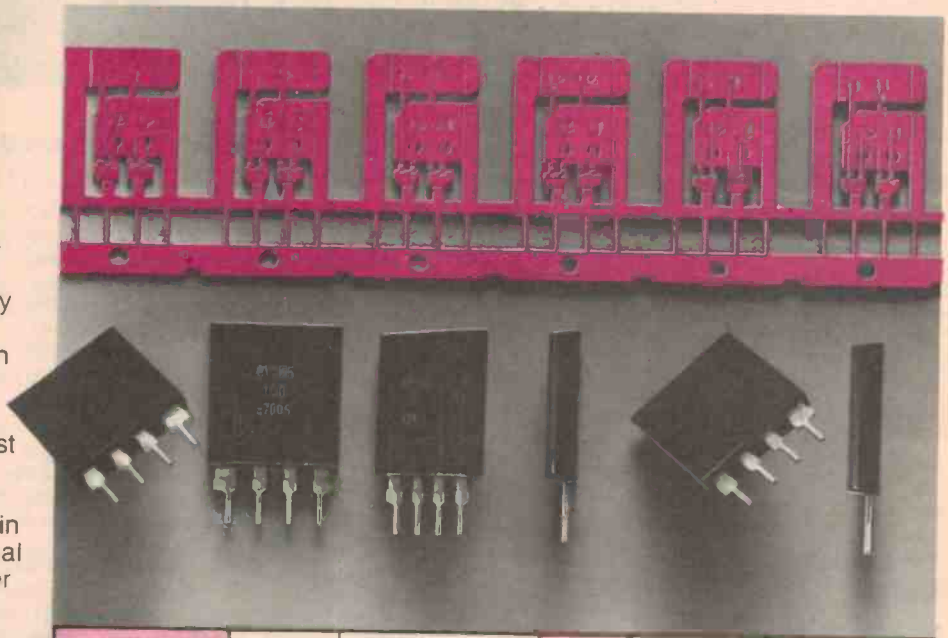

The new BY224 and BY225-series of full wave silicon bridge rectifiers have a thickness of only 5.5mm. This means *your* new equipment designs can cut down on PCB space needed for the older type bridges.

These bridge rectifiers consist of four double-diffused diode crystals assembled on a copper comb, and plastic encapsulated in a SOT-112 package. Their internal construction, in which the copper comb is in close proximity to the back of the device, makes them suitable for operation with a heatsink (using clip 56366).

The smaller Philips bridges BY164 and BY179 and the Mullard BYW44 to 47 series complement the BY224 and BY225 series to provide an extensive range of bridge rectifiers for both PCB and bolt-down mounting.

For older equipment the Mullard OSH series remains available.

	Type No.	'OSH' type superseded	Encapsulation	Input voltage $V_{sin(rms)}$ max.	Repetitive peak input voltage V_{RRM} max.	Non-repetitive peak current I_{FSM} max.	Average output current $I_{O(AV)}$ max.
PCB MOUNTED TYPES	BY179	–	All-plastic module (SOD-28)	280V	800V	25A	1A
	BY164	–	All-plastic module (SOD-28)	85V	120V	25A	1.4A
	BY224-400 -600	–	Plastic module with heat-sink face (SOT-112)	280V	400V 600V	85A	5.5A
	BY225-100 -200	–	Plastic module with heat-sink face (SOT-112)	85V 140V	100V 200V	100A	4.2A
BOLT-DOWN TYPES	BYW44-200 -400 -600 -800	OSH03-200 -400 -600 -800	Plastic single-hole fitting	140V 280V 420V 560V	200V 400V 600V 800V	40A	4A
	BYW45-200 -400 -600 -800	OSH05-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	6A
	BYW46-200 -400 -600 -800	OSH07-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	8A
	BYW47-200 -400 -600 -800	OSH10A-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	180A	12.5A

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Portable speech recognition aids the deaf

A device which fills in the 'spaces' for a deaf person by means of a microprocessor speech recognition system is being developed in the States.

For example, when the speaker says "fee" or "see", the computer, which fits in the user's pocket, will recognise the "ee" sound and display the fact on a 'head-up' LED array onto a pair of glasses. The lip-reader can use the information presented by the machine along with the information which he gains by watching the speakers face — which tells him whether the first sound is an "f" or an "s" — to work out the entire sound of the word. It is hoped that this will eventually become completedly automatic for the deaf person.

The computer will have to run off less than 100 mW and require 16 K of ROM and 4K of RAM.

The research is being done at the Centre for Technological Applications, Research Triangle Institute, Gallaudet College, Washington.

Errata

February 79, p 15, "Communicating With Other Worlds"

Near the bottom of the left-hand column, the phrase, "a diameter of 305 m (500 feet) in the air." should read, "a diameter of 305 m (1000 feet). This telescope has a fixed spherical reflector which rests in a natural depression in the ground between limestone hills, since the cost of digging a hole big enough to hold this reflector was felt to be prohibitive. The radiation received by the reflector is focused onto a platform some 150 m (500 feet) in the air."

May 78, pp 90 — 91. ETI 640 VDU

The link 2 of IC38 should be pin 10 (and not pin 12 as shown in the circuit diagram).

Also, the inputs to IC16/1 (pins 4 and 5) should not be connected together.

Thermostat

A cheap, handy little thermostat which plugs into the wall between the heater and the mains has been released by A & R Electronics.

The price of the device will be around $18 and it will handle a 10 A load. The mid-position of the control corresponds to 20 Celcius, which is the usually accepted level for comfort.

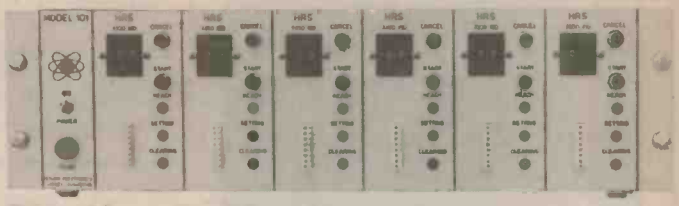
A & R Electronics Pty. Ltd, 30 Lexton Road, Box Hill, Victoria 3128, Ph: (03) 89-0661.

NASA To Develop Ion Engine Power

NASA's Marshall Space Flight Centre will develop the Solar Electric Propulsion Stage (SEPS) for use in the 1985 Halley's comet fly-by.

The principle behind the ion engine is that electrostatic or electromagnetic forces are used to eject charge-carrying reaction mass at high velocities. This allows thrust to be generated over a long period of time for a small weight penalty.

The engine is being developed for a projected 1985 mission to fly past Halley's comet and rendezvous with comet Tempel II.



Service Indicator

Designed by Studio Electronics and distributed by Plessey (Components Div.), this unit will indicate when a service is required for the piece of equipment to which it is connected.

The operating time between services is set by the distributor who plugs the device into a control unit (also shown above). For users who have several of the service indicators, this control unit is available so that they can do their own re-setting.

When the equipment to which the device is connected has been operated for the preset period (which can be from 10 to 390 hours), a green light goes out and a red one lights.

Plessey (Australia) Pty. Ltd, Christina Road, Villawood, NSW 2163. Ph: (02) 72-0133

Gould introduce zinc-air battery

Slightly more expensive than the silver oxide battery, but with a longer life, the zinc-air button cell will be used primarily in LCD calculators and other low-current applications.

This represents the first new battery in this range that Gould have released in the two years since silver oxide and alkaline batteries produced by their competitors made Gould's heavier nickel-cadmium batteries obsolete.

Briefs

A pump requiring no shaft seals has been developed by the Hartell Division of the Milton Ray Co. (Ivyland, Pennsylvania). The impeller is driven by magnets rotating around the pump walls.

NASA has developed a method for casting immiscible metals by rapid cooling of the melt. This could eventually lead to the production of room-temperature superconductors, according to a US report.

Philips in the Netherlands have built a data base which responds in English. The PHLIQA (Philips Question Answering) system operates through a keyboard and a video display.

A reflector which identifies itself when probed by microwaves is being used to monitor bus travel in Stockholm. Up to 10 billion unique identity codes can be used.

Toshiba hopes to market the world's first fixed-head videotape recorder. The system uses a tape speed of six metres per second with multiple tracks on the tape giving an hour's recording on 100 m.

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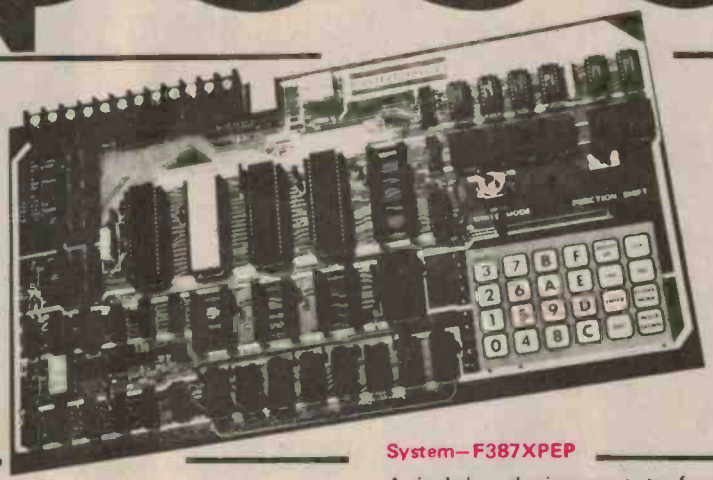

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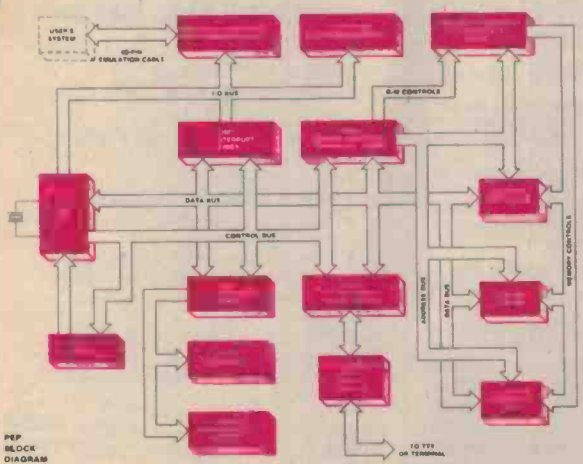
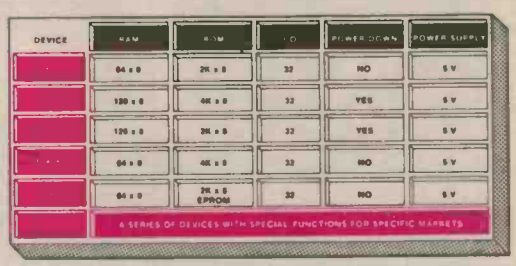


PEP BLOCK DIAGRAM



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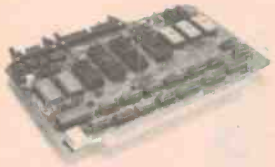

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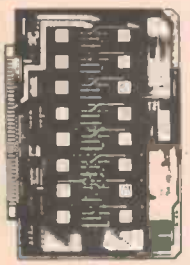

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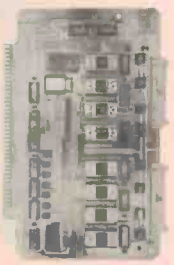

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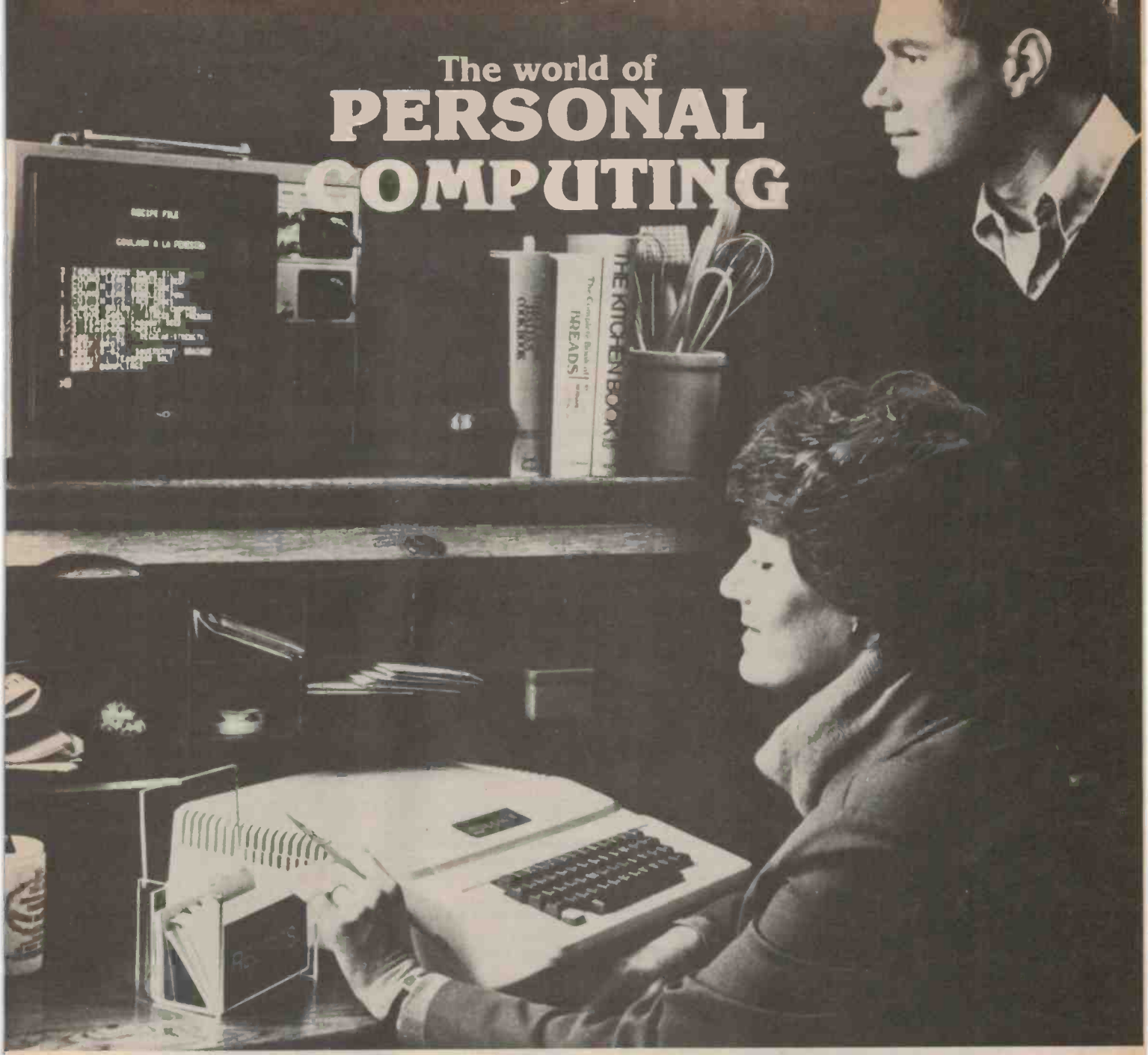
The world of PERSONAL COMPUTING



Soon, if not already, you will have a computer in your home and another on your desk at work. These personal computers will serve you in many and varied ways. They will entertain you and educate your children. They will help you manage the masses of information that surround you. They will correct your spelling, select your personalized news report, and figure your taxes. This article introduces the world of personal computing, tells where it's at and where it's headed.

THE FIRST popular personal computer, the MITS Altair, appeared in the US in January, 1975. It was available only in kit form at a cost of about US$400.

MITS hoped to sell a few of these kits to electronic hobbyists. To their surprise they were actually flooded with orders after a Popular Electronics magazine cover story in January, 1975.

The idea of owning one's own computer spread very rapidly. Thousands of people, including me, painstakingly assembled these early kits in order to experience the joy and excitement of turning on the power switch knowing that we had a real computer to do our bidding.

A sophisticated array of peripherals soon became available including audio cassettes and disks for sorting programs and data, keyboards, TV interfaces, printers, CRT terminals, colour graphics interfaces to colour TVs, joy sticks for playing games, music synthesis attachments, analogue to digital conversion interfaces, speech recognition interfaces, and a host of other attachments.

Portia Isaacson
Electronic Data Systems

The kits soon give way to fully assembled units, and the users of micro- ▶

computers were no longer limited to those people willing to solder. Business uses of personal computers became very common. Personal computers were purchased by elementary schools, high schools, and colleges. Many people bought computers to learn how to write programs.

In Business

About 70% of all personal computers sold in the US in the past two years were bought by businesses, both large and small. Businesses use personal computers for many different reasons. One common application is word processing in which the computer is connected to a typewriter-quality printer and is used to produce documents. Once the document has been entered into the computer, corrections or additions can be made and a new manuscript typed very simply. Lawyers find word processing very useful for composing contracts. I even know a psychiatrist who keeps all his patient records using a word processing computer.

Other common business applications include accounting functions and payroll. The general ledger for my computer store is kept on a microcomputer. Accounting applications are limited to small businesses because large corporations have too much data to be stored by a personal computer. However, large corporations find many uses for personal computers. The most common are process control applications where the computer is used to control some industrial machine or process such as an assembly line or numerical control metal cutting machine.

The majority of personal computers are bought by businesses at present. They are used for such applications as accounting, word processing and process control.

In Education

About 15% of all personal computers sold to date are being used in educational applications. Personal computers have many uses in education at all levels. A kindergarten uses a microcomputer with preschool children in left-to-right scan drills to prepare them for reading. Elementary schools use personal computers to drill students in arithmetic exercises. There are many educational games.

In a geography game a map is displayed on the screen. The child is asked to enter the names of randomly selected states, their capitals, and the proper abbreviations. In another game the child is taught ecology through a simulation of a country. The child is the emperor of the country and must make decisions about land usage. If the land usage is wrong, people in the simulated country may starve. Simulation games such as this one, in which the child can see the result of an action, are powerful teaching tools.

Of course, personal computers are used to teach about computers and programming. Universities use personal computers in teaching computer sciences, in making calculations in engineering and science courses, to do simulations, to process data, and to do many of the tasks once performed by larger, more-expensive computers.

Schools are making increasing use of personal computers as instruction tools in the classroom

Hobbyists

Only about 15% of all personal computers sold in the US have been sold to computer hobbyists. In 1975, the first computer hobbyists were electronic hobbyists, electronic technicians, or electrical engineers who wanted to learn about computer hardware. They enjoyed assembling and debugging the early kits. Later, computer hobbyists came from fields other than electronics. Many of today's computer hobbyists know very little about electronics or computer hardware. Their hobby is programming. Most computer hobbyists want to learn more about computers. Many of them make use of the knowledge gained in their jobs.

What is a Personal Computer?

Exactly what is a personal computer? It is the general purpose computer having scaled-down versions of the same ▶

parts as the very expensive large computers.

Every computer has five parts: the central processing unit (CPU), the main memory, the mass storage, input and output. In personal computers, the CPU is an expensive microprocessor which is slower and is limited to much smaller amounts of memory than bigger computers.

In today's personal computers the main memory is usually limited to about 65 000 bytes. Large computers usually have millions of bytes of main memory. For mass storage of programs and data, large computers commonly have entire rooms full of huge disc drives. Each disc may hold 500 million bytes of information.

It is in mass storage that personal computers differ most from large computers. The least expensive form of mass storage is the audio tape cassette. Floppy disks, which hold up to one million bytes, are also commonly used. The personal computer input device is a single keyboard. On larger computers, input may come from hundreds of keyboards at one time and from punched card readers. The personal computer output device is usually a video monitor, television, or a slow printer. Larger computers output to many terminals simultaneously and use very high speed printers.

Rapid advances in computer technology have caused the cost of a small, but general purpose computer, to drop so far that now many people can afford one of their own. The fact that it is a general purpose computer means that the personal computer can do most things big computers can although in some cases, it may be done more slowly or more awkwardly or on smaller amounts of data. A business may afford to buy one for every employee. A school can afford to use them in classrooms.

Many sophisticated games are available — including the popular chess and Mastermind among others which are specifically designed to run on a personal computer.

The Boom

During 1978 about 250 000 personal computers were sold by US companies. Many experts agree that by the early 1980s personal computers will number in the millions. They will certainly be the next big boom in consumer electronics.

Presently, the most popular personal computers in the US are the Radio Shack TRS-80, the Commodore Pet and the Apple II.

In 1978, Radio Shack sold about 100 000 computers, Commodore sold about 25 000 and Apple about 20 000.

These three computers have many similarities. Each costs under $1,000 in the US. Each is based on an eight-bit microprocessor, has a small amount of memory, and uses cassettes or floppy disks for data and program storage. All three have alphanumeric keyboards (figures and numbers), although the PET keyboard is like a calculator rather than a typewriter. The PET and the TRS-80 have build-in black and white video monitors. The Apple connects to a color TV set that is not included. All three computers have a simple 'Basic' language interpreter stored in a read-only-memory (ROM) so that one can type in a program in Basic as soon as the power is turned on.

The home computers to be introduced in 1979 will be significantly improved over earlier ones — for about the same price. The main features will be a standard typewriter keyboard, more memory, an expanded Basic language, color graphics, sound output, voice output, and much lower cost disks (about US $300 for a 100 000 byte disk).

Every year for at least the next ten years new personal computers will be introduced with significant improvements over the previous year's models. The major areas for continued improvement are more memory, less expensive and greater capacity disks, higher-resolution graphics and better animation, easier-to-use and more powerful programming languages, lower cost printers, voice and sound output, and voice input.

The personal computer is surely the most important tool ever invented, for it expands man's ability to think — the very trait that sets him apart from other living creatures. How lucky we are to live at this time! We will be able to watch as the new world of personal information processing unfolds.

I hope to share with you a view of this new world from my vantage point here in the USA. ●

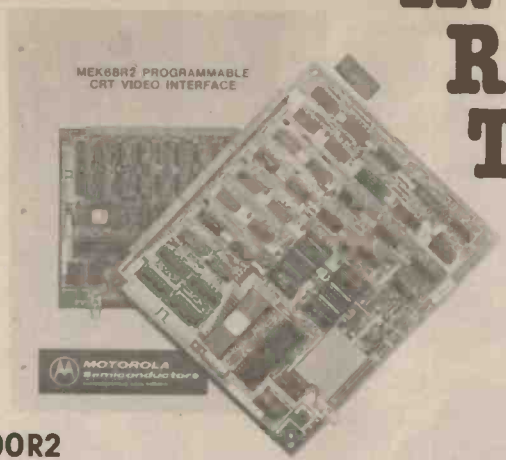
Biography - Portia Isaacson

Dr Portia Isaacson is an Electronic Data Systems Fellow. She is also co-owner of the Dallas area (Texas) Micro Stores. She was conference chairman of the US 1977 National Computer Conference (NCC) and is presently chairman of the Association for Computing Machinery (ACM) Special Interest Group on Personal Computing and ACM Council Member-at-Large.

Dr Isaacson is president of the Computer Retailer's Assosciation. She is also a contributing editor for *Datamation*, an associate of *Byte*, and Technical Editor for the IEEE Computer Society's *Computer* magazine. She is a member of the American Management Association Management Systems Council and the NCC Committee.

Dr Isaacson has several publications in personal computing, microprocessors, and operating systems. She was previously a member of the computer science faculty at The University of Texas at Dallas and North Texas State University and worked on the engineering staff of Xerox Corporation, Recognition Equipment, and Computer Usage Company. Dr Isaacson holds a BS in physics and mathematics from East Central University Oklahoma, an MS in computer science from North Texas State University, and MAS and Ph D in computer science from the Southern Methodist University.

IN STOCK READY TO GO



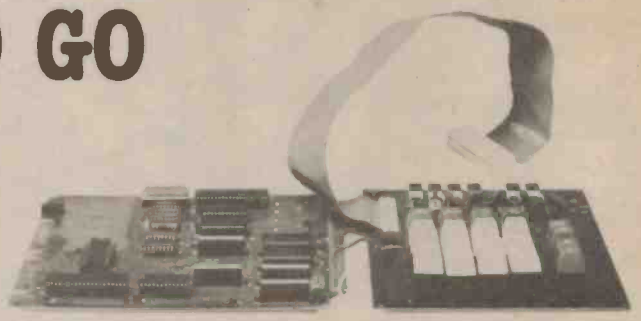
MEK6800R2

TV Interface Board Output is Composite Video.

Programmable CRT Video Interface for MEK6800D2 Kit.

The MEK6800D2 Accessory board is designed to provide a complete interface between the D2 Kit, an ASCII keyboard and either a professional video monitor or standard TV set. Included with the board is a custom programmed ROM which contains the necessary video driver. This ROM is to be inserted into the ROM socket provided in the D2 Kit. These drivers are written as callable subroutines enabling the user to operate in either a stand alone mode of operation or as a CRT terminal.

Price $195 + Tax = $267.25

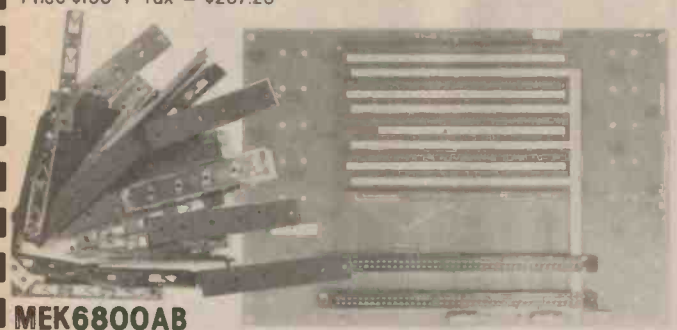


M6800 — Family Evaluation Kit II

MEK6800D2 provides a useful and expandable tool for those who wish to develop systems with the M6800 Microprocessor without investing in expensive terminals. All parts needed to complete the system and get up and running are provided in the kit with the exception of the power supply. In addition to the expansion available on the basic microcomputer module, additional RAM, ROM and I/O parts can be accommodated at a later date to implement more complex systems. Machine language programmes can be entered through the system keyboard or via a built-in audio cassette interface system. Hexademical LED displays are provided for monitoring data and address information. A crystal-controlled clock generator is used to eliminate timing adjustments.

- JBUG Monitor Trace One Instruction Set up to Five Breakpoints Examine and Change Memory and Registers
- Parallel and Serial Interface Capability
- 16 I/O Lines, 4 Control Lines

Price $235 + Tax = $267.25



MEK6800AB

7 Slot Motherboard/Adapter Board for MEK6800D2 Kit

The MEK6800AB provides two MEK6800D2 compatible 86-pin buss connectors and five 6800 type 60-pin accessory board connectors. The purpose of this board is to provide an inexpensive connection between the MEK6800D2 Evaluation Kit and accessory boards such as the MEK68R2 CRT interface board and the MMS68104 16K x 8RAM board. All electrical signals are transferred via the buss between the 86-pin connectors and the 60-pin connectors. Provision has been made for connecting an external power supply.

A typical configuration would have a D2 kit in motherboard connector 1, an MMS68104 16K x 8 RAM board in motherboard connector 2, and a MEK68R2 CRT interface board in accessory connector 1. With external power supply, this allows expansion of the MEK6800D2 Kit to systems capabilities. Price $75 + Tax = $86.25.

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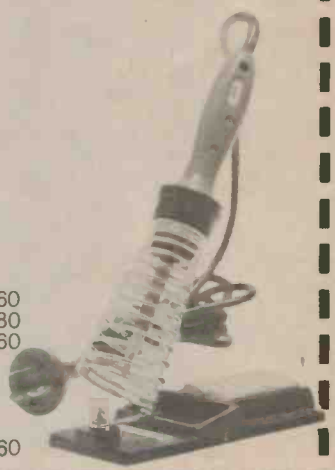
LL	Replacement Tips	$ 1.60
	Your choice — 1.6mm Double Flat, 2.4mm Double Flat, 4.8mm Double Flat	
AS	Anti Seize Lube	$ 1.60



Silicon Valley Mail Order Division
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THRUST TUBE AND STRUT ASSEMBLY
REACTION CONTROL SUBSYSTEM
APOGEE KICK MOTOR
AFT THERMAL BARRIER

Japanese satellite to watch over our weather

Weather-watching meteorological satellites are of vital importance since they provide pictures and other information which enables accurate weather forecasts to be made. They also enable warnings of dangerous storms to be given long before they reach heavily populated areas.

Brian Dance

THIS IS an ideal field for international collaboration and arrangements have been made for a number of satellites to be placed in geosynchronous orbits where each craft will remain over a particular region of the earth as a "weather-watcher" for that area.

The regions to be covered by satellites are shown in Figure 1. The U.S. GEOS craft (see ETI, pages 14 and 15, October 1978) covers North and South America and the Eastern Pacific Ocean regions, the European Space Agency's Meteosat covers Europe and Africa and the Russian GOMS craft will cover much of Asia.

The cover for Australia, New Zealand, Japan, China, Malaysia, Burma, Korea, Vietnam, Laos, Tibet, Indonesia and Mongolia is provided by the GMS-1 satellite (Geostationary Meteorological Satellite); this will be replaced by a GMS-2 craft also at 140°E longitude directly south of Tokyo, in August 1981.

GMS-1

THE GMS-1 craft was manufactured by the Hughes Aircraft Company of El Segundo, California and was launched on 14 July 1977 from Cape Canaveral by the U.S. National Aeronautics and Space Administration (NASA).

However, the procurement, launch and initial checkout of this spacecraft were the responsibilities of the Japanese National Space Development Agency (NASDA) on behalf of the Japanese Meteorological Agency (JMA).

◁ Fig. 2. The GMS-1 craft undergoing final anechoic chamber tests before launching. The striped section is a sun shield to protect the VISSR. Inset, component parts of the craft (Courtesy, Hughes Aircraft Corpn.)

NSDA and JMA share control and use of the GMS-1 during its planned five-year lifetime. The prime contractor of the craft was the Nippon Electric Company (NEC) of Tokyo.

The GMS-1 has been designed to observe cataclysmic events on earth, including hurricanes, typhoons and regional weather phenomena, day and night. It also relays meteorological data from collection points (ships, buoys and weather stations) to a processing centre in Japan. In addition, it provides for the relay of processed imaging data for facsimile reproduction at distribution points in the Western Pacific area.

Many aspects of the weather which daily affect the lives of people in various parts of the world exist for such relatively short times that polar-orbit weather satellites miss them.

However, each of the satellites in geosynchronous orbit about 36,000 km above the earth's surface can keep about one-third of the earth under constant observation and can obtain almost instantaneous information on rapidly changing weather patterns.

Quite a number of instruments are carried on board the GMS-1. One of these is a visible/infra-red spin scan radiometer (VISSR) which measures the radiation from the earth and its atmosphere.

Developed by the Hughes Santa Barbara Research Centre for making pictures of the earth's cloud cover in ▶

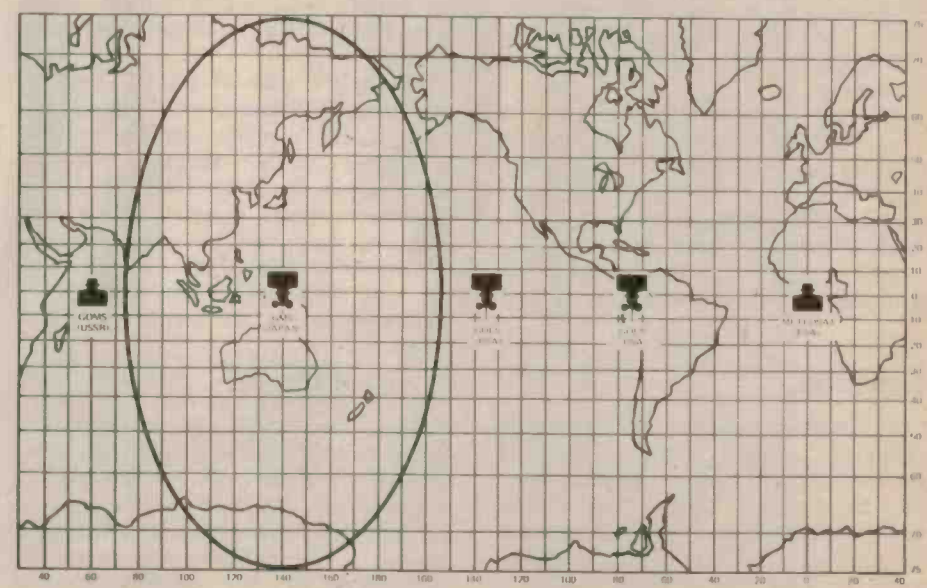


Fig. 1. The meteorological satellite stations; the GMS craft cover the region in the ellipse at 140°E.

Japanese weather satellite

One of GMS-1's first pictures — recorded by the VISSR on 8th September 1977. Note Australia near the bottom of the picture and a typhoon off the coast of China in the upper left.

daylight and darkness, this scanning camera is able to send back black and white television-like images of one-third of the earth every thirty minutes; these pictures enable meteorologists to identify, monitor and track severe windstorms, heavy rainfall and typhoons.

A Space Environment Monitor (SEM) developed by the Nippon Electric Company is also carried on GMS-1. This instrument investigates the energetic particle activity radiated by the sun and helps to study the effect of extreme solar activity on the earth's telecommunications systems. The SEM detects solar protons, alpha particles and solar electrons.

Telemetry data from the GMS-1 craft is received and processed at the NASDA Tsukuba Space Centre in Japan, while the VISSR and the SEM data are received and processed by JMA earth-based equipment. Tsukuba acts as the control centre for the tracking and command system of the satellite.

GMS-2

GMS-2 is being manufactured by Hughes Aircraft Company under a contract awarded by the Nippon Electric Company in February 1978. Two GMS-2 satellites will be manufactured; one will be launched in August 1981 by NASDA from the Tanegashima Space Centre in Japan using a Japanese N-11 rocket. The other will remain on the ground as a back-up vehicle to provide cover if the operation craft should fail.

The height (240 cm over-all) and the diameter (216 cm) of the GMS-2 will be the same as that of the GMS-1, but the weight of the GMS-2 is 268.3 kg as opposed to the 304- kg orbital weight of the GMS-1.

The weight was reduced by using lighter material and fewer solar cells of higher efficiency. This reduction was necessary to match the payload capacity of Japan's N-11 launch vehicle (which is similar to a 2914 Delta-type three-stage rocket).

As in the case of GMS-1, NASDA and JMA will share the control and use of the GMS-2 satellite during its planned three-year mission lifetime. Like its predecessor, the GMS-2 will be able to transmit current weather information pictures every half hour from its geo-synchronous orbit. It will provide coverage over 168 million km^2 (65 million square miles) of the earth's surface at all times.

The GMS-2 will carry the same camera instrument as that used in the GMS-1, the VISSR, and a SEM. The Sharp Corporation of Japan will manufacture the solar cells for the battery charge array. Assembly and testing of the telemetry and command subsystem on one of the spacecraft will be the responsibility of the Nippon Electric Company.

Spectral bands	Visible	Infra-red
	0.4 to 1.1um	10.5 to 12.5um
No. of channels	2	1
No of lines per image	5000	2500
No of samples per line	5000	2500
Resolution	2.5km	5km
Line duration	300ms	
Image taking time	25 minutes	
Image recurrence period	30 minutes	

Table 1. The imaging performance of a meteorological satellite

The VISSR is the main payload of a meteorological satellite. It scans the earth from East to West owing to the spin of the satellite; the image system is stepped once in each spin period so that the scanning line is moved from South to North across the disc of the earth.

As indicated in Table 1, there are normally two visible channels operating over virtually the full visible range from 0.4 um in the violet region of the spectrum to 1.1 um in the near infra-red.

In addition, there is an infra-red channel operating over the spectral range of 10.5 to 12.5 um and a spare infra-red sensor is normally carried. (A special feature of the European Meteosat-1 is an additional infra-red channel which operates in a time-shared module with one of the visible channels; this addjtional infra-red

channel covers the water vapour absorption band of 5.7 to 7.1 um and provides new data on the water cycle of the atmosphere.)

The earth's images are transformed into data, each line of the image being transmitted during the time the next line is being scanned. One image is obtained in 25 minutes, but this is followed by a five-minute interval for the telescope to be reset and stabilised. Thus one image is transmitted each 30 minutes.

The infra-red data can be used to estimate the oceanic temperatures to around ±1°C, and the temperature of the tops of the clouds can be estimated to about ±3°C.

The height of the cloud tops can be estimated to within about 1.5 km. Small clouds can be used as tracers to estimate the wind velocity to within a few metres per second using three successive images and the velocity may be estimated at up to three different altitudes.

Conclusions

The GMS satellites have a vital role in the new weather watch program which encompasses the globe; this program is described by meteorologists as the most detailed study of the atmosphere of the earth which has ever been attempted.

Apart from the main participating nations whcih have undertaken the responsibility of contracting for and launching the satellites, the weather watch program involves the United Nations, the World Meteorological Organisation, the International Council of Scientific Unions, the aerospace industries and about 145 nations which will contribute surface and atmospheric measurements every day.

The GMS satellites form part of the Global Atmospheric Research Program (GARP) which is sponsored by the International Council of Scientific Unions and the World Meteorological Organisation.

The long-tern aim of the projects consists of successive experiments which it is hoped will eventually lead to an understanding of the boundary region between the ocean and the atmosphere.

This region is especially important, since it is the place where heat and moisture are exchanged and where the immense heat capacity of the oceans can exert its influence on the atmospheric heat engine so as to develop high energy air currents and the clouds and the tropical storms which influence the general motion of the atmosphere.

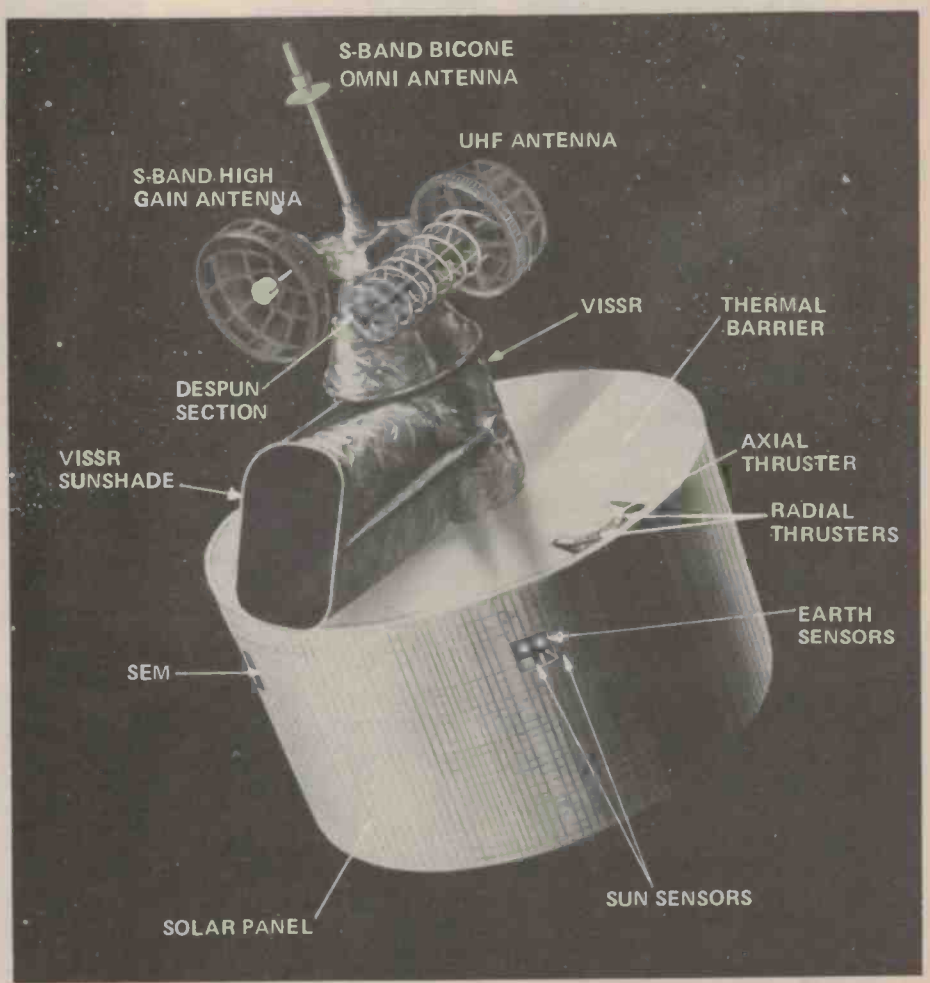
In future the roles appropriate to geosynchronous and to low orbit meteorological satellites must be considered and so must the way they will provide the data required in the global system.

In addition, there is the possibility of using small, economical satellites of a modular construction (known as "Minimetstats") in space-to-space links with geosynchronous satellites.

Eventually a common platform for meteorological and remote sensing satellites may be developed.

Apart from the vitally important uses of meteorological satellites in the modern world, the importance of international collaboration in projects of this nature should not be underestimated.

The more nations collaborate with one another, the better they will understand each other's points of view and this greatly reduces the possibility of major wars. ●



An artist's concept of the second generation Geostationary Meteorological Satellite, GMS-2, pictured against a starry sky. We have annotated its various functional features. Like the GMS-1 it is spin stabilised and will be built by Hughes Aircraft Corporation under contract to the NEC of Japan.

AMPEX 360 Professional Series Cassettes

Low noise/high output
Wide dynamic range
Ferrosheen ™ polished oxide surface
Superior quality shell and components

HERE IS A UNIQUE OPPORTUNITY to obtain world-famous AMPEX tape cassettes at truly bargain prices.

The AMPEX 360 series are standard tape cassettes but made to professional standards using professional grade materials. They are made specifically for applications in which consistent and reliable performance is as essential as top quality electromagnetic properties. The tapes are of course completely suitable for all general purposes – the main difference between AMPEX 360's and many other tape cassettes is that these are made properly!

The Ampex Professional Series cassette has a wide dynamic range due to its low noise/high output oxide formulation, providing clean, well defined response across the spectrum.

The recording surface is polished by the exclusive Ampex Ferrosheen ™ process to produce a glass-slick oxide surface that achieves close tape-to-head contact, maintaining sound fidelity.

The shell, and its internal components, are precision products designed for the highest mechanical reliability. The pressure pad system is a felt/beryllium copper spring assembly. Rotating guide rollers run on lubricated stainless steel pins.

A special formulation in the interior top and bottom liners reduces tape edge friction and minimises possible wow and flutter. The cushioning effect created by the liners helps to reduce mechanical noise to a practically inaudible level. The convex shape of the liners causes a spring-like action which controls tape torque and tape alignment and helps in forming a uniform tape pack for smooth, jam-free operation.

The cassette shells are assembled with five screws to maintain precise internal dimensional uniformity. The shell may be dis-assembled for editing or splicing if required.

Windows, which allow visual inspection of the tape packs, are made of solid transparent polystyrene to protect the tape from dust.

CHARACTERISTICS	SPECIFICATION	
CASSETTE TAPE SYSTEM		
PLASTIC SHELL		
Dimensions:	Manufactured in conformance to Philips Dimensional Standards.	
Materials of Construction:	High heat, medium impact polystyrene.	
Torque Control Liners:	Graphite coated, preotensioned polyester.	
Pressure Pad Assembly:	Felt/Beryllium copper spring.	
Magnetic Shielding:	Full-width steel.	
Closure Method:	5-screw assembly.	
Tape position Windows:	Rigid polystyrene. Welded.	
Tape Guide System:	Rotating guide rollers operating on lubricating stainless steel pins.	
SYSTEM PERFORMANCE		
Rotating Torque:	Less than 25gm/cm without hold-back.	
Wow and Flutter:	Less than 0.10% DIN weighted.	
INTRINSIC MAGENTIC OXIDE PROPERTIES		
Coercivity (Hci) in oersteds	290	290
Retentivity (Brs) in gauss	1100	1100
Erasure (1000 oersted field) in db	−60	−60
PHYSICAL PROPERTIES		
Base film thickness in mils	0.50	0.30
Base film type	Tensilized polyester	Tensilized polyester
Oxide coating thickness in mils	0.20	0.17
Total thickness in mils	0.70	0.47

AMPEX CASSETTES

SPECIAL READER OFFER!

Each cassette is packaged in a transparent "Norelco" container. The insert label is reversible, providing space for programme contents and title to be written or typed.

Dindy Marketing has arranged with Ampex for Dindy to offer these tapes to our readers for a limited period of time, and at genuinely bargain prices. Electronics Today International has tested these tapes and supports Ampex's claims for performance and quality.

NOTE: Dindy has available ex-stock — 10,000 C45's; 40,000 C60's and 10,000 C90's. If demand exceeds Dindy's stock, Ampex has agreed to make further supplies available to Dindy within two weeks notice

Due to the extreme care taken in manufacture, it is extremely unlikely that any faulty cassettes will be found — in the improbable event that you receive a faulty cassette, Dindy guarantee to replace it (at their discression) within 30 days.

Organisations able to purchase at sales-tax free prices should enclose a valid sales-tax certificate and deduct C45 (10c); C60 (11c); C90 (12c) for each cassette.

This offer is made by Dindy Marketing and this magazine is acting as a clearing house for orders only. Cheques should be made out to 'Ampex Offer' and sent together with the order form to 'Dindy Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process the orders and pass them on to Dindy who will send out the goods by IPEC or certified mail. Please allow approximately four weeks for delivery.

SPECIAL BARGAIN PRICES

Quantity	1 – 50	51 – 100	101 – 200	201 +
C45	$1.25	$1.20	$1.15	$1.10
C60	$1.35	$1.30	$1.25	$1.20
C90	$1.45	$1.40	$1.35	$1.30

Plus postage – $2.00 (any quantity).
If valid sales tax certificate enclosed deduct 10 cents – C45's, 11 cents – C60's, 12 cents – C90's.

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15 Boundary Street
Rushcutters Bay, NSW 2011

Please supply:

Quantity

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Postage (any quantity) $2.00

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Please make cheques/postal notes payable to 'Ampex Offer' and send together with the order to 'Ampex Offer', Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. Offer closes 15 July 1979.

'D' series high efficiency speaker systems

The LD D Series enclosures are an excitingly new concept in loudspeaker design — the component parts and range have evolved from the highly successful LD A Series — the first enclosures produced by LD some five years ago. This range of enclosures reflects the latest trend in speaker design plus a most pleasing departure from the conventional.

Model LD-D-12522H

System Type	12" 4 way 5 Speaker
Speaker Component:	
Bass Driver	12" Roll Surround High Compliance Bass Drive Unit
Mid Range	5" Curvlinear Cone Type
Tweeters	Two x 2" Cone Type and one x 3" Super Horn
Power Capacity	50 watts RMS Integrated Programme
Frequency Response	25 Hz to 20,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000-10,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	685mm H x 470mm W x 340mm D
Colour	Australian Walnut

Model LD-D-104H

System Type	10" 3 way 3 Speaker
Speaker Component:	
Bass Driver	10" Roll Surround Bass Drive Unit
Mid Range	4" Curvlinear cone type
Tweeter	3" Horn
Power Capacity	30 watts RMS integrated Programme
Frequency Response	35 Hz to 18,000 ± 3 dB
Crossover Frequency	1,000-5,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	610mm H x 360mm W x 270mm D
Colour	Australian Walnut

Model LD-D-1555H

System type	15" 3 way 4 Speaker
Speaker Component:	
Bass Driver	15" Cast Chassis — Edge Treated High Compliance Bass Drive Unit
Mid Range	Two x 5" Curvlinear Cone Type
Tweeter	High Efficiency 3.5" Metal Horn Super Tweeter
Power Capacity	65 watts RMS Integrated Programme
Frequency Response	20 Hz to 20,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000-10,000 Hz at 12 dB/octave
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	795mm H x 510mm W x 360mm D
Colour	Australian Walnut

Model LD-D-125H

System Type	12" 3 way 3 Speaker
Speaker Component:	
Bass Driver	12" Roll Surround Bass Drive Unit
Mid Range	5" Curvlinear Cone Type
Tweeter	3" Horn
Power Capacity	40 watts RMS Integrated Programme
Frequency Response	30-18,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	685mm H x 390mm W x 340mm D
Colour	Australian Walnut

Manufactured in Australia by

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274 Victoria St, Brunswick.
3056. Ph. 387-6170.

Distributors in other States required.

Ferris Audio car hi-fi system

At a recommended retail price of $469, the MOFI system comprises a cassette deck, tuner and power amp, with a switching unit for source selection.

The cassette features automatic play and tone controls — these have been duplicated on the tuner to allow independent control. The tuner has FM muting and a signal strength meter.

For further information, contact J J Manneken, Ferris Audio Products, 42 Grantham St., West Brunswick, VIC 3055. Ph (03) 387-4833

Microprocessor-controlled receiver

The Audio Pro TA-150 receiver is a remarkable device, using only one front panel control knob. No audio signals pass through the control itself — any movement is detected optically and fed to a microprocessor which makes the necessary changes to the sound.

To increase the volume for instance, you press the button marked 'volume' and rotate the control knob. The processor detects that the knob has been moved and increases the volume correspondingly. The same system is also used for the rest of the amplifier controls as well as the tuning function.

For the technically minded, the volume is controlled by means of a stepped attenuator using CMOS analogue switches.

The front panel features also include a LED VU meter and a clock.

The TA-150 is distributed by Depro Industries P%L, Suite 5, 83 Walker St., North Sydney 2060. Ph. (02) 92-6561.

FM tuner kit

The Jostykit HF-325 FM tuner kit comes complete with a full set of instructions and even a plastic aligning tool. It will give reasonable quality mono FM reception for only $79. A stereo decoder may be added (available for another $24).

The tuner uses printed circuit coils and other advanced techniques not normally found in kits of this type. The specifications include:

Supply.....12-18 V dc at 50 mA
Range.....87.5-108 MHz
Sens.....1.4 uV (26 dB S to N)
Output.....200 mV
Dist.....0.18 percent

The instruction manual is well written and even covers such fundamentals as how to solder.

Vicom, 68 Eastern Road, South Melbourne, VIC 3205. Ph. (03) 699-6700.

Sound Briefs

AM-stereo latest

As reported in this column last month, the FCC is about to decide which of five competing AM stereo systems is to be used.

The issue has suddenly become confused however by a **newly patented system from Sansui** (British Patent 1 534 418 refers) which is quite different from the systems currently being considered.

Sansui's new method involves **simultaneously transmitting three separate carriers all of the same frequency** but separated in phase. The left and right channels are spread between the three channels.

An interesting claim is that the proposed new system can be used to transmit a normal mono programme using **half the previously required bandwidth.**

Dolby FM

The FCC will shortly investigate a proposed system in which the Dolby noise reduction circuitry of FM receivers would automatically be **activated by a special pilot tone.** The tone would be transmitted whenever a 'Dolbyized' transmission is in progress. More later.

Liquid cooled amp

Sony has developed a **liquid-cooled power amplifier** using a tubular heat exchanger filled with a 'special fluid'. The technique has been developed to enable **more compact output stages** — it may well mean wider usage of **high power Class-A output** stages which are currently restricted because of the necessity for massive heat sinks.

Car stereo false claims

Many claims for **car stereo amplifier ratings** are as suspect as those of the old domestic hi-fi days when manufacturers would add the last three digits of their phone number to the power output.

Fortunately the FTC brought **those** people into line . . .

The IHF standards committee are actively looking at the current situation with car stereo — and at least one manufacturer **(Pioneer) has called for standards to be enforced.**

In the meantime **when you see an advt for '100 watt car systems' beware!** It's not always the same sort of watts that we've now come to respect.

Sanyo — Uher

Although **Uher still strongly deny** that their German operation may be taken over by Sanyo — see this column last month — rumours persist throughout the industry that the deal will take place within 12 months.

According to our sources, Sanyo want Uher's reel-to-reel recorders and Uher want access to Sanyo's technological facilities and know-how.

Despite the denials of a trade link we understand that **Uher's new mini-separates system is made for them by Sanyo** while in return Sanyo is now selling Uher's CR 240 cassette deck **under the Sanyo brand-name!**

Watch out for a possible **Sanyo version of the mini-separates** that Sanyo make for Uher.

KENWOOD needs 25 audiophiles...

... who will probably have read in the February edition of "Hi-Fi and Music" magazine, the performance reviews on KENWOOD'S direct drive power systems Models LO7C, LO7M, LO9M and LO5M, and have both the desire to own, plus the capability to critically evaluate, these untis under their normal domestic conditions.

TRIO-KENWOOD is anxious to have feed-back information and critical owner comment to guide their design considerations for the next generation of amplifiers.

The following proposal is limited to the first 25 enthusiasts who have their applications approved by any of the KENWOOD Hi Fi Centres who will be displaying some or all of the above equipment. On the understanding that each buyer will provide a freeform substantive or technical evaluation review within six months of purchase, TRIO-KENWOOD (Australia) Pty Ltd hereby offer to sell, through the Retailer submitting the application, all or any of the Models mentioned, at 30/ off the prices quoted in the review in "Hi-Fi and Music" magazine, page 16, February 1979 Issue.

Not all applications will necessarily be accepted.

Addresses of KENWOOD Hi Fi Centre Retailers displaying the equipment and having application forms will be advised on request by filling and returning the coupon below.

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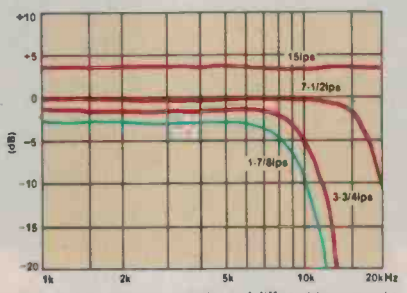
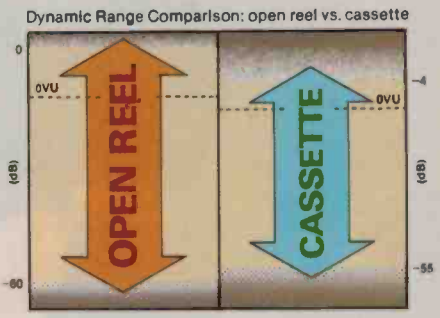
The advantages of open reel are open ended.

The serious audio fan already knows how much convenience and performance he can expect from cassettes. But there's an extra measure of performance and versatility offered by the open reel format that can change your whole stereo system. Here's why:

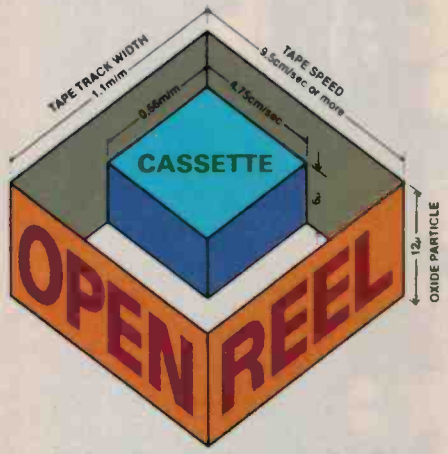


Frequency response comparison of different tape speeds.



More tape particles for each note.

One of the biggest differences between open reel and cassette systems is track width. With an open reel deck each track is twice as wide as cassette. What's more, the oxide coating on the tape is twice as thick (12 microns instead of 6), to give you four times as many oxide



particles for each note. And that's not all: open reel speed is twice or even four times as fast as cassette, so the music gets up to *16 times greater* recording density. Here's what it means:

Fuller Frequency Response.

Since the tape travels faster with open reel, the shorter high-frequency wavelengths are more easily captured by the playback head. The result is extended high frequency response, and more linear, balanced fidelity throughout the whole range. It's a difference you can hear when you switch to open reel.

Full Dynamic Range.

Obviously, with more area to record on, the signal is stronger. That means a drastic improvement in dynamic range. And since the recorded signal can be much higher than the tape's inherent noise level, you get a better signal-to-noise ratio for every type of music. Give it the ear test.

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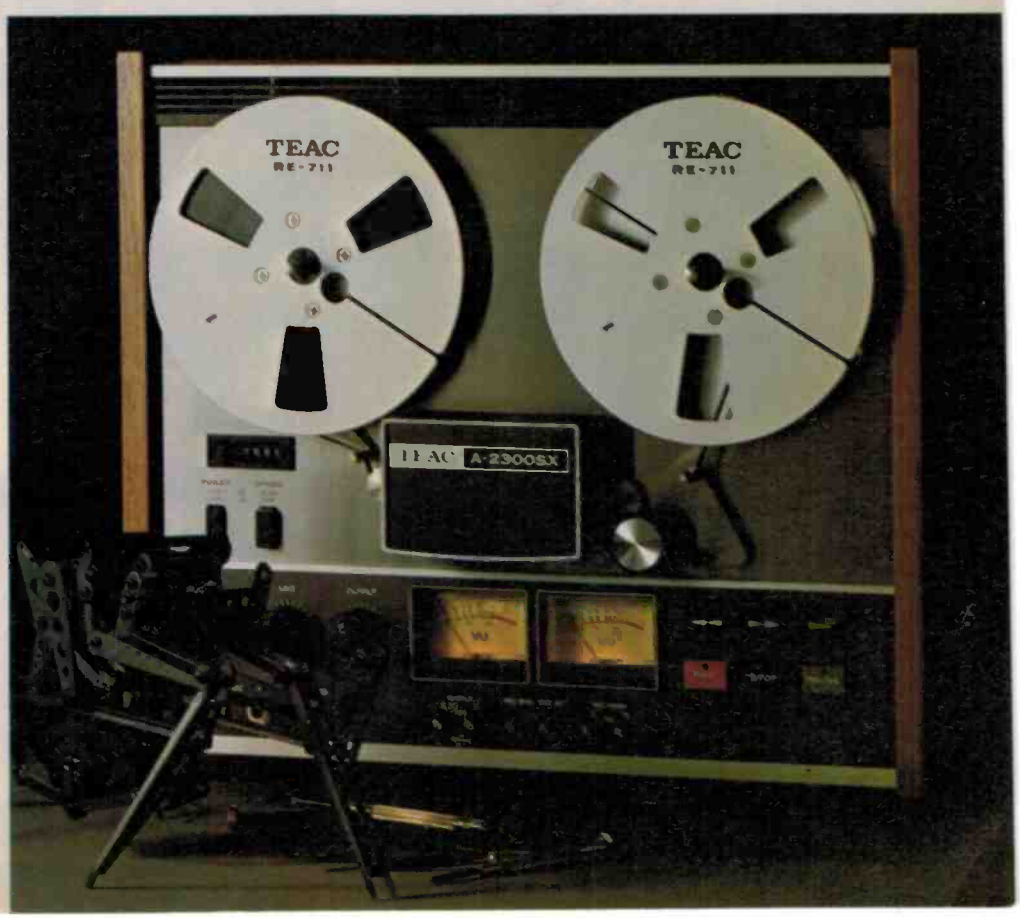
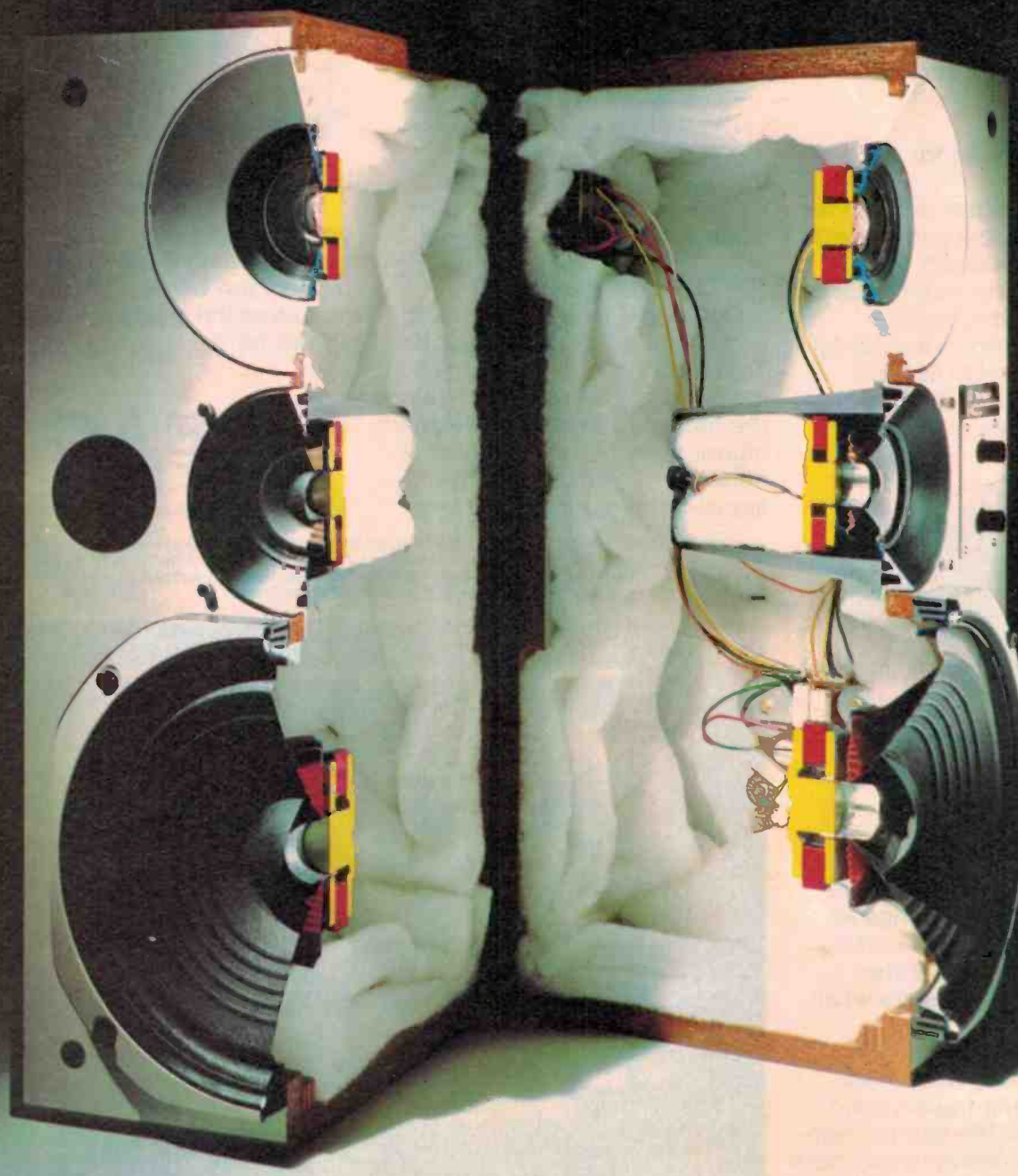


This cutaway view of a National Technics three-way loudspeaker shows typical internal construction of speaker drive units and enclosures. At the bottom is the woofer, covering bass frequencies. Centre is the midrange driver in its own enclosure and top is the tweeter covering the high frequencies. All are moving coil types. Crossover network is behind the woofer.



Looking at Loudspeakers

The number and variety of loudspeakers — drivers and enclosures — available today can bewilder the casually interested and enthusiast alike. This article should help reduce any confusion.

ON PAPER most loudspeakers look to be terrible pieces of design. Distortion averaging 1%-2% -- and what's worse varying with frequency. Efficiency only rarely exceeding 1% — so that the vast majority of those carefully nurtured, 0.002% THD amplifier watts pumped in down those non-inductive $15 a metre cables turn into nice, safe, unmusical heat!

Of the many types and variants of speaker which have been developed, the ones we shall cover are:

1. Moving coil
2. Electrostatic
3. Isodynamic
4. Ribbon
5. Piezo-electric
6. Exotic drivers
7. Motional feedback
8. Sub-woofers

Moving Coil

The most commonly used speaker drive unit is the moving coil and, while no where near the theoretical best, it is cheap, reasonably efficient, and works.

The diaphragm of the moving coil drive unit is usually cone-shaped, with the apex secured to a cylindrical former, around which is wound a coil of wire. The coil and former assembly is suspended in a powerful magnetic field and when an electric signal is applied to the coil, the coil's magnetic field reacts against the permanent field. This moves the coil, and so the diaphragm.

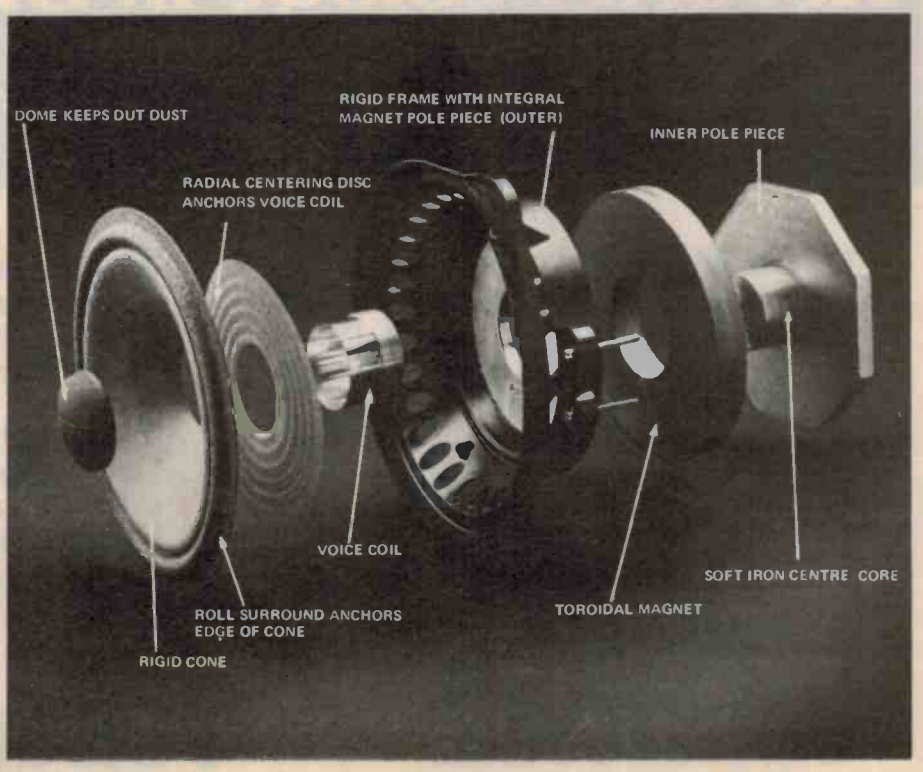
When a signal passes through the coil the force produced tries to push it out of the field in one direction or another, and this movement is transferred to the air by the movement of the cone. This movement is related more or less linearly to the input as long as the coil remains within a constant field.

If it moves out of the constant field, then the relationship will change, introducing non-linearity or distortion. For this reason large and powerful magnets are employed, which have as great a depth of field as possible.

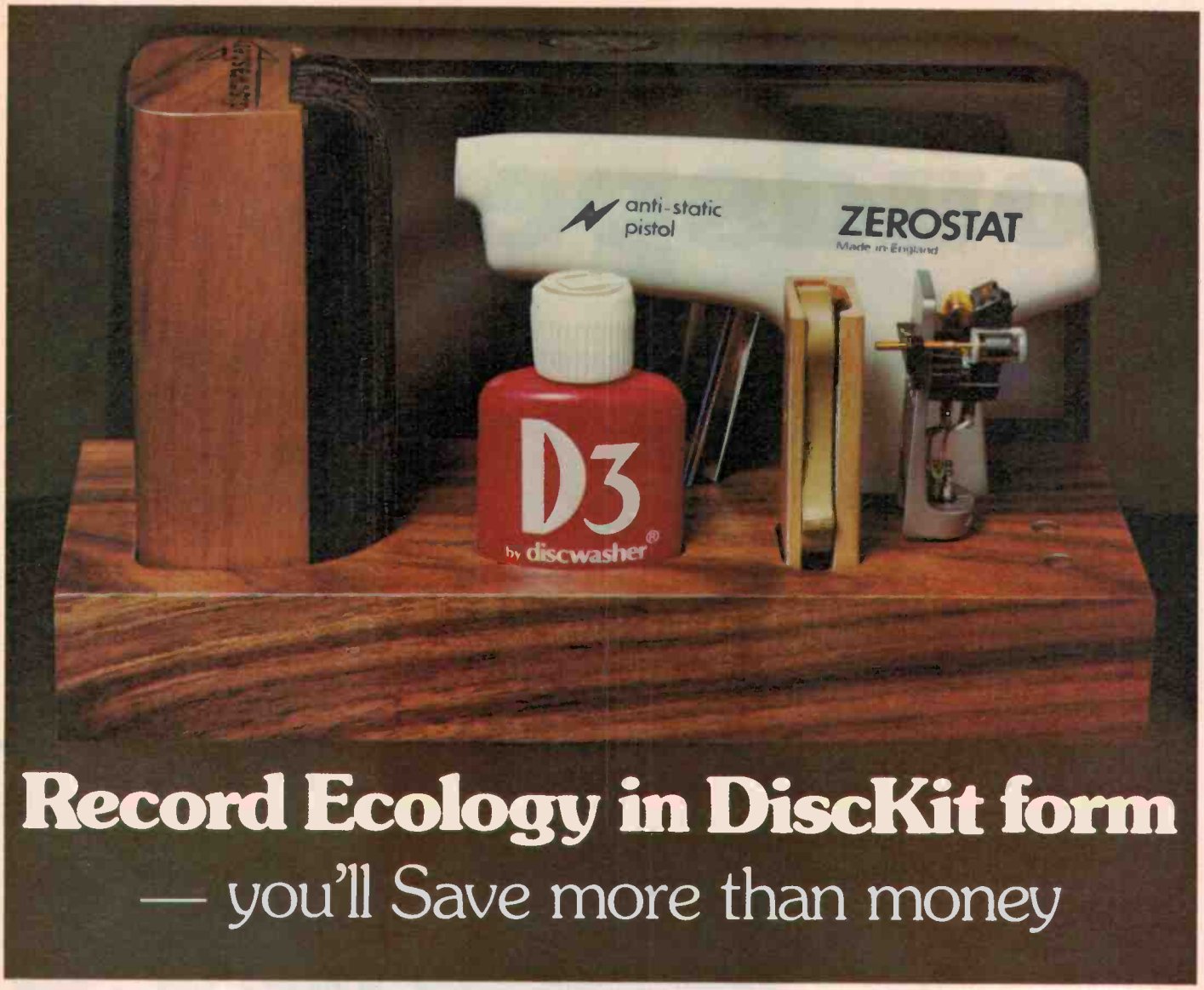
Another solution is to use very long coils so that the number of turns of wire within the gap between the pole pieces remains reasonably constant.

The speaker chassis must be as rigid as possible, since the only reason the coil and cone move and it doesn't is that it weighs more! Any resonances present in the structure will transfer energy from the coil movement and hence distort the output.

The greatest drawback of this system is the cone itself. This is usually either doped paper or Bextrene — an ▶



An exploded view of the most common drive unit — the moving coil speaker — showing the various components in its construction (Picture: courtesy Bose).



Record Ecology in DiscKit form

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DiscKit is a crafted walnut tray and dustcover that saves you 20% with the Discwasher products in the kit. ($55 versus $69 separately) DiscKit includes: 1) The Discwasher System Record Cleaner with D3 Fluid, 2) the Zerostat anti-static pistol and test light, and 3) the SC-1 Stylus Cleaner.

But you'll save more than money. You'll save your records from imbedded micro-dust, your cartridge stylus from abrasion and your ears from a lot of static.
It's your choice, disposable records or Discwasher. (Walnut tray and dust cover are available separately as the Discorganizer, $15)

Cartridge and DiscTraker (pictured) not included in Kit, ask your nearest dealer for details.

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erstwhile packing material. It should act as a piston to the air, with the entire surface moving together to produce the required air movement.

Mass is a consderable problem, because of inertia. With a diaphragm this means that it will try to keep going in one direction when it should be going in the other — it overshoots. The compromise between the need to maintain low mass and the need for diaphragm rigidity is very tricky, and presents speaker designers with many headaches.

Even the best moving coil system will show some signs of overshoot. In a speaker the movement caused by overshoot produces an electric current in the moving coil. This current flows to the amplifier where it is absorbed, effectively creating a brake to the diaphragm motion.

This process is known as damping and the amount of damping an amplifier can produce is called the damping factor. (The damping factor is the ratio of the speaker's impedance to the amplifier's source impedance, and a large ratio improves speaker damping.)

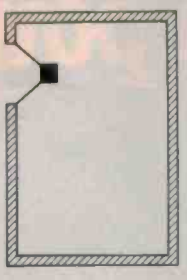
Thus the amplifier plays a very important part in the operation of the speaker, and a better amplifier will often improve the sound from a well designed speaker.

Tweeters

It is extremely difficult to make a single moving coil drive unit that will cover the entire range of frequencies (about 20 Hz to 20 kHz) needed for adequate hi-fi reproduction.

The reproduction of bass frequencies demands that a lot of air be moved relatively slowly, so a drive unit suitable for bass note reproduction has a large diaphragm that is capable of making long, fairly slow, to and fro movements.

High frequency reproduction, on the other hand, requires that fairly small amounts of air are moved very rapidly, so high frequency drive units have small, light diaphragms with very little to and fro movement.



'Acoustic suspension' or infinite baffle enclosures are totally sealed boxes (Courtesy Philips).

Two-way speakers, which are common, comprise a bass unit (commonly known as a woofer) which covers the lower frequencies and a tweeter, which takes over where the bass unit leaves off to cover the high frequencies.

All multi-way systems use a crossover network to divert the relevant frequencies to the appropriate drive units. It must be carefully designed to produce a smooth 'crossover' from one drive unit to the next, and often to compensate for differences in the sensitivity of the drive units so that the frequency bands are reproduced at the same levels.

Enclosures

Speaker enclosures are designed to counteract the tendency of the drive unit to produce an extra-loud sound at the resonant frequency.

There are basically six methods of providing a home for drive units and at the same time augmenting its performance. These are:

(i) Finite Baffle
(ii) Acoustic Suspension, (sometimes called Infinite Baffle)
(iii) Bass Reflex
(iv) Auxiliary Bass Radiator
(v) Transmission Line
(vi) Horn Loading

All of these apply primarily to moving coil units with the exception of horn loading which can be used to enhance efficiency of several types. In order then:—

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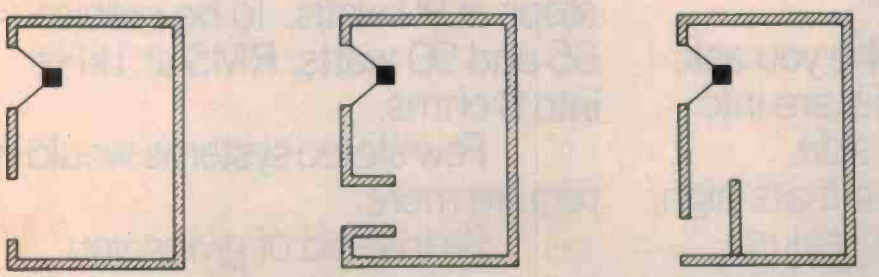
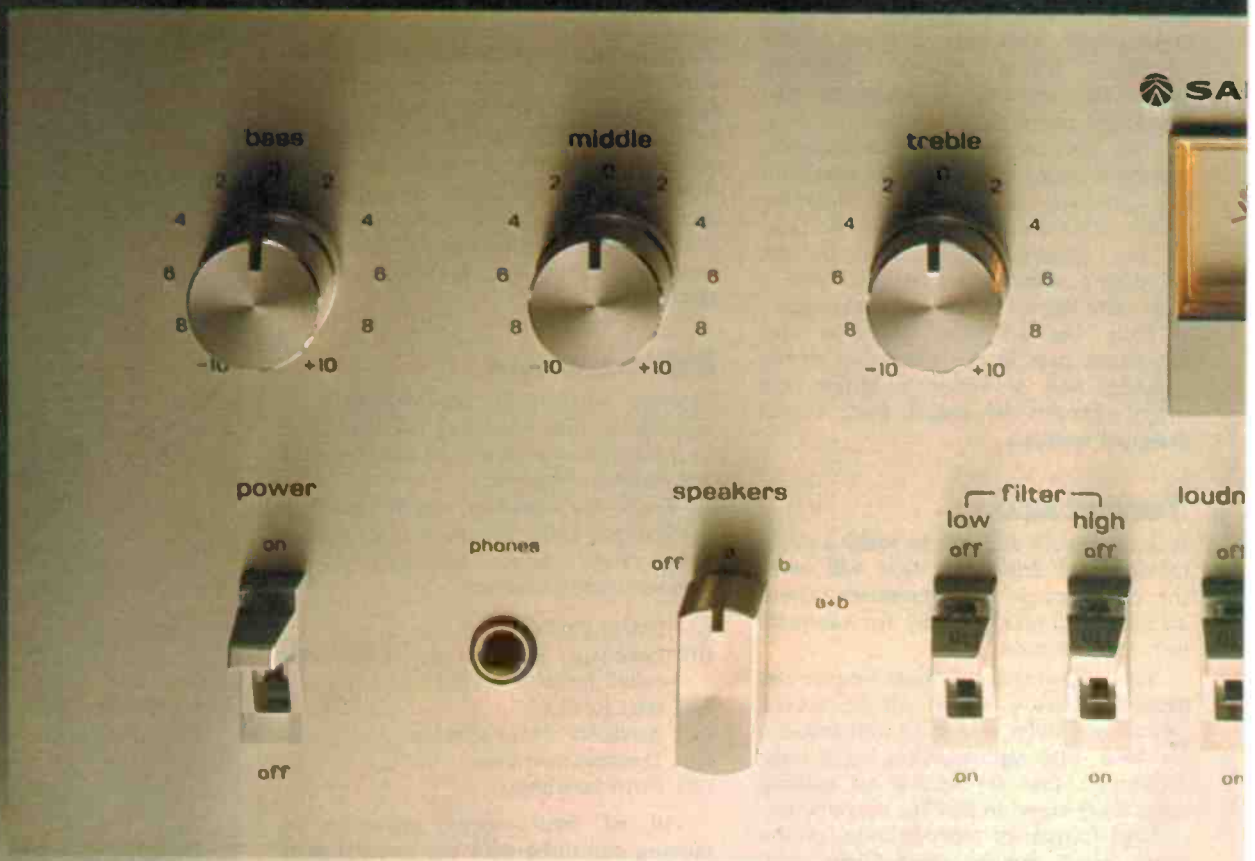
Various arrangements of a bass-reflex enclosure (Courtesy Philips).



How much power should we put



How much power do you really need in an amplifier?

It depends on who you ask.

Some Hi-Fi freaks are into hundreds of watts per side.

The kind of figure that's high enough to cook most speaker systems.

You'll find the Sanyo range stops at 90 watts. To be precise 45, 65 and 90 watts. RMS at 1kHz into 8 ohms.

Few stereo systems would ever require more.

So instead of giving you unnecessary output, our energy has

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gone into improving the sound itself

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If you want a great sounding amplifier that won't over-power you, you'd do well with ours.

SANYO

Hi-fi, not Hi-finance.

SAN3245/2

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Finite Baffle

Since the vibrating cone is emitting sound waves in both directions, unless prevented the two waves will interact causing cancellation and reduction in output. The effect is reduced by placing the speaker in the centre of a large solid board to make it difficult for a compression produced in front to cancel the rarefaction produced behind the speaker.

Obviously, an infinitely large plane wooden sheet would prevent this entirely.. As this is a practical impossibility, a finite baffle is an attempt to do the best that can be done.

Once the sound wavelength approaches the baffle size, destructive interference takes place.

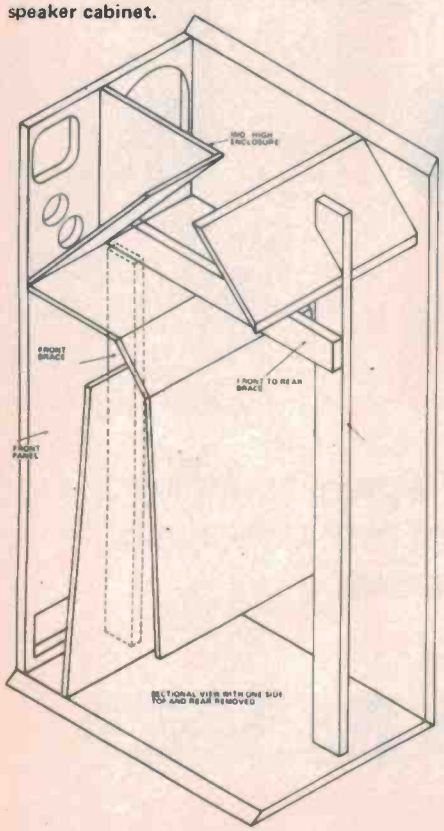
This method is responsible for those hardened enthusiasts mounting their bass units flush into walls and sides of houses!

The 'Infinite Baffle' type involves mounting a drive unit in a totally sealed box. There is no coupling between the front and rear of the cone.

Bass Reflex

The aim of this method is to raise efficiency at low frequencies and thus decrease the required enclosure size for a given bass output. This is accomplished by addition of a vent, or port, in the front panel of the enclosure.

Construction of a transmission line loudspeaker cabinet.



This allows a controlled movement of air between cabinet and room. The effect of careful design of vent dimensions and placement is to produce an effective addition to bass response below a certain frequency, such that the air moving out of the vent aids the air movement produced by the bass driver.

Above the operating frequency the vent has no effect on performance.

Transmission Lines

This is another method of 'losing' the rear radiation of drive unit, or making it think it is working into an infinitely long column. This is achieved by having a maze of woodwork inside the enclosure which is filled with graduated damping material. In this way total column length can be far greater than enclosure dimensions.

If the far end of the column is open then help is afforded to the bass performance in much the same way as bass reflex cabinets.

The design is usually for almost total absorption of the rear wave – and this leads to a gradual and smooth fall off in bass response due to the almost constant velocity working conditions for the cone.

IMF have championed the technique for a long time now as in their product transmission line bass possesses a 'solid' quality totally different to that from the other methods. It is more extended and more realistic.

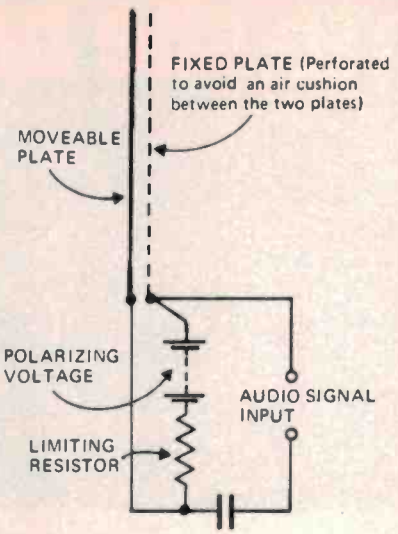
Horn Loading

A method which considerably reduces required driver excursion for a given acoustic output. The driving element is coupled to its air load by a gradually 'flaring' throat – usually exponential in cross section.

The horn converts the high pressure, low velocity sound energy present into low pressure, high velocity waves for propagation.

The advantages of this type of loading are good damping of the driver, and low distortion, but it has a limited frequency response.

To design a single horn to cover the entire audio spectrum is a confused exercise, and one yielding impractical results for domestic use, since an exponential horn to reproduce 30 Hz has a mouth of 1.5m diameter and is some 4m long! Folding the horn back and forth within an enclosure can reduce dimensions, and the American firm Klipsch market units which employ the room walls as extensions of the horn to reach lower frequencies. Usually though, the system is used to load MF and HF units within a system.



Simplified diagram of an electrostatic speaker.

Advantages of this principle are phenomenal efficiency ≈ 10% compared with 1% for bass reflex and 0.1% for transmission lines, and an attack unmatched by any other cone driver.

Electrostatics

As we have seen, the moving coil design suffers because the cone area is unevenly driven by the electrical signal. The electrostatic principle, developed by both David Tombs and Peter Walker (of the Acoustical Manufacturing Company) is an attempt to produce a unit in which the entire surface of the unit is driven by the input signal.

At its most basic the design consists of two plates. The moveable plate is made to have as low a mass as possible and is so suspended that it cannot touch the fixed plate at any point in its travel. The fixed plate will usually take the form of metal 'mesh'. A high polarising voltage ≈ 5 kV is applied between the plates and the audio signal superimposed on this.

An electrostatic force – such as that which holds dust on to LPs, is thus generated between the plates and the moveable plate vibrates in sympathy with variation in the input signal.

Distortion is greatly reduced using this push-pull arrangement and can equal 0.5% in a good design.

This system first appeared on the market many, many years ago in the form of the Quad electrostatic system – which remains largely unsurpassed for lack of colouration and mid-range clarity.

Turn to page 44 ▶

Neatness counts.

You are looking at graphic measurements of wow and flutter in two different cassette decks. The nice, neat one is ours. The one with the funny spikes is the competition. What is really interesting about this comparison is that the numerical specification for wow and flutter for both machines is identical: 0.05 percent.

How can that be?

The reason is that conventional measurements do not account for some kinds of disturbances caused by momentary tape speed variations. Many manufacturers simply ignore or overlook the spikes. We don't. Because we can hear them. And if we can hear them, you can hear them. So we build tighter tolerances into our parts—such as our precision-machined reel tables and shafts that prevent cogging of the cassette hubs. The fact is that we use a lot of unconventional methods of getting rid of a lot of conventionally ignored distortions.

We figure our most important test instrument is our ears. You can build good cassette decks in the laboratory. But you build great ones in the listening room. That's why our engineers listen, under dynamic test conditions, to every single electrical and mechanical component of our cassette decks that can affect the texture of the sound you hear.

You'll find that every one of the new Harman Kardon cassette decks has the features, specifications, the look and the feel you'd expect from equipment made by one of the world's great high fidelity manufacturers.

But you'll find something else too.

The clean, open sound that comes only when a company listens and pays attention to details that others tend to overlook.

That's what makes us so neat.

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Pictured: hk3500, hk2500, hk1500.

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HA134/78

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The advantage of driving the plate evenly over its whole area shows up as a linear frequency response – no rippling or 'break-up' – very low distortion and a good transient performance due to low driver mass.

However, this system does have inherent drawbacks. Consider the Quad system as an example. It is noted for its mid-range clarity and its high frequency accuracy – but also for its lack of extreme bass and its beaming of top end signals – poor vertical dispersion.

The reason for this is its physical size. Since the push-pull radiator is by nature a dipole radiator – sound emitted both front and back, some cancellation at frequencies whose wavelength exceeds the plate dimension is inevitable.

Isodynamic

With the (now-demised) Strathearn 2100 speakers, and the new Wharfedale series incorporating Isodynamic tweeters, this approach is gaining ground. It certainly has a lot of promise, which we shall undoubtedly see exploited as time goes on.

A drive unit built to this principle consists of a thin sheet of mylar, or some such material, with a conductive track bonded onto it in a pattern which covers the surface in as symmetrical manner as possible. This conductor acts as the voice coil of the speaker, and when an electrical signal is passed through it, it responds to nearby magnets by moving the diaphragm in sympathy.

Once again colouration is low, and

Decca London Ribbon high-frequency drive unit. The quoted response is 1 kHz to 25 kHz.

driver mass small – but also once again to obtain bass means large areas, and conductors capable of handling large currents. Strathearn's units covered above 500 Hz and were transformer coupled to the input. Wharfedale employ their invention in high frequency units only.

Ribbon

If we take the voice coil of moving coil speakers, and make this the active element, instead of the cone, we would do away with a lot of the causes of colouration in the process. Mass would be much smaller, break-up or rippling would be greatly reduced (if not eliminated) and thus transient handling improved.

The ribbon loudspeaker does exactly this. A very thin metal 'ribbon' is suspended between the magnet pole faces the signal passed through it. It will vibrate with the signal, and thus produce the sound output.

Acoustic output is low, and horn loading is usually employed to alleviate this problem. Once again obtaining bass is a major problem, and moving coil units will take over from the ribbon as the frequency decreases.

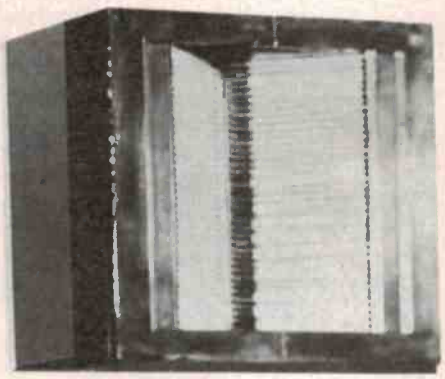
Decca market an excellent example of this principle, which operates above 2.5 kHz.

Piezo-Electric

Piezo-electrics have been around in hi-fi for a long time now in the guise of crystal/ceramic cartridges. The principle of operation is based upon the fact that when a piezo-electric crystal is stressed, a voltage proportional to the applied force is produced across its ends.

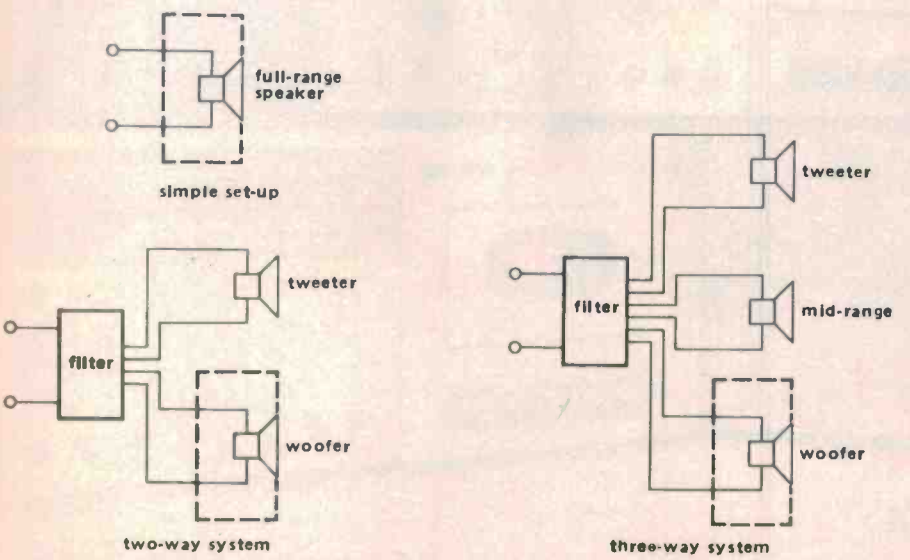
Conversely if we apply a varying voltage across the ends of the crystal, mechanical deformation occurs, sympathetic to that voltage. No magnets are required, and no coil is used.

In a Motorola design two thin



The Heil Air Motion Driver – a sort of cross between a speaker and a concertina.

slices of ceramic material are epoxied onto a brass separator, and nickel electrodes deposited on for electrical connection.



There are several methods used to cover the audio spectrum using a variety of drive units. The filter is generally referred to as the 'crossover network'. Dotted lines around the woofer denote the enclosure.

EXOTICA:

Walsh Driver

Looking something like a naked dalek, the Walsh driver is made up of progressively larger cone sections of titanium, aluminium and paper. A voice coil at the small end drives the device, while the large end is held in place by a surround. Sound is radiated by the side of the cone in a plane. The disadvantage is low efficiency.

Planar Magnetic

This is the equivalent of an electrostatic speaker but it uses a magnet and coil.

Turn to page 46 ▶

The High Speed DC integrated amplifier has arrived!

(It's fast. It's accurate. It's three-dimensional)

Think of the most mind-bending music you know.
Or an orchestra playing a full crescendo.
The Kenwood High Speed DC integrated amplifier lets you hear every note. Clearly.
It will also let you hear the subtle sound of fingers stroking guitar strings. Or the sounds made by the lips of your favourite singer articulating each word, just in front of the mike.
In other words, we're talking about *quality* in reproduced sound. And authenticity.
We could tell you about the astonishing transient response of the Kenwood amplifiers. And about their wonderfully clean low end response, free of phase distortion. About their remarkable clarity throughout the audible range.
Or we could describe the state-of-the-art circuitry that produces all this.
But you must hear for yourself just how much musical space and depth these amplifiers can offer.
Fresh from your own speakers.
It's a whole new world of realism in music.

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A sheet of insulating material with conductive tracks bonded to it is suspended between two perforated magnets. A current passed through the tracks causes the sheet to move in a similar way to a conventional voice coil.

Again, inefficiency is the major drawback.

Heil Driver

The Heil 'Air Motion Transformer' is a bit like a planar magnetic driver – a sheet with conductive tracks is the diaphragm but in this design it is folded like an accordion and suspended in a uniform magnetic field.

Audio frequency current through the tracks makes the 'accordion' squeeze and expand creating compression and rarefaction waves in the air in sympathy with the audio applied.

'Massless' Driver

In this highly unusual design helium is mixed with air and then ionised by a high voltage discharge. Audio current passed through the plasma causes it to expand and contract.

This system requires a bottled helium supply and a fanaticism not usually found even in hi-fi!

Motional Feedback

Although this is perhaps only a modification of earlier systems, the performance gains at LF are such that it warrants a closer look.

Motional feedback is a form of feedback control of the driver cone in moving coil systems. The power amplifiers are mounted within the enclosure, a separate amp for each drive unit, and signal is fed from a pre-amplifier. The system is marketed by Philips.

The main advantage of this extra complication lies at the bottom end of the range where the output for given enclosure volume is considerably enhanced. The complication lies in the sensor fitted onto the driver.

This is mounted on a small PCB and is a ceramic acceleration sensor. This generates a signal proportional to the actual driver output, and this is compared electronically to the incoming audio. Correction is applied to remove any errors present. Crossover is carried out at small signal level, and active filters with all their inherent superiority are applied.

Sub-Woofers

Nothing to do with old sea-dogs, these devices represent a very clever approach to the problem of speaker size in small rooms.

At frequencies below about 100 Hz, although sounds can still be heard it's very difficult to say where they're coming from. Why bother then with two gigantic bass units to give a stereo image at 20-100 Hz? They only take up space and cost money. Why not make do with one?

This single bass source is called a sub-woofer and makes the overall speaker configuration something like this: Two smallish medium/high frequency units in the room corners, as per normal, with one dirty great sub-woofer serving as a coffee table in the middle of the room. The only disadvantage is that it rattles the cups.

Sub-woofers usually have built-in power amplifiers and connect to both speaker outputs. The low frequencies are separated from the rest and both channels are added. ●

THE NEW ACCUPHASE E303 MOSFET AMPLIFIER

After intensive research and development, Accuphase proudly announce the release of the most advanced amplifier ever to be released in Australia — the new E303 Power MOSFET Integrated Amplifier.

The E303 is the result of many years of amplifier design experience. The E303 fulfills Accuphase's objective to produce an outstanding integrated amplifier with the same high quality performance of high quality separate amplifiers.

The E303 features an exciting new development in Hi-Fi — THE MOSFET POWER OUTPUT DEVICE. The MOSFET will ultimately replace the current transistor and valve designs of today in high quality amplifiers. It has far better sonic qualities than both without the inherent limitations of either.

The Accuphase E303 produces a very conservative 130 watts RMS/channel with less than 0.02% distortion and is designed for optimum perform ance with any loudspeaker load. Its quality and design are, of course, in keeping with the Accuphase "Grand Prix" award winning tradition.

The advanced specification of the E303 includes a Head-Amplifier with impedance matching facilities so that any moving coil cartridge can be used directly without the need for noisy external transformers or head amps. There is also a versatile tone adjustment system with variable loudness and turnover points.

For the technically inclined, some of the advantages of Accuphase's Power MOSFET are:

- Less active components, minimising phase shift.
- Extremely fast switching characteristics and negative temperature coefficient resulting in far less distortion.
- Less distortion in the extreme high and low frequencies due to an increased power band width.
- Instant switch on efficiency peak. Normal amplifiers take up to fifteen minutes to reach their peak efficiency.

RECOMMENDED PRICE $1698

You now have the opportunity to hear Accuphase's greatest achievement at the authorised dealers listed below.

West Australia
Alberts, PERTH
VIC. PARK and
NORTHLANDS.
Leslie Leonards,
PERTH.

N.S.W.
Douglas Hi Fi,
430 George Street,
Sydney 233 3922

Allied Hi Fi
330 Pacific Hwy.,
Crows Nest. 439 1072

QUEENSLAND
John Gipps Stereo,
12 Douglas Street,
Milton 36 0080

TASMANIA
Wills Hi Fi Centre,
11 Quadrant,
Launceston

STH. AUST.
Cheshers Pty. Ltd.
38 Liverpool Street,
Pt. Lincoln 82 1166

For Adelaide Dealer phone Arena.

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Accuphase

1979

Sansui's Pure Power G-7500 DC stereo receiver is unlike any other because of the exceptional musical quality of the reproduced signal. To achieve such quality, Sansui engineers went beyond coventional specs to annihilate TIM — transient intermodulation distortion.

TIM ordinarily occurs with the complex, pulsive signals that are typical of the actual music you enjoy hearing. Proof that Sansui has virtually eliminated such distortion is the super-high 60/μsec. slew rate and very fast 1.4μsec. rise time. We believe that no other amplifier, let alone receiver — at any price, can match such performance.

G-3500

G-4500

G-5500

Only hi-fi, everything hi-fi.

Sansui

Unlike any other!

Radically reduced TIM is only one benefit from Sansui's original DC circuitry. Eliminating capacitors in the NF loop and inputs and outputs is another vital step towards pure power for pure sound. An extraordinary frequency range — from DC (zero Hz) to 200,000 Hz — assures the cleanest and clearest sounds you've ever heard.

New standards. New features. A full 90 RMS watts per channel with low 0.025% T.H.D. Sansui's unique DC configuration means pure power for pure music. The same outstanding basics can be enjoyed in our other Pure Power receivers:

G-5500 (60 watts 0.03% T.H.D.)
G-4500 (40 watts 0.1% T.H.D.)
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For receivers that deliver the best, come to Sansui.

SANSUI

G-7500

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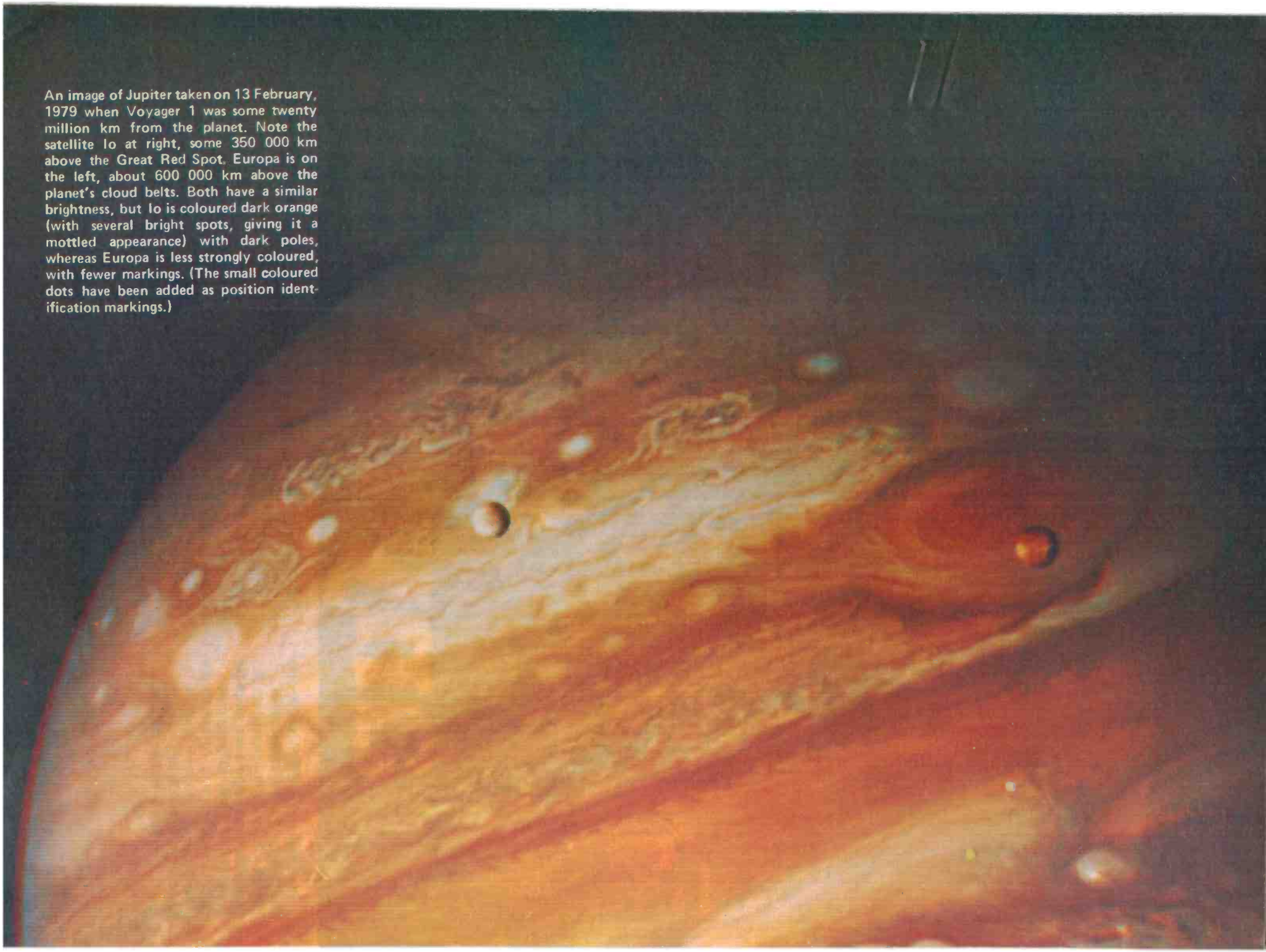


An image of Jupiter taken on 13 February, 1979 when Voyager 1 was some twenty million km from the planet. Note the satellite Io at right, some 350 000 km above the Great Red Spot. Europa is on the left, about 600 000 km above the planet's cloud belts. Both have a similar brightness, but Io is coloured dark orange (with several bright spots, giving it a mottled appearance) with dark poles, whereas Europa is less strongly coloured, with fewer markings. (The small coloured dots have been added as position identification markings.)

Jupiter Encounter

Brian Dance

On March 5th this year, the Voyager I spacecraft reached its nearest point to the largest planet in the solar system — Jupiter. Since December last year it has returned excellent photographs, not only of Jupiter itself, but also of the Jovian satellites.

LAUNCHED ON September 5th 1977, this spacecraft passed Jupiter at a distance of some 280 000 km above the visible surface (4.9 Jupiter radii from the centre of the planet) before the huge gravitational field of Jupiter swung it towards Saturn. Closest approach to Saturn will be on November 12th, 1980 at a distance of 209 300 km.

Saturn is beautiful when viewed from the earth, so we should be in for a real treat when Voyager 1 reaches its vicinity!

A companion craft, Voyager 2, was launched on August 20th, 1977 on a slower trajectory which will bring it to a closest approach to Jupiter on July 9th 1979, but it will pass the planet at 643 000 km from the visible surface or 10 Jupiter radii from the centre of the planet. This craft will also be swung towards Saturn for a closest approach on August 27th, 1981 and observation of seven of its satellites.

There will be an option to send the Voyager 2 craft onto Uranus for a January 1986 encounter and even onto Neptune for a September 1989 encounter.

The Voyager craft are not the first probes to visit Jupiter. Pioneer 10 arrived there early in December 1973 and Pioneer 11 in early December 1974.

The writer has just received an invitation to NASA's Ames Research Centre for the Pioneer 11 Saturn encounter on 1st September 1979.

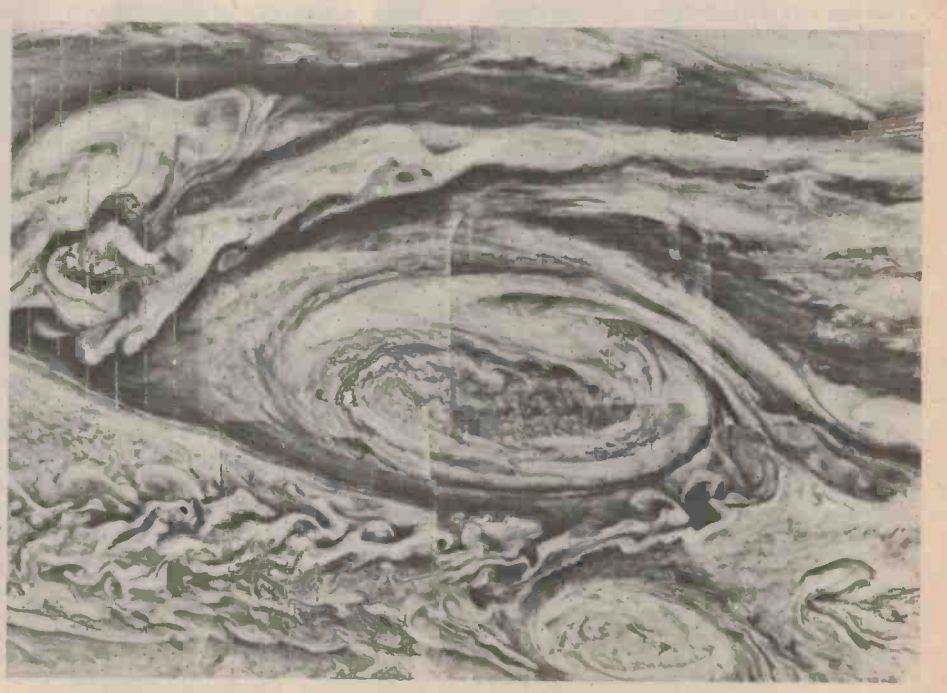
Voyager I

Jupiter is larger than all of the other planets of the solar system put together and has 13 or 14 satellites. The four largest satellites (Ganymede, Io, Europa and Callisto) were discovered in 1610 and a very few people can see them with the naked eye, so apart from Jupiter with its huge red spot, there is much to be seen.

Each Voyager craft weighs 815 kg, including 115 kg of scientific instruments. Compare this with the 270 kg of Pioneer 10 and its 30 kg of instruments.

As the intensity of sunlight is relatively small in the region of the outer planets, the power required for the Voyager transmitters and instruments cannot be conveniently obtained from solar cells. The Voyager craft employ nuclear power. A radio-isotope thermoelectric generator provides over 460 W at Jupiter encounter and about 410 at Saturn. This is much greater than Pioneer 10's 140 W at Jupiter encounter.

A particular feature of the Voyager craft is the 3.7 m diameter parabolic antenna reflector. This provides the gain required for data transmission using rates of 115.2 k bits/second from Jupiter when working with one of the huge 64 m diameter antennae of the US Deep Space Network. Pioneer 10 could work at only 1024 bits/second at Jupiter range, so developments used in the Voyager craft enable more high definition pictures to be returned to earth in a given time than was possible with the earlier Pioneer craft. ▶



This image of the Great Red Spot of Jupiter has been assembled from 12 pictures taken through orange filters from a distance of 1800000 km on March 4th, 1979. The smallest visible clouds are about 35 km across. The edges of the Red Spot show streaming characteristic of counter-clockwise circulation. ▷

Jupiter Encounter

Developments in modern electronic techniques have made this increased data rate possible. These will find many applications other than in spacecraft. The Voyager craft contain 540 M bits of data storage capacity. Pictures obtained by the scientific instruments are recorded and played back to earth daily from a distance which is so great that the signals take about 40 minutes to reach the earth.

Photography

The Voyager craft each carry two cameras. One of these is a narrow angle television camera with a 1500 mm focal length, whilst the other is a wide-angle camera with a 200 mm focal length. As Voyager 1 approached the planet, the narrow angle camera was used to give an image of the whole planet. At closer distances the wide-angle camera was used to view large regions of the surface, whilst the narrow angle camera gave high resolution photographs of chosen features.

Apart from the cameras, the two craft carry cosmic ray detectors, infra-red spectrometers and radiometers, magnetometers, photopolarimeters, ultra-violet spectrometers, plasma instruments, charged particle detectors, etc. Indeed, they are packed with instruments.

As Voyager 1 approached Jupiter, its cameras concentrated on the rapid changes occuring within the atmosphere of the planet over periods as short as 20 hours (two Jovian days) and on the famous Great Red Spot with its trailing wave-like patterns which continually change. A bright zone stretching across the planet's northern hemisphere is likely to be clouds of frozen ammonia gas similar to the cirrus clouds of frozen water in the atmosphere of the earth.

The Great Red Spot is the coldest place on Jupiter and covers an area so large that it is some three times the size of the earth. Scientists found a counter-clockwise motion within the red spot which is believed to float some 25 km above the surrounding clouds. There are dominant large scale motions of the atmosphere from West to East, but small scale movements include eddy-like circulations within and between the atmospheric bands which are such a prominent feature of this planet.

Apart from these well-known features of the Jovian atmosphere, some 'white ovals' were seen to form in 1939 and 1940 and have remained more or less unchanged since then; good pictures of these ovals were provided by Voyager 1.

All of these features have an intricate and involved structure which can only be seen from spacecraft near to the planet. Resolution on some photographs at the closest approach was about 20 km for objects at the surface of the planet.

The Satellites of Jupiter

As Voyager 1 swung in the gravitation field of Jupiter, it also gave us first class pictures of the satellites of Jupiter. On March 4th (shortly before closest approach), Voyager transmitted pictures of the small innermost satellite known as Amalthea from a distance of 425 000 km. This little red satellite orbits Jupiter every 12 hours at a distance of only 1.55 Jupiter radii from the cloud tops.

Voyager I's pictures of this satellite provide the first good views of it which have yet been obtained. It is about 170 x 130 km in size with an irregular shape — probably due to impact cratering, whilst the reflectivity of the surface is so low (less than 10%) that it appears much larger than the larger satellites of Jupiter.

This small satellite was discovered in 1892 by Edmund E. Barnard, Voyager I gave pictures with an effective resolution of about 8 km. It seems likely that this satellite has its long axis always pointed towards Jupiter as it moves around the planet.

Voyager 1 also sent pictures of all of the large Gallilean satellites as it moved away from Jupiter. It passed within 22 000 km of Io, 733 000 km from Europa and 120 000 km from Ganymede and Callisto. Pictures of Ganymede taken on March 4th, 1979 from a distance of about 2 600 00 km show complete views of this satellite (which is the largest of Jupiter's satellites) with a radius of about 2 600 km (about 1½ times that of the earth's moon).

However, it is thought that Ganymede is composed of a mixture of rock and ice which gives it a density of only about 2.0 g cm^{-3}, about half that of our moon.

Like the moon, Ganymede has many detailed markings including large dark areas and white spots which probably correspond with the mare and impact creaters of the earth's moon.

On March 5th Voyager obtained much more detailed pictures of small areas of the surface of Ganymede. Resolutions around 2 km at distances of over 200 000 km were obtained. Many impact creaters are visible, those without bright ray systems probably being much older than those accompanied by rays. Bright bands traversing the surface in various directions contain an intricate system of alternating linear bright and dark lines which may represent deformation of the crusted ice layer.

The surface of Io was also pictured by Voyager I on March 4th and is very different form that of Ganymede. There are no obvious impact features which can be seen from a range of 376 951 km with a resolution of about 8 km at the surface and this leads scientists to believe that Io's surface is quite young in terms of astronomical age.

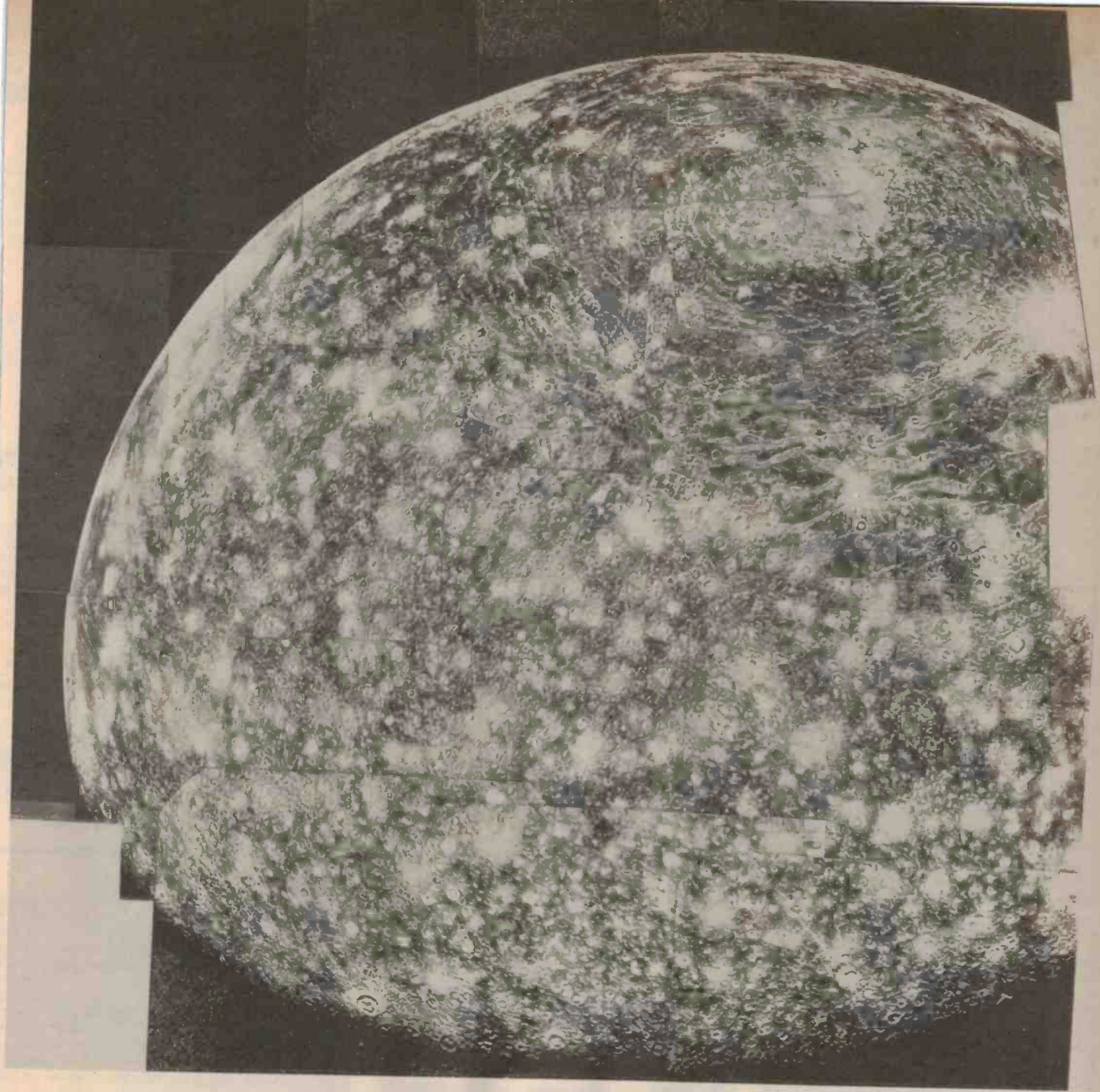
The highly coloured surface of Io may be due to mixtures of salts and sulphur, possibly brought to the surface by volcanic activity. This surface is believed to be the source of material for the clouds of neutral and ionised atoms around Io's orbit which have been observed by earth based telescopes; also of a doubly ionised sulphur torus discovered by Voyager I's ultraviolet spectrometer experiment.

Io is a most interesting satellite and Voyager I obtained several photographs showing volcanic eruptions. In a photograph taken on March 4th, an enormous volcanic explosion can be seen silhouetted against dark space over the bright surface of the satellite. Solid material was thrown to an altitude of about 160 km which implies an ejection velocity of some 1930 km/hour. (See front cover).

The vent area for this volcanic ejection was found to be a complex circular structure with a bright ring some 300 km in diameter and a central region of irregular dark and light patterns. Similar volcanic explosions occur on the earth when magmatic gases expand explosively as material is vented. On earth, water is the major gas driving the explosion, but as Io is believed to be dry, scientists are searching for other gases which might explain the explosion.

In one view of Io, with most of the planet in relative darkness, two simultaneous volcanic eruptions were observed. It was the first image in which an extra-terrestrial volcanic eruption has been seen. In one of the eruptions ash clouds rose to over 260 km above the surface of the satellite at the edge of the disc, whilst the second eruption occurred on the terminator (the edge of the day and night sections) where the volcanic cloud caught the rays of the rising sun. Although much of Io was facing away from the sun in this image, the whole sphere could be seen owing to light reflected by Jupiter (200 times brighter than the full moon on the earth and 40 times larger).

Voyager I's photographs of Callisto on March 6th show that the surface of this satellite has been heavily cratered by meteoric impacts. It is the most dis-



This photomosaic view of Callisto was assembled from pictures taken on March 6th, 1979 at a range of 202 000 km. Note the heavy cratering and the large bright spot near the upper left hand corner with the concentric rings around it.

tant of the four large satellites from Jupiter and probably has the oldest surface. Many of the craters display bright ray systems similar to those on earth's moon. One large, bright spot is an impact basin about 600 km in diameter, surrounded by numerous concentric rings probably resulting from the response of the icy crest to the shock waves of the huge impact. These rings extend outwards more than 1000 km.

Jupiter's Ring

An image returned by Voyager I on March 4th shows a ring around the giant planet. A multiple exposure of the extremely faint ring appears as a broad, light band crossing the surface of the planet. The edge of the ring is 1 212 000 km from the spacecraft and 57 000 km from the visible cloud surface of Jupiter. The ring is estimated to be about 30 km thick.

This photograph was taken as part of a planned sequence to search for such rings in the equatorial plane of Jupiter. The ring is invisible from the earth because it is very thin and very transparent when viewed from any angle except edge-on.

Conclusion

This article has reviewed only the photographs returned by Voyager I, but a great mass of scientific data remains to be analysed in the coming months.

Apart from the forthcoming Voyager 2 encounter with Jupiter, we may expect to learn a great deal more about this planet through Project Galileo (scheduled for launching about 1982) in which a probe will enter the Jovian atmosphere and an Orbiter vehicle will return images over a long period.

Acknowledgement is made to Don Bane of the Jet Propulsion Laboratory, California for sending photographs of the Voyager 1 images so quickly after their reception.

BUILD A COMPUTER KIT AND SAVE

KB05 FULLY ENCODED KEYBOARD

Elimlnates messy wiring between keyswitches and encoder. The KB05 is a full featured keyboard kit fully encoded for all 128 ASCII characters. Based on a design published in ELEKTOR November, 1978, it is an ideal low cost keyboard for microcomputer use. This clever design uses a single sided PCB to connect the switches and the encoder IC and few links are required. The kit includes 2 spare user definable keys and a metal mounting bracket to hold each switch accurately in place. The switches are supported on this bracket not on the PCB as with inferior designs. Spare mechanisms, cursor option and number pads are available.

KB05 encoded keyboard kit $84.00
KB06 cursor option $4.95
KB07 number pad $11.95

EA2650 STARTERS KIT

Described in EA May, 1978, this is an ideal project ideal for the beginner or educational applications. The kit comes complete with all instructions for assembling and running the 2650 computer, all components including 2650 microprocessor, PIPBUG ROM and 1K of RAM. The kit can be expanded to 4K and requires a serial terminal such as the EA LOW COST VDU detailed below. Sample programs are included for you to run and a cassette interface can be readily added so that programs can be stored on low cost cassettes.

EA2650 starters kit $65.00

EA LOW COST VDU SELLOUT!

This low cost stand alone VDU was described in EA February, 1978. Accepts parallel ASCII input and produces 16 lines with 32 characters per line with onboard sync generation and video driver. Supplies direct video to a converted TV set or to an RF modulator if required. The kit includes sockets for the RAM and character generator IC's, all components plated thru PCB, and step by step instruction manual.

EA VDU sellout (until stocks cleared)
$75.00 save $22.50!!

All prices include sales tax and are subject to change without notice. Our full technical support and service backup is available on all these kits.

Mail Orders: Box 355, P.O. Hornsby 2077. Please allow $2.00 towards post and packing.

Applied Technology Pty. Ltd.,
1a Pattison Ave., Waitara N.S.W.
(9 to 5 Mon. to Sat.)

DG640 VDU ON S-100 BUS

A most professional unit for serious microcomputer users. Features 16 lines and 64 characters (32 with strap select), upper and lower case with chunky graphics and full S-100 bus standard.

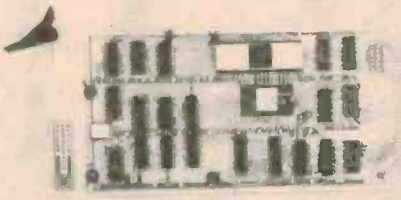
This is not a half kit! The DG640 kit includes:

- professional quality plated thru hole PCB with hard gold edge connector.
- all prime quality guaranteed components.
- sockets for all integrated circuits.
- 12,000M/C crystal.
- comprehensive owners manual (54 pages) describing assembly, troubleshooting, and operating software for 2650,Z80,8080,6800.

DG640 kit $149.50 (PCB with manual $35.00)

EUROCARD 2650 SINGLE BOARD EXPANDABLE 2650 COMPUTER

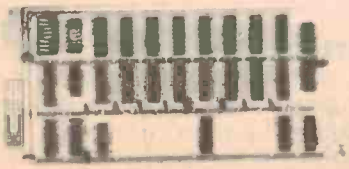
This professionally engineered 2650 single board computer is the answer to all those who want a systematically expandable computer system. The DB1001 uses a simple E58 bus which is readily adapted to S100 and Z80 bus requirements. The DB1001 uses the 2650A chip and has fully buffered address and data lines, on board 1K operating system in Eprom (PIPBUG SUPPLIED but easily reprogrammed), 1K RAM and a crystal controlled clock on a top quality plated thru PCB with hard gold edge connector. Readily expanded on the E58 bus for more memory, I/O and will accept floppy discs and high speed printer. The kit is supplied with all components, owners manual and full service backup. A conversion kit for the EA2650 is available.



DB1001 single board computer $135.00
($35.00 PCB with manual)
DB1001/EA2650 conversion kit $99.00

DB1008 8K STATIC 2114 RAM

A very useful add on memory module to support the DB1001 computer on the E58 bus, this 8K RAM is fully buffered and has been arranged as 2 4K blocks with DIP switch address boundary selection. The kit is supplied with all components, sockets for all memory IC's and a plated thru PCB with hard gold edge connectors and full instruction manual.



DB1008 8K memory kit $175.00
($35.00 PCB with manual)

EPS100 ECONOMY POWER SUPPLY

This popular modular power supply kit is ideal for use with micros. Based on the EA "BRUTE" power supply the EPS100 supplies 5V @10A regulated, +,— 12V @1A regulated as well as unregulated 8V,+/—16V for the S100 BUS. The module includes an on board heatsink which must be mounted on a suitable metal case for adequate heatsinking.

EPS100 power supply kit $60.00

ET1632 UART/BAUD RATE GENERATOR

Converts serial to parallel and parallel to serial. This low cost baud rate generator can be set for any speed from 50 to 9600 BAUD (continuously adjustable with multi turn trimpot) and can be set for 5 to 8 bits per character with 1 or 2 length stop bits. Requires +5V, —12V. and kit includes all components and 40 pin socket.

632U with full instructions $18.50

ETI 630 HEX ENCODER/DISPLAY

This simple kit includes a pair of 4 bit encoder/latches driving large .5" digits to display the HEX equivalent of any 8 bit data word. Ideal for troubleshooting and also programming in machine code.

ET1630 HEX DISPLAY $14.50

SECI CASSETTE INTERFACE

This reliable unit is easily aligned without a CRO and is KANSAS CITY STANDARD useable up to 1200 Baud. The SECI uses top quality multiturn trimpots for accurate long-term timing adjustments and is supplied with the clock preset to 4800 Hz. A computer generated test tape is included so that you can readily check the operation at any time. Connects directly to a low cost tape recorder and has TTL level input/output for connection to the microprocessor. Requires +5V and provision for optional regulator has been made on the PCB.

SECI Cassette interface kit $24.50

DB1048 4/8K ROM BOARD WITH HIGH SPEED CASSETTE INTERFACE

This card supports the DB1001 on the E58 bus and has provision for 2708 or 2716 EPROMS. Included on the board is a software controlled cassette interface (300 characters/sec!) controlling two tape recorders with full file handling. The DB1048 is supplied with a preprogrammed EPROM with the tape interface software, a utility tape with useful routines, all components, plated thru PSB and owners manual.

DB1048 ROM Board/Cassette interface $130.00

Heliostat solar power station begins tests

A system of mirrors that tracks the sun's motion — a heliostat — is undergoing trials in the US to demonstrate its feasibility in relation to the economics of its use in a giant power station designed to utilise the sun as a primary energy source.

THE WESTINGHOUSE Electric Corporation's advanced energy systems division (AESD) has funded, designed and constructed in prototype heliostat which began a three-month test period in March at the US Department of Energy's Saudi Laboratory solar thermal test facility near Albuquerque, New Mexico.

In areas which enjoy abundant sunlight electric utilities could use solar systems to meet a portion of the fuel needs for generating electrical power for the community.

Using a computer control system the Westinghouse heliostat tracks the sun as it moves through the sky. The rays of the sun are reflected from an array of 4m x 12m mirrored surfaces aimed at a target area on top of a central collecting tower about 300m away. When the sunlight strikes the power tower target, water is heated and converted into steam. This in turn drives a conventional electrical steam turbine-generator.

In a solar power plant for an electric utility, it is expected that 5000 mirrored heliostats would surround a single power tower on a 300-acre site. This arrangement would generate up to approximately 500 megawatts of electricity, the equivalent of a quarter of a million barrels of foreign oil per year.

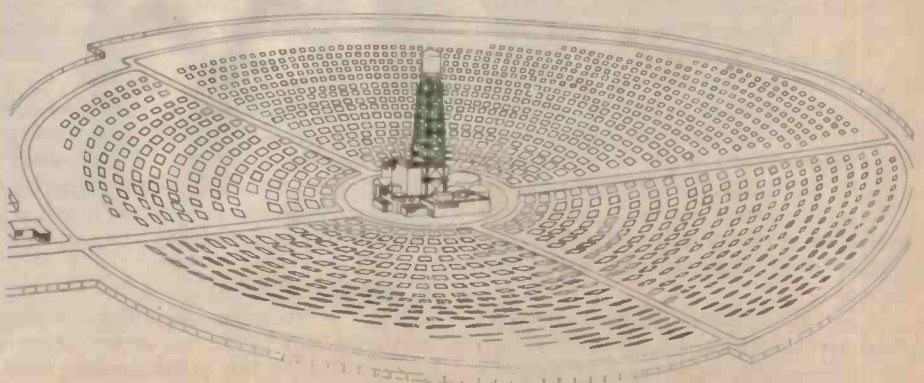
Westinghouse is interested in further developing solar projects through Government or independent foundation funding of research and development. Since 1975 Westinghouse's independent development of solar projects has been underway, with an estimated $US2 million investment so far.

"We at Westinghouse are devoted our resources to assuring that a combination of technologies including fossil, nuclear, advanced nuclear, fusion, solar and others is available in the upcoming decades to meet the world's energy needs," said George Hardigg, vice president of Westinghouse advanced power systems divisions.

A Westinghouse Lab Technician and a Computer Engineer put last minute touches to the low-cost heliostat before it is sent to Sandia Laboratories in New Mexico for final testing. The mirrored surface of the prototype heliostat measures 4 by 12 metres. Sunlight is reflected from the heliostat to a central collecting tower.

Mr. Hardigg stressed, "Even though the technology for generating significant amounts of electricity with mass produced solar equipment is still beyond commercial application, a serious attempt is being made to reduce the solar power costs to a level more nearly competitive with conventional generation methods.

"The larger question is not if electricity can be generated from the power of the sun, but rather how the costs of solar generation equipment can be reduced to an affordable level". ●



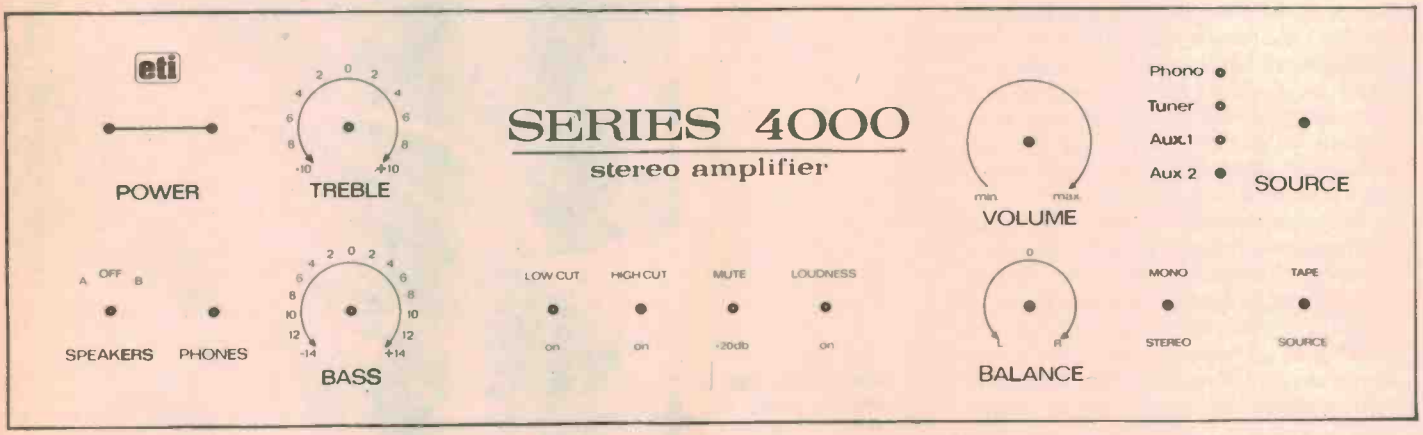
Artist's impression of the proposed Solar Power Plant. A field of heliostats reflects sunlight to a central 'power tower' where up to 50 MW of electricity may be generated.

Project 471

High performance stereo preamp control unit

Phil Wait

This project is designed to complement our 60 watt low distortion amplifier module and forms part of a complete stereo system, our "Series 4000" project — to be described in a forthcoming issue.



THIS stereo preamplifier is designed to drive two 60 watt, low distortion amplifier modules (ETI 470), described last month.

The requirements for this preamplifier/control unit were set down after many hours of office discussion. In fact it would be fair to say that the final design was evolved, rather than conceived.

Amongst the first requirements were low hum and noise and low distortion — much lower distortion than the amplifier modules it would be required to drive. Low distortion in a preamplifier is relatively easy to achieve and makes the subsequent addition of a high quality class A headphone amplifier worthwhile.

In the final design, we feel we have achieved performance figures well up front amongst commercial equipment.

Features considered essential included loudness, high cut and low cut filters. These are common in commercial preamp/control units but lacking on most kit designs. The low cut filter incorporated in our design will effectively reduce bass rumble while the high cut filter is useful for reducing tape hiss or 'monkey chatter' and heterodynes from an AM tuner.

The disc amplifier stage of a preamp must be capable of handling very high input signals before clipping to preserve dynamic range, especially as moving coil cartridges with voltage boosting transformers and/or amplifiers are finding increasing popularity. The disc input of this design can handle 400 mV peak-to-peak before clipping, giving it a dynamic range in excess of 100 dB!

Finally, and by far the most difficult of our requirements to implement, was the idea that all switches and potentiometers be mounted directly onto the pc board, with as few links and external leads as possible. All this, while preserving an attractive and stylish front panel layout! The advantage of this is that assembly is easy, and straightforward and there is less room for wiring errors to creep in and, should it be necessary, the board can be removed for servicing in its complete, functional form. All interconnections to and from the board are via RCA sockets using standard audio 'jumper' leads.

The 60 watt power amplifier module and this preamp/control unit project form the basis of our "Series 4000" high performance stereo amplifier project, complete details of which we plan to present next issue.

Construction

All the components, including the pots, switches and LEDs, are mounted onto the pc board. The board is then fixed, component side forward, behind the mounting panel of the case using standard 25 mm spacers and countersunk screws. A dummy facia — with the control markings etc on it, is subsequently held in place by the switch nuts.

If all directions are followed, then construction is quite straightforward — it's easier to do than describe!

Firstly, the mounting panel and facia must be cut and drilled to the dimensions shown on the drawing (unless you have bought a kit, in which case this may already be done). The drilled pc board may be used as a template. Dimensions shown in brackets refer to the facia panel which must be cut slightly smaller if you wish to use the same case for your stereo as we have.

The holes for the pot shafts are only 7 mm in diameter on the facia panel to ensure correct knob alignment. Countersunk holes are drilled in the mounting panel, but not in the facia, for the bolts securing the pc board through the spacers.

Once the mounting panel and facia are drilled, carefully check the alignment of all holes with the corresponding holes in the pc board. The drilling must be reasonably accurate.

ETI 471 – STEREO PREAMPLIFIER SPECIFICATIONS (Measured on prototype)

Distortion	0.015% at 1 kHz 0.015% at 10 kHz (For all inputs, with 500 mV RMS output – distortion is mainly 2nd harmonic).
Hum and Noise	83 dB unweighted (With respect to 10 mV phono input).
Frequency Response	Phono: Within 0.5 dB of RIAA from 20 Hz to 20 kHz (Follows new IEC curve). Other inputs: 20 Hz to 20 kHz ± 0.5 dB Subsonic rolloff: 6 dB/octave below 20 Hz
Output	7 V p-p before clipping
Tape output	150 mV RMS
Sensitivity	For 500 mV RMS output phono: 3 mV RMS other: 150 mV RMS (Phono overload level is 400 mV p-p).
Tone controls	Bass: ± 13 dB at 50 Hz Treble: ± 11 dB at 10 kHz
Filters	High: 6 dB/octave, –3 dB at 5 kHz Low: 6 dB/octave, –3 dB at 100 Hz
Loudness	8 dB boost at 15 kHz and 10 kHz.
Mute switch	20 dB attenuation

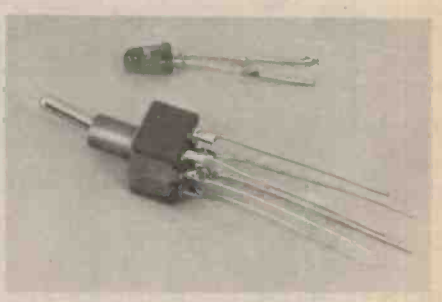
Once this mechanical work is completed the components may be mounted on the pc board. Start with the RCA sockets. Take care not to use too much force on the nuts and check that electrical contact has been made to the earth plane of the pcb using an ohm-meter. Join the centre pin of the RCA sockets to the pc board pads using lengths of tinned copper wire – refer to the overlay.

Mount the potentiometers next so that their terminals are directly above the pads on the pc board. The lower pot terminals can be cut, bent down and soldered directly onto the pads. Connect the upper pot terminals to the pc board, as shown in the overlay, using tinned copper wire.

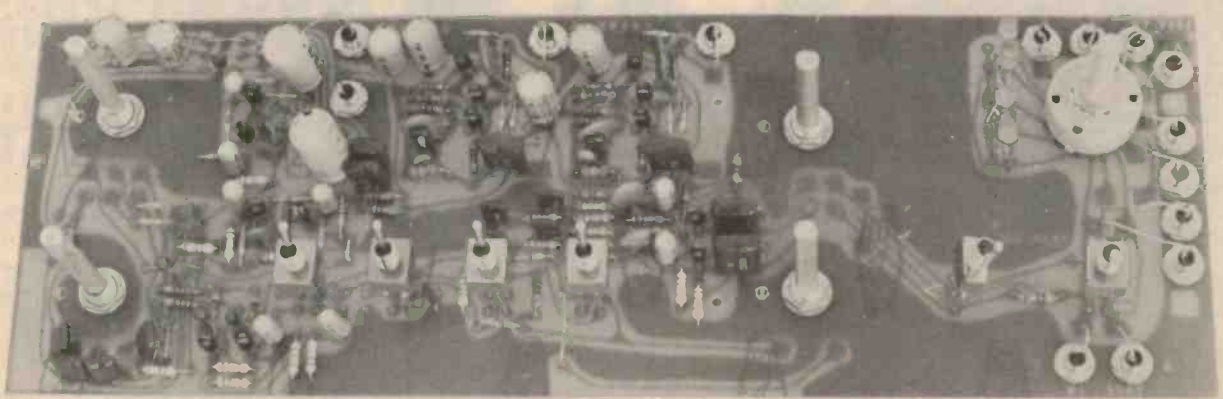
Either of two types of rotary switch may be used for the source selector. We have specified a C & K pc-mounting type but a standard rotary wafer switch may be used instead. The C & K switch mounts directly onto the pc board. If a standard rotary switch is used it will bolt to the front panel of the case and is wired in as detailed shortly.

Once the major parts are assembled onto the pc board, all the minor components may be loaded and soldered in place. Make sure that any large components (electrolytics particularly) are less than 25 mm high, otherwise they will foul the front panel. Check that all transistors, tantalums and electrolytics are correctly oriented. Refer to the overlay as you proceed.

The switches and LEDs must be mounted and spaced correctly off the pc board. Solder 50 mm lengths of tinned copper wire onto each of the switch terminals and LED leads (see illustration). Pass the wires through the ▶



Above: The switches and LEDs have lengths of wire soldered on to them so that they can be inserted into the pcb before being attached to the front panel. They can then be soldered in place. This procedure ensures that there is no strain on the joints. Below: the completed unit. Full details of metalwork will be given in a later article, in which we will describe how to use this preamp with two of the ETI 470 60W units to build a high-performance, low cost stereo amplifier.



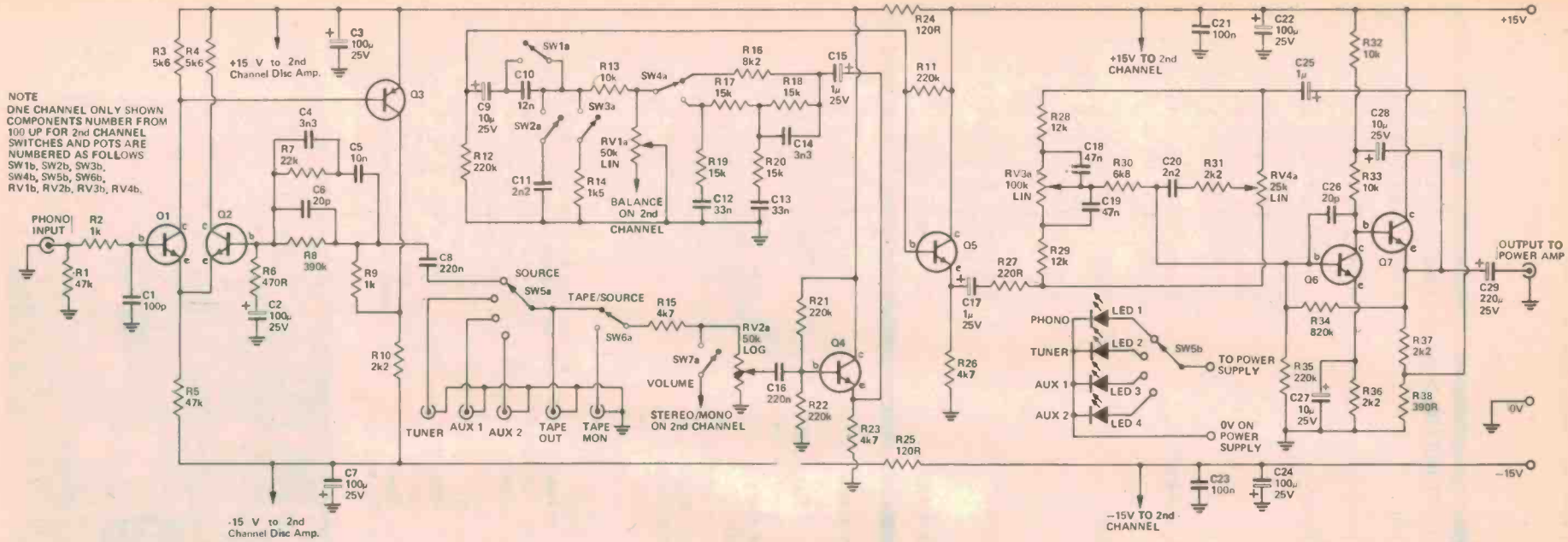


Fig. 1. Preamplifier circuit diagram. Only one channel has been shown for clarity. The component numbering of the other channel begins at 101.

HOW IT WORKS - ETI 471

The signal from a magnetic cartridge is fed to the base of Q1 via a low pass filter, (R2 and C1) for attenuation of radio frequencies. Q1 and Q2 form a differential pair, each half operating at low collector current to minimise noise. The output of the differential pair is taken from the collector of Q1 and further amplified by Q3. Feedback is taken to the base of Q2, the negative input of the differential pair, through the RIAA equalisation network. Overall gain of the phono stage is set by the ratio of the feedback network impedance to the value of R6.

Subsonic bass roll-off of 6 dB/octave, to conform to the new IEC 65 specification, is achieved by a high pass filter consisting of C8 and RV2.

Output from the disc preamplifier is then fed via the Source Switch (SW5), Tape-Source switch (SW6), R15 and the volume control (RV2), to an emitter follower, Q4. This emitter follower presents a high impedance for the aux inputs and a constant impedance for driving the filters.

When switched in, the loudness network boosts the high and low frequencies with respect to the midrange. In actual fact, all frequencies are attenuated but the midrange is attenuated more. When the loudness is switched out, R16 approximates the impedance of the network.

Muting is achieved by switching R14 to earth. The ratio of R14 to R13 sets the attenuation to 20 dB. C11 shunts high frequencies to earth for high cut, while C10 reduces low frequency content when switched in, providing low cut.

A second emitter follower, Q5, presents a constant impedance to the filters and acts as a low impedance source to the tone control stage.

A Baxandall tone stage is used here, a common circuit in many designs. Q6 is a gain stage with a bootstrapped collector load, via C28, to the output. Bootstrapping increases the gain by increasing the effective collection load impedance. Q7 is an emitter follower connected directly to the collector of Q6. This provides a very low output impedance. DC bias for Q6 is taken from the output.

Some of the output signal is fed back to the tone controls and split into high and low frequencies by RV3 and RV4. By adjusting the controls the percentage of the input to the negative feedback signal appearing at the base of Q6 can be varied, thereby varying the overall gain of the amplifier at either high or low frequencies. The gain of the tone stage is set by the ratio of R37 to R38. As R38 is reduced in value the negative feedback is reduced and therefore the overall gain is increased.

To preserve the very low output impedance of the pre-amplifier the balance control is placed ahead of, rather than after, the tone stage.

Power supply filtering and decoupling is provided by 100 μF capacitors and resistors in each rail.

Source indication is by LEDs from the spare section of the source switch. No current limiting resistor is on the pc board for the LEDs as one will be included in the power supply. (To be described).

corresponding pc board holes for these components but do not solder them in place yet. Check that the LED leads are the right way round.

Assemble the pc board onto the case mounting panel (using the 25 mm spacers and countersunk screws). Place the facia over the front panel, securing it in place with the switch nuts (three hands and a prehensile nose might help! . . . a little sticky tape and deft juggling is all that's really necessary). Once you've got it all together the protruding wires may be soldered to the pc board. Ensure that no short circuits have occurred.

That completes the assembly. For servicing purposes the pc board and all switches, LEDs and pots – all the operating controls – may be removed simply by undoing several nuts, removing the facia and the countersunk screws beneath.

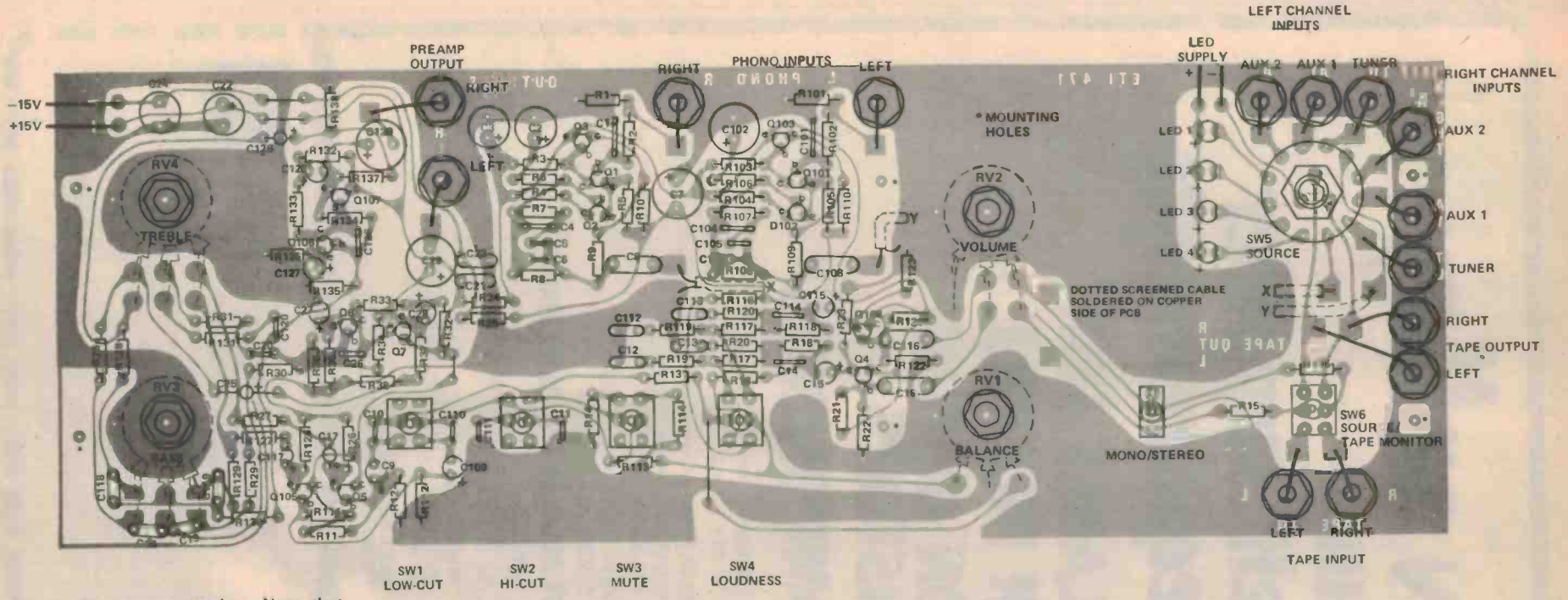


Fig. 2. Component overlay. Note that lengths of shielded cable are used to connect the outputs of the disc preamplifiers to the selector switch.

PARTS LIST - ETI 471

Resistors all ¼W 5%

R1, R101 . . . 47k
R2, R102 . . . 1k
R3, R4, R103, R104 . . . . . 5k6
R5, R105 . . . 47k
R6, R106 . . . 470R
R7, R107 . . . 22k
R8, R108 . . . 390k
R9, R109 . . . 1k
R10, R110 . . . 2k2
R11, R12, R111, R112 . . 220k
R13, R113 . . . 10k
R14, R114 . . . 1k5
R15, R115 . . . 4k7
R16. R116 . . . 8k2
R17 – R20, R117, R120 . . 15k
R21, R22, R121, R122 . . 220k
R23, R123 . . . 4k7
R24, R25 . . . 120R
R26, R126 . . . 4k7
R27, R127 . . . 220R
R28, R29, R128, R129 . . 12k
R30, R130 . . . 6k8
R31, R131 . . . 2k2
R32, R33, R132, R133 . . 10k
R34, R134 . . . 820k
R35, R135 . . . 220k
R36, R37, R136, R137 . . 2k2
R38, R138 . . . 390R

Potentiometers

RV1 . . . . . 50k single linear
RV2 . . . . . 50k dual log
RV3 . . . . . 100k dual linear
RV4 . . . . . 25k dual linear

Capacitors

C1, C101 . . . . 100p ceramic
C2, C3, C102 . 100µ 25V electro
C4, C104 . . . . 3n3 greencap
C5, C105 . . . . 10n greencap
C6, C106 . . . . 20p ceramic
C7. . . . . 100µ 25V electro
C8, C108. . . . 220n greencap
C9, C109. . . . 10µ 25V electro
C10, C110 . . . 12n greencap
C11, C111 . . . 2n2 greencap
C12, C13, C112, C113 . . 33n greencap
C14, C114 . . . 3n3 greencap
C15, C115 . . . 1µ 25V tantalum
C16, C116 . . . 220n greencap
C17, C117 . . . 1µ 25V tantalum
C18, C19, C118, C119 . . 47n greencap
C20, C120 . . . 2n2 greencap
C21. . . . . 100n greencap
C22. . . . . 100µ 25V electro
C23. . . . . 100n greencap
C24. . . . . 100µ 25V electro
C25, C125 . . . 1µ 25V tantalum
C26, C126 . . . 20p ceramic
C27, C28, C127, C128 . . 10µ 25V electro
C29, C129 . . . 220µ 25V electro

Semiconductors

Q1, Q2, Q101, Q102 . . BC549, DS549, BC109
Q3, Q103 . . . BC559, DS559, BC179
Q4–Q7, Q104 –Q107 . . . . . BC549, DS549, BC109

LED1–LED4 . TIL220R or sim LED's

Switches . . . . (see text)

SW1–SW4 . . . DpDT min toggle switch
SW5. . . . . 3 pole 4 pos rotary switch
SW6. . . . . DpDT min toggle switch
SW7. . . . . spdt min toggle switch

Miscellaneous

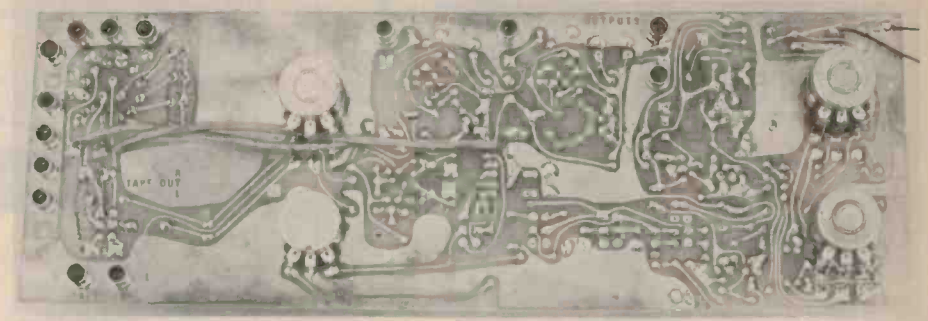
14 RCA panel mounting single hole sockets, ETI 471 pcb, tinned copper wire, length shielded cable, 25 mm spacers, 30 mm screws, nuts, mounting panel and facia plate.

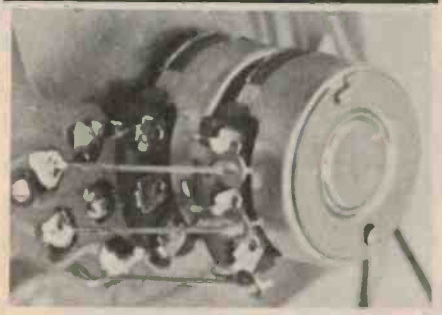
Power Supply

The preamplifier/control unit is capable of giving extremely good performance – but only with a good power supply. The supply should be well regulated and filtered for noise, especially if zener regulation is used.

Next month we will be publishing a suitable power supply design which will provide dc for both the 4000 preamplifier and two of the 60 W modules described last month.

Rear view of the assembled preamp, showing how the potentiometers and shielded cables are mounted. Note the use of pc mounting phono sockets for ease of assembly.





Potentiometer connections to the pcb are made via lengths of tinned copper wire.

Further Suggestions

We have designed this preamplifier to use commonly available components. However, some constructors or kit suppliers may wish to improve the appearance and the ease of construction of the project. One way of doing this is to use different switches.

The SOURCE switch which we suggest is a C & K Lorlin three-pole, four position pc mounting rotary switch. If only wire terminal models are available, the eyelets can be cut off and the switch mounted as if it were a pc mounting model.

C & K toggle switches may be used for the other switch functions. These are available on order with 'paddle' levers and 25 mm wire wrap terminals. The switches make the preamp look very professional and can also be directly mounted onto the pcb.

The appearance of the LEDs can be improved by using C & K Cliplite covers. These are available in a variety of colours.

C & K switches are available from:

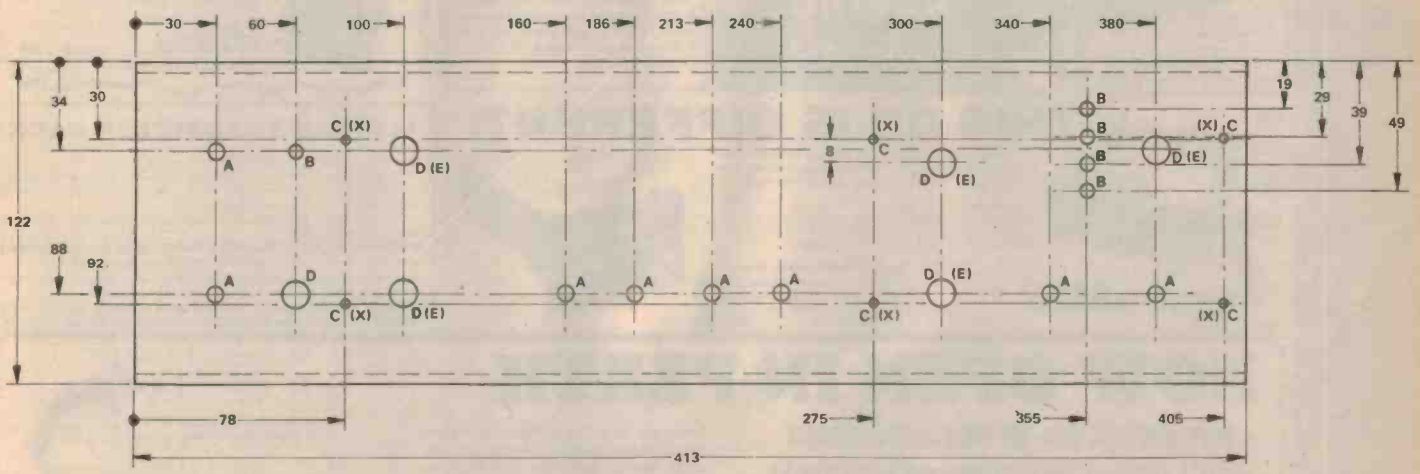
Radio Despatch Service,
869 George Street,
Sydney 2000

George Brown,
174 Paramatta Road,
Camperdown, NSW

JES Electronic Components,
13 Melrose Street,
Sandringham, VIC

C & K Electronics,
2/6 McFarlane Street,
Merrylands, NSW

This photo shows how the input sockets are wired into the pcb.



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C – 3mm COUNTERSUNK
D – 10mm
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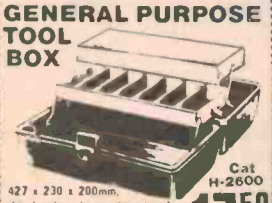
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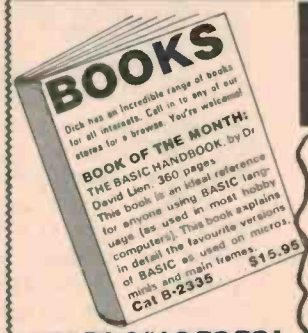

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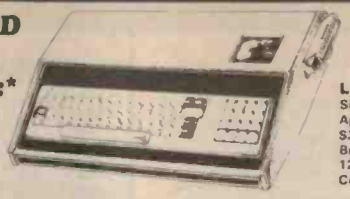

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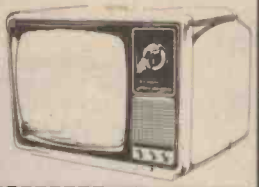

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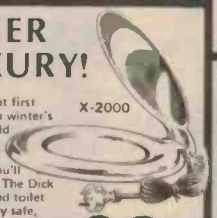

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PARTS FOR NEW KITS

PLAYMASTER STEREO EQUALIZER (See EA May)

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UA4136 Quad Op Amp	Cat Z-6105 $1.95
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INTERSIL LCD EVALUATION KIT (See Feb EA)

As used in the EA digital voltmeter	Cat. K-3450 $39.50

6 DIGIT CLOCK (See Feb EA)

Complete kit, including instructions	Cat. K-3495 $19.75
Case with mounting bracket and bezel	Cat. H-3194 $3.60
AC Mains adaptor	Cat. M-9514 $5.95

PLAYMASTER AM/FM TUNER (See Nov/Dec EA)

Complete kit, including instructions	Cat. K-3494 $129.50

SEPARATE PARTS

Pre-wired and aligned tuner module	Cat. F-4610 $59.00
Set of 4 PC boards	Cat. H-8357 $9.75
Signal strength meter	Cat. Q-2100 $4.95
Tuning meter - centre zero	Cat. Q-2095 $4.95

Most other electronic parts for this project in stock.

MODEL TRAIN CONTROLLER (See Oct 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

FET INPUT AC-DC VOLTMETER (See Sept EA)
Not produced as a kit- all parts available from 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 Scotchcal 8005 black Scotchcal photo-sensitive aluminium	Cat. H-5694 $6.00
CA-3140 FET op-amp	Cat. Z-5417 $2.50

VARI WIPER Mk2 (See Sept EA)
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

UPGRADED 40/200MHz FREQUENCY COUNTER (See Aug EA)
Same 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, including instructions	Cat. K-3437 $99.50
96H90 IC to extend range to 200MHz	Cat. Z-5360 $12.50

SEPARATE PARTS

PC boards (set of two high quality boards)	Cat. H-8346 $8.50
MC-10116 IC (triple differential amplifier)	Cat. Z-5415 $1.95
MM-5369M IC (oscillator - divider)	Cat. Z-5781 $2.50
74C926 IC (4 digit counter)	Cat. Z-5414 $6.50
3.579545MHz crystal	Cat. K-6031 $3.00
LT-303 7 segment display	Cat. Z-4103 $1.50

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Sumner Electronics
95 Mitchell St, Bendigo, Vic. Ph 431 977
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5a The Quadrant, Launceston Tas. Ph 317 075
Trilogy Electronic Supplies
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Project 144

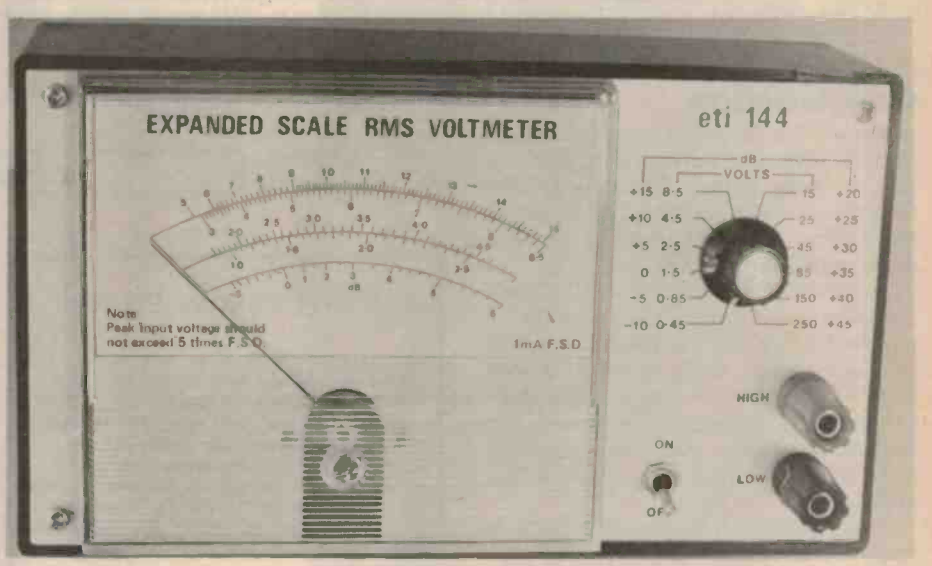
Expanded scale RMS voltmeter

Barry Wilkinson, of Nebula Electronics, needed to develop an RMS voltmeter to measure dc pulses in a particular application for a customer of his. It was only a few steps from there to this project.

THE LAST RMS voltmeter project we described appeared in the August 1977 issue, Project 134. This was an ac-only instrument that used an LH0091 RMS converter IC.

The instrument described here, while perhaps not as versatile in some ways as the ETI 134 which had a 0.3 mV to 30 V range and an A-weighting filter, is decidedly simpler to construct, will measure dc signals (square waves and pulses etc referenced to zero volts) and is less expensive.

This instrument will measure 150 mV to 270 V in 12 ranges and features a large (90 mm scale) meter, 2% accuracy and an expanded scale for ease of reading.



What is RMS?

At this stage, it would be a good idea to recap just what RMS means and its significance. Simply, the RMS value of any waveform is equal to that dc value which would produce the same heating effect in a resistor.

As an example, let's take the case of a light dimmer. The power in the light (the load) is varied using phase control in an SCR circuit. This varies the amount of time the load is connected to the mains over part of each mains cycle (see Fig. 1). The RMS value of the waveform across the load in this case is difficult to calculate, except at the point where it is half-on and half-off. The power is then obviously half the maximum value.

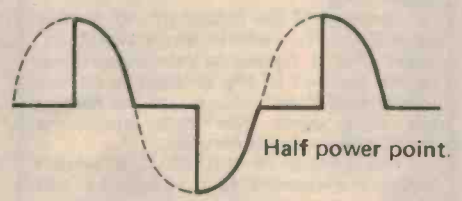


Fig. 1. The output waveform of a light dimmer running at half power.

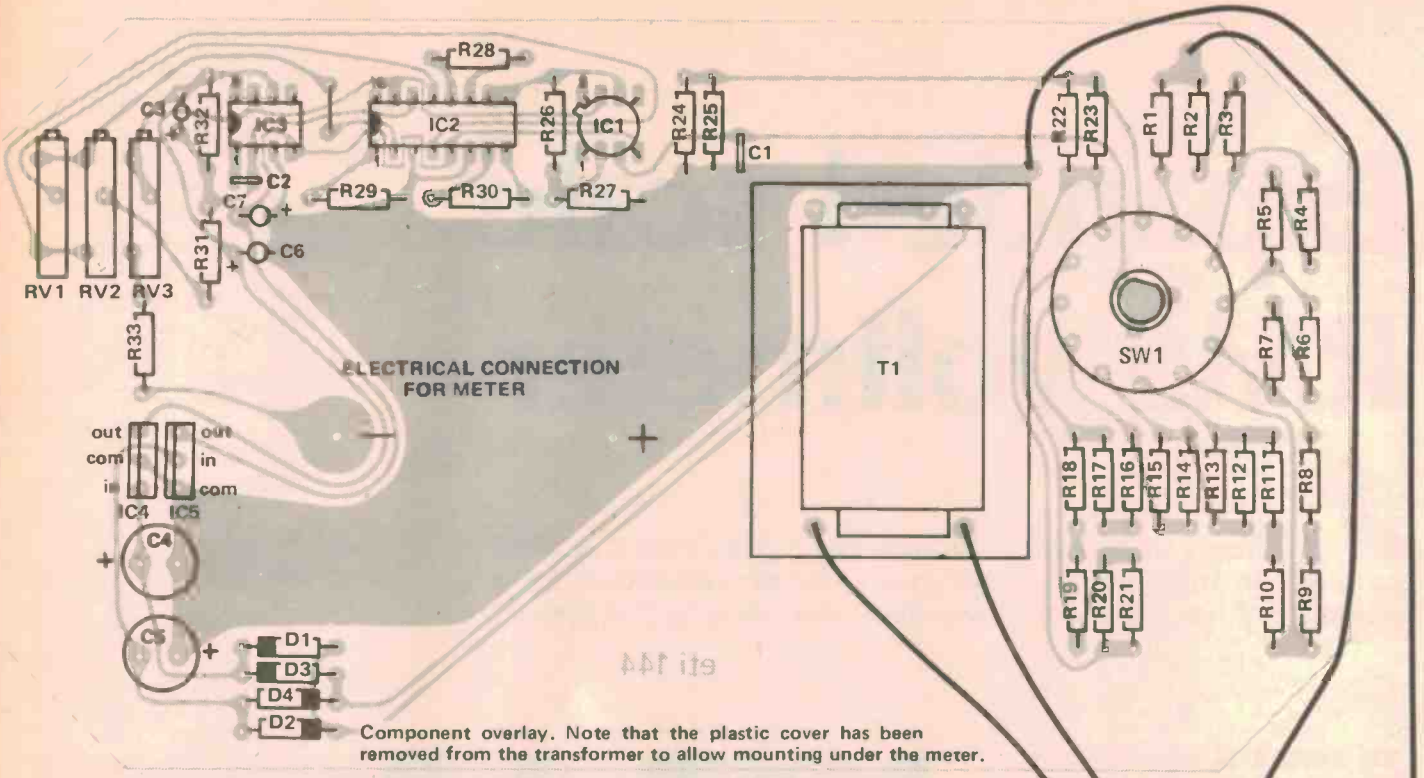
If the input voltage is 240 V and the load is 240 ohms, the power at maximum can be calculated from:—

$$P = \frac{E^2}{R} \text{ or } \frac{240 \times 240}{240} = 240 \text{ W}$$

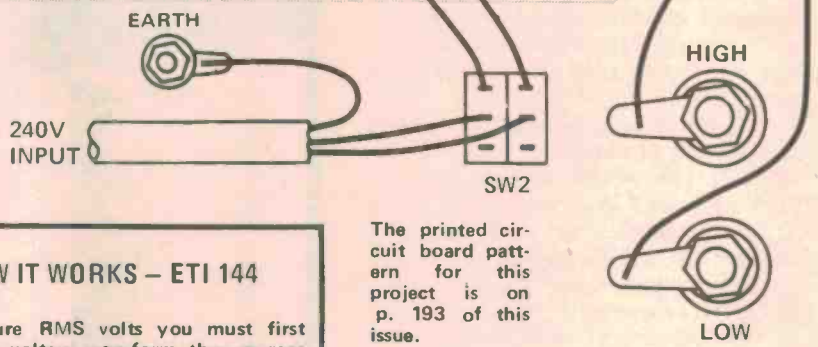
Half power is therefore 120 W. The voltage corresponding to this is given by:—

$$E = \sqrt{P \times R} \text{ or } 170 \text{ V (rms)}$$

On a 'normal' meter this will read 120V, — an error of 30%. ▶



Component overlay. Note that the plastic cover has been removed from the transformer to allow mounting under the meter.



Construction

Assemble the pc board according to the overlay diagram, starting with the low height components. Do not fit the switch or the transformer yet. Watch the polarity and orientation of the components before soldering.

Before the transformer can be used the plastic cover and base have to be removed to reduce its height. This can be easily done using a small bladed screwdriver. Do not remove the internal plastic cover over the windings. The transformer can now be mounted and soldered in place keeping it as close as possible to the board.

The rotary switch specified (C & K 1054) is a pc-mounting type but may not be as readily available as the CK1034 type which has wiring connections. This can be used however if the very ends of the terminals are cut off carefully When fitting it to the pcb ensure that the No. 1 pin is toward the top of the board. Do not solder yet.

Fit the Scotchcal panel to the aluminium front panel and drill all the holes. Fit the meter to the panel. Assemble the power switch and terminal posts to the panel. Attach wires, about 100 mm long, to the terminal posts and also wire up the power switch. Earth the front panel using one of the meter retaining screws and leave about 50 mm of wire on the two outputs from the switch.

HOW IT WORKS – ETI 144

To measure RMS volts you must first square the voltage waveform, then average it and finally take the square root of that average. In this unit we electronically square and average the input but we use the meter scale to take the square root.

The input voltage is divided by the input network such that the input IC1 is 0.47 volts (dc or RMS) for full scale deflection. IC1 provides buffering and a gain of two.

Squaring of the output of IC1 is done by IC2 (1494), a four quadrant multiplier, which gives a current output proportional to the product of the voltages at its two inputs (pin 9 and 10). As we are feeding the same signal into both inputs the result is the square function.

The output of this IC is a current which is converted to a voltage by IC3 which also provides the averaging network (C3, R32). its output drives the meter whose scale is a square root function.

Adjustments are provided for the input offset of IC2 (RV1) output offset (RV2) and overall calibration (RV3).

As the power requirement of all the ICs is +/– 15 V we use a mains supply and three-terminal regulators. Current drain is about 15 mA on both supplies.

The printed circuit board pattern for this project is on p. 193 of this issue.

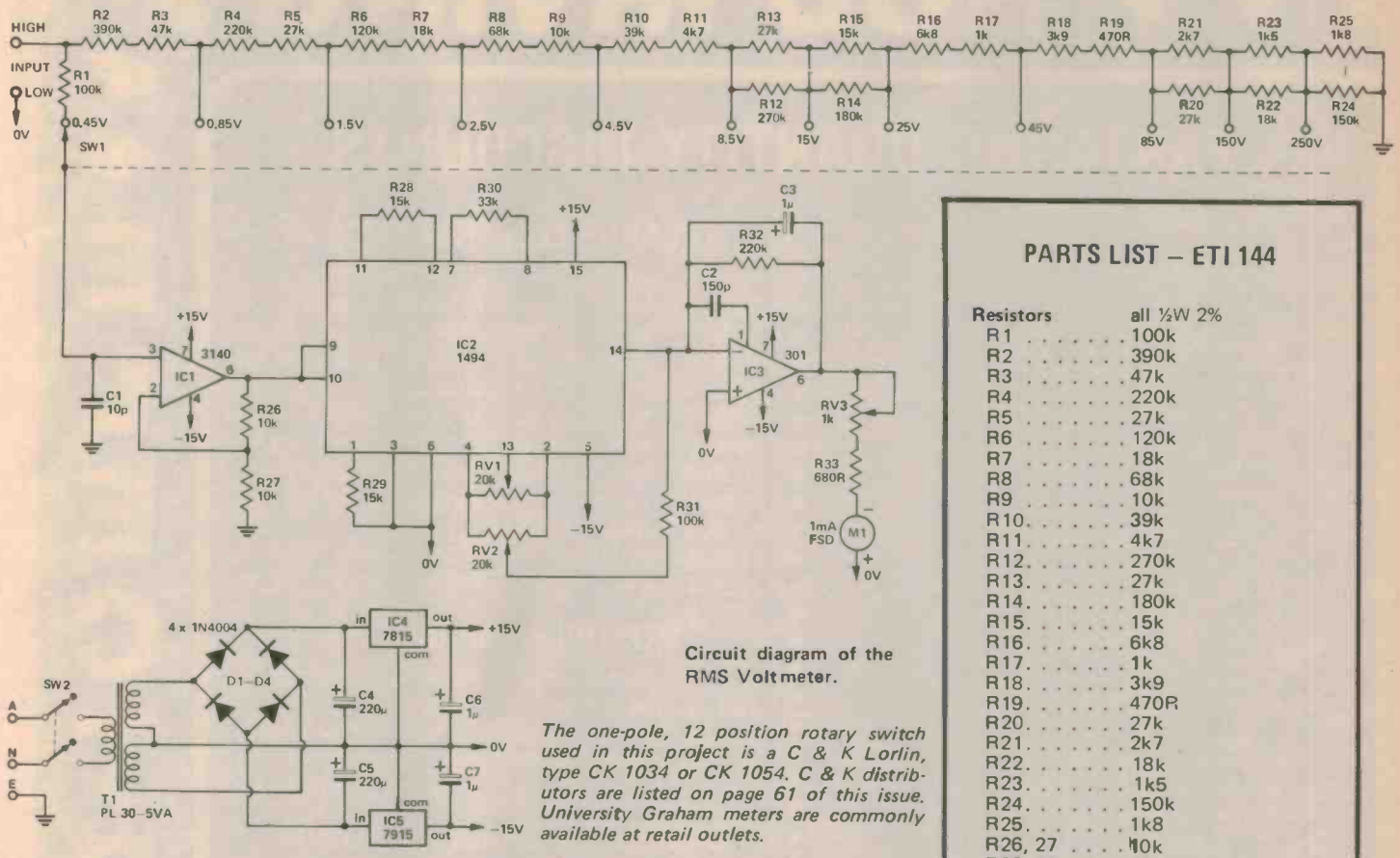
Now fit the pc board to the meter leaving the spring washers on the meter side of the board giving extra space to the front panel. As the switch now lines up with the front panel it can be soldered in place.

Connect the wires from the terminals to their position on the pc board. The 240 V wires from the switch come around the edge of the board and solder directly onto the terminals of the transformer. These connections should be covered with epoxy to prevent personal contact.

The meter scale can be fitted to the meter as follows:

Remove the clear cover from the meter (it clips on) then, carefully remove the existing scale. The scale should be sprayed white and allowed to dry.

Cut the Scotchcal to the borders marked, peel back the plastic a little and cut off about 5-10 mm of paper backing on one edge.



Circuit diagram of the RMS Voltmeter.

The one-pole, 12 position rotary switch used in this project is a C & K Lorlin, type CK 1034 or CK 1054. C & K distributors are listed on page 61 of this issue. University Graham meters are commonly available at retail outlets.

ETI 144 EXPANDED SCALE RMS VOLTMETER

SPECIFICATIONS

Input range	150 mV to 270 V in 12 ranges, 5 dB apart
Accuracy	+/- 2% FSD
Crest factor	maximum, 10
Frequency response	dc to 50 kHz (sine wave)
Input impedance	1 M
Meter type	moving coil, RMS volts, expanded scale calibration

PARTS LIST – ETI 144

Resistors all ½W 2%

R1 . . . . . 100k
R2 . . . . . 390k
R3 . . . . . 47k
R4 . . . . . 220k
R5 . . . . . 27k
R6 . . . . . 120k
R7 . . . . . 18k
R8 . . . . . 68k
R9 . . . . . 10k
R10 . . . . . 39k
R11 . . . . . 4k7
R12 . . . . . 270k
R13 . . . . . 27k
R14 . . . . . 180k
R15 . . . . . 15k
R16 . . . . . 6k8
R17 . . . . . 1k
R18 . . . . . 3k9
R19 . . . . . 470R
R20 . . . . . 27k
R21 . . . . . 2k7
R22 . . . . . 18k
R23 . . . . . 1k5
R24 . . . . . 150k
R25 . . . . . 1k8
R26, 27 . . . . 10k
R28, 29 . . . . 15k
R30 . . . . . 33k
R31 . . . . . 100k
R32 . . . . . 220k
R33 . . . . . 680R

Potentiometers

RV1, 2 . . . . . 20k 10 turn trim
R3 . . . . . 1k 10 turn trim

Capacitors

C1. . . . . .10p ceramic
C2. . . . . .150p ceramic
C3. . . . . .1µ 35V tantalum
C4, 5 . . . . . .220µ 35V electrolytic
C6, 7 . . . . . .1µ 35V tantalum

Semiconductors

IC1 . . . . . CA3140
IC2 . . . . . MC1494
IC3 . . . . . LM301A
IC4 7815
IC5 7915

D1–D4. . . . . IN4004

Miscellaneous

PC board ETI 144
Transformer PL30/5VA (Ferguson)
Meter TD118, 1mA FSD (University)
Meter scale to suit
Zippy box 196 x 113 x 60 mm
Scotchcal panel
2 pole power switch
1 pole 12 position rotary (see text)
Knob to suit
3 core flex, plug and clamp
2 terminal posts

The Scotchcal panel can now be placed on the meter scale and lined up while holding the sticky edge off the panel. Now press down the sticky edge to locate the panel then fold it back on itself to allow the rest of the backing sheet to be removed. Press the panel down from the edge already fixed removing any air bubbles from under it.

The scale can now be refitted to the meter and the cover placed back. ▶

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150uF	200V	$2.50	4000uF	15V	$2.30
220uF	350V	$6.90	4000uF	75V	$6.30
300uF	200V	$3.50	4700uF	35V	$2.90
1000uF	63V	$2.90	4700uF	100V	$9.50
1000uF	100V	$3.70	5600uF	40V	$1.90
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10,000uF	25V	$9.00	27,000uF	35V	$21.70
10,000uF	40V	$11.50	68,000uF	16V	$19.50

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Alignment and calibration

Equipment needed:
variable dc power supply
accurate dc voltmeter
two-pole change over switch

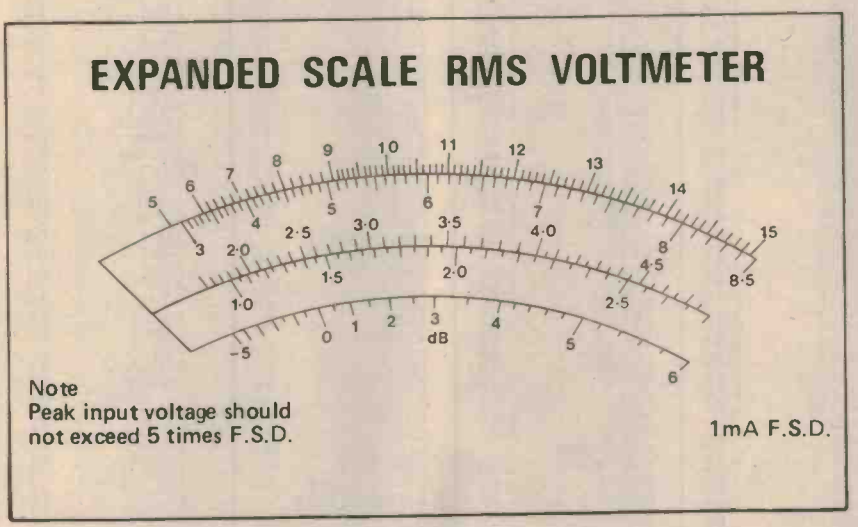
Connect the power supply to the input terminals, via the switch, connected to give polarity reversal. Switch on the unit and with no input voltage adjust RV2 to give a reading about a quarter of the way up the scale.

Allow the unit about five minutes to warm up and stabilize. You could check to see if the internal supplies are giving the correct voltages while you wait.

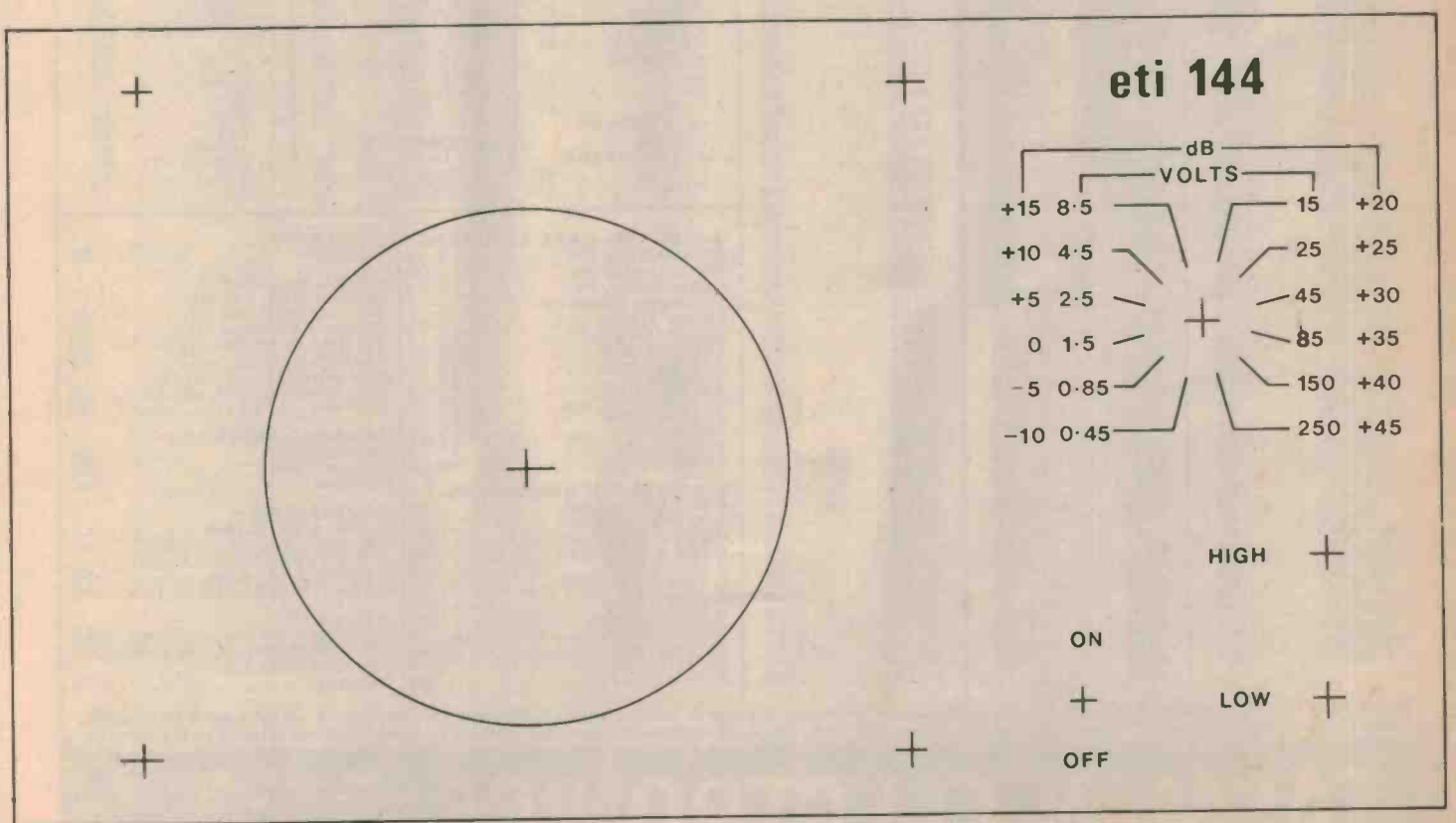
Now, switch to the 15 volt range and apply about five or six volts to the input. Reverse the polarity of the input and note the change in the reading. Adjust RV1 until there is no difference, irrespective of polarity.

It will probably be necessary to adjust RV2 again to keep the reading on the scale. Note that it is not the actual reading that is important just that both polarities are the same. Increase the voltage to around 14 volts to ensure the adjustment is correct.

Now, with no input voltage adjust RV2 to give a zero reading. Apply 14 volts and adjust RV3 to read 14 volts. Adjustment is now complete.



Both of these drawings are reproduced full size so that, if you wish, you can cut them out of the magazine and use them directly.



Chances are, if you can read this, you'll save money

• TRANSISTORS

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AC128	.80
AD149	2.60
BC107	.35
BC108	.35
BC108C	.39
BC109	.35
BC109C	.40
BC177	.38
BC318	.22
BC319	.22
BC320	.22
BC337	.24
BC338	.24
BC547	.24
BC548	.24
BC549	.24
BC557	.24
BC558	.24
BC559	.24
BD131	.65
BD139	.50
BD140	.50
BD262	1.20
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2N2222A	.40
2N2368	.25
2N2646	1.15
2N2647	1.15
2N2904	.50
2N2905	.50
2N2905A	.50
2N2907	.45
2N3107	1.00
2N3053	.50
2N3054	1.20
2N3055	.75
2N3300	.75
2N3642	.35
2N3702	.16
2N3704	.29
2N3740	1.70
2N3904	.29
2N4030	.92
2N4032	.97
2N4033	1.30
2N4036	1.53
2N4037	1.15
2N4231	.99
2N4234	1.87
2N4238	1.67
2N5088	.30
2N5458	.55
2N5459	.59
2N5462	.90
2N5871	1.53
2N5872	2.05
2N5873	1.53
2N5874	1.67
2N6124	.92
2N6126	1.11
2N6129	1.28
2N6130	1.43
2N6132	1.43
2N6134	1.53
MPS3565	.18
MPS3638	.19
PN3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
PN3569	.18
PN3638	.18
PN3638A	.22
PN3641	.20
PN3642	.20
PN3643	.20
PN3644	.22
PN3645	.22
PN3646	.22
PN3693	.29
PN3694	.29
PN4121	.35
PN4248	.22
PN4250	.29
PN4355	.29

• 74LS

74LS00	.20
74LS01	.30
74LS02	.25
74LS03	.25
74LS04	.20
74LS05	.30
74LS08	.25
74LS09	.30
74LS10	.25
74LS11	.30
74LS12	.30
74LS14	.95
74LS20	.28
74LS21	.30
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.30
74LS37	.38
74LS38	.38
74LS40	.30
74LS42	.70
74LS73	.60
74LS74	.46
74LS75	.55
74LS78	.50
74LS85	1.40
74LS86	.50
74LS90	.70
74LS92	1.10
74LS93	.80
74LS95	1.00
74LS109	.50
74LS113	.50
74LS114	.50
74LS125	.70
74LS133	.30
74LS138	1.10
74LS151	1.15
74LS157	.75
74LS160	.90
74LS163	1.15
74LS164	1.30
74LS165	1.15
74LS169	1.70
74LS174	.70
74LS175	.85
74LS190	1.25
74LS191	1.20
74LS192	1.15
74LS193	1.00
74LS194	1.15
74LS195	1.00
74LS196	1.20
74LS197	1.50
74LS221	1.50
74LS251	.85
74LS253	.85
74LS257	.75
74LS259	3.30
74LS279	.55
74LS290	1.15
74LS365	.70
74LS366	.70
74LS367	.70
74LS368	.65

• CMOS

4000	.25
4001	.25
4002	.25
4007	.30
4008	1.20
4011	.25
4012	.25
4013	.52
4014	1.30
4015	1.30
4016	.50
4017	1.30
4018	1.20
4020	1.40
4021	1.30
4022	1.30
4023	.25
4024	.90
4025	.35
4027	.70
4028	.95
4040	1.30
4042	1.10
4043	.95
4044	.95
4046	1.55
4049	.55
4050	.55
4051	1.20
4052	1.20
4053	1.20
4060	2.20
4066	.75
4068	.35
4069	.30
4070	.35
4071	.35
4072	.35
7076	1.75
4077	.35
4078	.35
4081	.35
4082	.35
4093	.70
4441	.95
4502	1.20
4506	.60
4510	1.40
4511	1.30
4518	1.40
4520	1.40
4528	1.20
4553	6.99
4555	1.10
4581	3.00
4582	1.00
4584	.75
40014	.60
40097	.90
40098	.90
74C02	.35
74C04	.40
74C08	.40
74C10	.40
74C14	1.60
74C20	.45
74C48	2.40
74C73	1.10
74C76	1.15
74C90	1.50
74C93	1.50
74C175	1.75
74C192	1.85
74C193	1.85

• TTL

7400	.20
7401	.20
7402	.25
7403	.25
7404	.20
7405	.25
7406	.45
7407	.45
7408	.30
7409	.34
7410	.30
7413	.54
7414	.45
7416	.50
7417	.45
7420	.30
7421	.30
7422	.30
7426	.40
7427	.40
7430	.30
7432	.40
7437	.50
7438	.40
7439	.40
7440	.30
7442	.83
7447	.90
7448	.95
7450	.30
7451	.30
7453	.30
7454	.30
7460	.30
7470	.50
7472	.45
7473	.50
7474	.50
7475	.65
7476	.40
7480	.95
7483	1.10
7485	1.40
7486	.50
7489	2.90
7490	.40
7491	1.00
7492	.70
7493	.40
7494	1.05
7495	.92
74100	1.95
74107	.55
74121	.50
74123	.85
74132	1.10
74145	1.80
47150	1.60
74151	1.00
74153	1.00
74154	1.40
74157	1.00
74160	1.30
74165	1.45
74172	1.10
74173	2.40
74175	1.45
74180	1.12
74188	2.50
74192	1.33
74193	1.33
74367	1.00

• VOLT. REG

7805	1.00
7812	1.00
7815	1.00
7818	1.00
7824	1.00
78H05	7.50
78H12	7.50
78HG	7.95
78L05	.40
78L12	.40
78L15	.40
78L18	.40
78L24	.40
7905	1.50
7908	1.45
7912	1.50
9715	1.50
7918	1.50
7924	1.50
79HG	9.95
79L03	.80
79L15	.80
79L18	.80
79L24	.80
78CB	2.30
723	.50
309	1.90
317	2.90

• DIODES

AAY30	.30
OA90	.15
OA91	.15
1N3493	1.70
1N3493R	1.70
1N4002	.11
1N4004	.11
1N4007	.20
1N4148	.06
1N5401	.43
1N5404	.43
1N5408	.45

• BRIDGES

W02	.90
VM48dil	1.25
MDA201	.95
MDA3501	3.40

• ZENERS

½W	.19
1W	.30
2½W	.65

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• SCR's/TRIAC

C103yy	.99
C106D1	.65
C106y1	.39
C122D1	1.80
SC141D	1.30

• LINEAR IC's

301	.40
307	.86
308	1.20
311	.75
324	1.25
380	1.70
381	2.87
3900	.99
555	.35
556	1.20
565	3.45
567	3.12
741	.30
747	1.15
748	.59
CA3046	1.65
CA3140	1.50
MC1494L	6.65
RC4136	1.45
TL071	.73
TL080	1.15
TL081	.52
TL082	.95
TL084	1.90
709	.65

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SYP2102A-4	1.90
TMS1000	7.95
2708	15.00
93448	10.20
1488	.96

• OPTO

9368	1.90
MCT2	.65
FND357	1.40
FND500	1.58
DL747	3.50
LED red	.20
LED green	.30
LED amb.	.43
LED TIL209	.18

• RESISTORS

½W, E24	.03
1W, E12	.07
5W, W/W	.25
Min. Presets	.18
Min. Trimpots	.48
Min. M/Turn	1.25

• TANTALUMS

0.1-1uf, 35V	.15
1.5 uf, 35V	.20
2.2uf, 35V	.25
3.3uf, 35V	.25
4.7uf, 35V	.25
6.8uf, 35V	.30
10uf, 25V	.25
15uf, 35V	.55
22uf, 35V	.55
33uf, 10V	.35
47uf, 6.3V	.30
4.7uf, 16V	.20

• CERAMICS

1pf to 0.0047	.05
0.0056- 0.01	.08
0.022- 0.1	.12
0.22uf	.18
o.47uf	.28

• TRIMMER CAP.

5pf to 65pf	.30

• SUPP. CAP.

NS5, 0.5uf	.60
NNS30, 3uf	2.00

• ELECTRO. CAPS. PC TYPE

6.3V, 470uf	.20
10V, 4.7uf	.08
22uf	.10
100uf	.12
16V, 10uf	.08
22uf	.12
33uf	.08
47uf	.12
100uf	.15
220uf	.15
470uf	.16
640uf	.42
1000uf	.32
2200uf	.50
2500uf	.62
25V, 1.5uf	.08
2.2uf	.08
3.3uf	.08
4.7uf	.08
10uf	.08
22uf	.08
25uf	.12
33uf	.10
47uf	.10
100uf	.18
220uf	.24
330uf	.24
470uf	.32
1000uf	.48
35V, 2.2uf	.08
3.3uf	.08
10uf	.11
100uf	.18
220uf	.21
1000uf	.53
2000uf	.71
2200uf	.88
50V, 0.47uf	.08
1uf	.06
2.2uf	.08
3.3uf	.06
4.7uf	.06
10uf	.08
22uf	.13
33uf	.15
47uf	.12
100uf	.16
220uf	.23
470uf	.60
63V, 0.47uf	.08
1uf	.08
2.2uf	.08
4.7uf	.10
10uf	.12
25uf	.15
47uf	.16
100uf	.23
220uf	.37
330uf	.40
470uf	.77

• ELECTRO. CAPS. CAN TYPE

2500uf/34V, RP	1.35
5600uf/40V, RP	1.99
6800uf/50V, RG	4.80
Computer Grade PW.	
6800uf/16V	6.85
10000uf/16V	9.15
68000uf/16V	23.70
10000uf/25V	10.30
15000uf/25V	12.20
22000uf/25V	14.50
27000uf/35V	26.00
2900uf/40V	7.15
10000uf/40	14.20
22000uf/40V	24.85

• POLYESTER GREENCAPS

0.001-0.018/100V	.10
0.022-0.033/100V	.11
0.039-0.056/100V	.13
0.068-0.082/100V	.16
0.10uf/100V	.19
0.12uf-0.18/100V	.20
0.22uf/100V	.30
0.27uf/250V	.30
0.33uf/250V	.34
0.39uf/250V	.44
0.47uf/250V	.47
0.047uf/630V	.28
0.47uf/630V	.60
1uf/250V	.55

• WIRE & CABLE

Speaker Wire, per mt	.17
Mic. Cable 1c, per mt	.25
Phone Cable 4c per mt	.25
TV Ribbon, cl/bk. per mt	.20
Coax 75 ohm per mt	.35
H/U Wire, 7/.254, per mt	.10
H/U Wire, 10/.254, per mt	.12
H/U Wire, 617K1/11, per mt	.20

• FUSEHOLDERS 3AG —;

Panel Mount	.65
In Line Type	.28
PCMount	.46

• FUSES, 3AG —

0.25A, 0.5A, 0.75A	.16
1A, 1.5A, 2A, 3A, 4A, 5A	.10
M205 TYPE (20mm) 0.25A, 0.315A, 0.4A, 0.5A	.30
0.63A, 1A, 1.6A, 2A, 3.15A	.20

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12V,220 Ohm coil, 1A cont	5.85
12V,220 Ohm coil, 5A cont	4.55
15V,530 Ohm coil, 5A cont	5.99

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Project 254

Novel Egg Timer 'bleats' when your egg is ready

Jonathan Scott is generally otherwise occupied while his breakfast eggs are on the boil — or so he tells us. "Having to get up in the morning is tedious enough without having to keep your eyes peeled for when the egg timer runs out", he says. An interesting argument, and an interesting solution . . .

OKAY, so you've *got* an egg timer. Odds on it's nothing like this one!

Conventional egg timers – the coloured-granules-in-a-three-minute-hour-glass variety – do their job efficiently, but silently. You have to watch them to see when your egg is ready. Either you stand and stare at it for the duration or you need sharp wits to instinctively 'know' when the time's up. Lack of audible indication on conventional egg timers is a consequence of inadequate design. Lack of sharp wits in the morning is a consequence of soft living.

This project tackles the first problem, the second is up to you!

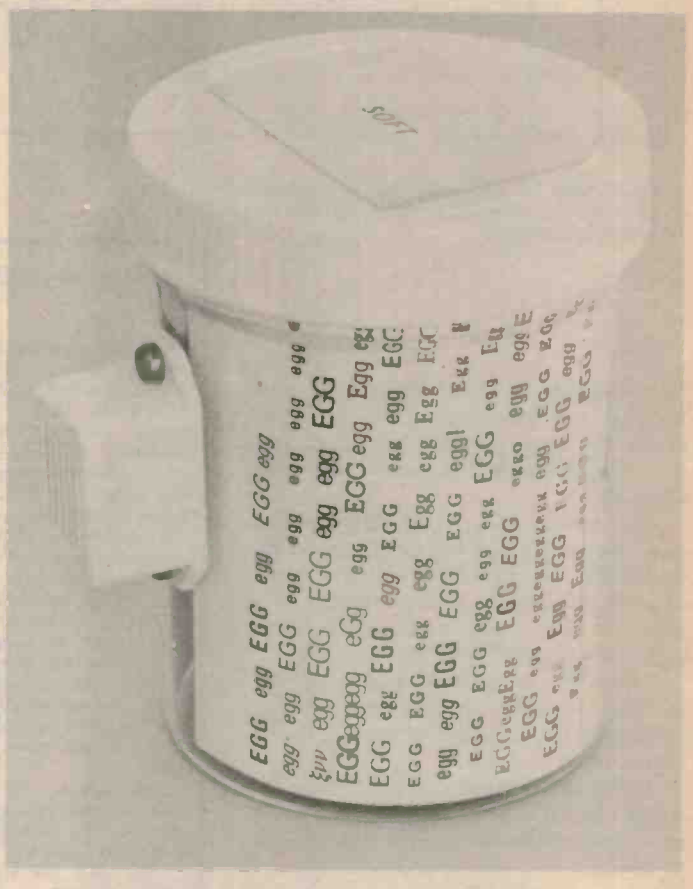
Features

Conventional egg timers (even electronic ones we've seen) lack the option of 'hard' or 'soft' timing. Even if the electronic ones have an audible indication, they have the disadvantage of including an on/off switch.

This egg timer project includes the hard/soft option, does not include an on/off switch and 'bleats' when your egg is ready. We could have had it go 'cluck, cluck' or even 'cock-a-doodle-doo', but considered this a little *too* corny, and besides, it complicated the project unnecessarily!

Operation is very simple. First, you pick it up and shake it – the device lets you know with a soft bleep when it's been shaken enough. You then put it down on one end. Which end depends on whether you want a long time period (for a hard egg) or a shorter period (for – you guessed it – a runny one). After the appropriate period has elapsed the timer will issue a one second-long bleat and turn itself off until shaken awake again.

Has it got a microprocessor inside?



The egg timer is 'set' by giving it a few good shakes and setting it down on one end. The ends are labelled 'hard' and 'soft' – according to how you like your egg, you set it down on either one end or the other. An on/off switch is unnecessary.

No, it's all done with one CMOS IC, a couple of transistors and a dollar's worth of mercury switch.

Construction

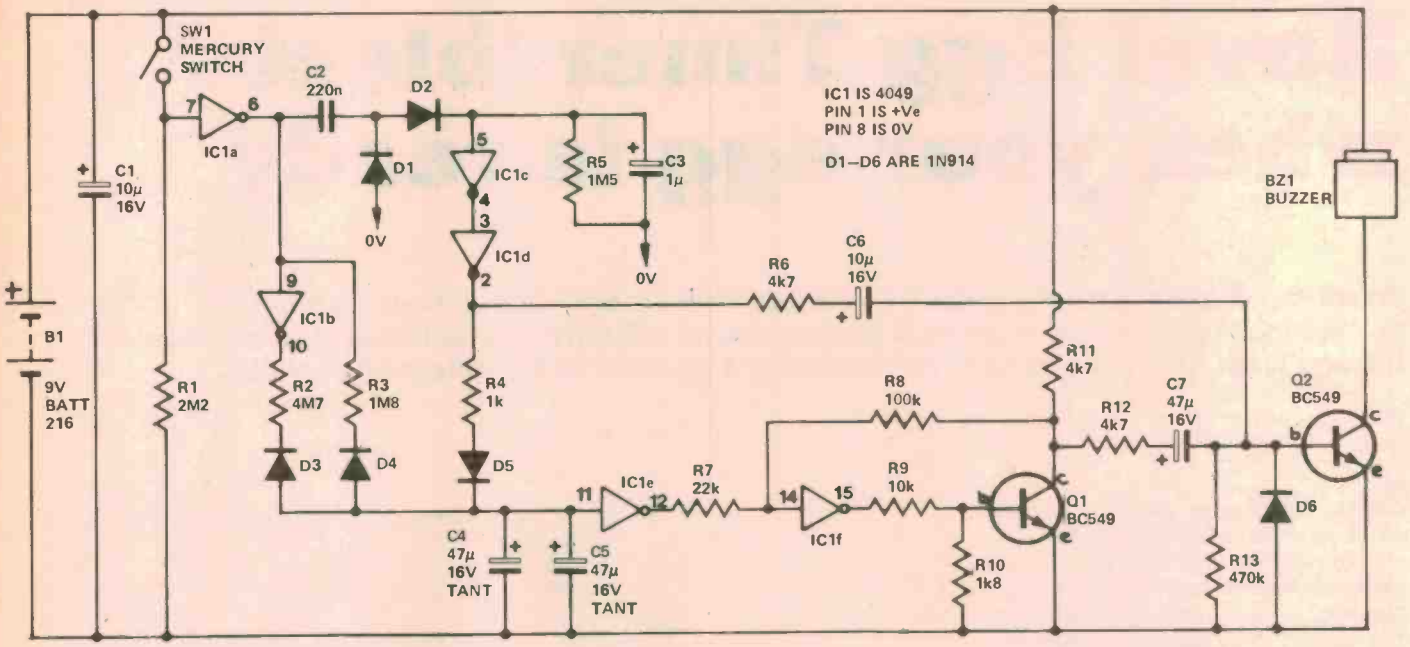
The project is best constructed on the printed circuit board designed for it. Be sure to get the IC, transistor and diodes correctly oriented when inserting the components in the board. Take care also with the electrolytic capacitors

Carefully follow the overlay diagram and you should experience little difficulty.

The choice of a housing for the project depends a little on your kitchen decor – select a container that's large enough to enclose the pc board and battery though. We've used a plastic jar and a salt shaker as examples.

However, that plastic ornamental ▶

Project 254



One CMOS IC, two transistors and a handful of components make up this timer. No on/off switch is necessary.

emu's egg that Aunt Aggie gave you for Easter may do just as well – assuming it will stand securely on either end (. . . maybe that's not such a good idea after all).

The buzzer may be mounted either onto the outside of the container or on the inside. The latter will result in a loss of volume though. A few holes in the case will allow the buzzer to be heard better if you wish to mount it inside.

The whole assembly should be packed in the container chosen using sponge rubber scraps – it has to stand a lot of shake, rattle and roll.

When you do this, make sure that the metal case of the battery does not come in contact with the copper side of the pc board.

Adjustments

If you like your eggs super hard – or perhaps extremely runny, or even somewhere between these extremes, the time periods may be changed by altering the value of R2 or R3 – one will alter the softness of the 'hard' egg, the other the density of the 'soft' egg. See 'How it Works' for an eggsplanation of the circuit operation (these puns will have to stop . . . Ed.). ●

ETI 254 – HOW IT WORKS

The timing period is initiated by shaking the egg timer. Initially, C3, C4 and C5 are discharged and both transistors are biased off. IC1a is a buffer whose output is high when SW1 is open and low when it is closed. Shaking the timer will therefore cause an alternating voltage to appear on the output of IC1a. C2, C3, D1 and D2 form a rectifying network which charges C3 using this output of IC1a. Once C3 has charged past the threshold voltage of IC1c (indicating that the timer has been shaken), two things will happen: Firstly, C6/R6 will pass current to turn-on Q2 and thus the buzzer, to indicate that it has been shaken enough. Secondly, C4 and C5 start charging via D5 and R4. When C4 and C5 have charged to the threshold voltage of the Schmidt trigger formed by IC1f and Q1, Q1 will turn on and terminate the bleep.

Meanwhile, C3 will have discharged through R5 (assuming you're not still shaking the thing) and IC1c and IC1d will have reverted to their original state.

C4 and C5 will then discharge via either R2/D3 or R3/D4, depending on whether SW1 is closed or open. This is the really clever part. SW1 is now only used to start the timing period but, depending on which end of the device is uppermost during that timing period SW1 will either be open or closed and either R2 or R3 will determine the length of the period.

When C4/C5 have discharged sufficiently, Q1 will switch off, charging C6 via the base of Q2, causing the final one-second beep.

Not bad for one CMOS IC, eh?

PARTS LIST – ETI 254

Resistors all ¼W 5%

R1	2M2
R2	4M7
R3	1M8
R4	1k
R5	1M5
R6	4k7
R7	22k
R8	100k
R9	10k
R10	1k8
R11, R12	4k7
R13	470k

Capacitors

C1	10µ 16V electro
C2	220n greencap
C3	1µ 16V electro
C4	47µ 16V tant
C5	47µ 16V tant
C6	10µ 16V electro
C7	47µ 16V electro

Semiconductors

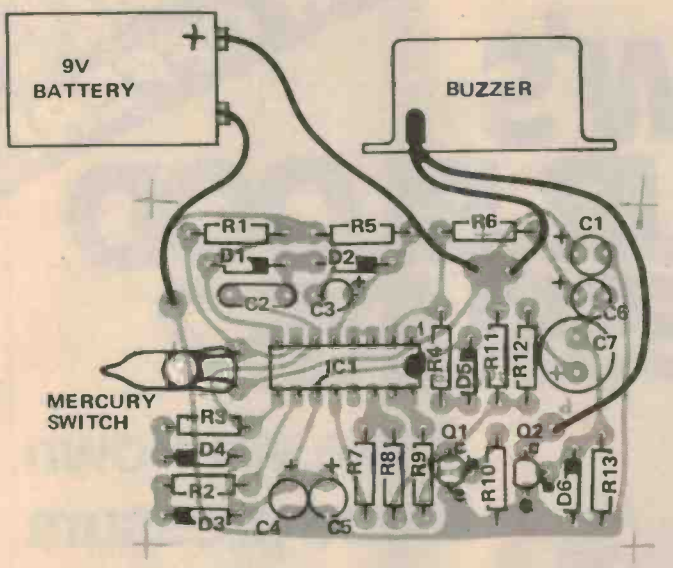
D1-D6	1N914 or sim
Q1, Q2	BC549, DS549, BC109, etc.
IC1	4049

Miscellaneous

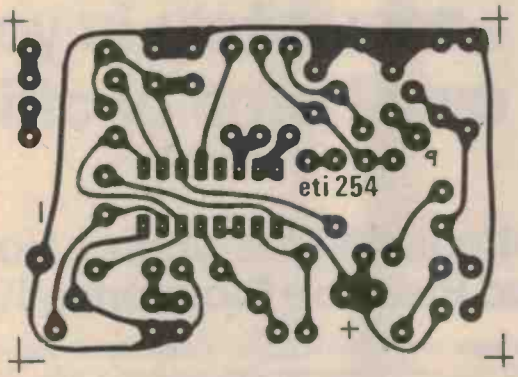
B1	9 volt, No. 216 battery
BZ1	piezo electric buzzer (such as DS, No: 6-7009)
SW1	Mercury switch

Suitable container, battery clip, packing material, ETI 254 pcb.

Egg Timer



Printed circuit board overlay. (overLAY?). Take care with the orientation of the diodes and electrolytic capacitors.

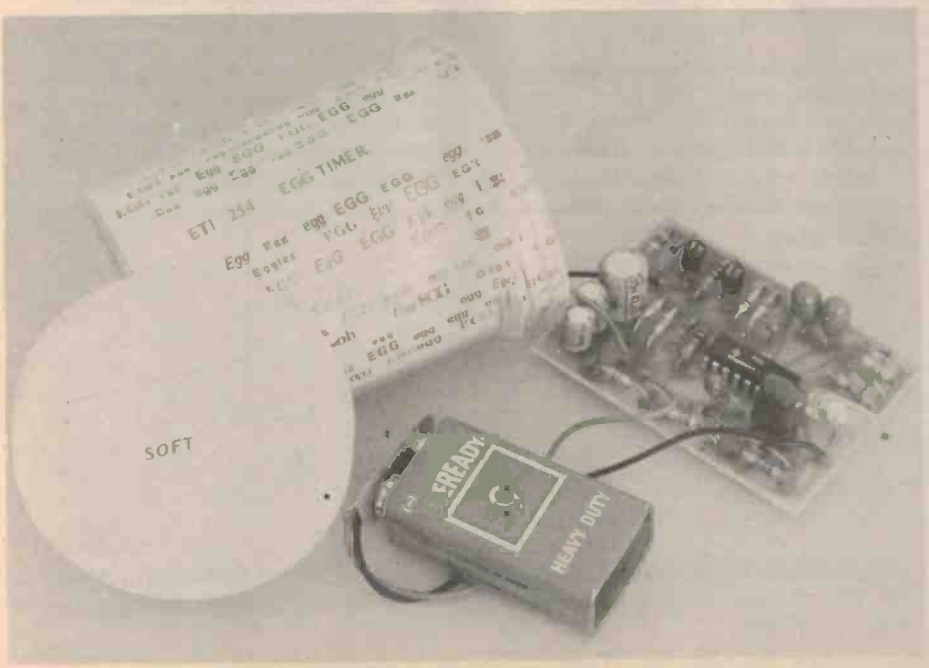


EGG egg EGG egg *EGG egg*
egg egg EGG egg egg egg egg egg egg
ξνν egg EGG EGG egg egg EGG
EGGeggegg eGg egg EGG egg Egg egg
EGG egg EGG *egg* EGG egg egg EGG egg
EGG EGG egg egg Egg egg Egg EGG
egg *egg* EGG *EGG* EGG egg! Egg Egg
EGG EGG egg egg egg EGG egg Egg egg
EGGeggEgg EGG *EGG* eggo egg *egg* EGG
EGG egg eggeggeggegg egg EGG EGG
EGG egg Egg *EGG* EGG EGG *egg* Egg egg
Egg egg Egg egg EGG EGG Egg EGG

ETI 254 EGG TIMER

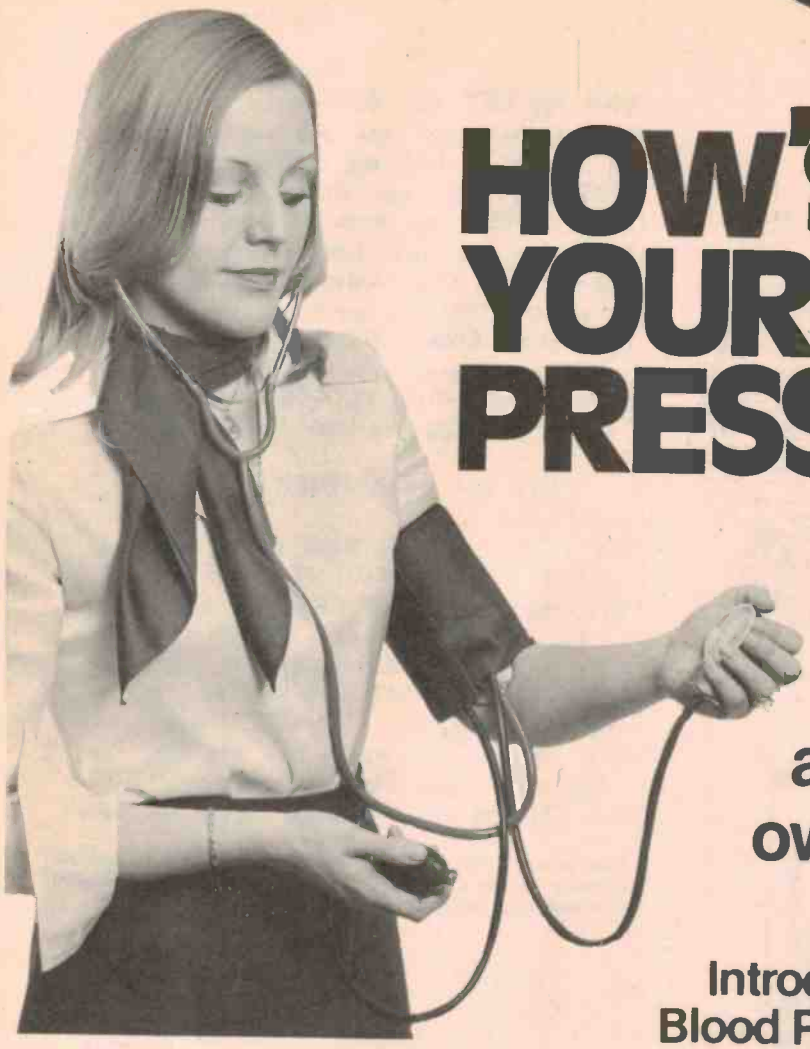
Egg *Egg* Egg egg EGG EGG *egg* egg
Egg egg Eggles EGG ξνν EGG EGG
Egg egg EGG *EgG* EGG EgE *egg* Egg eg
Egg EGG egg EGG EGG EGG EGG
Egg eGG E-E-EGG Egg EGG egg Egg
egg *EGGSES* egg *EGG* EGG *egg* egg egg
egg Egg Egg-oh *Egg* EGG Oeuf E'G
EGG EGG egg egg *Egg*
egg EGG egg EGG egg egg egg EGG
Egg ETI egg egg *EGG*egg EGG-254 *eggs*

This is the front panel of the egg timer. As there are no controls, the front panel design is rather a matter of taste. But then, eggs are rather a matter of taste, also.



The pcb and the battery should be protected against the shaking which this project is bound to receive. We suggest stuffing the case well with something soft.

SPECIAL READER OFFER!



HOW'S YOUR BLOOD PRESSURE?

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Introducing the Unitrex Home Blood Pressure Monitoring Kits!

A SPHYGMOMANOMETER can help protect you and your family against one of the most dreaded human killers in the world – heart disease and other illnesses associated with abnormal blood. It is not surprising then that hundreds of thousands of people world-wide are buying their own personal blood pressure monitoring devices – NOT as replacements for regular medical checks. But simply as an extra precaution for peace of mind.

One of the best known home units is the Home Blood Pressure Monitoring Kit from Unitrex. A substantial quantity of these were imported by Australia's Caldor Corporation and sold extensively via chemists – they were also offered via mail order. These units were generally sold at $29.95.

Caldor have a number of these units still available which they are offering to our readers for the very low price of **$19.95 – plus $2.50 post and packing.** The kit includes the professional blood pressure unit itself, a nurse's stethoscope, a complete instruction book and three month's supply of blood pressure recording forms.

Please note: This offer is made by the Caldor Corporation, 12 Terra Cotta Drive, Blackburn, Vic., 3130. This magazine is acting as a clearing house for orders only. Cheques should be made out to 'Caldor Offer' and sent together with order to 'Caldor Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process orders and pass them on to Caldor who will then send out the units by certified mail. Please allow approximately four weeks for delivery. Offer closes July 31st 1979.

Caldor Offer

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plus postage at $2.50 each $ . . . . . .

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Address . . . . . .

. . . . . .Postcode . . .

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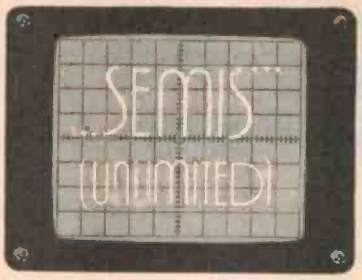

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LM334Z	1.10
UA339PC	.50
LM349N	1.45
LF356	.90
LF357N	.90
LM358N	.60
LM370N	2.50
LM373N	3.30
LM380	.85
LM381N	1.50
LM382N	1.30
LM386N	.90
LM387N	1.10
LM391N	1.40
LM393AN	.70
555	.25
556	.60
LM565CN	1.10
LM567CN	1.20
TBA641-BX1	2.00
LM709-CN	.50
UA710CA	.55
723	.40
LM723CH	.54
LM733CN	.75
741	.20
UA747PC	.85
LM748CN	.45
LM1458N	.50
LM2902N	1.20
LM3039H	.78
CA3065	.50
CA3130	1.05
CA3140T	1.05
UA3401	.60
LM3900N	.65
LM3909N	.85
LF13741N	.50
LF13741H	.50

TRANSISTORS

2N301	1.80
2N1711	.45
2N2219A	.35
PN2222	.18
2N2222	.20
2N2646	.55
2N2647	.90
2N2904	.40
2N2905	.35
2N2906	.30
2N2907	.25
2N3053	.35
2N3054	.60
2N3055	.45
2N3563	.18
2N3564	.25
2N3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
2N3569	.18
2N3638	.18
PN3638	.18
2N3638A	.21
PN3642	.14
PN3643	.16
PN3644	.16
PN3645	.16
2N3646	.16
2N3694	.10
2N3702	.20
2N3704	.25
2N3819	.25
2N3904	.18
2N3906	.16
2N4032	.45
2N4033	.80
2N4250	.12
2N5458	.40
2N5459	.40
AC127	.80
AC128	.60
AC187	.65
AC188	.65
AD149	1.60
AD161	1.35
AD162	1.35
AY6112	.40
AY6119	.40
AY6120	.40
AY6121	.40
AY8110	.50
AY8139	.40
AY9139	.40
BC107	.16
BC108	.16
BC109	.16
BC147	.10
BC177	.20
BC178	.20
BC179	.20
PC208	.15
BC547	.12
BC548	.12
BC549	.12
BC557	.14
BC558	.14
BC559	.14
BD137	.35
BD138	.35
BD138	.26
BD140	.26
BD234	.41
BD237	.47
BF115	.45
BF173	.60
BF180	.35
BF198	.10
BF199	.10
BFY50	.26
BSV17	.65
BU126	2.45
BUX80	6.75
FT2955	1.15
FT3055	.65
MEL12	.75
MJ802	2.95
MJ2955	.60
MJE2955	1.20
MJE3055	1.20
MPF102	.35
MPSA05	.18
MPSA14	.24
OA675	.10
OC910	.60
OC912	.60
OC925	.10
SE1010	.18
TIP31A	.25
TIP32A	.25
2SD200	1.00
TIP2955	.70
TIP3055	.65

TTL 7400 SERIES

7400	.14
7401	.16
7402	.14
7403	.18
7404	.16
7405	.20
7406	.18
7407	.30
7408	.16
7409	.20
7410	.14
7411	.22
7412	.26
7413	.28
7414	.32
7416	.40
7417	.40
7420	.16
7421	.16
7423	.35
7426	.24
7427	.24
7430	.16
7432	.24
7437	.30
7438	.30
7440	.20
7441	.90
7442	.35
7443	.65
7444	1.20
7447	.50
7448	.50
7450	.18
7451	.18
7453	.20
7454	.18
7470	.35
7472	.30
7473	.30
7474	.25
7475	.25
7476	.25
7480	.60
7485	.85
7486	.36
7490	.24
7491	.50
7492	.26
7493	.26
7494	.80
7495	.35
74107	.40
74121	.36
74122	.60
74123	.30
74126	.50
74132	.75
74145	.80
74150	.65
74151	.36
74153	.65
74154	.65
74157	.45
74160	.60
74164	.55
74165	.55
74175	.75
74192	.65
74193	.65
74221	.75
74365	.75
74367	.55

CMOS

4000	.20
4001	.18
4002	.18
4006	1.05
4007	.20
4008	1.00
4009	.65
4010	.65
4011	.18
4012	.18
4013	.42
4014	1.00
4015	1.00
4016	.41
4017	1.05
4018	1.00
4019	.52
4020	1.05
4021	1.05
4022	1.05
4023	.18
4024	.70
4025	.18
4026	1.55
4027	.60
4028	.78
4029	1.10
4030	.33
4040	.95
4041	.80
4042	.80
4043	.85
4044	.85
4046	1.30
4049	.40
4050	.40
4051	.70
4052	.70
4060	1.30
4066	.65
4068	.29
4069	.18
4070	.27
4071	.27
4072	.27
4073	.27
4075	.27
4077	.27
4078	.27
4081	.27
4082	.27
4093	1.30
40174	1.05
4510	1.05
4511	1.05
4518	1.05
4519	.65
4520	1.05
4541	1.30
4560	2.60
74C00	.22
74C02	.22
74C04	.22
74C08	.22
74C10	.22
74C14	.40
74C20	.25
74C30	.25
74C32	.25
74C48	1.40
74C73	.65
74C74	.65
74C76	.65
74C83	1.25
74C85	1.10
74C90	.85
74C93	.85
74C95	.55
74C107	.60
74C150	2.40
74C151	1.50
74C160	.80
74C162	.80
74C175	.80
74C192	1.10
74C193	1.10
74C195	.90
74C221	1.30
74C373	1.60
74C901	.50
74C902	.50
74C907	.50
74C925	4.10
74C927	4.10
80C95	.60
80C97	.60
80C98	.60

TTL 74LS SERIES

74LS00	.15
74LS01	.20
74LS02	.15
74LS03	.18
74LS04	.18
74LS05	.18
74LS09	.18
74LS10	.18
74LS11	.18
74LS14	.70
74LS20	.18
74LS21	.18
74LS22	.22
74LS26	.28
74LS27	.18
74LS28	.30
74LS30	.22
74LS32	.22
74LS33	.32
74LS37	.30
74LS38	.30
74LS40	.18
74LS42	.75
74LS51	.25
74LS54	.25
74LS55	.25
74LS73	.50
74LS74	.40
74LS75	.45
74LS85	.95
74LS86	.35
74LS90	.45
74LS92	.80
74LS93	.65
74LS107	.35
74LS109	.35
74LS112	.35
74LS123	.90
74LS125	.55
74LS126	.55
74LS132	.80
74LS138	.80
74LS151	.60
74LS154	1.20
74LS157	.60
74LS163	.70
74LS174	.60
74LS175	.60
74LS190	.95
74LS192	.70
74LS193	.70
74LS196	.90
74LS221	.90
74LS257	.50
74LS365	.55
74LS366	.55
74LS367	.55
74LS368	.55
74LS374	1.40

S.C.R.

C106Y	.30
BT100A300R	.50
C106D1	.50

DIODES

1N914	.04
1N4001	.06
1N4004	.06
1N4007	.12
1N5625	.35

ZENER DIODES

400mw 3.3 v to 36v	.12
1 watt 3.3v to 36v	.20

VOLTAGE REGULATORS

309	1.10
317	2.10
7805	.70
7806	1.00
7808	1.00
7812	.70
7815	1.00
7824	1.00
7912	1.10
7915	1.10
78L05	.35
78L12	.35
78L55	.35
79L05	.60
79L12	.60
79L15	.60

OPTO

FND 507	1.40
FND 537	1.00
FND 500	1.00

STANDARD LEDS

RED	.12
GREEN	.20
YELLOW	.25
CLIPS	.02

MICROS

2102	1.20
2114	6.00
2708	11.00

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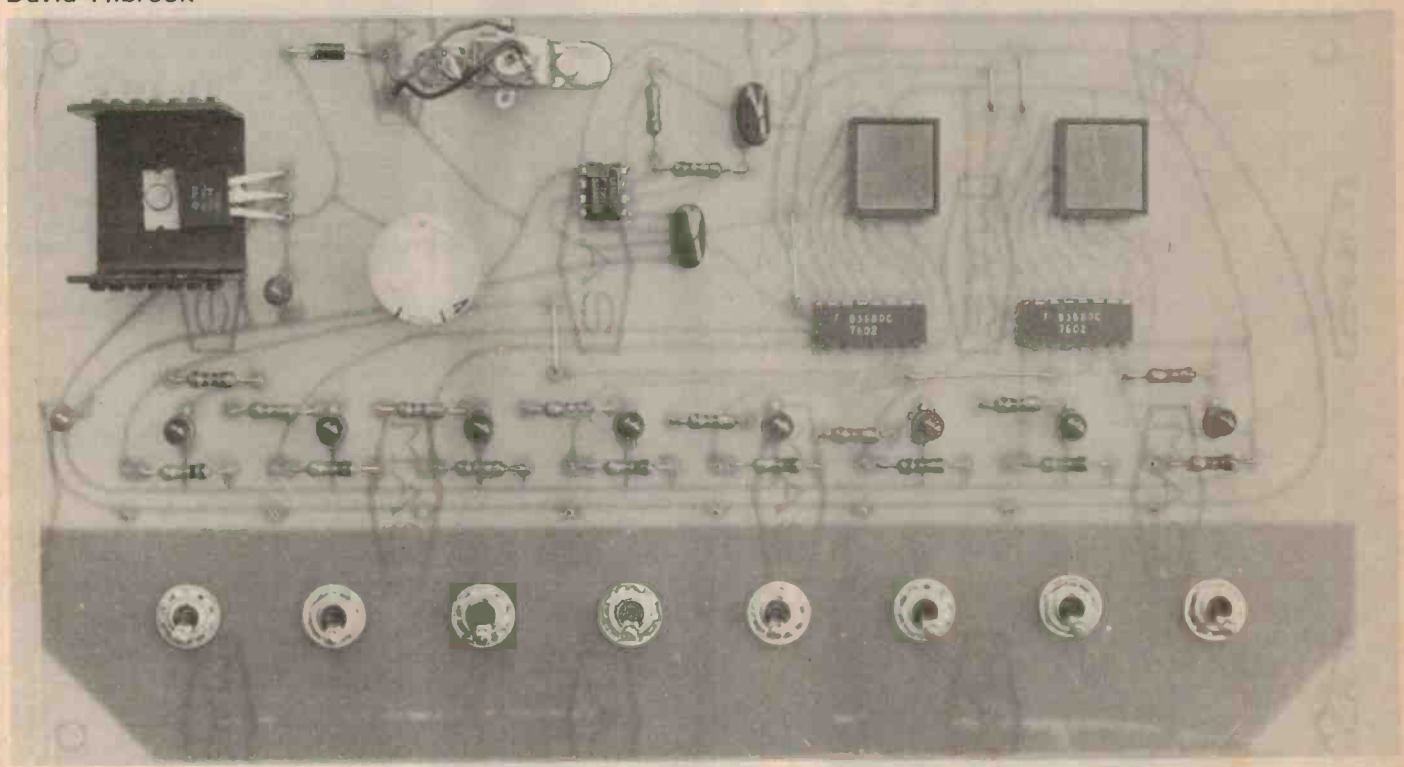
SEE OUR 'NUMBER SYSTEMS' FEATURE – PAGE 138

Project 651

Binary to hex number converter

For those enthusiasts ploughing their way through the number systems used in microprocessor equipment, or for those attempting the tedious chore of converting binary numbers into microprocessor opcode instructions, this project should prove very handy.

David Tilbrook



Constructed on a single printed circuit board, this project is intended to mount vertically from small brackets screwed onto a base-board. A 'plugpack' or small bench power supply may be used to power it.

IN MANY digital systems information is handled in groups rather than as individual bits. These groups are called words and they vary in size according to the needs of the particular job. If it is necessary to display or calculate using the normal decimal digits, a four digit binary word (four bit word) would be needed to represent each single decimal number. A four-bit binary word gives 16 possible different combinations. For a decimal number we only need ten, so the largest six combinations are ignored.

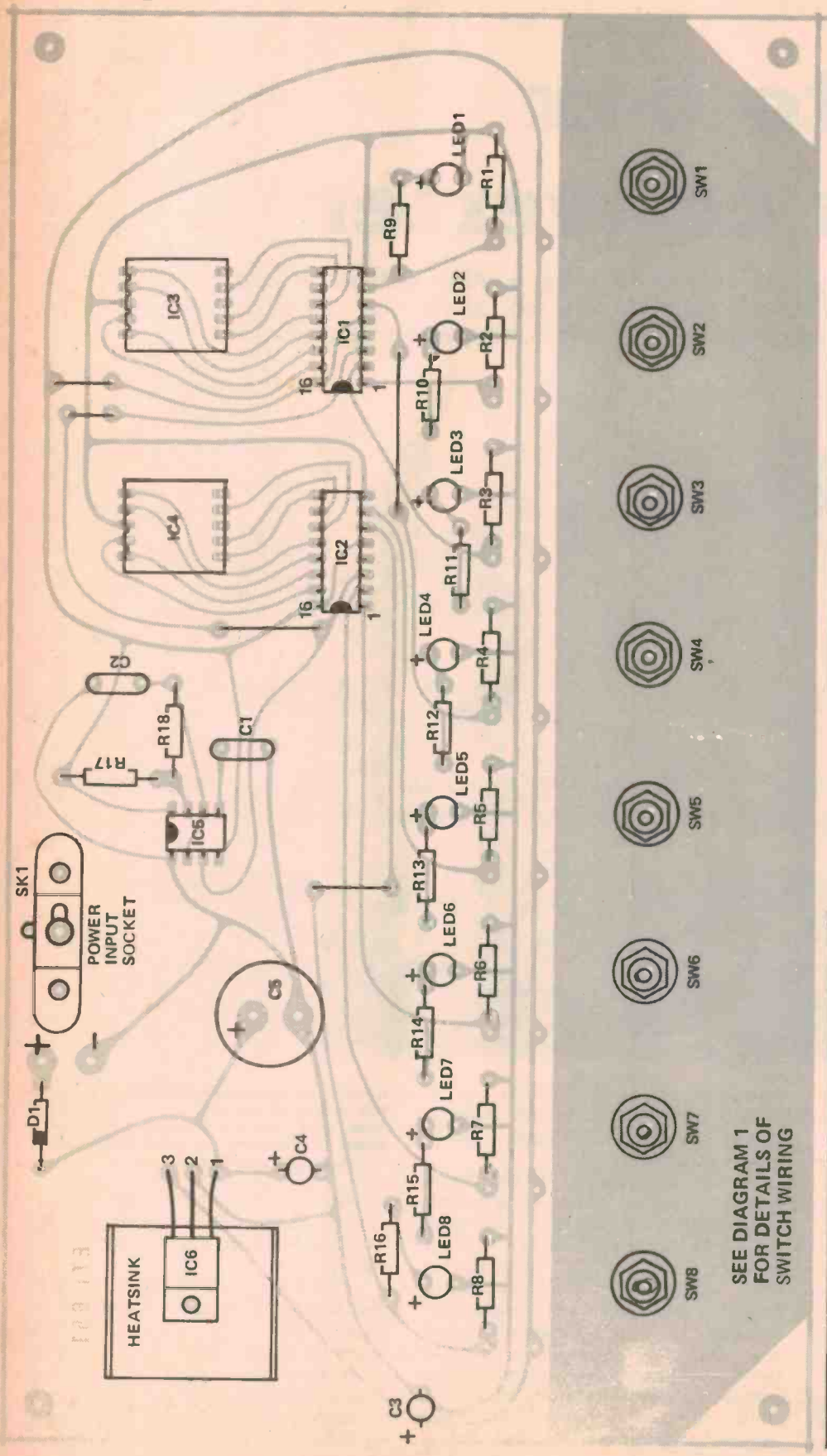
The number 0 is represented as 0000, 1 as 0001, 2 as 0010, 3 as 0011, 4 as 0100 and so on. This is called binary coded decimal or BCD and is used in many digital applications such as digital frequency meters, digital multi-meters, calculators, etc.

As the job required of the digital system becomes more complicated, word lengths are increased. This gives the circuit the ability to handle more complex numbers by manipulating single words. The most common word length in microprocessors is eight bits. The eight bit word is called a byte and contains 256 different combinations. In the bigger microprocessor and smaller computers a word length of 16 is used, while full-scale computers use word lengths of 32 or even 64 bits! This is all very fine for computers, but for mere mortals like ourselves calculating with 64 digit numbers can become a little tiring!

This project was designed to assist the newcomer in getting used to the hexadecimal and binary number systems. It can also be used by those working out opcode (microprocessor instructions) from binary numbers.

Some mini-computers and micro-processors, such as the 2650, have their ▶

Project 651



ETI 651 – HOW IT WORKS

The heart of the circuit consists of the two 9368 ICs. These are BCD to hexadecimal seven segment decoder-drivers. On receipt of a low on the clock input-pin 3, they load the binary word present on their inputs into latches, decode them into hexadecimal numbers and drive the appropriate segments in the FND500 displays. The binary number is reloaded into the input latches each time the clock input is taken low.

The 555 timer IC is operating as an astable multivibrator and generates a pulse used to trigger the clock input. The repetition rate is around 5 kHz, determined by the two 1k resistors connected to pin 7 and the 0.1 μF capacitor connected to pin 5 of the timer.

The inputs of the 9368's are connected via 1k pull-down resistors to zero volts to ensure the inputs stay low when the toggle switches are in the open position. When the binary number is selected, by closing the appropriate toggle switches, these input lines are taken high.

LED's are used to display the binary number and are connected to the toggle switches via 220R current limiting resistors.

A 7805 voltage regulator IC has been included on the board to allow the circuit to be run from a variety of DC supply voltages.

Component overlay. See diagram on page 82 for switch connection details.

PARTS LIST – ETI 651

Resistors
R1-R8 . . . . .1k0
R9-R16. . . . .220R
R17, 18 . . . .1k0

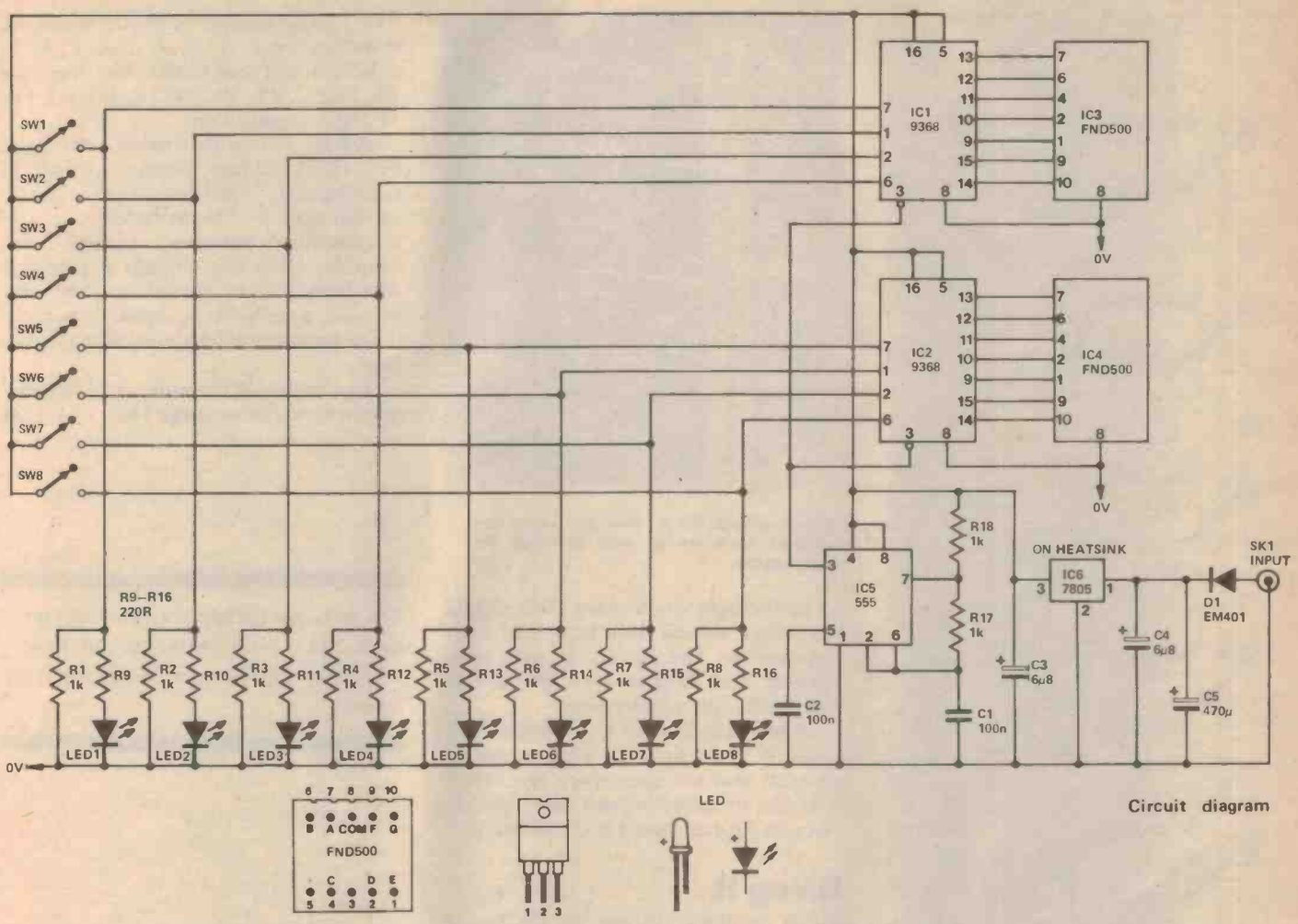
Capacitors
C1, 2 . . . . . .100n greencap
C3, 4 . . . . . .6μ8 16V tantalum
C5. . . . . .470μ 25V electrolytic

Semiconductors
IC1, 2. 9368
IC3, 4. . . . . .FND500
IC5 555
IC6 7805

D1 . . . . . .EM401 or equivalent

LED1-LED8. .red LEDs

Miscellaneous
SW1-SW8. . . .spst toggle
SK1. . . . . .9V power socket
pcb ETI651
heatsink for 7805



Circuit diagram

instructions written in the form of binary numbers, with some of the digits missing. Depending upon the particular variation of the instructions required, the missing 0s and 1s are filled in. When the total binary word has been formed it must be converted into hexadecimal form for keying into the microprocessor. A relatively large program for a microprocessor might have one or two thousand opcodes to be evaluated — this is one application where the binary to hex converter could be put to good use.

Construction

The entire trainer is made on a single printed circuit board and construction is fairly non-critical.

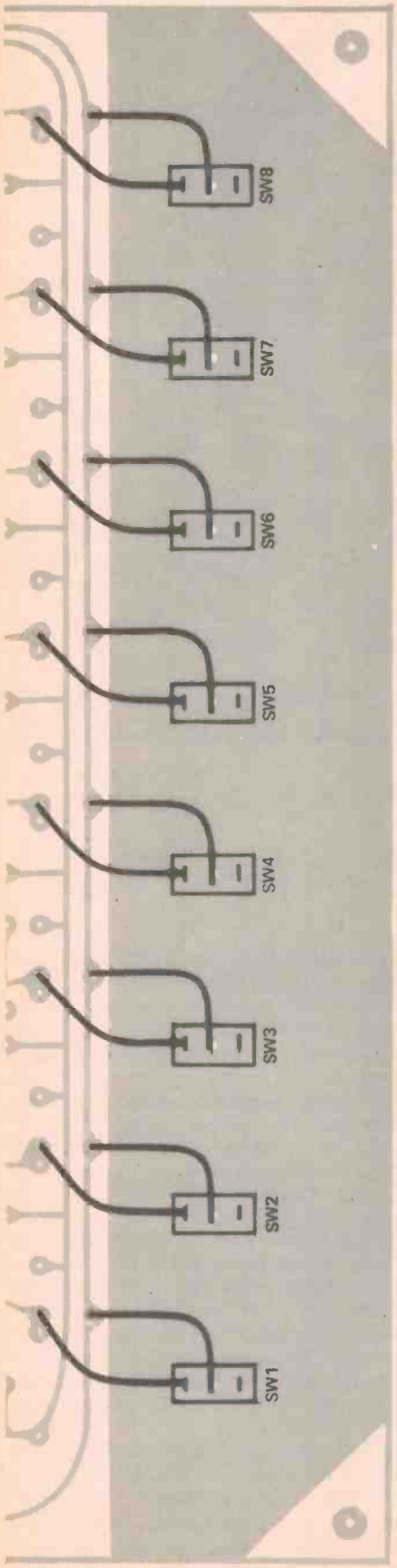
Start by mounting the resistors on the pcb. Next, mount the capacitors, with the exception of the big 470 µF electrolytic. Be sure to orient the tantalum capacitors correctly. If they are not marked with a +ve symbol they will probably be the type marked with coloured bands and a dot. With the dot facing towards you and the leads pointing down the positive lead is usually the one on the right. The IC's and displays should be soldered onto the board using reasonable care not to overheat the pins. Make sure they are oriented correctly also. If they are installed incorrectly and the board is powered up, they will probably be destroyed. The pads for the IC's are relatively close together and care should be taken to avoid bridging solder to adjacent pads.

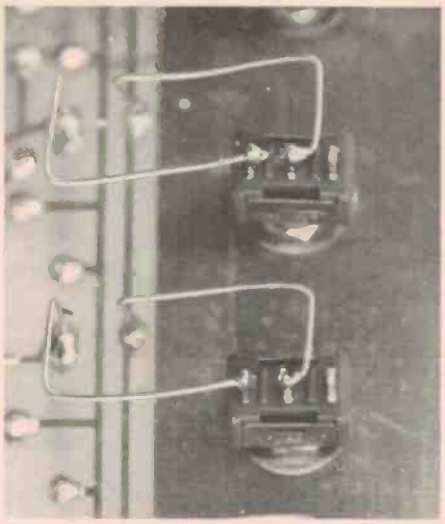
The LED's and diodes can be fitted next and once again make sure these are put in the right way around.

The voltage regulator IC should be mounted onto a heatsink and secured to the pcb by a single nut and bolt. Insulation between the regulator and heatsink is not needed but some type of thermal paste compound should be used.

Mount the regulator first and then solder its leads onto the board, this avoids straining these solder joints. Fit the remaining electrolytics and wire links. Often cut-off resistor leads can be used for these links. All that remains is to fit and wire the switches and power sockets. The board requires an external DC supply, the regulator makes sure the IC's get the correct voltage. The DC supplied to the board should be greater than about seven volts.

As this voltage increases, the regulator dissipates much of the excess power in the form of heat and this is why the heatsink is necessary. On 12 V the regulator on the prototype gets quite hot, but not excessively. The board requires 450 mA worst case, so some of the bigger plugpaks should do the job well. The socket for the power input can be a bit tricky to work out. The centre point on the socket is usually negative. Solder a wire from the centre terminal to the negative pad on the pcb. This is the pad not connected to the diode. The positive terminal on the socket is ther terminal connected ▶





Switch wiring. Note that the wires are soldered onto the pc pads provided for this purpose.

to the outside of the plug. This should be connected to the PCB pad that connects to the diode. If in doubt, connect the plugpak into the socket and check with a multimeter.

Almost any type of toggle switch will work in this project. Find a set of contacts that are open when the switch is in the up position, and wire these to the pcb pads as shown in the diagram.

Using it

Before applying power to the board check the capacitors, LEDs and IC orientations. When the board has been completely checked it can be tried out. Place all the switches in the up position and apply power. Immediately the seven segment displays should show '00'. As the toggle switches are changed the LEDs will light and the displays should change to indicate the correct hexadecimal number corresponding to the binary number shown on the LEDs.

The hexadecimal number system

We've already mentioned that a four bit binary word had sixteen different combinations. If we defined sixteen characters and let them be equal to these sixteen combinations we would write any four bit binary word using a single character.

This is the basis of the hexadecimal number system. The first ten digits are the same as in BCD, i.e: the normal decimal numbers. The six extra combinations not used in the BCD system are given the characters A, B, C, D, E and F. The number sequence would be therefore be 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f and would then continue 10, 11, . . . 18, 19, 1A, 1B, 1C, 1D, 1E, 1F, 20, . . . and so on.

A byte can be written as a two digit hex (hexadecimal) number, which is considerably shorter and more convenient. Nevertheless the relationship between binary and hexadecimal is not obvious at first and converting from binary to hex can become a tedious business, especially if the binary numbers are getting rather large.

For more information on computer number systems see page 138. ●

The pc board pattern is reproduced on page 193 – from which you can make a Scotchal negative to etch your own pc board.

PET POKE PROBLEMS

In the Commodore PET review, we showed the instruction:

POKE 59500, 72

for changing the display from graphics to lower case (ETI May 79, p 76). This works on the PETs in the UK and Canada, but Commodore have contacted us to point out that it doesn't work with Australian PETs. The instruction used for Australian machines is:

POKE 59468, 14

and to revert to graphics again:

POKE 59468, 12

Thanks, Commodore.

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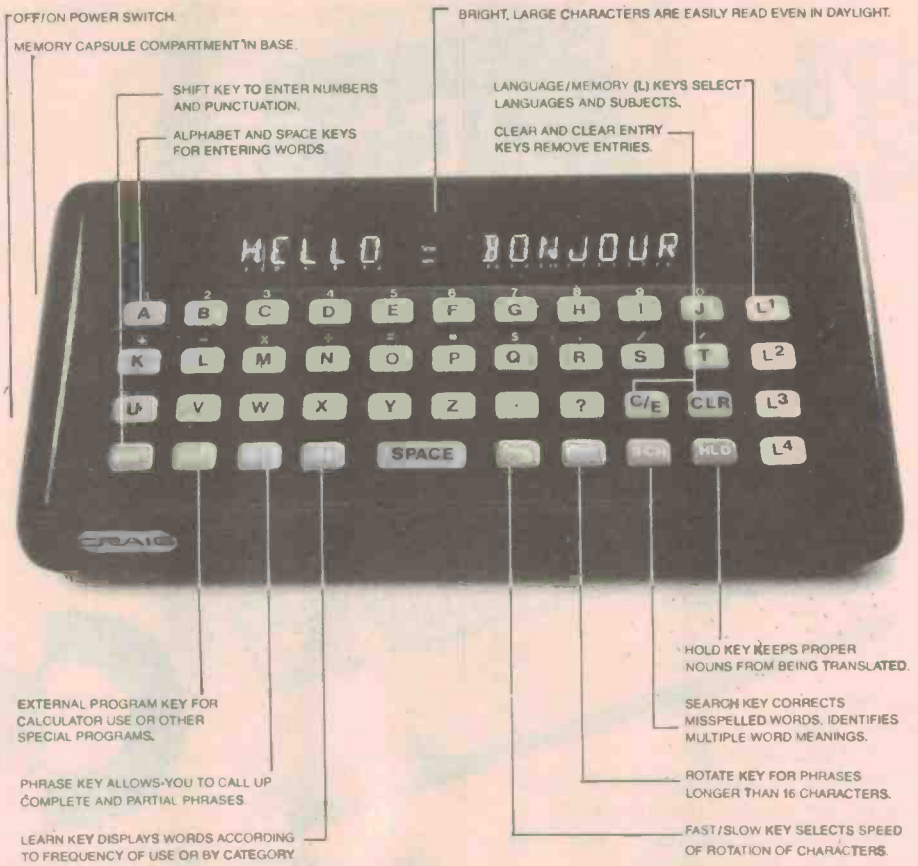

THE DEMAND for the Craig language translator is expected to be very high indeed — and only 5000 units have been made available to the importers (Caldor Corporation).
However, Electronics Today has arranged for Caldor to supply our readers on a preferential basis until stocks run out.
As the unit is not yet on sale in Australia, we cannot state a normal selling price for comparison — but we reasonably expect that most outlets handling the unit will price it at least as high as Caldor's price to our readers — $249.95 (post free). The English language capsule is supplied as standard and is included within the selling price. Additional capsules are available at $34.95 each. Please state language/s required. Units should be available as from the 26th of April — the offer remains open until 16th June (or sooner if stocks are exhausted before June 16).

This offer is made by the Caldor Corporation and this magazine is acting as a clearing office for orders only. Cheques should be made out to 'Craig Offer' and sent, together with the order, to 'Craig Offer' Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW 2011. ETI will process orders and send them on to Caldor who will send goods out by certified mail. Please allow at least five weeks for delivery.

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KITS FOR ETI PROJECTS

WE GET MANY enquires from readers wanting to know where they can get kits for the projects we publish.

We have only listed the projects published in the last two years, with their dates of publication, so this page can also be used as an index, even though kits are not available for some of them (as far as we know). We will repeat a complete list every 6-12 months depending on space limitations. Any companies who wish to be included in this list should phone Jan Collins on 334282

Key To Companies

A. Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077.

B. Bill Edge Electronic Agencies, 115 Parramatta Road, Concord, (PO Box 1005, Burwood North 2134).

C. J R Components, PO Box 128, Eastwood NSW 2122.

D. Dick Smith Electronics P/L, PO Box 747, Crows Nest NSW 2065.

E. All Electronic Components, 118 Lonsdale Street, Melbourne Vic 3000.

J. Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000.

K. S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109.

M. Mode Electronics, PO Box 365, Mascot NSW 2020.

N. Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011.

O. Orbit Electronics, PO Box 7176, Auckland, New Zealand.

P. Pre-Pak Electronics, 718 Parramatta Road, Croydon NSW 2132.

R. Rod Irving, PO Box 135, Northcote Vic 3070.

T. Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville Qld 4812.

V. Silicon Valley, 23 Chandos Street, St Leonards NSW 2065.

Project Electronics

041. . .	Continuity Tester	T,D,B
042. . .	Soil Moisture Indicator	T,D,B
043. . .	Heads or Tails Circuit — Oct 76.	T,D,E,A,B
044. . .	Two Tone Door Bell — Oct 76.	T,D,E,O,A,B
045. . .	500 Second Timer	T,D,O,A,B
047. . .	Morse Practice Set	T,D,O,A,B
048. . .	Buzz Board	T,D,A,B
061. . .	Simple Amplifier — Oct 76.	T,D,O,A,B
062. . .	Simple AM Tuner — Mar 77	D,E,B
063. . .	Electronic Bongos	D,A,B
064. . .	Simple Intercom — Nov 76	T,O,A,B
065. . .	Electronic Siren	D,O,A
066. . .	Temperature Alarm — Dec 76	T,D,E,A,B
067. . .	Singing Moisture Meter	D,B
068. . .	LED Dice Circuit. — Oct 76.	T,D,E,A,B
070. . .	Electronic Tie Breaker — Jan 77	
071. . .	Tape Noise Limiter — Jan 78.	E
072. . .	Two-Octave Organ — Jun 78.	D,B
081. . .	Tachometer — Mar 77	T,E,O
082/528. . .	Intruder Alarm	T,E,A
083. . .	Train Controller	
084. . .	Car Alarm	D,A,B
085. . .	Over-rev Alarm	
086. . .	FM Antenna	
087. . .	Over-LED	
088. . .	Hi-Fi Speaker	

Test Equipment

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Number Two ETI CIRCUITS

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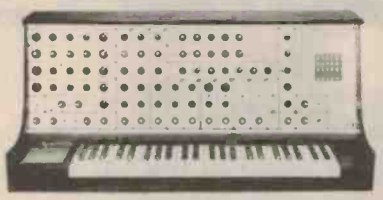
Please note: the Circuits Books are intended as 'ideas directories' — they are not meant for the beginner.

Jaycar Keyboard Kits



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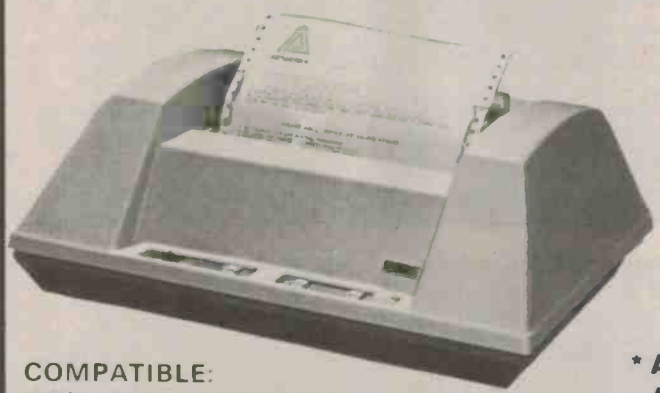

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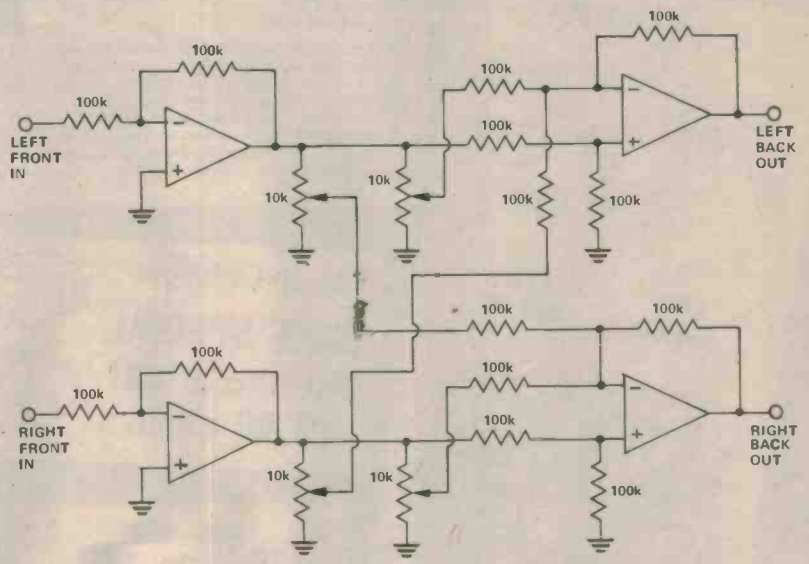
Ideas for Experimenters

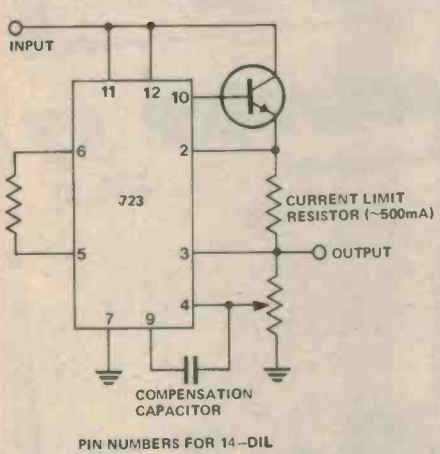
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Simpler 4-Channel Synthesiser

In March this year (p 105), we published a design for a circuit which synthesised the back channel signals for an 'artificial' 4-channel system, using the existing front channel signals.

Mr. P. Dennis of Berala has pointed out to us that the circuit we published can be massively simplified without affecting its operation. The above circuit uses less than half of the number of op-amps that the original used. It does this partly by utilising the op-amps as mixers with both inverting and non-inverting inputs, instead of separate inverters and inverting-only mixers as in the March circuit.





Regulator Problems

Also from Mr P. Dennis, some comments on the use of the 723 regulator IC.

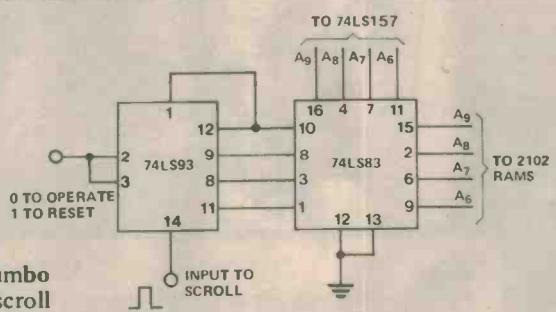
Firstly, the shown circuit configuration, designed to supply about 500 mA, will oscillate at times, even with a 220p compensation capacitor. The solution to this one is to use a transistor with lower gain. As long as the f_t stays the same, then the 3 dB corner frequency will go up by the same amount that the beta goes down.

Usually the lower gain presents no problem to the 723, although it does represent a higher load.

Secondly, if for any reason the wiper of the output voltage preset pot goes to earth, the IC may be damaged as the amplifier differential voltage (5 V max) may be exceeded. This usually occurs with multi-turn pots where the wiper position cannot be seen. It can easily be avoided by pre-setting the wiper to the output end of the track before switch-on.

Thirdly, when operating the 723 without an output transistor (in which case it can supply up to 150 mA), remember that it may heat up, causing the reference voltage to drift.

Hardware Scroll For ETI640



A cunning circuit from E. R. Rumbo of Weetangera adds a hardware scroll facility to the ETI 640 VDU.

Scroll occurs when the cursor (the point on the screen at which the computer is writing) reaches the end of a line. All the lines on the screen then have to move up to make room for a new blank line at the bottom. Usually, this is done by the processor laboriously moving all the characters on the screen up one line. This is rather slow and an alternative is the circuit shown.

The 74LS83, a 4-bit adder, is used to offset the address of the memories whenever the rest of the circuit calls for a particular character. That character will then 'appear' a number of lines further up the screen. The position of the characters is controlled by the 74LS93 4-bit counter, which will scroll the entire screen contents up one line every time an input pulse is received from the processor.

This configuration will not produce a blank line at the bottom of the screen, however. This will still have to be done by software as, with this circuit, the top line of the display appears at the bottom when the screen is scrolled. ▶

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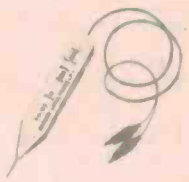

LP1: $55.50

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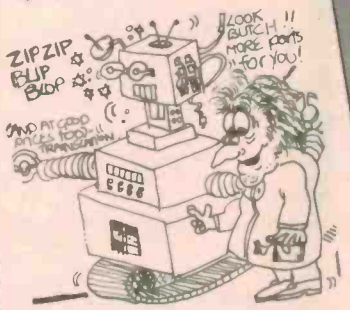

ELECTROKIT 39

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Designed to provide 6 alternative switched voltages with a current rating of 1 amp. Voltages are 3.0, 4.5, 6.0, 7.5, 9.0, 12.0. Also possible to set these voltages to any other preferred voltage within this range. The unit is short-circuit-proof against short period malfunctions. Regulation: plus/minus 2½ percent with mains variation of 10 percent. Ripple Voltage: Max 5mv at 1 amp rating. Current Limiting: approx 2.0 amps. Dimensions: 116 x 105 x 105mm approx.

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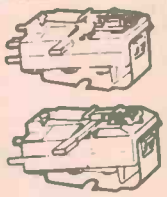

ELECTROKIT 60

CAR CASSETTE STEREO PLAYER

$29.95

This kit provides a fast forward facility in addition to the normal 'playback' and 'eject' operation. Nominal impedance of the head is 50K ohms. Output from preamp average approx 300mV. You can build this in just over 3 hours with only workshop tools. Comes complete with 4 transistor preamp kit.

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This kit has been designed for use as a high output amplifier for use on a 12 volt DC supply. It is ideally useable in conjunction with an Electrokit 60 which includes the pre-amplifier necessary to provide sufficient input drive for the amplifier. Maximum rating: Supply volts (no signal) 20.0. Supply volts (operational) 17.0. Power OP: 4.8 watts per channel. Voltage gain - 51.5 db. Average input required 50 mV approx. Output speaker impedance 4 ohm (8 ohm useable, but results in reduced power) Distortion at PO = 0.5w 0.6 · Voc 13.2V

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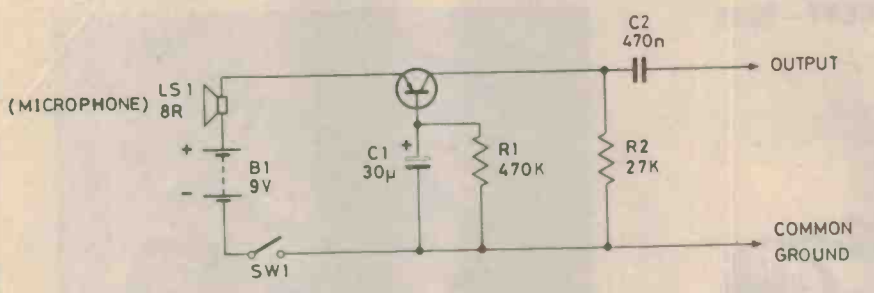
Ideas for Experimenters

Cheap Microphone



What do you do if you need a microphone in a hurry – the shops are closed and your friends are on holiday? Or you are just a little short of money? The answer is to build the following circuit from your odds and ends box. This circuit uses a small speaker as a microphone, one transistor and only four other parts and draws only about 2 mA current from a 9 volt battery.

The transistor shown is 2N1184 and is a PNP germanium medium power type but is not critical – try the ones you have first before buying this new type. The components too are not critical and the prototype was found to work OK with 20% variation in values. The output is high impedance and is fed into the mic input of a tape recorder or ceramic pick-up input of an amplifier.

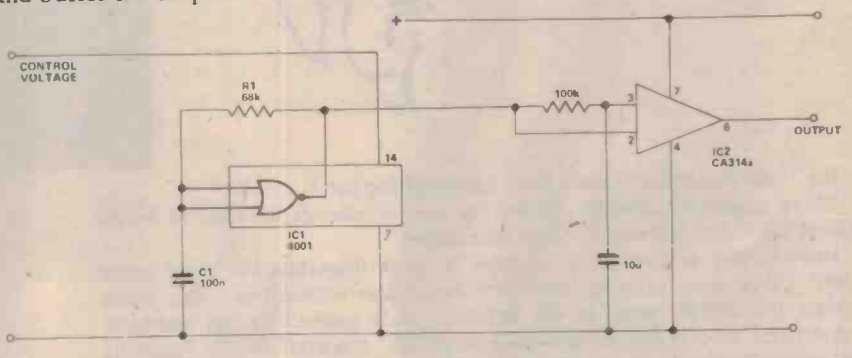
Wide Range Voltage Controlled Oscillator

This little circuit comes from our London office – it's an example of the lateral thinking for which the British are famous!

Any section of IC1 can be used but all unused inputs must be earthed – otherwise the CMOS will pick up mains hum and operate in its linear region, overheating as a result.

With the values shown, a frequency range of about 50 Hz to 20 kHz is obtained – just right for an audio sweep oscillator. If the mark/space ratio is unimportant, it can go down to 1 Hz.

The control voltage, which ideally should be in the range 1.5 V to 3.5 V, is applied to the power supply connections. IC2 is used to square up and buffer the output.



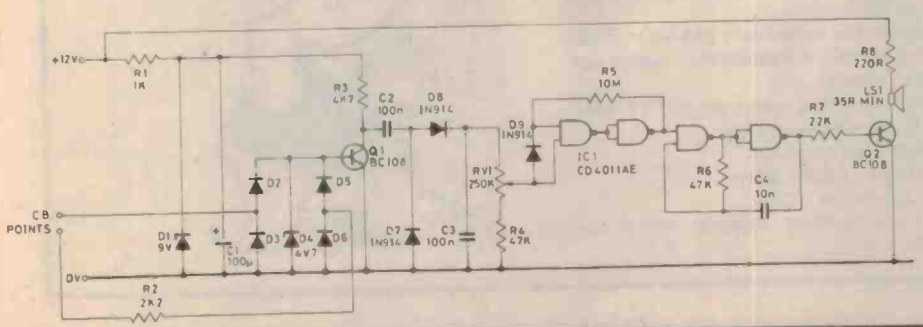
Speed Alarm

Also from our London office comes this cunning idea.

It is all too easy during a long journey to allow one's speed to gradually creep upwards. This alarm gives an audible nudge whenever you drift over a pre-set speed.

Pulses from the distributor points are passed through a current limiting resistor, rectified and clipped at 4V7. Via Q1 and the diode pump a DC voltage, which is proportional to engine revs, is presented to RV1; the sharp transfer characteristic of a CMOS gate, assisted by feedback, is used to enable the oscillator formed by the remaining half of the 4001.

At the pre-set 'speed' (revs) a non-ignorable tone emits from the speaker, and disappears as soon as the speed drops by five or six kph.



Calibration of RV1 may be conducted with an accurate pulse generator remembering that, for a four stroke engine, frequency = revs per minute times the number of cylinders divided by 120; for a car with a specification of 28 kph per 1000 revs, in top gear, f = 133Hz at 112kph, 124Hz at 104kph (4000 RPM and 3714 RPM). The necessary frequency should be fed to Q1 and VR1 set so that the alarm is *just* off. Reliable switching occurs on the prototypes with a change of only 5Hz (150 RPM), ie less than 5kph for the above example.

Direct calibration 'on the road', while covering discrepancies due to tyre size, etc, will only be as good as the speedometer and obviously should be carried out by a passenger rather than the driver.

more on p. 97 ▶

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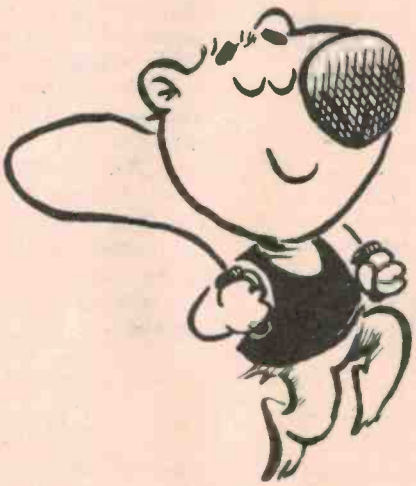

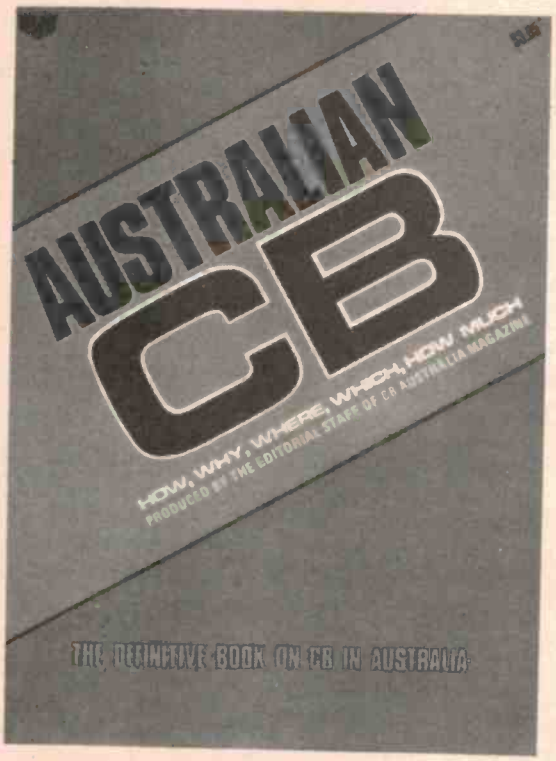

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'Australian CB' is the most important publication for CBers yet published. We hope you come to regard it as the 'bible' of the Australian CB scene.

Author, Roger Harrison, is a freelance technical journalist with many years experience in electronics and communications. His highly regarded technical articles have been published world-wide in several languages. Roger is one of Australia's best known 'hams' and has operated from such exotic locations as Antarctica and Cocos Island.

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- Buying a rig without doing your dough.
- Getting your CB licence.
- UHF CB - the truth.
- Installing a rig in your vehicle.
- How to operate.
- How to handle the ratbags.
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- Base stations can be fun.
- Don't be a SWR galah - use your meter sensibly.
- The how, when and why of DX and skip working.
- When the neighbours cut your coax.
- You've got the questions - we've got the answers.
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	1N4733	5.1v	1 W Zenner	.25
	1N4749	24v	1W	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25
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	2N3906	PNP (Plastic)	.19
	2N3904	NPN (Plastic)	.19
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	2N3055	NPN 15A 60v	.60
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1488	1.25
1489	1.25
1702A	4.50
AM 9050	4.00
ICM 7207	6.95
ICM 7208	13.95
MPS 6520	10.00
MM 5314	4.00
MM 5316	4.50
MM 5387	3.50
MM 5369	2.95
TR 1602B	3.95
UPD 414	4.95
Z 80 A	22.50
Z 80	17.50
Z 80 P10	10.50
2102	1.45
2102L	1.75
2107B-4	4.95
2114	9.50
2513	6.25
2708	11.50
2716 D.S.	34.00
2716 (5v)	69.00
2758 (5v)	26.95
3242	10.50
4116	11.50
6800	13.95
6850	7.95
8080	7.50
8085	22.50
8212	2.75
8214	4.95
8216	3.50
8224	4.25
8228	6.00
8251	7.50
8253	18.50
8255	8.50
TMS 4044	9.95

C MOS

QTY.		QTY.		QTY.		QTY.	
4000	.15	4017	.75	4034	2.45	4069/74C04	.45
4001	.20	4018	.75	4035	.75	4071	.25
4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
				4066	.75	74C151	2.50

– T T L –

QTY.		QTY.		QTY.		QTY.	
7400	.20	7492	.45	74H20	.25	74LS76	.70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.80	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	1.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.95
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.35	74LS51	.75		
7490	.55	74H11	.25	74LS74	.95		
7491	.70	74H15	.45	74LS75	1.20		

I^2L, LINEARS, REGULATORS, ETC.

QTY.		QTY.		QTY.	
MCT2	.95	LM320K24	1.65	LM373	3.95
8038	3.95	LM320T5	1.65	LM377	3.95
LM201	.75	LM320T12	1.65	78L05	.75
LM301	.45	LM320T15	1.65	78L12	.75
LM308	.65	LM323K	5.95	78L15	.75
LM309H	.85	LM324	1.25	78M05	.75
LM309 (340K-5)	1.50	LM339	.75	LM380 (8-14 Pin)	1.19
LM310	.85	7805 (340T5)	1.15	LM709 (8-14 Pin)	.45
LM311 (8-14 Pin)	.75	LM340T12	.95	LM711	.45
LM318	1.50	LM340T15	.95	LM723	.40
LM320H6	.79	LM340T18	.95	LM725	2.50
LM320H15	.79	LM340T24	.95	LM739	1.50
LM320H24	.79	LM340K12	1.25	LM741 (8-14)	.45
7905 (LM320K5)	1.65	LM340K15	1.25	LM747	1.10
LM320K12	1.65	LM340K18	1.25	LM1307	1.75
LM320K15	1.65	LM340K24	1.25	LM1458	.65
				LM3900	.95
				LM75451	.65
				NE555	.45
				NE556	.85
				NE565	1.15
				NE566	1.25
				NE567	.95
				TA7205	6.95
				76477	2.95
				95H90	9.95

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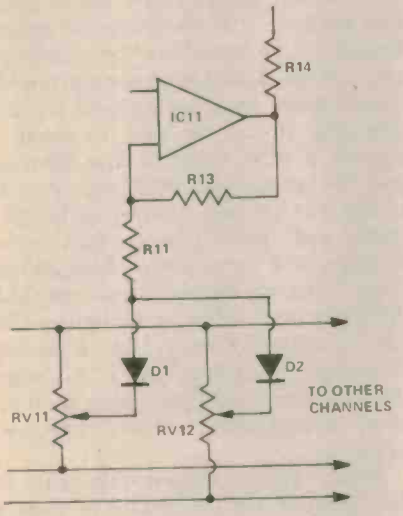
Ideas for Experimenters

Dimmer Modification

Readers involved in stage lighting may be interested in a modification to the ETI 588 theatre dimmer.

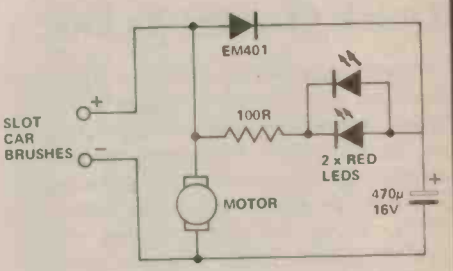


We are indebted to the reader who phoned this suggestion in to Nebula Electronics. Unfortunately, he didn't leave his name.

Resistors R12, R22, R32 ... et cetera are removed and the two diodes shown are added, one pair to each channel. This gives the dimmer the same operating format as commercial ones.

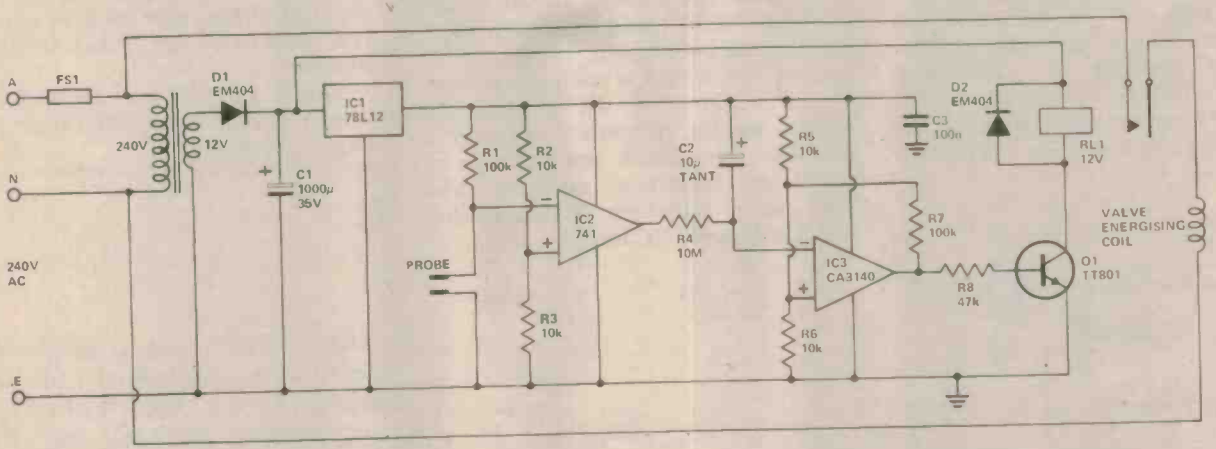
To explain: In most dimmers, the value of the master setting is multiplied by each individual fader and the *maximum* of the values from the two masters is used for the output. In the ETI 588, however, the *sum* is used instead of the maximum.

For example, if on Channel 1 both channel faders are at maximum, Master A is at half maximum and Master B is at zero, on the ETI dimmer *before* modification the output on Channel 1 will rise as Master B is moved from zero to half. After modification it will only start to rise after Master B passes the half-way mark.



Slot Car Brake Lights

A novel circuit for all you modellers. **P. Ruse** of Ferntree Gully has added some realism to his slot cars by building this little circuit into them. When the voltage on the track reduces, the LEDs light up. Neat and simple. Unfortunately, this circuit is not applicable to model railways as trains don't have brake lights.



Electronic Ballcock

After fitting a filter system to his pool, **Clifford Heath** of Camberwell found that the pump had to be re-primed every time the water level dropped due to evaporation.

This circuit detects low water level in a swimming pool and switches the water supply on for about 20 seconds when it occurs.

The inverting input of IC2 is held low by a short across the probe (which can simply be a couple of bolts through the side of a fibreglass pool). When the water level is low the probe will go open circuit and the output of IC2 will go low. C2 will begin to charge and after about 2 minutes, the output of IC3 will change state. This 2 minute delay is to prevent waves from setting the device off prematurely.

Once triggered, IC3 (which is connected as a Schmidt trigger) will give a high output voltage for at least 20 seconds — this is the length of time needed for IC2 to change the inverting input voltage of IC3 past it hysteresis point.

While the output of IC3 is high, Q1 will turn on and energise the water supply valve coil. Care should be taken with the valve mains supply — it's a good idea to put the end of the water supply hose into the pool. This will remove the possibility of mains-voltage water falling into the pool due to a short inside the valve.

▶

Ideas for Experimenters

'Quick Circuits' pc kits

For some time Bishop Graphics Inc have produced the excellent range of PCB design graphics with which most people are familiar. They have now released a range of adhesive-backed pre-cut copper patterns for prototyping and repair of PCB's. A kit of these shapes which includes tapes, pads, transistor and IC configurations as well as copper and insulating sheets sells for around $50. These may be stuck on to pre-drilled Matrix board being careful to align holes, or the board may be drilled after the pads are layed down. The adhesive used is very good, holding the shapes down yet allowing them to be repositioned several times. It even regains its adhesive properties after a very severe burst of heat from a soldering iron! The insulating sheet also withstands considerable heat without showing any damage.

The advantages of this system are fairly obvious. You can have one, two or up to about six sided boards. This is achieved by covering a lower track with insulating sheet before applying the upper copper layer on each side of the basic board. Thus, quite a nasty PCB becomes simpler to design. Let me assure you, once you have crossed tracks it's annoying to have to go back!

However, one needs to design ahead, and with all the fiddling around and extra soldering (every joint requires soldering whether there is a component termination or not) it is much easier, cheaper and faster to use a photographic process if all the gear is readily accessible and the board is not unduly complex. It is also more reliable since it is easy to miss soldering a joint and very hard to track the fault down. This stuff is then unlikely to completely replace the old ways for prototyping pcb's.

However, Quik-Circuit really comes into its own in a few special situations. Firstly, it is excellent for "adding a side" to an etched prototype pcb which cannot quite cope having only one side. Secondly it can be used to repair or modify a PCB. Suppose you have just got the prototype PCB and you see a mistake, or you inadvertently lift a track and pad. Usually this means another PCB or a job of hideous butchery. With Quik-Circuit you can fiddle the thing into operation without serious loss of time. Finally, for a one-off, exceedingly complex, job it is cheaper and faster and less frustrating than any other presentable method, bar wire-wrap.

While Bishop suggest this stuff for the hobbyist we feel that it is quite an investment – $50 plus buys a heck of a lot of PCB's from commercial outlets if you only want standard boards. It is, on the other hand, nice to have around if you want to get out of any tricky PCB situation.

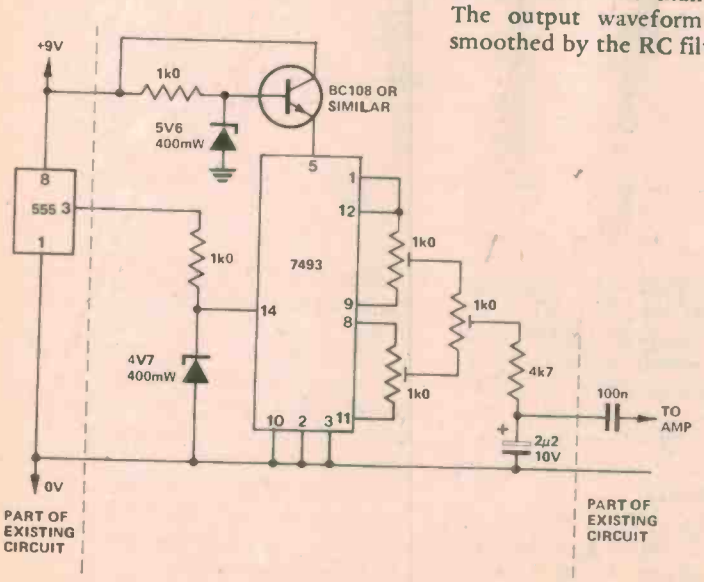
Quick Circuits are available from Circuit Components, 383 Forest Road, Bexley, Sydney 2207.

Square Wave Smoother

The output from the ETI 602 mini-organ can sound rather harsh, especially at the low end of the keyboard. R. Dall of Eight Mile Plains has used a Walsh function generator to overcome this problem (see 'Designing Oscillators', ETI December 78, p 15).

The 7493 is a four-bit counter which is clocked by the output of the organ's oscillator. The zenor diodes and transistor are necessary to interface the voltage levels from the existing circuit to the 7493. A 74C93 could have been used, but Mr Dall pointed out that the overall cost of this would actually be greater.

The outputs of the counter are 'mixed' by the trimpots to produce a sum waveform which can be made to sound less harsh than a square wave. The output waveform is then further smoothed by the RC filter.

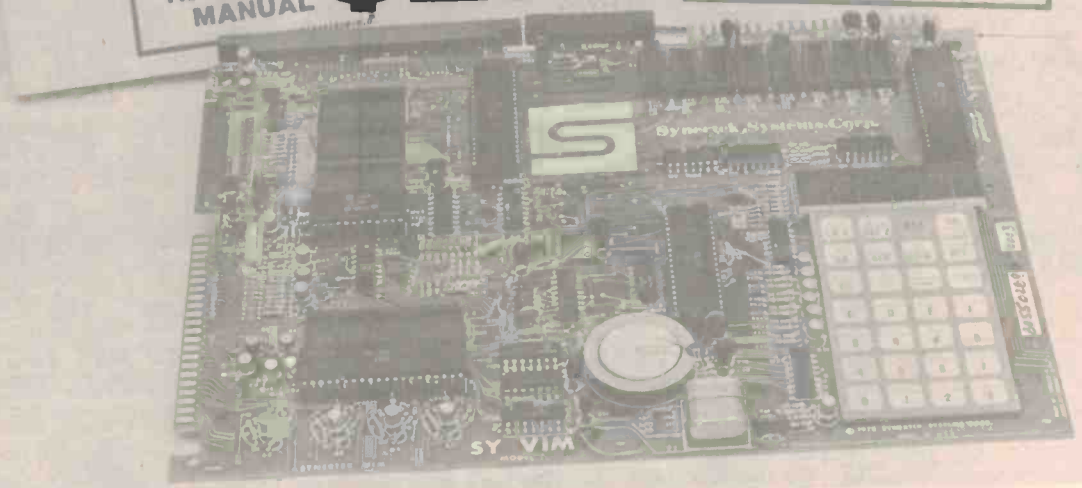


HAVE YOU had a bright idea lately, or discovered an interesting circuit modification? We are always looking for items for these pages so naturally, we'd like to hear from you.

We pay between $5 and $10 per item – depending on how much work we have to do on it before we publish it.

The sort of items we are seeking, and the ones we think that other readers would like to see, are novel applications of existing devices, new ways of tackling old problems, hints and tips.

A Single Board Computer for $215!*



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- ★ Oscilloscope interface

SYM-1 Offer

Please make cheques or money orders payable to 'SYM-1 Offer' and send, with this coupon (or a copy) to: SYM-1 Offer, Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. Offer closes Friday, August 31st 1979.

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EADER OFFER ..... SPECIAL READER

SYM-1 Special Reader Offer

BACK IN NOVEMBER of last year, you may remember, we reviewed a particularly nifty piece of computer hardware called the Synertek SYM-1. This latter-generation evaluation kit boasts a 6502 CPU, 1 Kbyte of RAM, a 6522 Versatile Interface Adapter, a 6532 RAM/I/O/Timer chip and an assortment of interfaces and buffers. These let the machine talk to the outside world through its in-built keyboard and display (or a teletype or VDU) as well as a cassette interface and general purpose parallel ports. Also on the board is 4 Kbytes of ROM containing a super-powerful monitor program called DEMON, which lets you control all that computing power.

At the time, we were particularly impressed by the way the SYM-1 design was carefully thought out (inclusion of user-definable commands in the monitor, both high-speed and KIM-compatible cassette formats, etc) and with the general value for money that the package provided. We are even more impressed with Synertek's follow-through performance, which includes the release of Microsoft BASIC on a couple of plug in ROMs and the introduction of a matching keyboard/VDU board called the KTM-2, which will turn your SYM-1 into a personal computer comparable to the PET or TRS-80.

Because we like to see good little computers go to good homes, we have made arrangements with Silicon Valley, who sell the SYM-1 in Australia, for them to make the SYM-1 available to ETI readers for only $215 plus $2 carriage including sales tax – a saving of **over $100 on the usual retail price!**

NOTE: This offer is made by Silicon Valley and ETI is acting as a clearing house for orders only. Cheques should be made payable to 'SYM-1 Offer' and sent, together with the order form or a copy thereof, to 'SYM-1 Offer', ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. We will then process the orders and send them on to the sponsor who will send out the goods by carrier. Please allow four weeks for delivery. The offer closes on Friday, 31st August 1979 and is open to Australian readers only.

*

This price includes sales tax but not carriage at $2.00 which should be added. The SYM-1 is a later name for the VIM-1, which was re-named (probably for copyright reasons).

EADER OFFER ..... SPECIAL READER

eti data sheet

The 558 is a quad timer — basically very like four 555s in a single package.

Each timer takes up three pins of the 16-pin package. One is the trigger input — a negative-going edge will initiate the timing period. The second is the timing connection, which goes to an RC combination. The timing period is equal to R x C. The final connection is the output which will sink 100 mA.

This leaves four pins, two of which are for power supply. The final two are connected together internally and provide the control voltage-reset function.

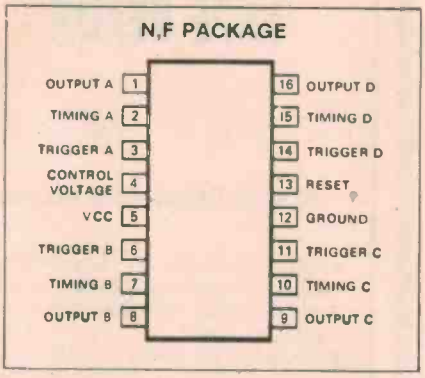
Basically this works as follows: Once triggered, the timing pin will be released from earth and allowed to rise (by virtue of the current flowing in the RC) until it reaches Vr, at which point the timing period will be over. Vr is derived internally from the supply by a resistor divider. The centre connection of the divider is connected to the control voltage%reset pins and can be used in three ways:

(A) A connection for an external reference or zener to reduce the effect of supply ripple on Vr.

(B) As a point for injecting a current into the internal divider to vary Vr and therefore the timing periods.

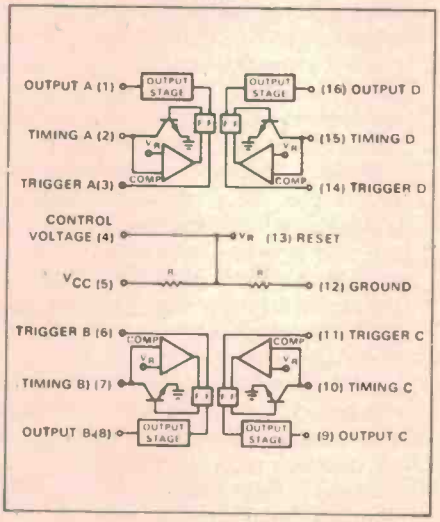
(C) As a reset pin — shorting it to earth will cause all the timing periods to end immediately.

PIN CONFIGURATION



More information on this device can be obtained from: Elcoma, 67 Mars Road, Lane Cove, NSW 2066. Tel: (02) 427-0888.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER		RATING	UNIT
V_{CC}	Supply voltage		V
	SE558	+18	
	NE558	+16	
P_D	Power dissipation	600	mW
T_A	Operating temperature range		°C
	NE558	0 to +70	
	SE558	-55 to +125	
T_{stg}	Storage temperature range	-65 to +150	°C
	Lead temperature (solder, 60sec)	+300	°C

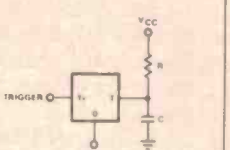
DC ELECTRICAL CHARACTERISTICS T_A = 25°C, V_{CC} = +5V to +15V unless otherwise specified

PARAMETER		TEST CONDITIONS	SE558 Min	SE558 Typ	SE558 Max	NE558 Min	NE558 Typ	NE558 Max	UNIT
V_{CC}	Supply voltage		4.5		18	4.5		16	V
I_{CC}	Supply current	V_{CC} = Reset = 15V		21	32		27	36	mA
T = RC	Timing accuracy	R = 2K to 100K, C = 1µF							
	Initial accuracy			1.0	3		2		%
	Drift with temperature			150			150		ppm/°C
	Drift with supply voltage			0.1			0.1		%/V
	Trigger voltage[1]	V_{CC} = 15V	0.8	1.5	2.4	0.8	1.5	2.4	V
	Trigger current	Trigger = 0V		5	30		5	100	µA
	Reset voltage[2]		0.8	1.5	2.4	0.8	1.5	2.4	V
	Reset current	Reset		50	300		50		µA
	Threshold voltage			0.63			0.63		xVCC
	Threshold leakage			15			15		nA
V_{OUT}	Output voltage[3]	I_L = 10mA		0.1	0.2		0.1	0.4	V
		I_L = 100mA		0.7	1.5		1.0	2.0	
	Output leakage			10			10		nA
	Propagation delay			1.0			1.0		µs
	Risetime of output	I_L = 100mA		100			100		ns
	Falltime of output	I_L = 100mA		100			100		ns

NOTES

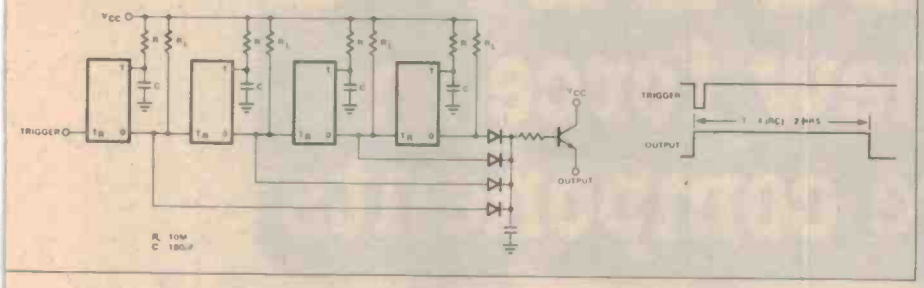
1 The trigger functions only on the falling edge of the trigger pulse only after previously being high. After reset the trigger must be brought high and then low to implement triggering.
2 For reset below 0.8V, outputs set low and trigger inhibited. For reset above 2.4V, trigger enabled.
3 The output structure is open collector which requires a pull up resistor to V_{CC} to sink current. The output is normally low.

MONOSTABLE OPERATION (ONE SHOT)

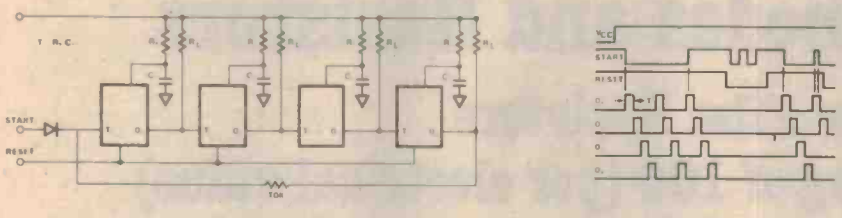


NE558 — Quad Timer

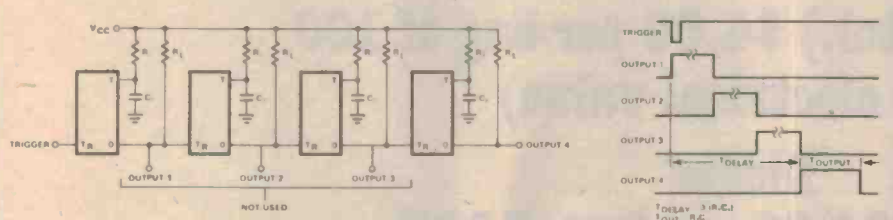
TWO HOUR TIMER



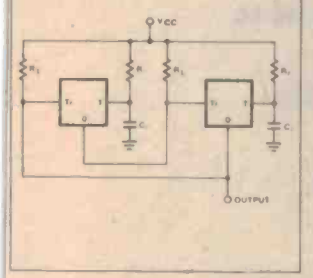
RING COUNTER



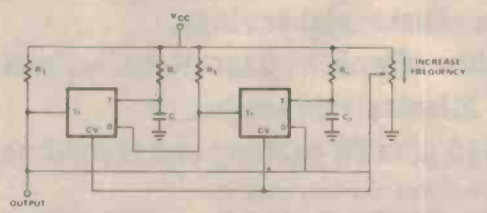
LONG-TIME DELAY



ASTABLE OPERATION (OSCILLATOR)



VARIABLE FREQUENCY OSCILLATOR WITH FIXED DUTY CYCLE



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CR25 $1.00 per bag of 100 (per electrical value)
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MR25 (2% tol.) $4.00 per bag of 100 (per electrical value)

Diodes

IN4148 $4.00 per bag of 100
IN4004 $6.50 per bag of 100
IN4007 $9.90 per bag of 100 *

Our computerized inventory access and control system now enables us to pass on substantial savings.
Similar savings are also now offered on Capacitors in the Green Cap and Electrolytic ranges.
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Brisbane: 22 Ross Street, Newstead. Qld. Tel: (07) 52 4261
Adelaide: 170 Sturt Street, Adelaide. S.A. Tel: (08) 51 6483
New Zealand: 7-9 Kirk Street, Grey Lynn. Auckland. Tel: 76 1169
and soon in Perth, Western Australia.

COMMUNICATIONS

Petition calls for 27 MHz CB after 1982

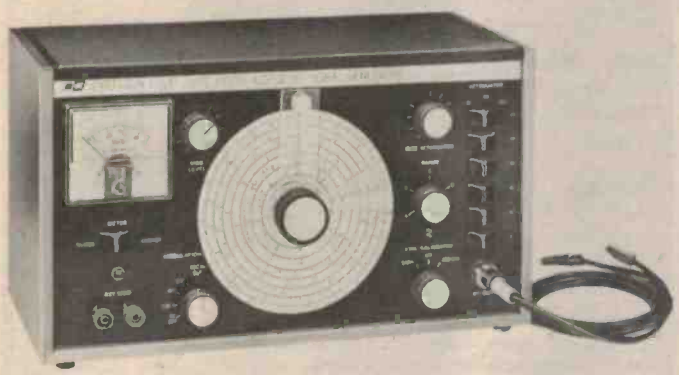
Existing legislation 'anticipates' the recall of the 27 MHz CB band in Australia after 30 June 1982. A private petition from Bob Mudge of Paraburdoo in W.A., lodged with the Government earlier this year, calls for this provision to be revoked.

In three parts, the petition argues for the retention of CBers' favourite band. Firstly, Bob Mudge examines emergency use of the 27 MHz band and concludes that, "... It is imperative that HF ... continue in isolated areas after 1982 due to the vast distances ... UHF is only a short range radio under normal operating conditions ... it should be noted that the cost of the huge number of repeater stations and their maintenance would be crippling, even for a government organization."

In the second part, truckie use of the 27 MHz band is examined. Mr Mudge concludes, "... due to the unusual conditions in isolated areas ... UHF, in the case of safe working and deliveries of vital food supplies ... is totally useless ... due to range limitations."

He examines personal use of both 27 MHz and the UHF CB band in the third part of his petition, arguing that, again, range limitations of UHF render the band "totally useless" in isolated areas.

Although the Petition has been with the Minister, Mr A.A. Staley, for some months, no reply has been forthcoming.



RF signal generator

The new B & K solid state RF signal generator model E2000 features silicon transistor circuitry and zener-regulated power supply for accuracy, stability and long life.

Six, individually shielded, step attenuators plus variable fine output level control with calibrated meter provide widest range of outputs with known signal levels. Double shielding reduces spurious radiation even at outputs of 1 uV.

A 200 uA meter provides for accurate monitoring and setting of RF carrier and modulation levels. A crystal calibrator provides audible an zero-beat through built-in speaker and accuracy better than 0.7 percent. It can also be used as crystal-calibrated marker.

The generator covers 100 kHz to 54 MHz on fundamentals and 54 to 215 MHz on harmonics.

For further information contact **Bruce McCarthy, Parameters Pty. Ltd., 68 Alexander St., Crows Nest NSW 2065, phone: 439-3288.**

Vicom supports WARC '79

As a contribution to the effort in preparing and maintaining a presence at the coming World Administrative Radio Conference Vicom have donated $1000 towards the Wireless Institute of Australia's funding for the project.

A spokesman for Vicom said that the Conference will have a profound effect on the long-term interests of both the amateur fraternity and the viability of the commercial interests throughout the world.

The photograph shows Russell Kelly VK3NT (Vicom Commercial Director) signing a cheque for presentation to Dr David Wardlaw (seated, right) the WIA Federal President. Peter Williams, VK3IZ (Vicom Technical Director) looks on.

CB around the world

Some 27 (!) countries around the world presently have CB services operating, generally on 27 MHz.

South Africa is the most recent country to take the plunge and it seems that Denmark is considering becoming country 28 — though not until early next year. Next door, Belgium has a 27 MHz business radio service and is considering changing their legislation in December.

The Dutch have labelled their CB-service-to-be MARC (translates to: 'licensing, general radio communication'). Licences are to be granted to individuals over the age of 16 following an examination similar to a simple amateur radio exam (though to be non-technical).

The usual licence restrictions will apply: no unlawful or obscene messages, no music, no advertising, etc. There will be a fee. (Licensing authorities all think the same way!) Transceivers will have to be type-approved and there will be a registration certificate for the user. Experimenting will be limited to the antenna and rig location.

Austria is understood to be looking at a 470 MHz system similar to Australia's.

144 MHz world record broken again

The world terrestrial DX record was shattered twice in March by contacts between amateurs in Greece and South Africa.

Around 1800 Z on 13 March, SV1DH in Athens worked ZS6DN in Pretoria on 144.219 MHz on cw, a distance of 7117 km. Three days later SV1AB, just north of Athens, extended the record to 7127 km when he worked ZS6DN on 2m at 1823 Z.

That probably represents just about the outside distance limit of Class II TEP — unless the right combination of conditions exists for a Sporadic-E extension.

SUPERB KITS from DENMARK

Additional high quality kits coming soon!

JOSTYKIT is Europe's leading manufacturer of electronic kits featuring attractively styled boxes of Scandinavian design and high quality electronic components which will satisfy the most demanding kit builder.

JOSTYKIT's staff of qualified electronic engineers and educationalists supply up-to-the-minute, reliable electronic kits, designed around space-age solid state technology, but capable of construction without any great technical know-how or practical experience.

The JOSTYKIT instruction booklets supplied with each kit give clear, precise directions for assembly and testing. For those with special technical interests, each instruction booklet ends up by describing how the kit works. You'll always learn something when you construct a kit from JOSTYKIT.

Audio

AF300 AUDIO AMPLIFIER – 3 WATTS

A real work-horse, this universal power amp has a wide range of applications such as car radio, record players and small receivers. Due to its well designed electronic circuit, the AF300 can be used over wide voltage ranges without deterioration of the specification parameters.

Kit AF300 . . . . . $25.00

AF340 40 WATT AUDIO AMPLIFIER MODULE

High quality 20-20,000 Hz, 37w RMS with low distortion.

Kit AF340 . . . . . $35.00

FM Tuners

HF325-2 QUALITY FM TUNER MODULE

The HF325 is a complete high quality FM tuner of professional standing. The tuner unit is ready-made and pretrimmed, making it child's play to assemble. Tuning range 88-108 MHz, operating voltage 12-55v ac.

Kit HF325 . . . . . $79.00
Stereo decoder HF310 . . . . . $24.00

HF310 FM RECEIVER

The HF310 is a very reasonably priced HF FM tuner. Fully trimmed, the sensitivity according to IHF standards is better than 10uV. Features 60 dB S/N radio and low harmonic distortion.

Kit HF310 . . . . . $49.00

HF330 STEREO DECODER

Gives 40-45 dB channel separation, just add to a good quality FM receiver.

Kit HF330 . . . . . $24.00

Pre-amps (RF)

HF395 RF PREAMPLIFIER

Gain 30 dB to 20 MHz, 10 dB to 100 MHz and 5 dB to 225 MHz. Ideal to boost reception on short-wave receivers.

Kit HF395 . . . . . $6.00

HF385 VHF/UHF ANTENNA PREAMP

Superb quality with two aerial inputs and one down lead which simultaneously supplies current from the power supply. Frequency range 40-250 MHz and 400-820 MHz. Gain 9-18 dB, depending on frequency.

Kit 385 . . . . . $30.00
Box B850 . . . . . $6.00
Optional Power Supply NT410 . . . . . $20.00

Quick assembly kits

JK01	GENERAL PURPOSE AMP 0.5W	$18.00
JK02	MICROPHONE AMPLIFIER	$19.00
JK03	SINE WAVE GENERATOR 20-20,000 Hz	$30.00
JK04	FM TUNER 88-108 MHz	$30.00
JK05	27 MHz RECEIVER	$33.00
JK06	27 MHz TRANSMITTER	$29.00
JK07	DUAL TONE DECODER FOR R/C MODELS	$43.00
JK08	240 Vac LIGHT OPERATED RELAY	$20.00
JK09	SIREN KIT inc. SPEAKER	$19.00
JK10	PHOTOGRAPHIC TIMER 240 Vac	$23.00
JK101	CAR BURGLAR ALARM KIT	$55.00

Light Shows

AT465 LIGHT SHOW

Turn your music into light. Simply connect this 3 channel light show to the audio terminals of your amplifier and this quality kit does the rest for you!

Kit AT465 . . . . . $64.00
Attractive box and knobs B6065 . . . . . $25.00

AT468 4 CHANNEL LIGHT SHOW

This superb kit drives 4 lights (400w per channel) from the audio amplifier output.

Kit AT468 . . . . . $75.00
Attractive box and knobs B3265 . . . . . $48.00

AT365 LIGHT SHOW

This quality kit uses microphone input instead of connection to the audio output. 1500w max.

Kit AT365 . . . . . $69.00
Box and knobs B3265 . . . . . $48.00

FM Transmitter

HF65 FM TRANSMITTER 60-148 MHz

Will run 5w output with heat sink. Ideal for signal testing or for a miniature transmitter which could be received on a standard FM receiver.

Kit HF65 . . . . . $9.00

Ham Converter

HF305 AMATEUR BAND 2m CONVERTER

Converts 2m FM down to the FM band 88-108 MHz.

Kit HF305 . . . . . $28.00

AM Receiver

HF61 MEDIUM WAVE RECEIVER

540-1600 KHz receiver complete with ferrite coil antenna.

Kit HF61 . . . . . $19.00

Power Supplies

NT415 LAB POWER SUPPLY 0-30V

1 amp well-regulated supply for professional use. Complete with box and transformer.

Kit NT415 . . . . . $128.00

NT300 LABORATORY POWER SUPPLY 2-30V

High quality supply, regulated 2-30V dc at 2 amps with overload protection. Complete with box and transformer.

Kit NT300 . . . . . $110.00

AT320 ALL ROUND AC/DC REGULATOR

This kit is a control unit with almost incredible possibilities. Use it as a touch control, burglar alarm, timer, heat/cold regulator. Power supply is built-in.

Kit 320 . . . . . $54.00

Sydney: Custom Communications, 6 Orchardleigh St, Yennora, Ph: 681-3544. **Adelaide:** Hamtronics, Goodwood Rd, Kingspark, Ph: 272-8417. Port Adelaide International Communications Systems, 75-77 Dale St, Port Adelaide, Ph: 47-3688. **Melbourne:** Eastern Communications, 898 Riversdale Rd, Camberwell, Ph: 836-8635. Rod Irving Electronics, Shop 499, High St, Northcote, Ph: 489-8131. Tasman Electronics, 12 Victoria St, Coburg, Ph: 354-5062. **Brisbane:** Delsound, 1 Wickham Tce, Ph: 229-6155. **Launceston:** Advanced Electronics, 5 A Quadrant, Ph: 31-7075. Tasmanian Hi-Fi Company, 87A Brisbane St, Ph: 31-5815.

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COMMUNICATIONS

$10 000 satellite station

A small Colorado (US) company has been awarded a US $1.5 million contract to provide satellite earth stations for meteorological monitoring that cost US $10 000 each and can be assembled in three hours.

Electronic Techniques Inc, a four-year old privately held company with an annual turnover of about $1 million, was awarded the strongly-contested contract for the 150 stations by the US Department of Interior April last.

The stations are to be built over the next 20 months. Housed in triangular aluminium sections, they stand six metres tall and are designed to withstand winds in excess of 160 kph.

The US Department of Interior's Bureau of Reclamation plan to use the stations in a meteorological surface observation network called Mesonet relaying data hourly via NASA's Geostationary Operational Environmental Satellite (GOES) to ground stations. From there, the data is to be relayed to a computer complex at Reclamation's Engineering and Research Centre at Denver.

Silicon photovoltaic solar cells will provide charging for the stations' lead-calcium battery supply (from Delco Electronics). Wind speed and direction, barometric pressure, temperature and humidity, precipitation and battery status will be relayed by each Mesonet station. Communications will be on the 402 MHz band assigned to GOES, each station having a single yagi antenna.

High reliability and low cost are remarkable features of the equipment, according to Department of Interior sources.

In the unlikely event the solar panels receive no sunlight for 30 days the batteries will still continue to supply power. All the environmental sensors and electronics are off-the-shelf items.

Articles of note

The May issue of Ham Radio, their 10th Annual Antenna Issue, features a fascinating article on "Quads vs Yagis", by Wayne Overbeck N6NB, that not only knocks over a few sacred cows but destroys some myths in the process.

Running 10 pages, he details practical comparisons he carried out on both commercial and homebrew antennas of both types. His conclusion — the fondly-held maxim that a quad is 2 dB better than a yagi of the same boom length is unsupportable in fact, except maybe for two-element quads. Read it and wince.

In the same issue of Ham Radio is an article on 80m broadband antennas. Author, Terry Conboy N6RY, discusses parallel and turnstile antennas — the latter driven with a Wilkinson hybrid. He also discusses the coaxial-trap antenna for this band. Makes interesting reading.

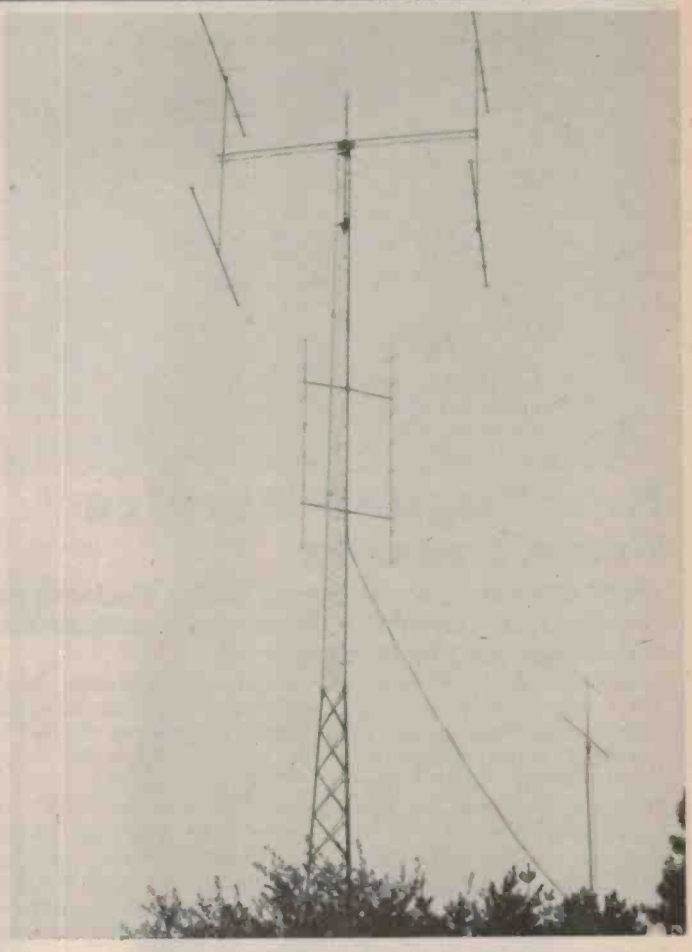
Additional articles on matching and reflectometers provide further interest in a very stimulating issue.

With current interest in reception of signals from satellites, the keen satellite chaser — and those mildly interested — should forage for a copy of the November 1978 issue of 73 Magazine.

Ralph Taggert, WB8DQT, describes an S-band (1691 MHz) receiving system for reception of GOES Environment Monitoring satellite signals. Using a down-converter system employing inexpensive modules available from Microcomm in California and a simple homebrew feed horn for a surplus dish, the author was able to receive good quality FAX pictures from the satellite with a very makeshift set up.

The article includes very practical details.

Ralph Taggert is the author of a very informative book on the subject, published by 73 Publications, it is called The Weather Satellite Handbook.



Six metre skeds wanted

Joe Burke, WA80GS, from Cincinnatti Ohio, is seeking correspondence from stations in Australia and surrounding regions interested in conducting skeds on six metres. Joe has trans-Pacific F-layer DX and moon bounce in mind.

He runs 2 kW PEP of sideband to four six-element yagis in a H-frame configuration (pictured here). Joe has heard his own EME echoes from the setting moon and is currently working on an elevation system for his antenna. He intends to install either larger antennas on the existing mount, or eight six-element arrays, later this year.

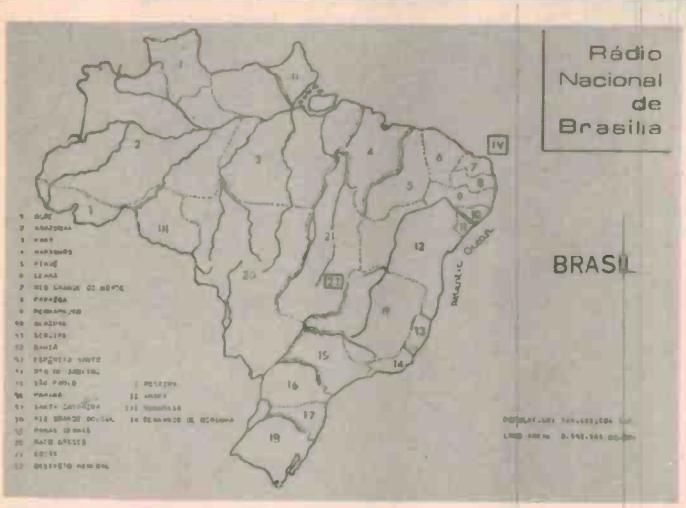
For those interested, Joe's address is **6381 Mullen Road, Cincinnatti, Ohio 45239 USA.** Phone 513-385-4198 after 1930 (US time).

Swan Hill radio club

For those amateurs and like-minded enthusiasts in the north-western district of Victoria, the Swan Hill and District Radio Club meets on the first Thursday of each month, excepting January.

Venue for meetings is Room 20 at the Swan Hill Technical School. Club callsign is VK3BSH and the club's repeater, channel 46 on two metres, is VK3RSH. The repeater has a mobile range around 50 km.

For further information, contact club secretary **Peter Forbes VK3QI on (050) 37-2591**. Postal address is **P.O. Box 682, Swan Hill 3585.**



New English Service From Brasilia

After several years absence, Radio Nacional de Brasilia has returned to the airwaves with an External Service programme.

Until late this month, Brasilia will be carrying out experimental transmissions for overseas listeners. English programmes have been observed in Melbourne from 0200 until 0300 on 15 280, with Spanish programmes from 0300 daily. Even though the transmitter power is listed as 250 kilowatts, propagation conditions are not favourable, and the English service may be heard at only a weak level.

Radio Nacional de Brasilia operated a daily English service from 2100-2200 until 1977. However, this and other external service programmes were terminated in favour of a Home Service programme directed to the vast Amazon region.

The present test transmissions on 15 280 are intended as a prelude to the re-introduction of a regular external service from Brasilia, where several new 250 kilowatt transmitters are being installed for this purpose.

Radio Nacional de Brasilia is anxious to receive reception reports for the current test programmes, their address is: **C.P. 04-0340, 70000 Brasilia, DF, Brasil.**

Grenada

Since the coup on this Caribbean island in late March, the radio station now calls itself Radio Free Grenada.

It has made changes to its broadcast schedule on shortwave and now uses the new outlet 15 045 from 1945-2245 daily, while from 2215 the station uses 15 370.

There is a further transmission listed for broadcast at 0015 which uses the old 19 metre band outlet of 15 105.

Radio Free Grenada has two shortwave transmitters, each of 5 kilowatts, yet even with such low power the station does give good reception on occasions, especially in the 2000-2100 period here in east Australia.

Programmes are in English, and advertisements are also carried making excellent items for inclusion in reception reports to the station.

Their address: **P.O. Box 34, Morne Rouge, St. George's, Grenada.**

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of ARDXC may be obtained from either PO Box 67 Highett VIC 3190, or from PO Box 79 Narrabeen NSW 2101, for a 30c stamp.

Chile

Further to our information of last month about English programmes from the Voice of Chile, the 1100 English programme for Oceania is now broadcast on 15 125, with no other channels currently observed for this service. Santiago has recently dropped the use of 15 110 at 1100.

Bangladesh

The Overseas Service of Radio Bangladesh has an English program every day from 1230 to 1300 directed to audiences in South East Asia.

The station has been experimenting recently with various frequencies in the 19 metre band for this programme.

The latest outlet is 15 285 which gives fair to good reception on a clear channel at present.

Radio Bangladesh uses two ageing 100 kilowatt transmitters for its overseas service and plans shortly to upgrade external coverage with the installation of two transmitters of 250 kilowatt each at Kabipur, near Dacca.

Afghanistan

The overseas service of Radio Afghanistan in Kabul currently has English programmes from 1400-1430 on 4775, and again from 1900 to 1930 each day on both 11 890 and 15 140.

Reports of reception conditions may be sent to **P.O. Box 544, Kabul.**

The station advises that return postage (in the form of International Reply Coupons) should be included with reception reports.

Lebanon

Radio Lebanon, official station of the Lebanese government, has introduced the new frequency of 15 440 replacing 11 925.

This will be for the northern summer months for overseas service programmes.

The new 19 metre band frequency is used for the English service to North America from 0230-0300 daily, and remains in use for the programme in Spanish for the Americas from 0300 until sign-off at 0330.

Greece

In line with increasing sunspot activity, the Voice of Greece has begun use of the 13 metre band.

Transmissions in this band include Greek at 1200-1250 daily on 21 655, and on 21 455 from 1500-1550. Both these transmissions include an English news bulletin at 1215-1225, and 1515-1525. These 13 metre band broadcasts emanate from the transmitters located at Avlis near Athens, with power of 100 kilowatts.

loggings

Radio Free Europe

This station has been in the news recently, with USA President Jimmy Carter planning to provide greater funding for its activities.

RFE and Radio Liberty are both essentially anti-communist in character, with RFE broadcasting for audiences in socialist eastern Europe, and Radio Liberty directing its programmes to residents of the USSR. Radio Liberty is to receive US funding, too.

Transmitters are located at various sites, including Gloria (Portugal), Playa de Pals (Spain), and Lampertheim and Biblis (West Germany).

Few listeners will be aware that Radio Free Europe now has a daily programme in English. This is broadcast from 2050-2100 on 7255, using the 50 kilowatt transmitter at Gloria in Portugal. All other programs from RFE and Radio Liberty are in east European or Soviet languages.

English from the Ukraine

Radio Kiev broadcasts in English for European and North American audiences, but some of these transmissions may also be heard in Australia.

The service for Europe is broadcast every day from 2000 to 2030 on 6020, 7400 and 9640, and this transmission should propagate well for Australian reception. There are two daily programs for North America, the first 0030-0100 on 17 870, 15 240, 15 100, 11 790, and 9580; the second is on air 0300-0400 on 17 720, 15 455, 15 180, 12 050, 11 790, 9610 and 7400. With winter now upon us, reception of both North American services should be reliable, especially on bands from 11 MHz upwards.

Latin America Loggings Peak

Reception on the lower frequencies is now reaching a peak, this is the time to catch up with loggings and reception reports for this area.

Stations currently active include:

Honduras: Radio Juticalpa provides fair signals on 4781, with a fast moving format of orchestral tunes and Spanish advertisements.

It is audible from 1100 until past 1200.

Ecuador: Radio Rio Amazonas at Macuma in the Ecuadorian interior can be heard on 4870 from sign-on at approximately 1055.This station broadcasts in Indian languages as well as in Spanish, with religious programmes and Andean music.

Also in Ecuador is Radio Splendit at Cuenca on 5025, which is more commercial in flavour and currently operates 24 hours.

It is audible between 0800 and 1100 most evenings.

Colombia: La Voz de los Centauros at Villavicencio operates on 5955 and opens transmission at about 0950 with station identification and morning greetings in Spanish.

Features Colombian popular music, and is audible until after 1030. Radio Super de Bogota in the Colombian capital is operating to a 24-hour schedule, and gives good reception on 6065 between 0900 and 1100.

African Beat

Winter means the best time for hearing the Home Service outlets of many stations on this continent. Some African countries only operate in the low frequency tropical bands of 60 metres, 90 metres or 120 metres.

Lesotho: The Lesotho National Broadcasting Service at Maseru has just one transmitter which is on 4800 with a power of 10 kilowatts.

Currently, this may be heard between 1830 and sign-off at 2103.

Most programmes are in the local Lesotho language, but on Sundays there is an English language religious programme presented by an American-based evangelist group between 2030 and 2059.

On some days the sign-off time for Maseru is earlier, usually at 2030.

Cameroons: Radio Cameroons has a central station located at Yaounde and others located at the towns of Garoua and Bertoua all of which are currently audible in Australia.

The central Yaounde station may be heard on both 4850 and 4972, with most programmes in French, although there is a regular news bulletin in English at 1830 each day, which is also carried on relay by all regional stations.

Radio Garoua offers good reception on 5010 from 1700 until 2200 sign-off. Radio Bertoua uses 4750, and may be heard with French programmes from 1845 following the English news.

For DXers really seeking a challenge, now is the best time of year to try hearing the regional station at Buea, operating on 3970 in the 75 metre band with a transmitter of 8 kW.

Radio Buea is active on 3970 from 1630 until 2200 in English, French and local languages.

Belgium

The Overseas services from Brussels are organised in two networks. There is the Dutch language network, BRT (which is also responsible for the programmes in English and Spanish) and the French language network RTB.

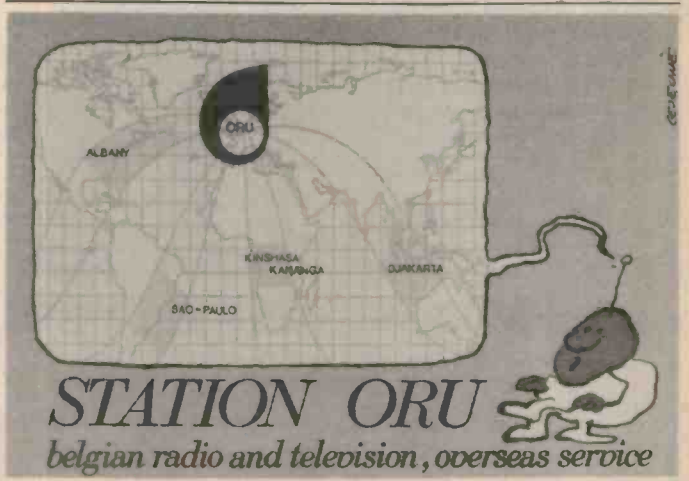
The schedule for BRT shows two segments in English which are entitled 'Brussels Calling'. The first is broadcast from 1610-1700 on 17 740 and 21 475. The second daily English segment is between 0015 and 0100 on 11 750 and 15 190. Both English programmes include "DX Corner" every second and fourth Sunday of the month.

The French service RTB directs its broadcasts mainly to African audiences, and includes extensive relays of the Home Service programmes.

The Monday to Saturday schedule shows broadcasts on 17 765 and 15 210 from 0500-0705; on 21 460 and 15 210 from 1000-1230; on 5965 and 21 460 from 1400-1545; from 1600-1700 on 21 460 and 15 210; and on 17 730 and 15 210 between 1700 and sign-off at 2100.

BRT's address is: **P.B. 26, B 1000 Brussels.**

RTB's address is: P.B. 202, 1040 Brussels.



Number Two ETI CIRCUITS

Contents

Please note: the Circuits Books are intended as 'ideas directories' — they are not meant for the beginner.

ELECTROPHONE AM CB RIGS

CB-510 and CB-530

Just how **do** a couple of 'ordinary' 27 MHz mobile CB radios perform? Matt Whelan, from our associate Modern Motor, and Roger Harrison put two rigs through their paces. The Electrophone brand rigs have been popular, consistent sellers — there has to be a reason.

THE 'Australian P & T approved' range of Electrophone CB transceivers were originally released way back in September 1977. Imported and distributed in Australia by Radio Parts (through Standard Components in NSW), the range is comprised of a 'basic' AM rig, the CB-510, a 'deluxe' AM set, the CB-530, an AM/SSB unit, the CB-550, and a base station (AM/SSB), the CB-590.

All are 18 channel units, manufactured by Cybernet in Japan, and were type approved shortly after CB was introduced in July 1977 — the 'champagne days' of CB in Australia.

While many brand names have come and gone in the past two years, Radio Parts have consistently maintained their market position and the Electrophone brand name is well known. It is surprising that, while many similar CB rigs have been offered at extraordinarily low prices, the Electrophone transceivers have not become victims of the price-cutting war. Many have fallen by the wayside following drastic price drops. It is unclear whether this phenomena was a symptom or a cause of the CB market collapse.

While all the marketplace brouhaha and fisticuffs were going on, Radio Parts quietly hung around maintaining their prices and a wide service network. It seems to have gained them a 'steady, dependable' reputation. They're still around!

Recent conversations with the CB retailing trade indicate that 'Mr Suburbia' is drifting in to look at CB radios — the days of the rabid enthusiast have come and gone. It seems that a 'reputable' image and a reliable product are high on the buyer's list these days.

The rigs

The CB-510 is just your 'basic AM mobile. No frills, no fuss, only three knobs and a tiny S/RF meter. Conveniently, the mike plugs into the front panel.

The CB-530 is the 'deluxe' AM mobile featuring LED digital channel readout, a three-function panel meter, switched ANL and noise blanker, monitor facility, delta tune switch and manual RF gain. Inconveniently, the mike plugs into the left-hand side of the case.

Both transceivers are housed in the same-sized case and have a satin-finish front panel with chrome surround.

On the air

Putting the CB-510 through its paces, we found the sensitivity was adequate — the channels are generally so crowded that you can only copy relatively strong signals anyway. Adjacent channel rejection wasn't all that one would desire, but this is characteristic of most basic rigs. Both the squelch and volume controls reacted smoothly and did the expected thing. The channel numbers on the skirt of the selector knob are a little small and would be difficult to read under some conditions. One advantage — they're back-lit.

Audio quality on reception proved a mild surprose — not the tinny sound so prevalent with mobile transceivers. Noise suppression is poor. Stick to the strong signals.

The tiny meter serves little purpose other than as a basic indicator.

The transmitter did the job required of it. A listening test showed that the modulation was clear and well balanced.

The CB-530 on reception performed much the same as its little brother. The ANL and noise blanker made some impression on the ignition hash but we felt it could have been improved upon. The RF gain control was quite a convenience and certainly aided adjacent channel rejection.

The transmitter performed much the same as for the CB-510, as expected.

The larger-sized meter, and the additional SWR function, proved quite useful.

On the test bench

Both transceivers have very similar performance. Sensitivity of the receivers was more or less what the manufacturers claimed but adjacent channel rejection, at 40 dB is nothing wonderful. This is average though for many similar transceivers we have tested.

The two transmitters did their thing and could not be overmodulated. At 80% peak depth nobody would be able to tell that you don't have 100% mod.

The transceivers draw a modest current on transmit and frequency accuracy is all that one would desire in an AM rig.

Summary

Both average rigs really. Appearance is attractive and for the price you pay, performance is fine. If used in mobile situations on the highways — away from the major cities — you'd rarely notice their shortcomings. Actually, with all the nerds to contend with in city metropolitan areas you'd probably never notice as the rig would be switched off!

With local serivce warranty and wide backup through the Radio Parts dealerships, these Electrophone AM mobiles represent quite fair value for money. ▶

SPECIAL THIS MONTH

ONLY $195 for Fringe or DX

1 — Crown Model 24. Rotator 13kg weight loading. Wind loading 70 miles per hour. NORMAL PRICE $99.00.
1 — Hills TL4-11 element wideband log periodic. NORMAL PRICE $48.48.
1 — Kingray 20 dB Masthead amplifier. 75 & 300 ohm input and output. NORMAL PRICE $74.97.

TOTAL NORMAL PRICE $220.45

This month only $195

CB SPECIAL
Replace your aerial systems.

1 — Belling & Lee helical 5ft whip aerial with base and 12ft lead and plug. NORMAL PRICE $27.00
1 — Ecraft ¼ Ground plane aerial. NORMAL PRICE $37.73.

TOTAL NORMAL PRICE $64.73

Special Price $40

ROYCE POWER/SWR TWIN METER MODEL 2-098.
Range measured: 0-10 WATTS, 0-100 WATTS. 2 ranges. SWR Meter 1:1 to 1:3 V.S.W.R. Frequency response 3 MHz-114 MHz. THE BEST BUY EVER IN SWR/POWER METER. AN INSTRUMENT NOT A TOY. **$19.70.**

2 ONLY. ME-IIX TWIN SWR/POWER METER.
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ELECTROPHONE CB-510

* **Supplied by:**
  Radio Parts,
  562 Spencer St.,
  WEST MELBOURNE, VIC. 3000
* **P&T Approval No:** 249022
* **Serial No:** K00042133
* **Recommended Price:** $75

MANUFACTURER'S SPECIFICATIONS

General

Channels	18
Freq. Control	PLL Synthesizer
Tolerance	+/– 0.005%
Voltage Supply	13.8 Vdc (nom.)
Grounding system	pos. or neg. ground
Dimensions	62mm x 160mm x 200mm

Transmitter

RF power output	4W carrier
Spurious emissions	60dB
Modulation Capability	less than 100%

Receiver

Sensitivity (10dB s+N to N)	0.7uV
Selectivity	6kHz (at –6dB)
Adjacent ch rejection	50dB
Image rejection	60dB
AGC range	75dB
Audio output	3W

TEST REPORT — CB-510

Supply voltage	*13.8Vdc*
Current drain	
Rx only:	*215mA*
Tx:	*1.4A (full mod.)*
Freq. Accuracy	*within 200Hz*
Transmitter	
RF power output	*4W*
Harmonic level	*not measured*
Modulation %	*80%*
Receiver	
Signal to noise ratio at specified input	*8dB (at 0.7 uV)*
Adjacent ch. rejection	*40dB*

ELECTROPHONE CB-530

* **Supplied by:–**
  Radio Parts,
  652 Spencer St.,
  WEST MELBOURNE. VIC. 3000
* **P&T Approval No:** 249023
* **Serial No:** K00033916
* **Recommended Price:** $119

MANUFACTURER'S SPECIFICATIONS

General
as for CB-510

Transmitter
as for CB-510

Reciever

Sensitivity 10dB s+N to N)	0.7uV
Selectivity	6kHz (at –6dB)
Adjacent ch. rejection	50dB
Image rejection	60dB
Spurious rejection	60dB
AGC range	75dB
Audio output	3W
Delta-tune range	+/– 1kHz

TEST REPORT — CB-530

Supply voltage	*13.8Vdc*
Current drain	
Rx only:	*240mA*
Tx:	*1.35A (full mod.)*
Freq. Accuracy	*within 150Hz*
Transmitter	
RF power output	*4W*
Harmonic level	*not measured*
Modulation %	*80%*
Reciever	
Signal to noise ratio at specified input	*10dB (at 0.7uV)*
Adjacent ch. rejection	*40dB*
Delta-tune range	*+/– 1.4kHz*

TEST EQUIPMENT

Hewlett Packard model 8558B signal generator
Hewlett Packard noise and distortion set 334A
Bird Model 43 RF power meter. Sierra 500 W dummy load.

U.H.F. CB antenna strength loss is no longer a problem.

Philips introduce the battery operated Field Strength Meter which lets you measure the efficiency of your U.H.F. C.B. band antenna. F.S.M. sensitivity is such that measurements are normally made at distances greater than 20 metres from the antenna being monitored or tested. The small detachable quarter wave pick-up antenna is inserted into the INPUT socket on top of the F.S.M. If a remote antenna is required in place of the one provided the feeder from the antenna is connected to the input socket.

The F.S.M. enables day to day checks of transmitted radiated power, comparison of relative gain between antennas, and accurate measurement of radiated power to construct a polar diagram.

Service
Service
Service

PHILIPS

An important addition to your U.H.F. C.B. radio operation. For further information contact your local Philips Service Branch on the following telephone numbers, or bring your rig in for a test.

Sydney 736 1233, Newcastle 61 1631, Canberra 95 0321, Melbourne 699 2731, Hobart 28 0121, Brisbane 221 5422, Townsville 79 7422, Adelaide 223 4735, Perth 322 4653.

Specifications of the Philips U.H.F. field strength meter

Frequency Range	477MHz + 5MHz. Input Impedance...50 Ohms.
Input Level	−30dBm (+ 1.5dB) at maximum sensitivity.*
Scale Calibration	− 10dB to + 1dB, relative to −30dBm input.
Power Supply	2 Standard 9V transistor radio batteries.
Battery Life	With normal intermittent use − over 150 hours. This will be double with long life batteries.

*When the sensitivity control is set at MINIMUM, a further reduction of approximately 10dB is provided. This control is combined with the ON/OFF switch.

(Also illustrated are 2 of the new Watt meters for signal measurement)

McCANN 184.0013

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Sale Ends 30th June, 1979

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Regular Retail Price 149.95

129.95

Specifications

Sensitivity for 10 dB S+N/N: 0.5 microvolt. Adjacent Channel Rejection: 80 dB. Audio Output: 5 watts max. RF Output: 4 watts max. Spurious Radiation: Better than −65 dB. Frequency Tolerance: Better than 0.002%. Modulation Capability: 90 to 100%. Power Requirement: 240VAC. Size: 12.0x30.0x24.7cm.

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Realistic TRC-420. Compact, yet loaded with features for "big radio" performance. Auto-modulation to maximise your talk-power. Two ceramic filters for superior selectivity and freedom from adjacent channel interference. Features lighted S/RF meter, full-time ANL, external speaker jack. With mobile mounting bracket, dynamic mike with locking plug. DC power cables. 21-9420

79.95

Regular Retail Price 89.95

Specifications

Sensitivity for 10 dB S+N/N: 0.5 microvolts. Adjacent Channel Rejection: 60 dB at 10 kHz. Audio Power Output: 5 watts maximum. RF Power Output: 4 watts maximum. Power Requirement: 12VDC positive or negative ground. Size: 4.1x13.3x19.6cm.

AM/SSB Base — Goes Mobile Too!

- *Auto-Modulation control*
- *LED Channel readout*
- *ANL*

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Realistic TRC-458. Put your signal across with far more power than the best AM radios. PLL circuitry for rock-stable performance on all 18 AM and 36 upper/lower sideband channels. Includes jacks for mobile PA and remote CB speakers, front panel ¼" headphone jack, RF gain control and S/RF meter. Adjustable mounting bracket, AC and DC power cords. 21-9458

AM/SSB CB Transceiver Budget Priced! Noise Blanker and RF Gain Control

- *12-watt P.E.P. SSB output*
- *18 AM Channels, 36 SSB Channels*

229.95

TRC-448. Includes many fine features like PLL circuitry, clarifier for fine tuning SSB reception, dual IF's and a crystal/ceramic filter for sperb selectivity. Noise blanker cuts impulse interference and an automatic modulation gain circuit provides 100% "talk power" without a power mike! Mobile bracket. Push-to-talk mike, DC power cord with inline fuse. 21-9448

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TS-820S series
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January's great tropospheric opening

Roger Harrison, VK2ZTB

There was considerable excitement on the two-metre band during January when it 'opened' for nigh on a week between the NSW seaboard and New Zealand. Although most readers will have heard about or read the details by now it's interesting and instructive to go over the event in relation to the weather patterns of the period.

THE OPENING appeared to commence late in the afternoon of the 7th of January. John, VK2AYC worked ZL1DR via New Zealand repeater D just before 0700 Z that day. The first direct contacts followed around 0900 Z. From that time, right through to 1200 Z, Australian stations from up and down the NSW coast worked into ZL1 at signal strengths around 5 x 4 up to S7 at times. Both SSB and FM (simplex, and via repeaters) were used.

The Bureau of Metereology, Sydney, kindly allowed me to examine their records of daily balloon flights from Mascot covering 6–13 January. From these I have obtained details of the temperature inversion over the Sydney end of the tropospheric path. The Bureau also supplied the daily weather maps reproduced here.

On the evening of 7 January a cold front passed across the lower south-east corner of the continent and a high of around 1020 millibars (mb) was sitting over New Zealand. At 0300 EAST on the 7th there was a developing temperature inversion over Sydney commencing at 350m, the temperature rising from 18°C to 26°C between 350 and 700 metres. then steady at 26°C to 1.2 km.

On the 8th, another cold front advanced across the Great Australian Bight, but this didn't reach the south-eastern corner of the continent till the following day. The high remained over New Zealand, with some change in the isobaric contours. The action this day seemed to peak between 0800 Z and 1300 Z, although this may be the times when amateurs are not otherwise employed! The 0300 EAST balloon flight showed a possible duct develping between about 1 km and 1.5 km. the record shows a distinct temperature inversion between 900 and 1.2 km returning to the usual negative lapse rate up to 1.45 km where it once again 'inverted', the temperature going in the positive direction up to 1.7 km.

Again, VK2 to ZL contacts predominated. Stations up and down the NSW coastline were working each other, for the first time during the event, on this day. Tropospheric refraction conditions were certainly greatly improved.

On the 9th, the cold front south of the continent had pushed the isobaric contours up diagonally across the Tasman and a low sat over eastern Victoria. Signals between VK2 and ZL1 were generally better this day and the action peaked between 0700 and 1400 Z (1700 to 2400 EAST). *A number of contacts were made on 432 MHz.* Rod, VK2BQJ worked ZL1TAB at 0815 Z, continuing to 1025 Z and then again at 1100 Z, though much weaker.

This appears to be the first 432 MHz trans-Tasman contact reported. It shatters the NSW distance record for the band but falls just short of the Australian record.

Dick, VK2BDN, unfortunately had difficulty as the ZL station could not properly resolve his signal.

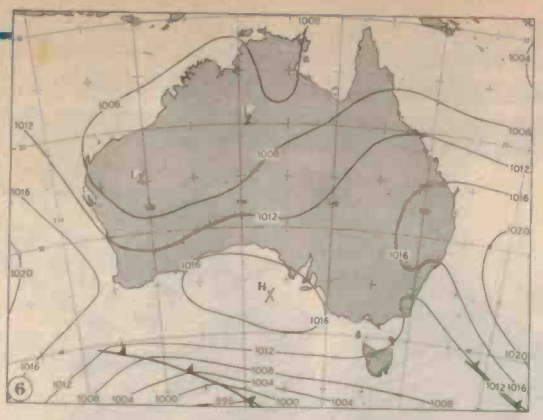
The 0300 EAST balloon flight showed the inversion to lie between 200 and 800 metres over Sydney, the temperature rising from 21 to 29°C.

On the 10th, plenty of signals were up to S9 or more. ZL1 to VK2 again mainly, with several ZL2 stations appearing – a rarity in NSW. One-way signals were heard on 432 MHz after 2100 Z. Best 2m band performance was between 2000 and 2300 Z. The weather map for the morning of the 10th shows the cold front slipped down beneath Tasmania, a high of 1016 mb sitting over the Bight and the high remaining over New Zealand. The inversion over Sydney was between 150 and 500 metres, the temperature rising from 23°C to 33°C.

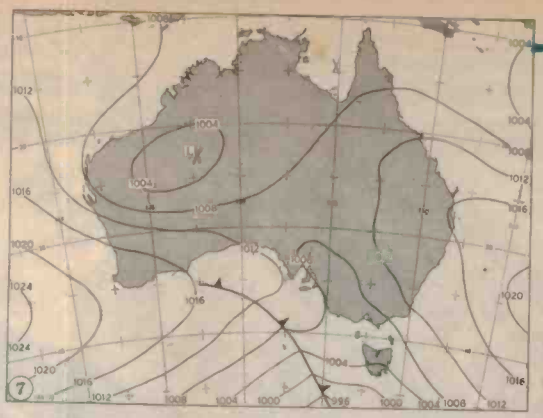
Conditions deteriorated rapidly the following day, and nothing was heard after 0700 Z. The 0300 Z balloon flight showed that the temperature inversion had risen to 900m at the base, the temperature increased from 16°C at that height, to 27°C at 1.2 km. Atmospheric conditions became disturbed and, by the balloon flight at 1700 Z (0300 EAST the next day), the inversion layer was clearly broken up, some not well-developed inversions existing around 1 km and 1.6 km over Sydney exhibiting only small (1–3°C) positive temperature changes.

The weather map for the 11th shows a cold front which passed into the Tasman, between NSW and New Zealand, running NW-SE and a considerable change in the isobaric contours. This cold front was probably largely responsible for the break up of the excellent tropospheric conditions of the previous week.

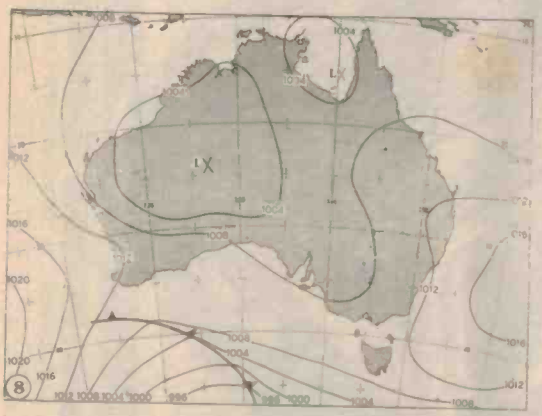
The most notable features of the weather pattern over the period were the fairly constant air pressure over the NSW seaboard (around 1012 mb) and the stable high located over New Zealand. A number of low pressure systems over the northern area of the continent probably contribute to the inversion conditions being confined to the NSW coastal region, and not spreading to Queensland.



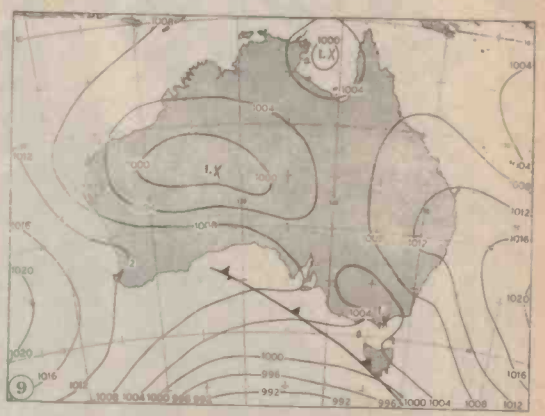
6 Jan: a high over NZ, cold front passes south of the continent



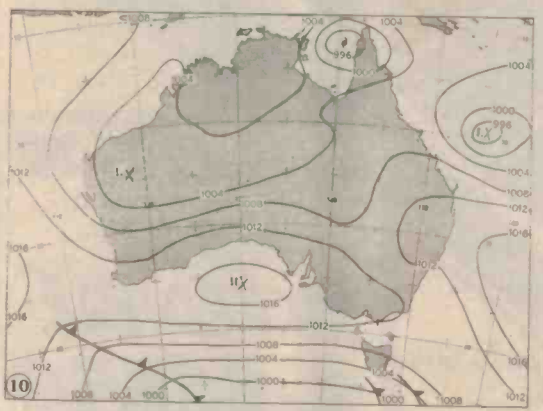
7 Jan: high remains over NZ cold front passes across southern states.



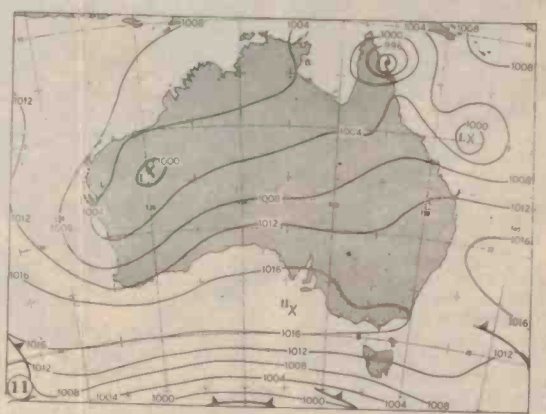
8 Jan: it seems a duct developed over the Tasman this day.



9 Jan: a cold front south of the continent alters the isobaric contours.



10 Jan: a high has moved over the Bight. More 432 MHz action on this day.



11 Jan: conditions dropped out finally and nothing heard after 0700 Z.

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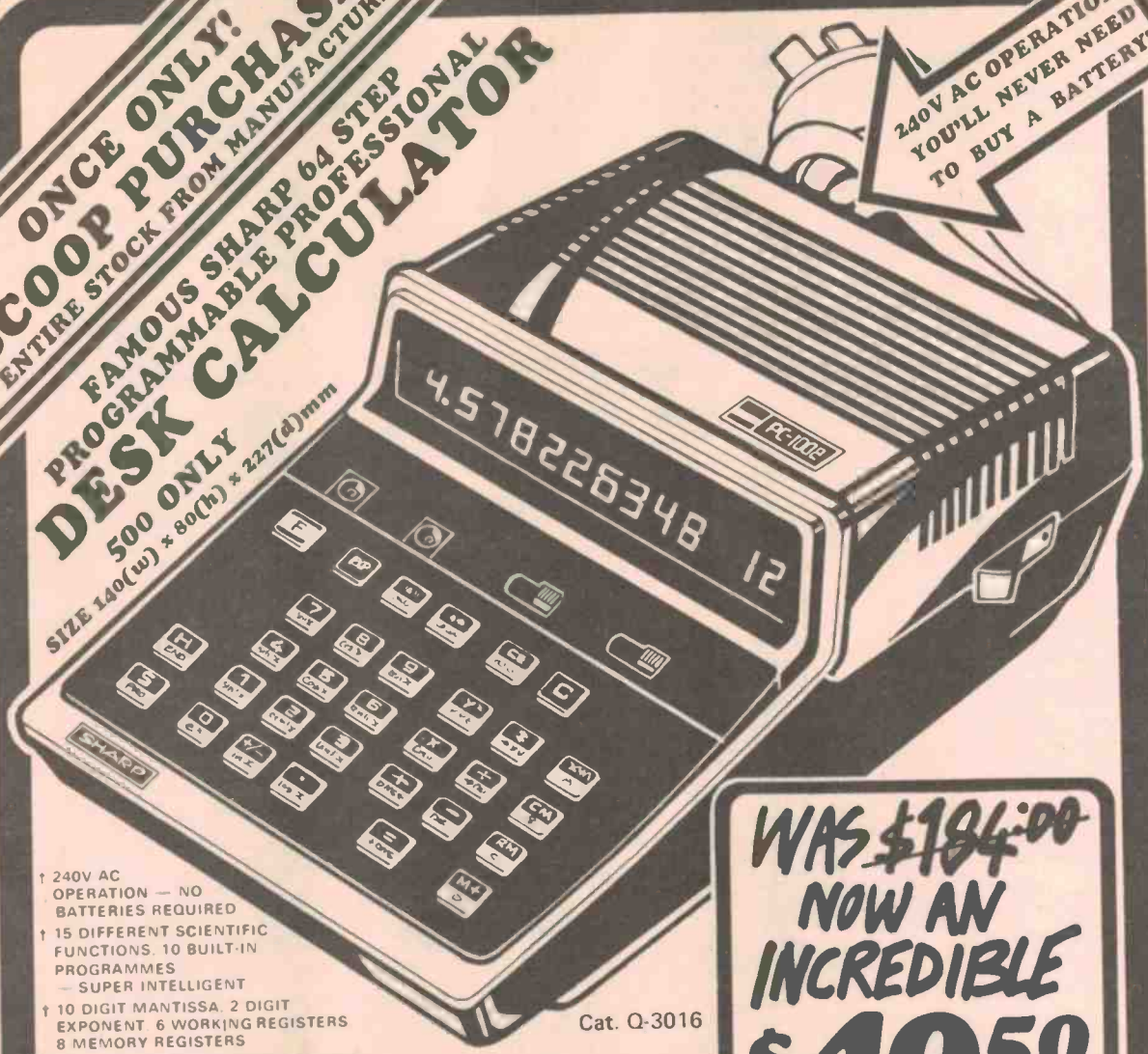

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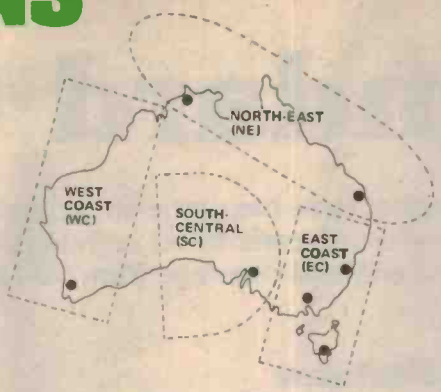
PREDICTIONS JULY 1979

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time – commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

ETI – Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.



These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

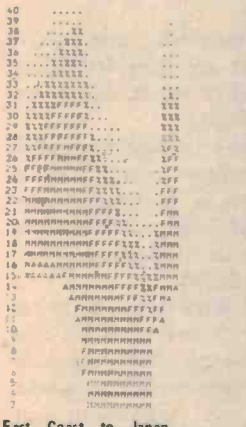
F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

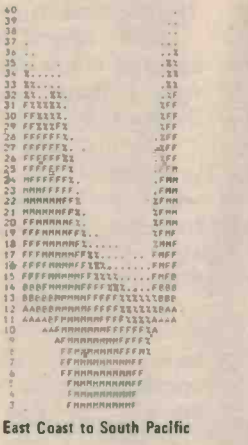
M . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

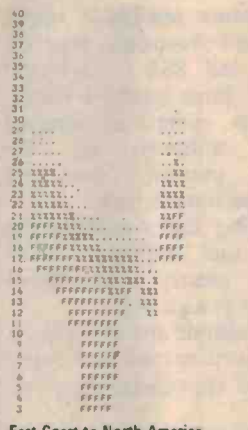
A . . . . . High absorption indicated. Expect weak signals.



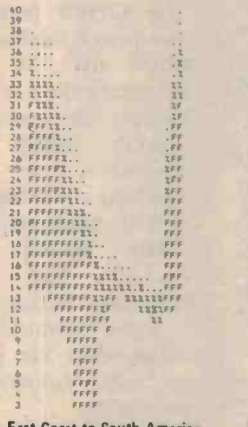
East Coast to Japan (Also serves N.E. and S.C.)



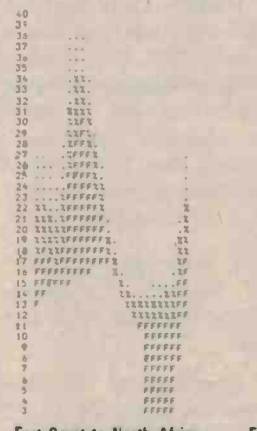
East Coast to South Pacific



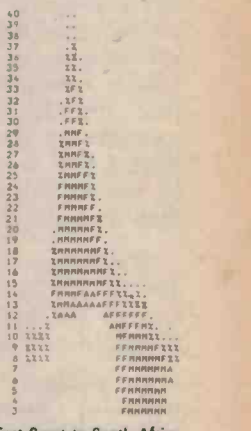
East Coast to North America (Also serves N.E. and S.C.)



East Coast to South America (Also serves S.C.)



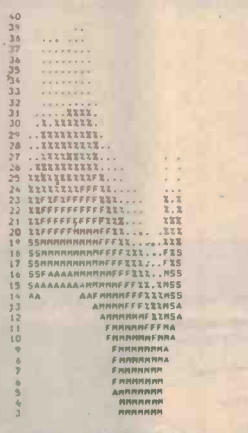
East Coast to North Africa (Also serves S.C.)



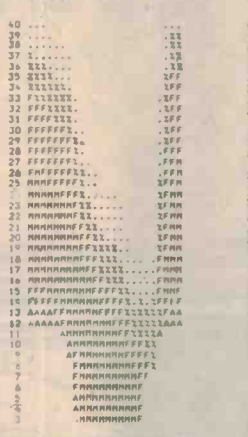
East Coast to South Africa (Also serves S.C.)

East Coast to Europe (Short Path)

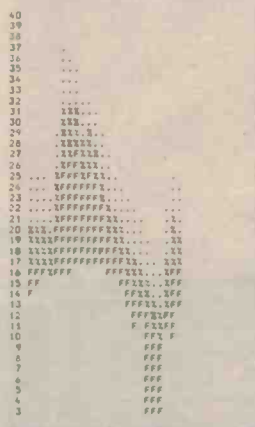
E.C. and S.C. to Europe (Long Path)



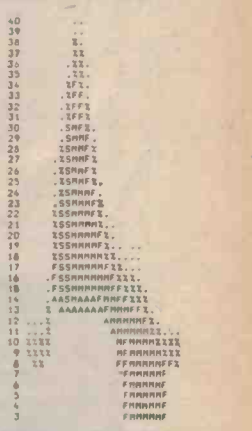
East Coast and S.C. to Persia



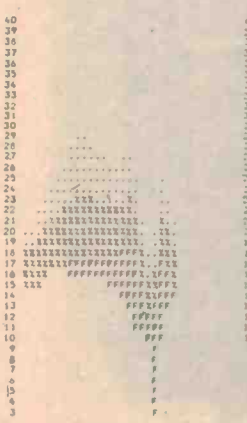
North East to South Pacific (Also serves S.E.)



North East to North Africa



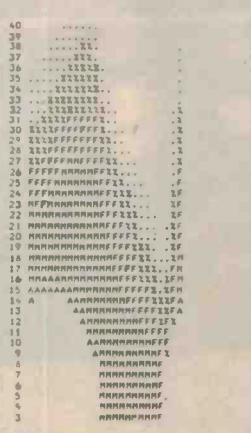
North East to South Africa



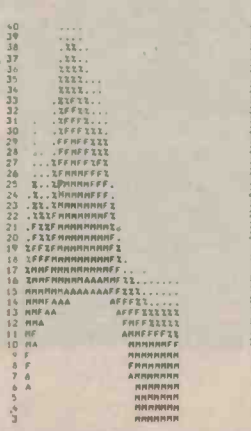
North East to Europe (Short Path)

S. Central & W.C. to Europe (Short Path)

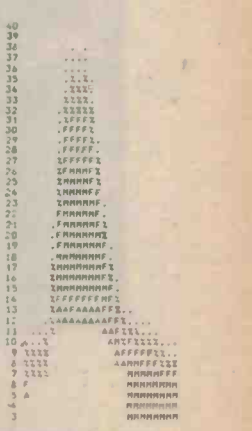
West Coast to North America



West Coast to Japan



West Coast to North Africa



West Coast to South Africa

A Review of the

Standard C6500

With the rising sunspot cycle has come an increased interest in shortwave listening — and a rash of receivers to cater to an enthusiastic market. This receiver features a 'Wadley loop' front end and coverage from 500 kHz to 30 MHz.

GENERAL COVERAGE shortwave receivers using the Wadley Loop method of frequency band selection first began appearing in the early '70s. The Wadley loop is a frequency conversion scheme that provides selection of 1 MHz segments by the receiver's 'front end', these 1 MHz segments then being tuned by a more or less conventional receiver that has only a 1 MHz tuning range.

Wide frequency coverage, a 'slow' tuning rate and accurate frequency readout are features possible with the Wadley loop scheme.

A detailed examination of the technique appeared on pages 71 to 73 of our February issue this year in a review of another Wadley loop receiver.

Features

The C6500 features selectable upper and lower sideband reception, separate filters for AM and SSB – selected automatically, a large scale S-meter, battery or mains operation, internal speaker, whip antenna, an RF attenuator to prevent front-end overload and a tape output jack.

The main tuning dial combines the "MHz" readout dial and the "kHz" readout dial, greatly facilitating frequency readout at a glance.

Panel layout is simple and functional, all controls are well spaced and easily accessible. General appearance is unprepossessing.

The S-meter is particularly easy to see and use, although one should remember that such things are only 'relative' indicators.

Both screw terminal and RCA antenna connectors are provided along with a 'mute' facility via terminals on the receiver's rear facia.

The dial light may be switched off – presumably to reduce current drain when the receiver is operated from batteries. The C6500 may be run from eight UM1 dry cells if desired. They mount inside the cabinet.

A detachable telescopic whip is provided with the receiver. This is a handy little adjunct for portable operation under circumstances where antenna erection is impossible or inadvisable. It's also good if you want to use the receiver as a signal monitor.

receiver

Performance

On the air, the C6500 is quite a lively performer. Sensitivity is excellent, it pulled in many quite weak stations with good clarity. Selectivity is not 'communications receiver' standard, but good for this type of receiver. Separate filters for AM and SSB makes quite a difference.

The tuning rate is a little 'fast', although one would get used to it. The clarifier has reasonable range without being 'savage' in operation. It's a little touchy clarifying SSB signals.

The MHz selector is quite easy to operate — putting the MHz and kHz dials together was a good idea, it certainly makes frequency readout much simpler than a separate-dial arrangement. The addition of a 'lock' indicator would have been a great help.

The pre-selector operates smoothly and is neither too broad nor too sharp in tuning.

Audio quality was excellent — not hi-fi mind you, but quite pleasant for this sort of application.

Front end overload and cross-modulation was evident with a number of strong, closely-spaced signals on crowded bands, but the RF attenuator improved matters markedly. One cannot really expect 'communications receiver' performance at the modest price of this equipment.

In general the controls, other than the tuning, operated smoothly. Frequency stability proved excellent — certainly up to good SSB standard.

A handbook as such is not provided, but a fold-out poster-sized sheet, printed both sides, accompanies the receiver. Though unusual, it is clear, well laid out and informative. It includes details on operation of the receiver and details on antenna arrangements.

On the test bench

Sensitivity was quite a deal better than what the manufacturer quoted. A number of difficulties prevented us from measuring the SSB selectivity (Murphy's Law), but, as the AM selectivity exceeded the specifications, one could expect reasonable figures. Separate AM and SSB filters are unusual in this type of receiver, although included in higher-priced models.

Crossmodulation and overload, while nothing wonderful, are all one could expect from a piece of equipment in this price class. Certainly better than a number of the higher-priced "all-singing, all-dancing" general coverage 'consumer' portables.

AGC performance is not bad at all with a range of 90 dB for only 6 dB change in audio level. It certainly takes care of the sort of fades generally experienced on the shortwave bands. It shows up quite well on the broadcast band as well.

The S-meter is a delight. It's easy to read with scale intervals not too far from 6 dB per S-point (the 'classic' division) from S1 to S8. It wouldn't even reach S9+20 at one volt input! The AGC won't let it.

Summary

Overall, quite a neat performer — definitely worth close scrutiny at the price whether you're considering casual general listening or serious DXing.

STANDARD C6500 RECEIVER

- Supplied by:— G.F.S. Electronic Imports, 15 McKeon Road, MITCHAM. VIC. 3132 (03) 873-3939
- Serial No: E050090
- Recommended Price: $359

MANUFACTURER'S SPECIFICATIONS

Frequency Range	0.5MHz to 30MHz
Types of emission	AM, SSB, CW
Sensitivity: SSB/CW (at 10dB s+N/N)	AM: 5uV at 0.5—1.5MHz 1uV at 1.5—30MHz SSB: 1uV at 0.5—1.5MHz 0.5uV at 1.5—30MHz
	(AM, 30% modulation, 1kHz)
Selectivity: SSB/CW	4kHz @ —6dB 8KHz @ —30dB
AM:	7kHz @ —6dB 13kHz @ —30dB
Stability	Within 500Hz after warmup
Audio output	1.5W @ 10% distortion
Power supply	220Vac, 12Vdc or 8x1.5V
Dimensions	290mm deep, 156mm high, 340mm wide
Weight	6.4kg

Fine tune control, internal speaker, internal/external battery operation, tape recorder output socket, attenuator switch, both terminal and RCA (coax) antenna connectors, attachable telescopic antenna, 'mute' connector.

TEST REPORT

Sensitivity: 10.5MHz (10dB SINAD) 28.5mHz	*AM: 0.55uV SSB: 0.14uV AM: 0.65uV SSB: 0.2uV*
Selectivity: at —6dB	*AM: 6.2kHz*
at —30dB	*AM: 10.8kHz*
at —50dB	*AM: 12.5kHz*
Stability:	*within 200Hz over one hour after 30 min warmup*
Crossmodulation:	*A signal 55dB above wanted signal and 100kHz away produces approx. 6dB increase in audio output.*
Overload:	*Output distortion commences at 70mV signal input (—10dBm)*
AGC performance:	*Less than 6dB audio output change for 90dB change in signal level*
S-meter:	*Roughly 6dB per S-point from S1 to S8. will not indicate S9+20 even at 1V input! S1 = 0.3uV; S9 = 90uV*

TEST EQUIPMENT:

Hewlett Packard signal generator model 8558B
Frequency meter: digital counter in HP sig. gen. above.
Hewlett Packard noise and distortion meter model 334A.

Print-out

Computer Graphics Allowed As Trial Evidence

A hearing to determine the causes of a rail accident which killed seven people in the US has allowed the use of a computer simulation of the event to be used as evidence.

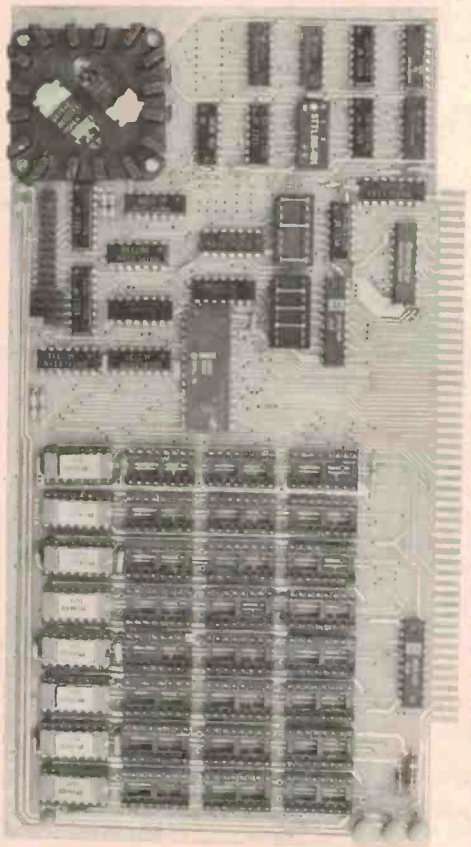
The question was: at what speed was a boxcar travelling when it was being coupled to a tank car carrying LPG (liquified petroleum gas — a potentially very explosive substance).

Was the railroad to blame — by coupling the two cars too fast, or were the tank car's designers to blame — by not allowing enough strength in the coupling mechanism?

The essential parts of both vehicles were simulated colliding at various velocities and the resulting deformations in the tank car were displayed. The result of the hearing was that the collision had occurred at over 50 km/hr and so the design had been pushed beyond its specifications.

The railroad company had to pay damages in excess of $US20 million.

The accident happened in Decatur, Illinois.



This is the new S-100 RAM card from Rod Irving Electronics. It is shown with 16 K of RAM chips inserted. The card has sockets and decoding for a total of 64 K. **Rod Irving Electronics, at Shop 499 High St, Northcote, Vic 3070.**

Computa-Guard

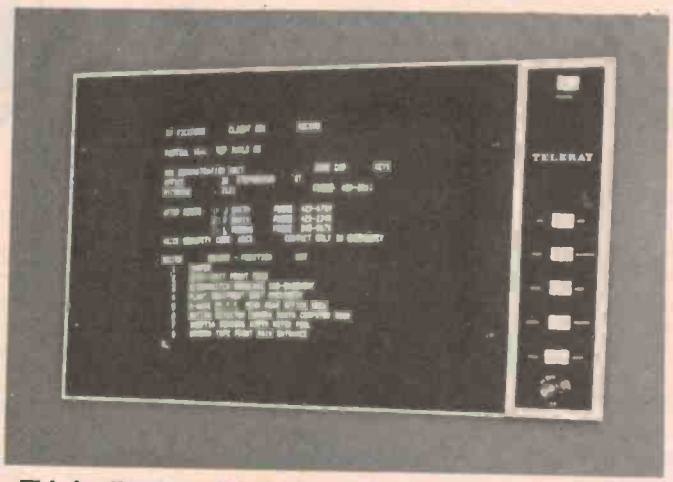
For years, burglar alarms were simply devices that made a noise when a premises was broken into. They were installed entirely within that premises and were easily tampered with. Now Metropolitan Security Services have unveiled a system which monitors all the alarms in an area using a central computer.

The 'front end' of the system is a variety of break-in detectors, such as conductive window tape, door switches, microwave motion detectors and the like. These are installed by MSS and connected to a monitoring unit, also in the client's premises. This is connected by Telecom land-line to a central microprocessor-controlled 'interrogator' which, every couple of seconds, sends a signal to the monitoring unit to ask it if it is okay.

This makes the whole system almost un-tamperable.

The chances of a burglar being able to disconnect the monitoring unit while it is not being interrogated and connect something which will simulate its response is very small.

The client's monitoring unit also has a keyswitch which enables him to change the status of the unit from 'day' to 'night' mode.



This is all very well, but it's what the system does with the information it receives from the monitoring unit that's the really clever bit.

Unlike most similar systems, the central computer can tell which of the alarm circuits has been set off. This has several advantages.

The central computer operator (who telephones the police whenever a break-in occurs) can tell where the thief entered the premises.

He can also tell if the client has forgotten to switch his unit into 'day' mode — an alarm will be given for the front door at the time it is usually opened.

He can even tell if the owner has forgotten to set the alarm as he left — the computer can be programmed to check for the alarm being set to 'night' mode after a certain time. The operator will then phone the client — whose telephone number will be given to him by the computer — and see if he is still in the building. When he gets in touch, or when the client telephones to change any of the information he has given MSS, a four-letter code is used which identifies that particular client.

At any time, a report can be generated by the computer, specifying the events (false alarms, normal entries, or whatever) that have occurred in a specified period.

Metropolitan Security Systems, 17 Tennyson Rd., Mortlake, NSW 2137.

Bringing home the bacon

Australian computer manufacturer D.D. Webster Electronics Pty. Ltd. of Scoresby, Victoria, recently completed its most unusual installation to date — to a pig farmer.

Development tool

A new gizmo called the Microcommunicator Model 177 is now available from **measuring and Control Equipment Co. Pty. Ltd., PO Box 78, Epping, NSW 2121. Tel: (02) 86-4060.** Incorporating an ASCII keyboard, printer, digital cassette recorder, alphanumeric display, EPROM programmer/verifier, and editing keys, the unit measures only 80 x 300 x 210 mm and weighs just 3.9 kg — small enough to fit into an executive briefcase!

The discharge printer provides 32 characters per line of hard copy transmitted from the keyboard, cassette tape, PROM or other on-line system. The digital cassette recorder employs an ANSI spec data minicassette capable of recording 32K bytes in 64 byte fixed length records.

Display of four lines of 16 characters is provided by sixteen 18-segment alphanumeric LED readouts with an additional line number readout. In an alternative mode eight lines of eight hexadecimal characters can be displayed. A further three character display indicates ROM address and special messages. The EPROM socket accepts 2758s and 2716s which can be programmed and verified by the unit.

A 20 mA current loop or TTL interface provides communication at eleven, switch-selectable speeds ranging from 75 to 19 200 baud.

Paul Davis of Bamawm, is a Diploma of Business Studies (EDP) graduate from the Royal Melbourne Institute of Technology who spent 12 years as a programmer and systems analyst before taking up pig farming in partnership with his wife and parents three years ago.

The computer, Webster's double-sided double density Computex Spectrum-II model D, has been installed in the farmhouse lounge room with an ADM3A video terminal, a Teletype 43 printer, and RT11 operating system at a total cost of $13 500. It will be used to assist breeding a superior bacon stock and also provide information and advise on all management and accounting matters.

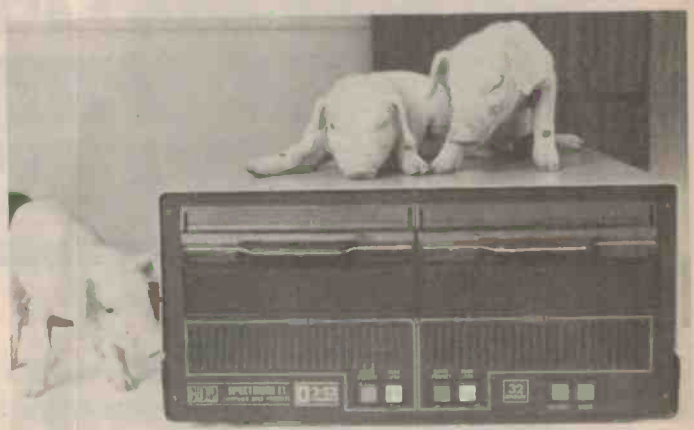
Further information from D.D. Webster Electronics Pty. Ltd, 1326 Ferntree Gully Road, Scoresby 3179. Tel: (03) 763-7294.

Matrox boards

Two new boards from Canadian manufacturer Matrox Electronic Systems provide 24 line x 80 column alphanumeric displays for the S100 and EXORciser busses.

The ALTR-2480 and EXO-2480 boards employ a new design to eliminate bus contention when the processor tries to access the video memory at the same time as the CRT controller. The transparent memory design is completely general and does not depend on the peculiarities of a particular processor's memory access timing; it is claimed to obviate annoying flashes on the screen or processor slow-down and halts.

Matrox products are available from **Measuring and Control Equipment Co. Pty. Ltd., PO Box 78, Epping, NSW 2121. Tel: (02) 86-4060.**



Z-8000 is coming!

Launched on the crest of a veritable wave of rumours and speculation, Zilog's (and AMD's) Z-8000 microprocessor is now becoming available in production quantities. Widely touted as 'comparable to a PDP11/70', the Z-8000 is the most advanced 16-bit microprocessor to date.

Sporting a set of sixteen general-purpose 16-bit registers, the Z-8000 can operate on seven main data types: bits, BCD digits, bytes, words (16 bits), long words (32 bits), byte strings and word strings. Eight user-selectable addressing modes include five main modes: Register, Indirect Register, Direct Address, Indexed and Immediate. For certain instructions there are several other addressing modes: Base Address, Base Indexed, Relative Address, Autoincrement and Autodecrement.

Over 410 meaningful combinations of instruction types, data elements and addressing modes are available with the Z-8000, which also provides signed multiply and divide instructions in hardware for both 16 and 32 bit values.

In view of its intended application area in large systems, the Z-8000 can address a large memory space; up to eight megabytes in each address space. There are six address spaces; code, data and stack for both the system mode and the normal mode.

The Z-8000 will be second sourced by Advanced Micro Devices (AMD), whose version is designated the AmZ-8000.

Obviously, it is impossible to give more than a tantalising glimpse of the power of the Z-8000 in a short news item, and we will have more to say on the Z-8000 in the future. In the meantime, further information is available from the distributors: for Zilog, **Zap Systems Pty. Ltd., 3 Small Street, Broadway, NSW 2007.** and for AMD, **R & D Electronics Pty. Ltd., 23 Burwood Road, Burwood 3125.**

New clubs

Two new clubs have come to our attention this month:

From Adelaide, R.G. Stevenson writes to advise us of the formationof a **TRS-80 User's Group** in that city. Monthly meetings are held; for further details contact **Mr Stevenson at G.F. Stevenson Printers, 34-36 Sturt Street, Adelaide 5000.**

Geelong Computer Club meets on the second Thursday of each month at **Tybar Engineering, Hampton Street, Newtown, Geelong 3220.** The contact for information is Ian Stacey on (052) 22-1455 (business hours).

WORD PROCESSING PLUS FROM VECTOR GRAPHIC. A SMART INVESTMENT.

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● Type anywhere on screen ● Automatic carriage return ● Variable tabs, evenly spaced or arbitrary ● Tab ruler on screen ● Cursor "arrow" key for cursor up, down, left, right ● Cursor to top of screen, top of text, end of screen, end of text, beginning of line ● Variable speed, variable directional scrolling, automatic or manual ● Scrolling by pages under operator control, for proof-reading ● Status report of memory usage ● Count of words and characters in document ● Character-oriented editing, no need to specify text to be changed, line number or page number ● Over-type or insert modes ● Insert line ● Automatic realignment and repagination after insertion or deletion ● Delete: character, to end of line, line, portion, to beginning of text, to end of text ● Backspace with or without automatic realignment ● Cut and paste ● Search, with wild-card characters if desired ● Global or partial search and replace ● Keyboard is under video console for operator comfort

PRINTING

● 55 Characters/second, bidirectional, typewriter-quality printer ● Mid-text (changeable) stored format directives ● Standard values for format variables can be used ● Reset variables to standard by embedded directive or keyboard command ● Variable margins ● Automatic paragraph indentation ● Automatic right-justification, using variable character, not word, spacing ● Variable type density ● Variable vertical spacing ● Variable page length ● Different size pages may be mixed ● Automatic bold face ● Automatic underscore ● Automatic centreing ● Sub-scripts, super-scripts ● Automatic forward or backward paper rolling ● Print and move columns ● Automatic page numbering: right, left, or centre, top or bottom ● Alteration of layout for both-sides printing ● Optional manual control of page and line number during printing ● Automatic headers, footers; right or left justified or centred ● Append text in mid-page at print time, for document too long for memory ● Line-by-line, page-by-page or continuous printing ● Temporary stop for print-wheel or ribbon change ● Formfeed from console ● Printer test from console ● Status of format variables on screen during printing or anytime desired ● Type directly to printer ● Merge sorted mailing list with letter ● Create, modify, sort by post code, sort by date, sort by name, and print mailing list.

COMPACT DISK FEATURES

● View status of disk ● Write-protect disk ● Copy disk ● Initialize disk ● 2 Quad-density disk drives ● 160 pages typed text per disk ● To reference document, move cursor to name in directory on screen; never need to type document name ● 2-second document update on disk ● No constant automatic update to disk to slow system down ● Recall and save document ● Append document; fast boilerplate assembly ● Erase document ● Protect, unprotect document ● Copy document to order drive.

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Print-out

Meanwhile, at Intel . . .

The latest AMD ads in US publications compare the AmZ-8000 with Intel's 8086, obviously favouring the AmZ-8000. It is true that the Zilog designed processor is more powerful than the 8086 CPU, as even Intel's engineers would perhaps admit, but AMD may be accused of counting their chickens, etc.

Motorola and TI . . .

Motorola have been talking about the forthcoming 68 000 16-bit micro for some time now, and it certainly sounds great, but so far there's been no sign of actual hardware. However, that could have changed by the time you read this, as first samples of the 68 000 were due out of the ovens in mid-May. Who said it was too big for Motorola to make it?

Motorola have also been talking to Hitachi, who will be the first second source (?) for the micro (somehow it doesn't seem right to call it a **micro**) and will also assist with development of peripheral chips.

At Texas Instruments, the TMS9900 product line is being filled out with the addition of a new Direct Memory Access (DMA) controller IC. The TMS9911 provides independent I/O at rates up to one million 16-bit words per second on two separate channels. The DMA controller takes over the bus, shutting out the CPU and other bus masters, and generates all the appropriate address and timing signals.

Is anybody out there doing anything with 8-bit processors? (Or maybe how about 32?).

'Versatile' computers

Most computers are versatile, but this one is more versatile than most; the 'Versatile 4' small computer system is made by Computer Data Systems, of Wilmington, Delaware and is available in Australia from **Microprocessor Applications, Maskell's Hill Road, Selby 3159. Tel: (03) 754-5108**

The basic system features an 8085 processor, 32K RAM memory and dual Micropolis disc drives with a total of 630K bytes of formatted storage. The disc controller allows the addition of another two drives. The system comes complete in a fully enclosed cabinet with built-in keyboard and 24 line by 80 character video display.

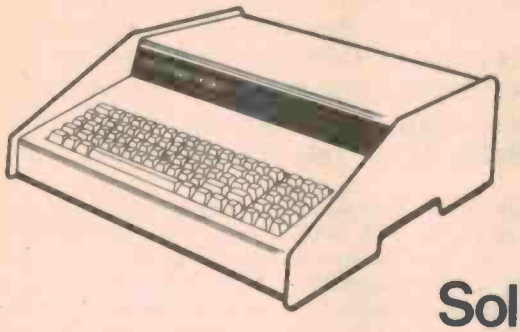
Standard software with the unit is the Micropolis DOS which includes a line editor, 8085 assembler and program development utilities and the new Micropolis extended BASIC interpreter. The total retail price is $5900 before tax.

Additional software packages include CP/M, CBASIC II, Microsoft BASIC, COBOL and FORTRAN. Australian-written accounting packages are also available. Leasing arrangements, a full 90 day warranty and complete service back-up are also provided.

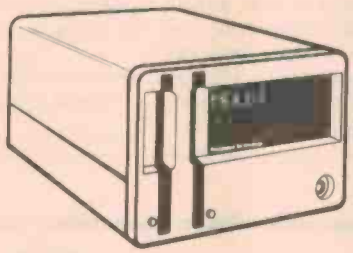
Microprocessor Applications are also agents for the Integral Data Systems printer, as well as offering consultancy services, particularly for users of Intel iSBC and similar systems.

Compiled by Les Bell

COMPUTER BITS



Sol



Helios II

ProcessorTechnology

Sol Specifications

- Keyboard: 85 key upper/lower case with separate numeric keypad. Upper-case shift, shift-lock, cursor control and repeat keys provided. System reset performed by simultaneous depression of control keys. Indicator lights (LED) for local, upper case and shift.
- Character set: 96 printable ASCII upper and lower case characters plus 32 optionally displayable control characters.
- Cursor: Switch-selectable blinking. Block video inversion. Program controlled positioning standard. Cursors may exist at any or all character locations.
- CPU: 8080A. Uses same machine language as other 8080 systems. 2 MHz clock cycle time. 78 instructions.
- Cassette interface: 120 character per second CUTS format or 30 character per second Kansas City format, selected by software. Uses audio cassette function of microphone start-stop switches. AGC for level insensitivity. Phase-locked data recovery tracks with speed variations. Software performs CRC data integrity check each 256 characters.
- Serial interface: RS-232 and 20 mA current loop, 75 to 9600 baud, asynchronous. 25 pin female "D-type" connector on card.
- Parallel interface: Eight data bits for input and output; output bus is tristate for bidirectional interfaces; levels are standard TTL. 25 pin male "D-type" connector on card.
- External memory: Expandable to 65,536 bytes total ROM, PROM, and RAM. Uses S-100 standard modules.
- Video signal output: 1.0 to 2.5 volts peak-to-peak. Nominal bandwidth is 7 MHz.

Your key to effective, economical computer power.

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Beginners' Buying Guide

Thinking of getting into personal computing? Which route should you choose — an 'up-market' system, such as the Exidy Sorcerer (right) or the cheaper and more demanding way, with a single board development system such as the Synertek VIM (left). Phil Cohen gives some pointers.

WHAT EXACTLY *is* a personal computer? Is it an oracle which sits in the corner of the room and gives out mathematically precise predictions? Or a robot which tirelessly controls house lighting and air conditioning?

Or just a rich man's toy?

The hobby computer market has split into two clearly-defined areas: The first is exemplified by products such as the Commodore PET, the Exidy Sorcerer and the Tandy TRS-80. This is the "easy-to-use, plug-in-and-go" high end of the market. Applications. Teaching the buyer how to use a computer, working as a calculator, figuring bank balances and astrological charts, playing 'sophisticated' computer games.

The other half of the market is the get-you-started systems (usually sold as kits) which don't do anything useful as they stand but are very much more instructive. Products which fall into this area are too diverse to mention, as the capital needed to begin production of these devices is much smaller than that required to produce a larger unit. They can't immediately be used as calculators and to do anything with them except learn, you have to have a fairly high level of knowledge – which you can get by buying one and studying.

The *eventual* application of one of these smaller systems is, however, more interesting than the complex calculator type mentioned earlier. Due to the level of knowledge the smaller systems offer, the possibilities depend only on the ability of the user. You can turn one into a calculator type system if you want to. You can also use it to control air conditioning or vacuum the floor or even tell you jokes.

The high price systems can, of course, be used for 'control applications' (house lighting, etc.) but they are more difficult to modify for this purpose and the user would presumably be happier modifying something he paid $200 for and built himself than something for which he paid $1000 and has never seen the inside.

Up-market Machines

What do we mean by an 'up-market' personal computer? Essentially, it's one that can work out 2+2 = 4 as soon as you plug it in. It's a super-calculator. It's (usually) programmed in Basic (Beginner's All-purpose Symbolic instruction Code).

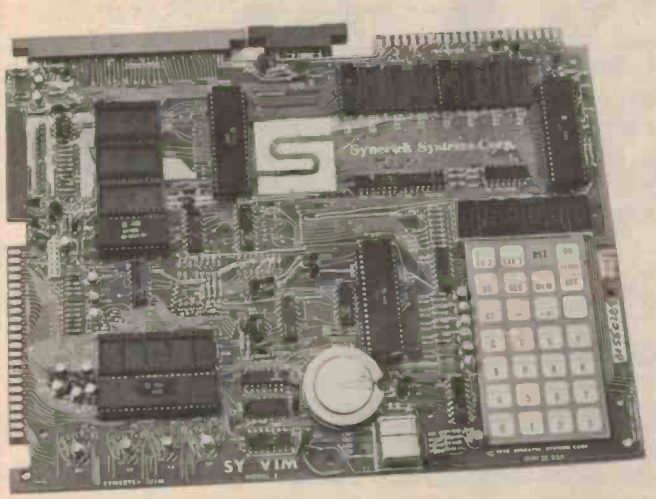
Fine. What do you do once you've got it out of the packing case?

First, you plug it in to a wall socket. This is usually all the wiring up you have to do. Let's take the example of the Commodore PET (see review in May 79 ETI). The PET has a Video Display Unit (VDU) (which looks just like a TV screen, except that it displays words instead of pictures) built into the top of it. You switch it on, type in "? 2+2", and the PET will display on its screen:

```
? 2+2
 4
```

showing that the answer is 4.

What if you want to program it? There is a comprehensive guide with the machine which tells you how to go about this. A program is a sequence of instructions which you want the machine to carry out. Once you have ▶



entered them, the computer will do them in sequence on request – just like a programmable calculator. If, however, you turn the machine off, it will forget the program that it is holding at present. This is pretty useless if it's a program which you want to use again and again, and so the PET has the facility of recording any given program onto a cassette using an inbuilt cassette recorder. You simply insert a perfectly normal audio cassette and type in the word "SAVE". The PET will record the program onto the tape. You take the tape out, turn the machine off and the next time you want to use that particular program, you put the tape back in and type "LOAD". The PET will play the tape and remind itself of the program which you had it store earlier.

Now let's look at the Exidy Sorcerer, as reviewed in ETI in April '79 issue. Although the Sorcerer is a more powerful machine (i.e. it can so more things in a shorter amount of time than the PET can) it doesn't have a built-in VDU and cassette deck. It this a problem? Not at all. You simply connect the aerial socket of your TV set to the back of the Sorcerer and behold! it becomes the VDU. Similarly, when you want to save a program, you connect it to your cassette deck (the one you've just recorded "ABBA" on) and away you go. The Sorcerer is also programmed in Basic (although it has the facility to change languages when Exidy, the manufacturers, get around to producing the hardware) and also comes complete with a full instruction manual on how to go about writing a program.

The Signetics Instructor 50, being marketed in this country by Philips. This is a get-you-started system.

A machine very similar to the Sorcerer is the Sord M-100. The major difference is that it has an S-100 output built in (see later) and two analogue inputs for connecting it to . . . well, anything you can think of!

The Apple offers much the same facilities as the Sorcerer, except that if you happen to have a colour TV set to plug into the back, it will allow you to have letters and words in different colours – for example, if you have written a program to tell you when your biorhythms are at their worst, you can arrange to have the words "take care!" flashed on the screen in bright red whenever you are about to go through a bad patch.

The Tandy TRS-80 is also much the same in its basic structure as the Sorcerer, except that Tandy supply a specially-designed cassette recorder and cut-down TV set to go with it as part of the package.

MICRO'S – what's the difference between them?

The most commonly used microprocessor chips in the hobby market are the 8080, Z-80, 2650, SC/MP and 6502. Other variants can be easily spotted – the 8085 is very similar to the 8080 but with certain changes. The Z-8000 is an upgraded Z-80. When choosing a system, which processor is best?

This is a difficult question – it's like high-level languages (of which there are many different types and variants), people who are used to a particular one will prefer it to any other. Long arguments develop between programmers over the good and bad points of each language. It's the same way with processors.

The 8080 is probably the processor with the most 'software support' – it has the most programs written for it. The Z-80 can run any program written for the 8080, as well as some which the 8080 cannot.

The 2650 has been promoted in Australia by Philips, who introduced it, and has become quite popular.

The SC/MP has the advantage that it needs practically no 'support chips' – it will more or less stand alone and is thus ideal for many 'dedicated' applications, such as doorbells, alarms, etc.

The major differences between the processors in terms of programming are the instruction sets and the number of registers.

The instruction set of a processor is a list of all of the different arithmetic and logical operations it can perform – like the number of keys on a calculator. The registers in the processors are the same as calculator memories – the more, the better.

The 8080 instruction set is about the same level of complexity as the 2650 and the 6502. This is adequate for most applications.

The SC/MP has a rather limited instruction set and relies on it's ease of application for its appeal.

The Z-80 instruction set includes the 8080 set – and then some! It also has twice the number of registers. In general, though, it is usually felt that the 8080 level of complexity is sufficient for the beginner.

What's the Difference

Right about now, you should be asking yourself the question, "What's the difference between all these systems, apart from the prices?". In order to answer that one, we'll split the facilities offered into several areas:

1) VDU
2) Tape recording
3) Keyboard
4) BASIC
5) Inputs and Outputs

First, the VDU. The only special feature in a VDU is whether it's colour or black and white.

Tape recording is very simply dealt with as well – they either have it built in, supplied or external (ie: you use your own). In terms of reliability of recording, there's not *that* much difference (although the PET has come in for a bit of criticism on this count, it's not *that* bad, really).

The keyboard is really only an important consideration if you can type. If you can't, there's very little to chose between the makes mentioned above. If you can, the PET is going to be a bit slower to use than the rest as it has very small keys.

BASIC, the language in which all of the above machines are programmed (except for the Sorcerer, which may at some time in the future be able to handle several languages) comes in many different shapes and sizes. Some are easy to use and very powerful (ie: fast) and some are not so easy, others not so fast. The particular brand of BASIC used in the PET is written by a Californian firm called Microsoft and is very easy to use and reasonably fast.

The Sorcerer's Basic is essentially the same as the PET's but with a few little add-ons. The Apple and TRS-80 BASIC are also about the same as the PET's.

What it all boils down to is that Apple users will swear blind that the Apple version is streets ahead of the rest and similarly any PET user will go blue shouting that the PET's version is the best and so on . . .

If at some time in the future, after you have completely mastered your upmarket machine (which takes about six months on average) you may want to add a few things to it, such as a printer, a floppy disc (see article in this issue on Memories) or even something to control your air conditioning. All these need I/O. I/O is a lazy way of saying Inputs and Outputs.

The PET has a particularly obscure I/O scheme, using what is called the IEEE 488 bus. No other personal computer on the market (that we know of) uses this scheme. Luckily, the PET has become so popular in the States and Europe that it's worthwhile for people other than Commodore to produce add-on bits which will convert the PET to S-100.

S-100 is an almost universal I/O scheme. Printer, floppy discs and even voice recognition units are readily available which will plug straight into anything which uses the S-100 bus system.

The Sorcerer has a system called the RS-232. This is a rather old fashioned ▶

BUS SYSTEMS – S-100 AND ALL THAT

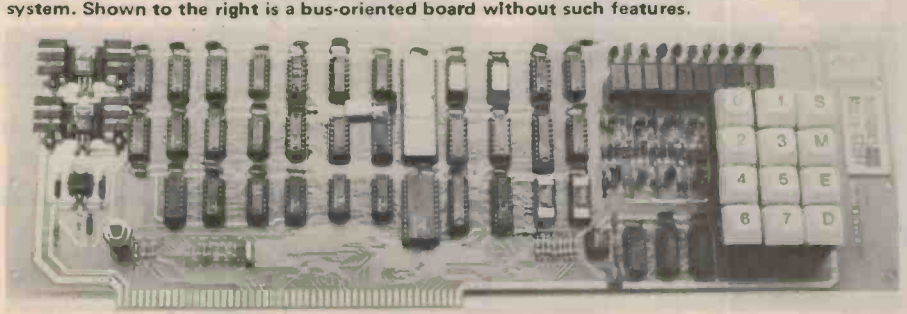
What exactly is the S-100 bus? Or any bus for that matter? No, they're nothing to do with public transport. The word 'bus' is short for 'omnibus' (literally: 'for all'). Basically, it's a method of interconnecting parts of a computer system so that they can communicate with each other.

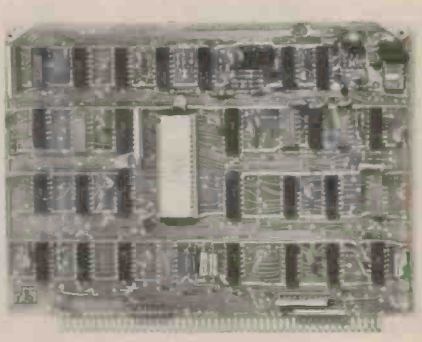
It takes the form of a 'backplane' or 'mother board' which holds several edge connectors. Printed circuit boards can be plugged into these, one edge of the board being covered in gold-plated strips right up to its edge. Contacts on the edge connector make electrical contact with these strips. The S-100 bus system uses double-sided boards with 50 strips per side (thus the 100 in S-100!).

Each board – one of which will be the microprocessor board, holding the micro chip itself plus all the other 'support' chips necessary to get the thing to work, such as oscillators and buffers etc – has some outputs and some inputs which are connected to the bus in a standard configuration. There are sixteen lines of the bus which carry information on 'addresses'. This is how a position in memory is defined – by a sixteen digit binary number. When the microprocessor wants to find out what's at a particular address on the board which carries the memory, it puts that address on the sixteen address lines, puts out a request on some of the other lines of the bus and the memory board looks up the required information and puts it onto the 'data' section of the bus. The microprocessor board then reads the data from the bus.

Other buses have differing numbers of lines and the positions of the data and address lines are also different but they work in essentially the same manner. Unfortunately, it is a difficult to connect a board intended for one bus system to a board intended for another. For this reason, each manufacturer either uses his own bus structure, or sees the light and uses the S-100, which is about as close to a standard as the hobby computer field has.

Shown below is the Morrow front panel. This is an S-100 processor board but with a difference – it has the sort of front panel features more usually found on a development system. Shown to the right is a bus-oriented board without such features.





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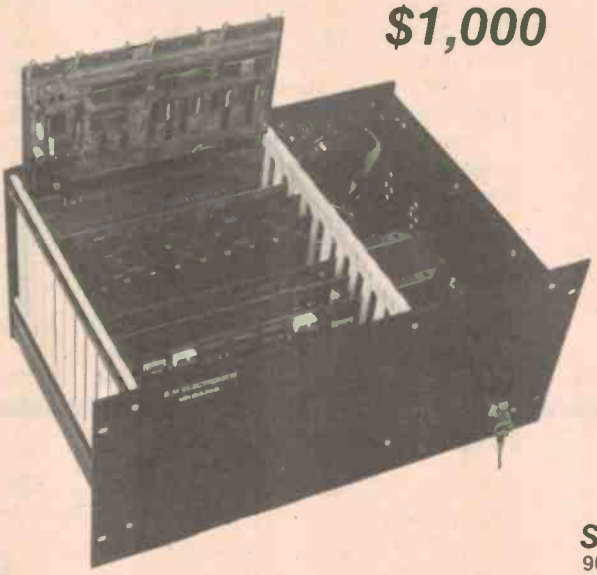

DEALER: The Byte Shop, 29 Colbee Crt, Phillip, ACT. 81-5011.

SOFTWARE AND FIRMWARE

Monitor Prom 2708 Z80 16 functions,
Disk Bios Prom for CP/M boot up;
Disk Test Prom with random read/write, format, read & write to sectors etc;
ETI 640 Driver Prom (Z80). All proms supplied with listings and instructions, Std. versions $25 ea. Customised versions $30 ea.

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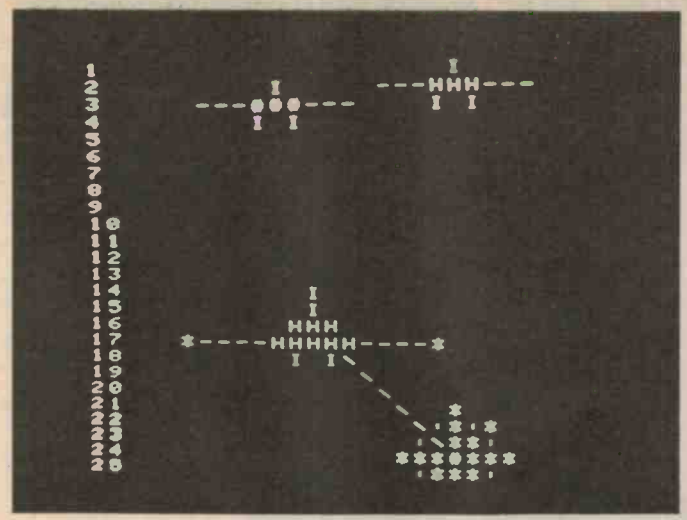


The picture above shows the sort of 'graphics' capabilities offered by most VDUs. The display shows part of a space 'dogfight' simulation, made up from standard typewriter characters.

I/O system which was used with teletype machines. It also has a more sophisticated system for which S-100 adaptors are available.

Both the Apple and the TRS-80 have their own systems, with S-100 adaptors being available for either.

Commodore have not produced any peripherals (add-ons) to go with the PET, Exidy have not produced any to go with the Sorcerer and the availability of cheap S-100 based add-ons is such that it's probably worth getting an S-100 adaptor to fit *any* personal computer when you want to expand it.

Cheaper Alternatives

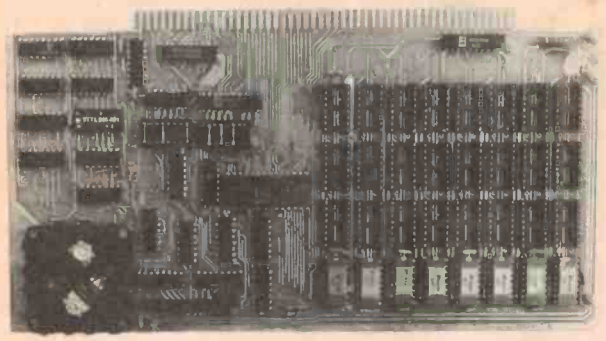
The 'Up-Market' systems mentioned above will cost you hundreds of dollars each. What about something easier on the bank balance?

For some time there have been units on the market which are described as 'evaluation kits', intended for use by industrial concerns who are wondering whether to use a particular micro-

Turn to page 135. ▶

Many systems have a VDU output which can be used to provide a display on a normal TV screen.

COMPUTER PRODUCTS by central data



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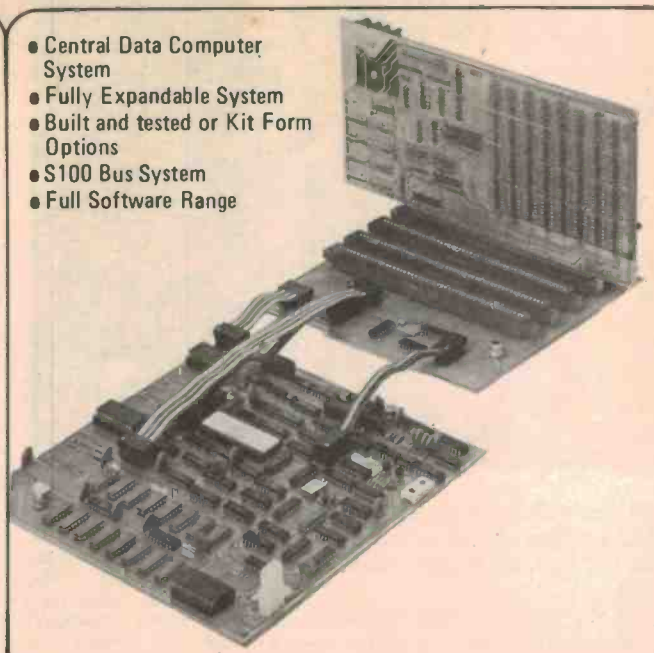

ASSEMBLED PRODUCTS

– MOTHERBOARD	427.80
– S100 BOARD	161.00
– 16K DYNAMIC RAM BOARD	376.00
– 32K DYNAMIC RAM BOARD	641.70
– 48K DYNAMIC RAM BOARD	903.90
– 64K DYNAMIC RAM BOARD	1,117.80
– FLOPPY DISK SYSTEM SINGLE DRIVE	1,247.80
– ADDITIONAL DISC DRIVE	641.70
– CENTRAL DATA ASC11 KEYBOARD	223.00
– ASSEMBLED MAIN FRAME C/W POWER SUPPLY	410.00

COMPLETE KITS

– MOTHERBOARD KIT	285.00
– S-100 BOARD KIT	139.00
– MAIN FRAME AND P/S KIT	410.00

SOFTWARE

– STARTREK GAME	55.20
– EDITOR/ASSEMBLER	34.50
– 8K BASIC	34.50
– 12K BASIC	52.00
– DEBUGGER	34.50
– ASSEMBLY LANGUAGE PACK	52.00

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– IC13) SUPERVISOR PROGRAM	31.00
– IC17)	31.00
– IC49 CHARACTER GENERATOR	31.00
– CDXTAL CRYSTAL	20.70
– 2650 P.C.B.	45.00
– S100 P.C.B.	35.60
– S100 CABLES	32.20
– DOS SYSTEM DISK	43.00
– DISK CONTROLLER BOARD	232.00

MANUALS AND INFORMATION

– 2650 COMPUTER SYSTEM MANUAL	14.00
– DESIGNING WITH MICROCOMPUTERS	14.00
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processor or an alternative one. These kits have evolved into the 'single-board' devices available to amateurs at very low prices today.

They usually consist of a single printed circuit board, carrying all of the devices necessary to teach the user just what is going on inside a computer.

They carry a set of keys which enable you to input hex digits (see article on computer number systems in this issue) and a number of 'control keys', such as 'RUN', 'DELETE' and the like.

Most of these units come with their own power supplies, so that all you have to do is to plug them in. Most of them also come with fairly good instruction manuals, although there are one or two which are not so good. Try to get a look at the instruction manual before you buy – in some cases it's a more important consideration than the unit itself.

A good instruction booklet will usually begin with something you can understand and will continue with something you can understand after you've read the first bit.

A poor instruction booklet will begin with something which you can understand and then continue with something which is totally foreign to you.

What can you do?

These evaluation kits are basically for education only. In order to do anything useful with them (such as add 2 + 2), you have to know how to use them and programming the problem almost always takes longer than working out the answer on paper. These machines are not designed as super-calculators.

The output will usually *not* be via a VDU although there are some exceptions in which there is a TV output similar to the one on the Sorcerer or Apple.

A more usual form of output though is a number of calculator-like digits (called seven-segment displays). These can indicate the numbers and letters 0 to 9 and A to F necessary to display hex digits.

The sort of thing you can do with the unit as it stands is to look at a specific memory location (or pigeon-hole, of those of you who learned about computers at school) to see what's in it. This is exactly the same as displaying the contents of one of the calculator's memories, except that each location will only hold (usually) two hex digits. So you enter (via the keyboard) A56B, which is the number of the location you want to look at. You then press the 'MEM' button, or whatever it's called on the particular model you have bought, and the display shows A56B 6F, which indicates that the value stored in 'pigeon hole' A56B is 6F. This won't mean much to you until you realise that A56B is the location which stores, say, the result of an addition which the machine has just carried out and that 6F is equivalent to 111. Then the information becomes a big more interesting.

In fact, the whole thing becomes fascinating once you get into it.

Once you have completely mastered this sort of unit (and that takes a lot more time than it takes to master the more up-market all-singing, all-dancing units) then you reach a bit of a problem. Most of these get-you-started kits are essentially non-expandable.

This is not as much of a problem as it might seem, though. Although you may have spent over a hundred dollars on the unit, you have gained well over that in education. You can now graduate to a more flexible system.

S-100 Systems

Remember S-100? Earlier in the article we mentioned it as a standard for interconnection of peripherals (add-ons such as printers, disc drives and the like) to large hobby computers. There is another form in which S-100 units are found.

Suppose you buy a get-you-started unit with S-100 connections on the bottom of it. These take the form of 100 'edge connections' which allow you to plug the board directly into a dirty great socket.

This socket is connected, pin for pin, with several other such sockets, all mounted on a printed circuit board called a backplane or motherboard.

Other S-100 boards, containing extra memory, or the electronics necessary to connect to a printer, or a voice synthesis board, or a TV display, (or whatever you want) can be plugged into the motherboard and are connected automatically with the main board, which carries the microprocessor.

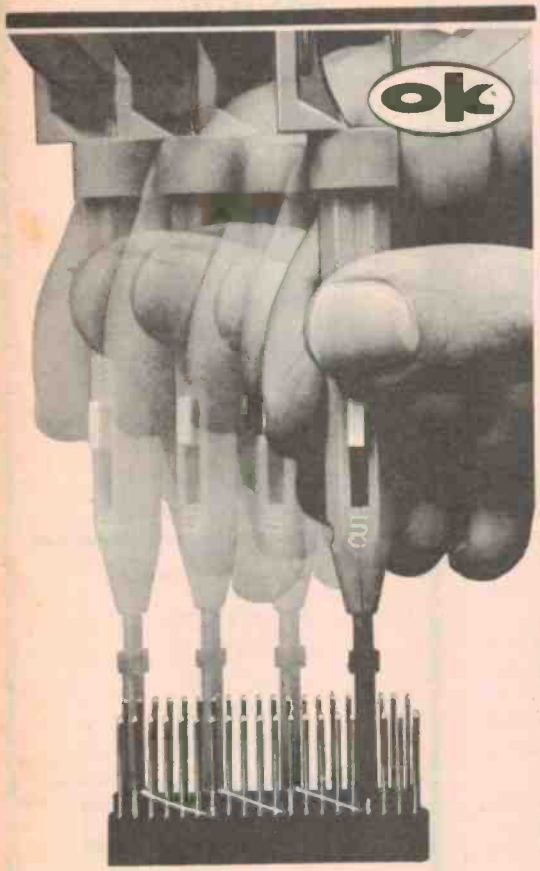
Why not start with an S-100 system if you'll want one eventually anyway? The answer is the price (isn't it always?).

A complete S-100 system – complete enough to start computing on – will cost you just less than a large hobby computer. It's also much more difficult to get going. Some people have started on S-100 and got off the ground, but it's difficult (at the moment).

Summary

Computing is just like hi-fi. What you buy depends on how much time and money you want to spend and how enthusiastic you are (which is not always the same thing). What ever you *do* buy, you can rest assured that if you stick at it you will not only gain a very valuable tool, you'll have a lot of fun doing it. ●

NEW!



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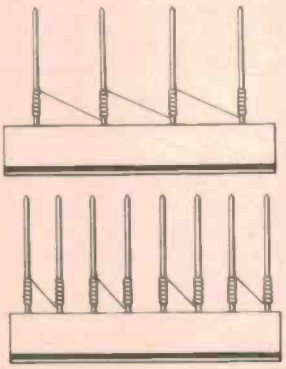

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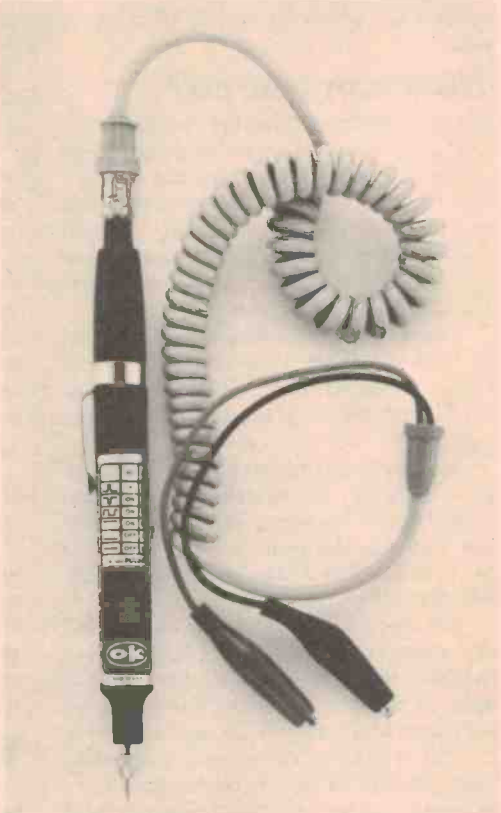

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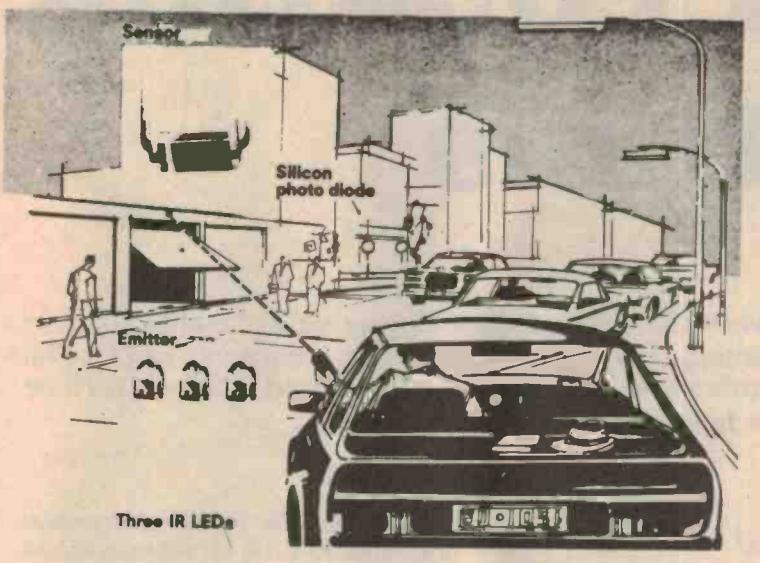
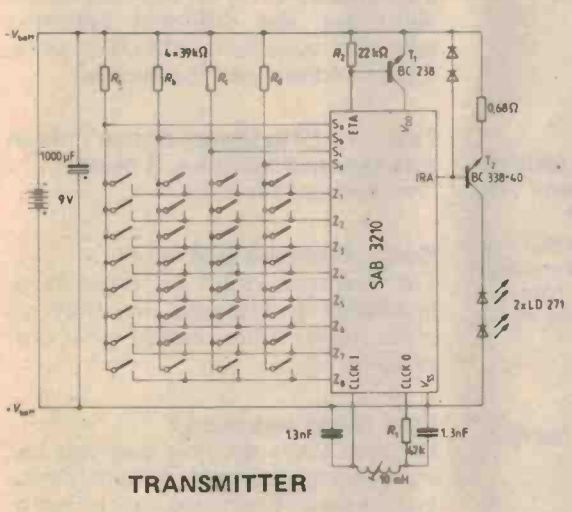
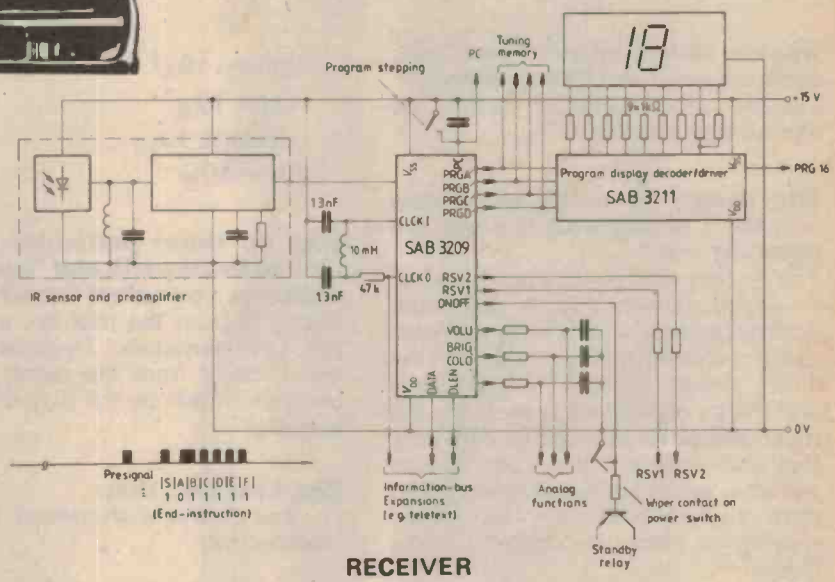


Infrared remote control, e.g. for moving automatically the garage door. When the remote emitter is actuated a command is given by the pulsed IR light. The signals are coded so that only the receiver on the garage door will understand (safety lock).



TRANSMITTER



RECEIVER

The IR 60 System permits the construction on a reliable IR control for 60 different commands. Because of its great variety of functions possible, this remote control system will find applications not only in the entertainment field but in the industrial area as well. The system concept contains an essential data bus. Because of this feature the remote control can be universally extended. Examples: Remote control of radio and stereo equipment, TV sets, light dimmers & switches, projectors, toys such as model railways, cars, cranes, garage doors, etc. Because of its high immunity to noise it will operate in bright sunlight.

Special Properties:
* No interference from wall reflections and Doppler-effects;
* High rate of information transfer, combined with improved noise immunity, because of the use of pulse-code-modulation (PCM) in the biphase code.
* Extensive instruction set containing 60 instructions.
* By means of three analog memories, three analog functions can be controlled in approx. 64 steps.
* A large permissible tolerance of the operating frequency in the transmitter and receiver makes the use of quartz-stabilized oscillators unnnecessary. A simple LC tuning circuit is sufficient.

TRANSMITTER
The transmitter Circuit (18 pin IC), developed in P-MOS depletion technology, converts the instruction obtained from a matrix (keyboard) to a 6-bit biphase code. By means of this code up to a maximum of 60 commands can be transferred, through an infrared transmitting stage, to a receiver equipped with the matching receiver IC.

Special features:
* Without special means, 32 instructions are possible — an extension to 60 is possible through the connection of additional diodes or the use of double contacts.
* Low power consumption of typically 3 mA (5mA max.). An external transistor driven by the transmitter IC, disconnects the battery during dwell periods, thereby extending its life period considerably.
* Large supply voltage range, from 5 to 16V.

RECEIVER
The receiver IC (18 pin IC) developed in MOS depletion technology, evaluates the IR signals coming from the transmitter circuit. Through a serial interface, which is externally accessible, the commands get to the program memory and the analog memory. The receiver IC permits the control of 16 programs and three analog functions. In addition, the circuit contains two spare outputs and on input or output for the ON/OFF function. With the addition of an extra decoder IC and 2-digit LED display a visual indication from 1 to 60 is possible.

The complete kit contains: one coded IR Transmitter IC, three IR diodes, one IR receiver sensor with IR filter, one preamplifier IC, one receiver IC, one display decoder, one dual LED display plus 35 pages data sheets. Price including post and pack $34.50.

(35 pages data sheets only $3.00)

Computer counting systems

Counting by tens is known to every person who ever went to school. Counting by two's or eight's is not so well known. As computers, by necessity, use counting systems foreign to those commonly taught, Phil Cohen decided to ask a computer how these number systems work. Binary, Hex and Octal — you'll be confronted by these terms one day soon. Here's how the conversation went . . .

What is all this jargon about hex, decimal, octal and binary anyway?
They're all different ways of representing numbers.

Why should we use different ways — what's wrong with the one we normally use?
The system you humans normally use — which, by the way, is called the decimal system — is fine for everyday use, but computers have to work in the binary system (which I'll explain later) and the binary system is probably the most difficult for humans to work with. Hex and octal are two compromise systems, which are easier to work with than binary and can be easily converted either to decimal or to binary.

Okay, how do they all work?
They all look fairly similar. For example, the number "10" would mean 2 in binary, 8 in octal, 10 in decimal . . .

Of course.
. . . and 16 in hex.

How do you tell them apart, then?
When you write a number in binary, you put a little "2" after it: 10_2

Why a "2"?
Because the binary system is base 2.

What do you mean by that?
Hold on, first I'll tell you what the number you use after each of the systems is, then at least you'll be able to tell them apart as I explain them.

binary: 10_2
octal: 10_8
decimal: 10_{10}
hex: 10_{16}

Why do those particular names refer to those particular "bases", or whatever you called them?
Binary is from the root bi-, meaning two. Like bi-metallic. Decimal means ten. Octal is from the same root as octopus, which by the way has eight tentacles . . .

Yes, I realised that.
. . . and hex is a shortened form of hexadecimal.

Hexawhat?
Hexadecimal. Means sixteen.

Oh.
Now, binary only uses the characters 0 and 1 to represent any number.

Why is that?
Because the computer is based on digital circuitry, which can only work in ones and zeroes. These can either be current flowing in a particular wire, or none.

How do you represent a number in just ones and zeroes?
In the decimal system, the number "142" means one hundred, four tens and two ones, right?

That, I learned in primary school.
Yes, I hoped you had. Well, in the binary system, if we only used ones and zeroes, we'd only be able to represent the numbers 1, 10, 11, etcetera. Unless we make the different columns represent something other than ones, tens, hundreds and thousands.

I see . . . 10 in binary doesn't mean one ten and no ones, it means . . .
One two and no ones.

Sorry, I missed that one.
The columns don't go ones, tens, hundreds and thousands, they go ones, twos, fours, eights, sixteens, etcetera.

Why those numbers?
Because that's the only way you can represent any number using only ones and zeroes. Each column is worth twice the value of the one to the right of it. That's why it's called base two — because it's twice the value.

And that's why the normal system we use is base ten?
Yes, because each column is worth ten times the value of the one to the right of it.

Fine. Show me some numbers in binary.
What number would you like?

The trouble with you is that you've no imagination. How's about 14.
Okay. 14_{10} equals 1110_2

That was fairly unspectacular. I take it that 1110_2 means no ones, one two, one four and an eight . . . which add up to fourteen. I see. Now what's difficult about that —

why the other two systems?
You may think it's easy, but try recognising an eight-digit binary number in a list of them.

I see what you mean. Well, what are the alternatives?
The first approach that people tried was octal. This is the base eight. Any number can be represented in the base eight using only the characters 0, 1, 2, 3, 4, 5, 6 and 7.

That's like in base ten — we only use the numbers 0 to 9. So in base eight, we'd only use 0 to 7.
Yes. Now whereas in binary each column was twice the previous one, in octal . . .

They must be eight times.
You catch on fast. The number fourteen would be 16_8 — that is, one eight and six ones, which adds up to fourteen.

You said that this was easily convertible to binary. How do you do that?
Well, if you consider a binary number you will notice that every column is eight times the value of its next neighbour but one to the right.

Eh?
The binary number 101001110_2 is equivalent to 516_8
Don't you see the connection?

No.
Oh. Well, if you split the binary number into independent groups of three digits and convert each to decimal as if they were ones, twos and fours . . . the easiest way to explain is to show you, I think. The three right-most digits of the number are 110. Convert them into decimal.

Let's see . . . that's one four and one two and no ones . . . that's six.
Okay, now the next three digits.

The next three are 001. Treating that as no fours, no twos and a one . . . makes one.
Got it yet?

I see! The next three digits are 101 . . . that's five. If you convert the digits three at a time, they spell out the octal equivalent.
Yes, like this:

binary: 101 001 110
decimal: 5 1 6
octal: 516_8

So it's easy to convert from octal to binary and back again — you just do it in three digit binary blocks.
Try this one: what's 331_8 in binary?

That's three — 112 . . .
But remember that it's to be in three-digit groups.

Oh, yeah. Well, then it's 011. Followed by 011 again, then 001. Stick them all together and it makes 011011001_2.
Right. Except that you can forget the zero on the left-hand end. It doesn't do anything.

Okay, then 331_8 equals 11011001_2.
Yes. Easy, isn't it. Now what is it in decimal?

Ah, now that's a bit more difficult.
Not really. We'll go from octal to decimal. 331_8 is one one, three eights and three sixtyfours.

Sixtyfours?
Yes, eight times eight is sixtyfour.

Oh, yes.
That all adds up to 217_{10}. Now we come on to hex.

That's base sixteen.
Right. Most hobby computers store numbers in groups of eight binary digits. Each group of eight is called a byte.

Why a byte?
Probably because each digit is called one bit.

That doesn't make a lot of sense.
I know. There are very good historical reasons why computing is full of jargon, but I won't go into them now. One digit of a binary number is called a bit and a group of eight bits is called a byte. Now each byte of information can be represented by three octal digits.

A group of three octal digits can represent nine binary ones.
I know. That's why most people use hex these days instead of octal. It's neater — a byte can be represented by two hex digits.

Each hex digit for four bits?
Yes. Now, remember that binary uses only the characters 0 and 1. Octal uses the characters 0 to 7 and decimal uses 0 to 9. What is hex going to use?

Why . . . it'll need sixteen characters.
That's right. For starters, we use 0 to 9 and then, because we've run out of digits, we have to use A, B, C, D, E, and F as well.

Whew! And the first column is ones, the next is sixteens and the third will be . . .
256s.

Yeah.
The number 10110011_2 will be B3.

That's weird. A number with letters in it.
Seems perfectly normal to me. What's wrong with it?

Oh . . . never mind. Say, show me how to convert from binary in to hex.
Okay, take the number 10010000_2. Splitting that into groups of four digits, it becomes:
1001 0000
and the hex equivalent to these is 9 and 0, so the answer is 90_{16}.

Say, one last question: what do you call a computer with no voice input?
I don't know . . . what **do** you call a computer with no voice input?

Anything you like — he can't hear you!
I don't understand that.

Didn't think you would.

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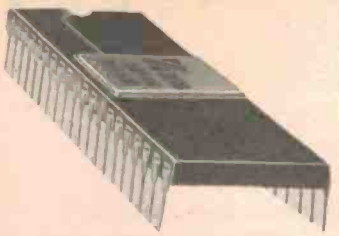

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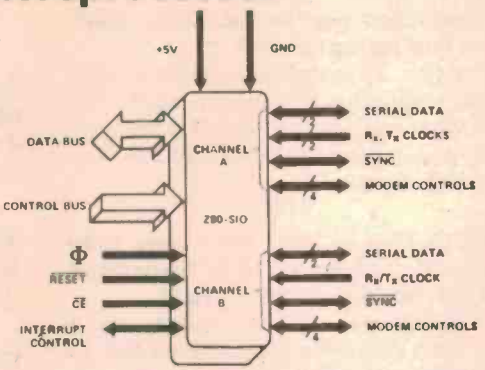

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MEMORIES

WHAT DOES a computer do with its memory? Well, first it has to store the program it has to carry out. For this, it uses a section of memory called program memory or Read-Only Memory (ROM).

It must also have a section of memory where it can hold numerical values of various types: data which has been fed in, the intermediate results of calculations, etc. This second type of memory is called Random Access Memory (RAM) — for reasons which will be explained later.

To the computer there is no real difference between the two types of memory, although the programmer sees them as being completely different. As far as the computer is concerned, all it requires of its memory is that, when it 'asks' for a particular part it is 'read' out to it and when the computer wishes to, it can 'write' into a section of memory.

The computer sees memory as an homogenous block of 'locations' (the term used to describe a unit of memory). Each location can be thought of as a pigeon hole, where a small amount of information can be stored. The computer takes no notice of what type of memory is used — to it each location is identical. It may seem from this that the choice of memory type is unimportant. This is definitely not the case, as very often the speed of operation of a computer depends solely on the type of memory used.

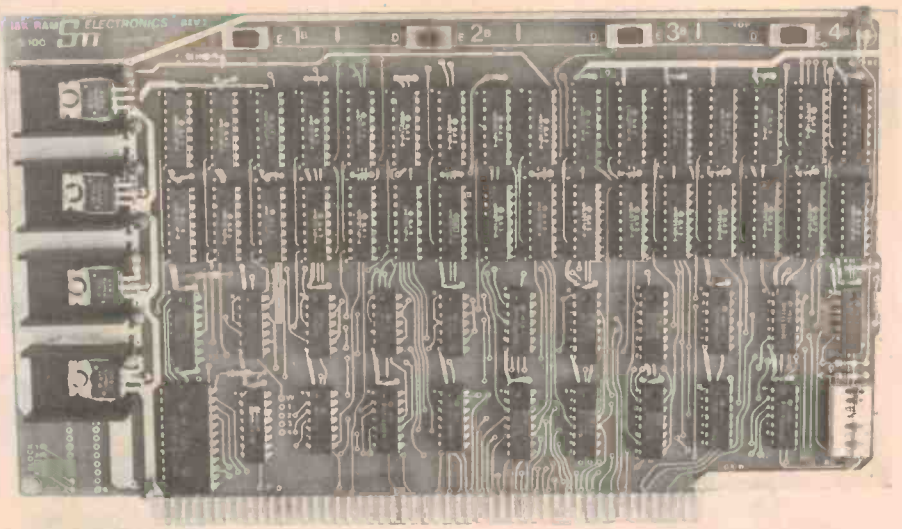
ROM: Read-Only Memory

A computer's 'operating system', as in the case of the PET BASIC system. This is held in ROM in the PET and is automatically started up on switch-on. This means that, unlike other systems, all you have to do to begin using the PET is to plug it in and switch it on.

RAM: Random Access Memory

The alternative to ROM is 'random-access memory', (RAM). This is usually used to hold the numerical information which the machine is working with and which is constantly changing.

There are TTL and CMOS chips which contain large numbers of semi-conductor gates which hold information by being in one of two states. This information is lost, however, when the power is switched off. The gates are read from or written to by inputting an 'address' to the chip which specifies the memory location.



Example of a Random Access Memory. This is the ETI 642 project, designed by Mike Pratt of SM Electronics. It has a capacity of 16 K bits and suits the S 100 bus system.

Memory Peripherals

For information which is not required very often, some sort of memory peripheral is used. (A peripheral is simply anything which plugs into the existing system.)

Say, for instance, that you want to store a mailing list. It is essential that the information is retained when the power is switched off. Another consideration is that, if you tried to store a large number of names and addresses in normal RAM, it would cost a fortune.

Instead, a slower, cheaper system is usually used — since each name and address on the list is only accessed once a month (or whenever), the access time for the memory is unimportant.

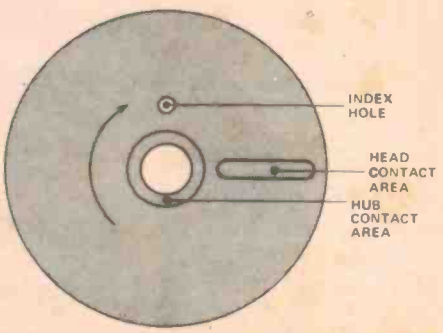
Discs

A disc system consists of a film of mylar passing a 'head' which reads it and writes on it magnetically.

The cheapest form of disc system is known as a 'floppy' — because the disc in it is floppy (what else could you call it?!). A floppy disc is made up of a flexible circular piece of mylar, about the size of a 45 rpm gramophone record. One side of the disc is covered with metal oxide, as is one side of a cassette tape. The information is recorded on this side in the following way: As the disc spins around at about 360 rpm, the head moves in and out along the radius of the disc. The disc is enclosed in an envelope to protect it and a slot is cut in the envelope along the line of travel of the magnetic recording head. The inside of the envelope contains a felt-like material which cleans the discs and traps any foreign particles as it spins.

The head is moved in and out over the surface in increments of 0.53 mm (in the case of the IBM 3740 standard 'diskette'). Every 0.53 mm is defined as being a 'track', starting at a predetermined distance from the edge of the disc. Thus data is written on 77 concentric tracks and nowhere else.

At a specific point on the mylar a hole is punched so that light can pass through it. This point is defined as being



The basic arrangement of a disc system — used to store large amounts of data or information permanently.

the start of all the tracks. As the disc spins past this point, no matter which track the head is over, it will be at the beginning of that track.

Each track is further divided into 26 'sectors'. In some disc systems, a hole is punched in the mylar to signal the beginning of each sector. These are known as 'hard-sectored' discs. The IBM 3740 is a 'soft-sectored' disc, since the start position of each sector is determined by a calculation based on the time interval after the main index hole has passed.

At the beginning of each sector is written a series of identifying marks telling the electronics which controls the disc which track and sector it is at. These are compared with the required sector address to see if there has been any error. Also found at this point is a series of check marks specially encoded to test that the head is decoding the magnetic flux changes properly. Following the above 'preamble' there are 128 locations of data, followed by some more checking marks called the 'postamble'.

The disc thus holds 2002 x 128-location sectors with an access time of about 0.2 sec.

Cassette

Cassette memory is the most commonly used peripheral memory system found in domestic computing. Basically, it consists of a normal audio cassette recorder along with sufficient electronics to perform the 'translation' from digital signals to audio which can be recorded on to the cassette and also from audio back to digital. The circuitry needed for this is called a MODEM (for 'modulator/demodulator') and is, in general, relatively inexpensive, making this type of storage ideally suited for home computing.

Most small MODEMs work on the principle known as FSK (frequency-shift keying) in which a burst of tone at one frequency represents a '1', while one at another frequency represents a '0'. Special characters mark the start of a new line or the start of a program. By 'special character' we mean a specific pattern of notes which will not occur in the normal course of the recorded text (a sort of 'signature tune'!). Most advanced systems also provide some way of 'labelling' programs, so that if several programs follow one another on a tape, only the required one is read.

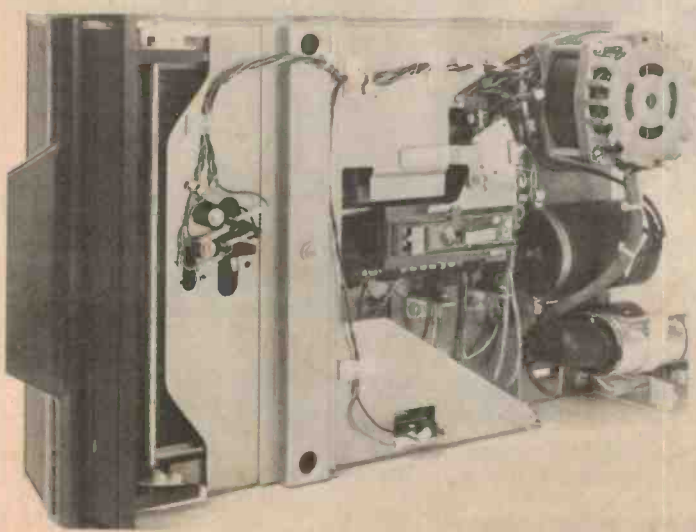
The standard domestic computing tape format is known as CUTS (computer users tape system) and uses a tone at 2400 Hz to represent a '1' and a tone at 1200 Hz to represent a '0'. CUTS is becoming very widespread and is likely to remain the home computing communications standard for some time.

Ordinary, inexpensive cassette recorders are used to store programs 'permanently' on tape.

Access Time

'Access time' is the term used to describe the length of the time lag which occurs between the computer's request to read from or write to a location in memory and the transfer actually taking place. Typical access time for a semiconductor integrated circuit memory is 500 ns, while the access time for paper tape may be 5 mins! For this reason the type of memory used for specific tasks must be chosen carefully.

Another important consideration (particularly in domestic systems) is cost. This is usually expressed as a cost per bit. In general, the lower the access time, the higher the cost per bit (unfortunately) and so the choice of memory medium is usually a compromise between cost and speed.



Example of a floppy-disc drive system and mechanical assembly.

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Computing Glossary

ACCUMULATOR: One of the REGISTERs inside a microprocessor chip – a memory location built into the chip in which the intermediate results of calculations can be held. For example, if you want to add the contents of one main-memory location to another, you will probably first load the contents of one of them into the accumulator and then add the contents of the second to the contents of the accumulator.
ASSEMBLER: A program which takes in a series of MNEMONICS and puts out binary code.
BASIC: The most widely-used high-level language in the hobbyist field. Allows you to communicate with the computer in a fair approximation of pidgin English. See article in this issue.
BAUD: A measure of the speed of data transmission. One baud is one BIT per second.
BINARY: The 'base two' number system, in which everything is represented in ones and zeroes. See number systems article in this issue.
BIT: A single binary digit, consisting of either 'one' or 'zero'.
BUG: A mistake or similar problem which prevents a program from working. Introducted when a small insect crawled into an early computer and halted its operation. The 'bug' was ceremoniously taped to a page of the report which explained the reason for the fault.
BUS: A system of interwiring.
BYTE: A binary number eight bits long. It can represent a number from 0 to 255, as there are 256 possible combinations of ones and zeroes eight digits long (try them if you like).
CPU: This is the part of the microprocessor that does all the addition, subtraction and whatever. A knowledge of the meaning of "CPU" is almost totally useless to anyone except a microprocessor designer. For historical reasons which we can't fathom, it is always included in glossaries.
CUTS: Computer User's Tape System. See the article in this issue on memories. It refers to a method of putting 'ones' and 'zeros' from a computer into ordinary cassette tape (See MODEM).
EXECUTE: Carry out a series of programmed steps.
FLOPPY DISC: One type of memory peripheral. See article on memories in this issue.
HARD COPY: Essentially, printed matter.
HARDWARE: All the circuitry, metalwork, et cetera, needed for the computer system, excluding manuals and other information.
HEXADECIMAL: Base sixteen number system. See number systems article in this issue.
HIGH LEVEL LANGUAGE: A way of telling the computer exactly what you want it to do in a way that is handy for you.
INSTRUCTION: Usually used to refer to one or more BYTEs of memory which cause the microprocessor to perform a particular act, such as adding one to the number stored in its ACCUMULATOR.
INSTRUCTION SET: All of the possible INSTRUCTIONs which a particular microprocessor is designed to carry out, The larger the instruction set, the more powerful the microprocessor.
INTERPRETER: A program which enables the computer to understand a high-level language. There are other ways of achieving this, such as the use of a 'compiler', but these are rare in hobby computers. (as yet).
MEMORY: The part of the computer in which information is stored.
MEMORY LAP: A diagram showingwhich parts of MEMORY are used for what.
MICROPROCESSOR: If you don't already know by now, an integrated circuit chip a few centimetres long which does all that it took a computer filling a room to do twenty years ago. And faster, yet!
MNEMONIC: A nickname for a particular INSTRUCTION. Mnemonics are easier to work with (as far as the programmer is concerned) than the HEXADECIMAL which the microprocessor can understand and an

ASSEMBLER is therefore used to enable the programming to be done in terms of mnemonic (which, collectively, form the 'assembly language').

MODEM: Or 'modulator/demodulator' is a device which represents digital information in terms of audio tones which can then be recorded onto tape or even sent down a telephone line. It also interprets these tones back into binary when receiving.

NON-VOLATILE: Term used to describe types of memory which retain information even when switched off.

OCTAL: 'Base eight' number system. See article on number systems in this issue.

PERIPHERAL: Any 'add-on' which can be bought after the main system and fitted to it easily.

PROGRAM: A set of instructions, either in MNEMONICS, in digital form, or in a HIGH-LEVEL LANGUAGE, which tell the computer to perform a particular sequence of tasks.

PROGRAM COUNTER: REGISTER in the microprocessor which keeps track of which part of the program it is EXECUTING.

RAM: Random Access Memory. When the computer field was younger, this meant a part of memory that could be read in any order, but it now means that part of the system's memory which stores information which will be lost when the unit is turned off.

REGISTER: A general-purpose MEMORY location built into the micro-processor chip itself.

ROM: Read-Only Memory. Memory which the computer cannot change. A section of NON-VOLATILE memory in which the system has stored information which it will need as soon as it is turned on.

SOFTWARE: Information in the form of PROGRAMS, data or what-ever, as opposed to HARDWARE – the guts.

VDU: Video Display Unit. A converted TV set (usually) on which the computer can display lines of text, even 'graphics' (isometric figures, graphs etc).

VOLATILE: Term used to describe MEMORY which will lose its stored information when the machine is switched off.

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And while the Calinda's performance will do full justice to your music, its elegant shape is sure to enhance your room.

Listen to the Calindas, discuss them with your local dealer, and discover just why KEF call themselves "the speaker engineers."

Distributed in Australia by Audioson International Pty. Ltd., 64 Winbourne Road, Brookvale, N.S.W. 2100.

KEF

The Speaker Engineers

with Douglas Saunders

THE KEF 105 speakers are a three-way system using plastic cone, moving coil drive units. This has been the trademark of KEF and whenever plastic cones are mentioned, their name springs first to mind.

They produced their first speaker driver, if I remember correctly, in early 1961. It was an open-front, waffle-type rectangular construction of enormous proportions and was soon replaced by the more viable B.1814 of identical frame size but with a flat-faced, solid cone of expanded polystyrene finished off with a covering of lightweight alloy film.

After many months of anticipation I auditioned the KEF 105 system over last Christmas.

Through the auspices of my friend Sid McClory the managing director of Audioson, who import KEF products, I experienced the 105's in my own listening rooms with my preferred line-up of electronics and source material. This, once again, proved to me that there is really no way to fully realise the potential of any piece of equipment except in one's own acoustic environment which, so necessarily, becomes part of one's own listening ethos.

KEF's departure from their well established B.139 bass driver in the new 105's is another sign of the technically advanced times. They obviously wanted a driver with different parameters to perform in a certain manner in a particular cabinet volume with their new electrical tailoring circuit. Today's understanding of speaker-cabinet relationships often precludes top flight drivers from certain concepts.

In any case, this new 305 mm Bextrene cone woofer is a very well made speaker with a good 10 mm peak-to-peak excursion, a hefty magnetic circuit and a power handling capacity well over 100 watts peak.

Its shallow profile is formed from Bextrene, the same material used for the B.110 and B.200, but here the wall thickness is greater. It has a dull black, non-reflective surface and is very smooth to touch. Free-air resonance appears to be around 22 Hz and I would guess the efficiency has to be higher than the associated midrange B.110 due to the low frequency tailoring circuit.

Here, I was surprised to see a variation on the original suggestion by Australia's Dr Ernest Benson, where a series capacitor turns a nominal 2nd-order Butterworth enclosure into a 3rd-order Butterworth. As this suggests, the 7–litre cabinet is actually an electrically modified infinite baffle with a resulting low frequency decay set midway between an optimised vented enclosure and a fully sealed enclosure.

KEF specify a low frequency limit of 30 Hz but put tolerances of +/- 2 dB at the 38 Hz point. Low frequency propagation is restricted below this, but even so, a clear and surprisingly deep bass is punched through on such discs as have it. Otherwise, the lows do tend to fall off below about the piano's low A (27.5 Hz).

Crossover frequencies are set at 400 Hz and 2.5 kHz , rolling off at 24 dB per octave (4th order filters).

Maximum continuous sinewave power is clearly specified for once. Specs are – 35 V RMS 100 Hz – 400 Hz, 28 V 400 – 2500 Hz and 11 V from 2.5 kHz to 20 kHz. At a nominal eight ohms this translates to 153 W, 98 W and 16 W respectively. The maximum peak programme rating is 200 watts.

The ingenious robot-knight style of combined treble and midrange cabinet is one of those ideas we've all wanted but never got around to making. KEF have installed an adjustable stand for this assembly . It may be rotated through +/- 20 deg. horizontally and +/- 5 deg. vertically.To ensure correct treble dispersion, alignment is gauged by sighting LEDs situated in a tunnel between the drivers. I found this of enormous advantage, saving annoying measurements. Amplifier misbehaviour is indicated by a clever and effective warning device set according to the amplifier's clipping specifications.

The complete speaker is only 965 mm high with an almost square cross-section of 415 mm by 455 mm at the base and is fitted with silent castors for easy movement. Nett weight is 36 kg.

My sample pair were finished in walnut with a black slip-over speaker grille which has a removable black panel giving access to the head assembly and the warning-LED controls. Another ingenious touch is the concealed speaker wiring tube extending right through the cabinet from the base to the speaker terminals on the head enclosure. Each of the drivers is positioned on a different vertical due to KEF's phase arrangement which includes the crossover networks. The black speaker grille cover also slopes rearward giving a touch of architectural correctness to the appearance.

The KEF 105 – ". . . one of the few best bets for high quality music reproduction . . ."

My preferred listening room is some 9.2m long by 6.3 m wide and 4m high. The gross volume of 230 cubic metres is substantially reduced by regularly placed 3m-high bookshelves and record shelves on every wall. The acoustic is on the live side due to a polished timber French-line ceiling but the floor is largely covered with heavy rugs and undercarpeting.

The 105's were placed about one metre away from the protruding record shelves on one wall and about 2.5m apart on cabinet centres. This made for a listening distance of about 4m. According to the illustrations supplied (I had no instruction manual) I set them squarely to the front and angled the head assemblies to maximum toe-in.

– continued p.179. ▶

Bye Bye

Sansui's new DC amplifier has the best slew rate and rise time for the lowest TIM known to Tom, Dick or Harry.

TIM — transient intermodulation distortion — is probably the most important neglected distortion in today's quality amplifiers. That's why Sansui engineers went beyond ordinary specs to analyze and virtually annihilate TIM.

Why the ordinary way wasn't good enough

Ordinarily, a steady simple sine wave is used to test amplifiers. But it's not a realistic method because music consists of complex, dynamic signals. And Sansui is nothing if not realistic.

Sansui research showed that poor response to complex pulsive signals caused clipping and TIM. Obviously a new design approach was essential for truly superior reproduction of the original sound.

The new design is exemplified by Sansui's PAT. PEND. Diamond Differential DC circuit (or DD/DC). The results are simply extraordinary.

Why hundreds of watts may not be enough

Remember we said that TIM is primarily caused by poor amplifier response. If an amplifier cannot respond rapidly with high stable current to a sudden pulsive signal (a sudden trumpet blast, for example), serious distortion occurs. And it occurs regardless of how many hundreds of watts a "muscle-bound" amplifier may have.

Sansui discovered that the conventional notion of "transient response" was far too vague to be of much help. More careful in-depth analysis revealed that response could be accurately measured by slew rate and rise time. Slew rate tells you how many volts can be delivered in a micro-second and rise time is how long

it takes for a 10 to 90 percent rise of the peak voltage of the square wave input.

In a nutshell, slew rate and rise time tell you how much and how fast an amplifier responds to a signal.

New standards for amplifier performance

Here are the proven effects of the unique DD/DC circuit used both in the power amplifier and phono amplifier of the AU-919. Slew rate is 200V/μ sec. — the highest in the world. Rise time is 0.5μ sec. — the fastest in the world.
And to perfectly complement such unparalleled response to pulsive dynamic signals is the AU-919's frequency response — better than DC to 500,000 Hz — the widest in the world. And THD at full rated output is 0.008% — the lowest of any amplifier you can buy.

Closer to perfection

These four accurate and verifiable specifications assure virtual elimination of TIM. They assure you of clearer and more accurate reproduction of even the most complex nuances of recorded sound. With exclusive Diamond Differential DC circuit design, the "Straight DC" AU-919 integrated amplifier comes closer to theoretically perfect performance than any other comparable unit.

Sansui's AU-919: the standard by which all others will be measured.

SANSUI
AU-919

Write for interesting detailed catalogue.

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Toshiba's adres cassette deck

FOR THE LAST eight years cassette recorders incorporating the clever and effective Dolby "B" noise reduction system have dominated the cassette market. Many manufacturers have offered alternatives aimed at circumventing Ray Dolby's patents, but without exception all have bowed to the undeniable merits of his system.

Toshiba, it would appear, may be the first to offer a viable alternative having merits comparable with or superior to those offered by the Dolby system.

They call their system *adres* which stands for *automatic dynamic range expansion system*. In simple terms, it is a compander system. This means that on record it compresses and on replay it expands the dynamic range, shifting the recorded signal levels in such a way as to achieve the main benefits of the Dolby and DBX systems. The major problem with this system is that, although its record to replay performance is excellent, it is not compatible with the Dolby system and therefore pre-recorded tapes incorporating Dolby are not reproduced correctly with the adres system.

Features

The Toshiba PC-X6AD is, in some respects, a fairly sophisticated machine. It features a form of motorised operation of its control functions and an editor control which facilitates the fade in and fade out of recorded signals without fading the monitoring output. It has a two-head configuration for record/replay with integral bias and a separate ferrite erase head. A single DC motor powers the tape transport system. Two conventional VU meters, covering the range -40 VU to +10 VU, are supplemented by a peak level LED indicator whose threshold of illumination is adjustable to 0 dB, +6 dB or + 12 dB. It indicates instantaneous peaks too short for the VU meters to follow. This feature, whilst possibly novel, would have been better had it been provided by three separate LED's set up to trigger at each of the indicated levels.

The semi-professional feature of the fade in/fade out editor control not only works very well in providing a smooth transformation without any of those nasty switch on "clicks" and "plops" which many machines produce at the start and end of recordings, but also provides the semi-professional facility of "pre-fade listen" which may be used to great advantage in eliminating unwanted announcements and the like from recordings.

Toshiba include in their instruction book a sheet detailing recommended equalisation and bias settings for the chromium dioxide, ferrichrome and normal gammaferric oxide tapes of BASF, Sony, Maxell, Scotch, Fuji and TDK. In each case the bias and equalisation switches are set to the same positions as one another and whilst some tapes may possibly require independent adjustment of the bias and equalisation settings, we have not yet seen any examples which would benefit from such adjustments. Consequently we question the need for the switches which double the operating complexity for what appears to be no real benefit to the purchaser.

The reason for the peak indicator setting of +12 dB escapes us because although the adres system may well be capable of responding faithfully at +12 dB, without significant distortion, we doubt that many people would want to operate their cassette recorders in such a fashion as to have consistent or even transient signals exceeding that level.

Performance

Since no tapes were supplied with the machine, we decided to test it with Hitachi UD, Sony ferrichrome and BASF chromium dioxide tapes (three good tapes offering high performance in the medium to upper price field).

The record to replay response with all three tapes exhibits good bandwidth with remarkably low bumps at the low frequency end. There is a significant rise in output in the 12 kHz to 16 kHz region when the adres is not in use but with the adres system in circuit the top end frequency response rolls off rapidly above 13 kHz but still provides a very smooth overall performance.

Frequency response with the adres out is substantially better, being +2 dB from 27 Hz to beyond 16 kHz with Hitachi UD. Very few people can complain about this sort of performance in what is effectively a fairly "straight" machine.

The performance with ferrichrome is not as good as we would desire. There is a 3 dB lift at the low frequency end; a 2 dB drop between 5 kHz and 12 kHz; and what can be described as a "nasty" rise in response centred on 15 kHz.

The most significant feature of the machine was its replay frequency response when using our reference gammaferric oxide and TDK SA replay tapes. These were recorded on a Nakamichi

PC-X6AD

1000 Cassette Recorder and both had frequency responses extending to beyond 20 kHz when reproduced on the Nakamichi.

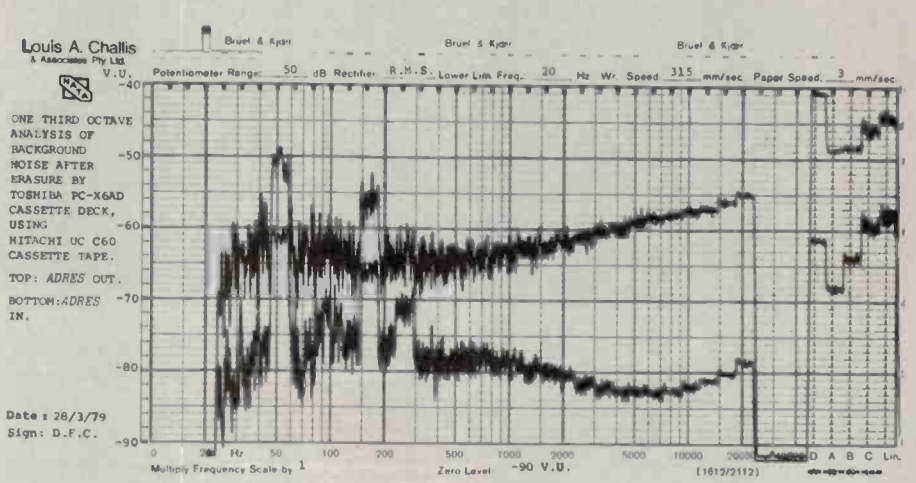
They show respectively a 4 dB rise in frequency response at 35 Hz and a -3 dB point at 10 kHz for the gamma-ferric oxide tape and 7.5 kHz for the TDK reference tape. This indicates that pre-recorded tapes would lose much of their lustre above 8 kHz when replayed on this machine. This problem could be minimised by the use of high frequency boost using the amplifier tone controls, but this would be at the expense of an increase of hiss and background noise.

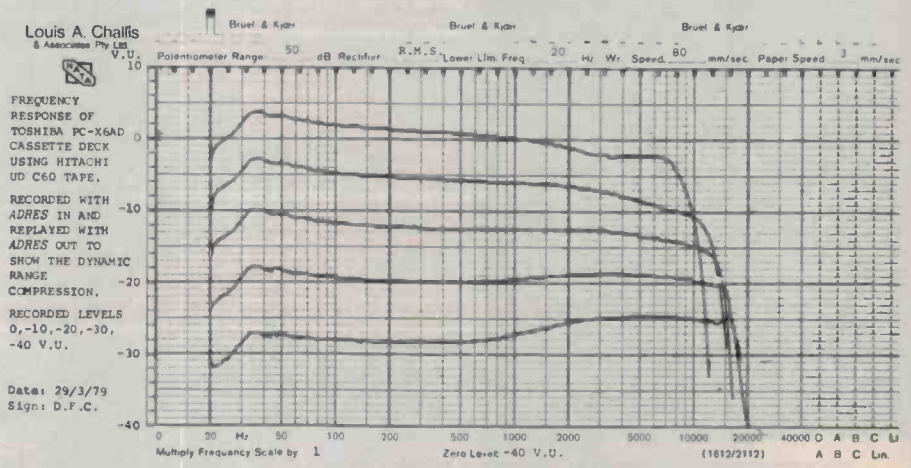
The signal to noise ratio of this machine is particularly good, especially when the adres system is utilised. A close examination of the third octave band threshold noise figures shows that the adres system not only increases signal to noise ratio in the critical 1 kHz to 16 kHz region (as does the Dolby system) but, in contrast to Dolby, it also shows reductions in noise level at the low frequency end. The level of improvement does not appear as great as the "magical" claims of the manufacturers (who claim 17 dB, 20 dB and 30 dB improvement at 100 Hz, 1 kHz and 10 kHz respectively) but our measurements show an effective 10-15 dB improvement at both 100 Hz and 1 kHz, and 25 dB at 10 kHz – still a worthwhile improvement in anyone's language.

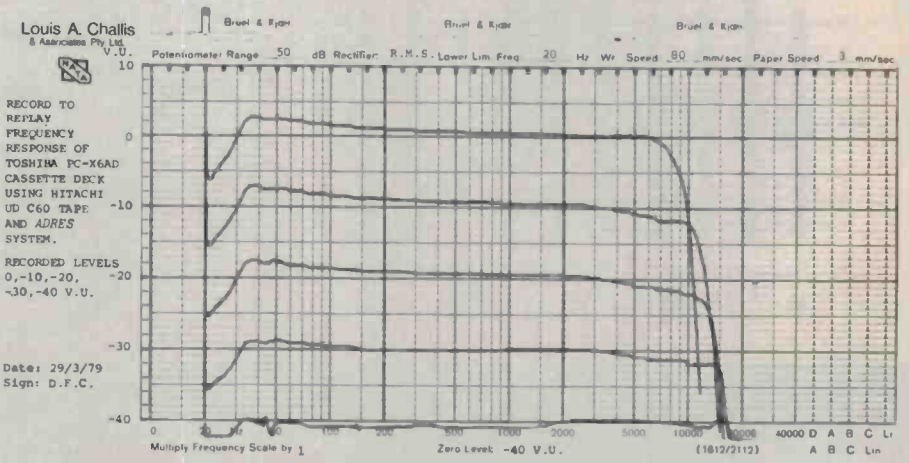
Distortion

This machine came up with some of the lowest distortion figures we have experienced to date in a non-professional machine, To be honest, we had difficulty in measuring the distortion. At -6 VU the figures are typically less than -50 dB (0.3%) which makes their evaluation that much more complex, particularly as wow and flutter can shift the frequency distortion components up and down with respect to the narrow band tracking filter being used to evaluate them.

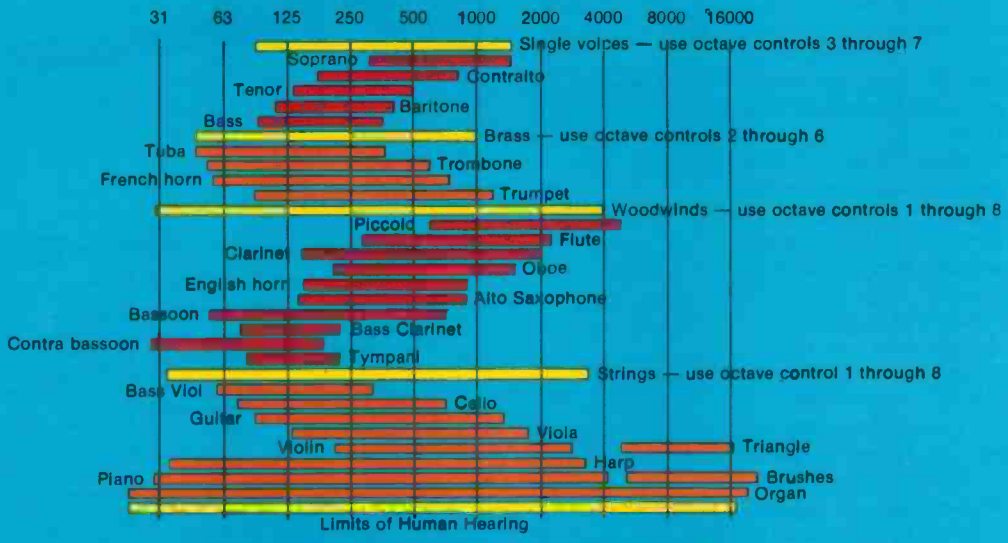
continued on page 157 ▶



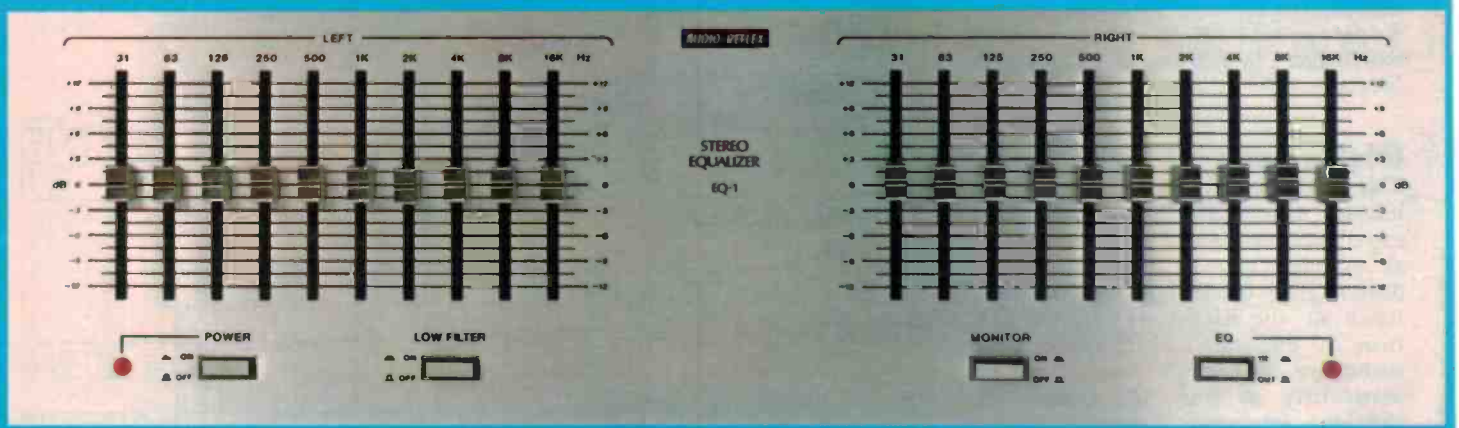




Upgrade any system
Upgrade your system



Frequency Ranges (Hertz) of musical instruments and voices



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Now you can dramatically enlarge the dimensions of your sound system without changing a single component

After you experience an equalizer at work, unequalized sound just won't seem like music anymore.

1 **Bad rooms become good rooms**
The listening room is the final link in the audio chain. It determines as much as any component, the sound that will reach your ears. Most homes are designed for comfort not for acoustics. An equalizer can let you have it both ways by transforming a comfortable living room into an excellent listening room.

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A musical instrument, a band of instruments, or a vocalist can be emphasised on a recording to aid in learning a specific tune or admire and enjoy the playing of a particular instrument.

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An equalizer can upgrade the sound of your source material by reducing record rumble and surface noise, hushing tape hiss and stiffling radio static.

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Get professional quality effects by shaping the sound of the program material to achieve the results that you want on tape.

7 **Make your own music**
Listen to the music the way you want to hear it, not the way the recording engineer felt like hearing it when he mixed it down. Bring up the vocals or fade the guitar. It's your choice. An equalizer can make music anyway you want to hear it.

An equalizer is the final component, the catalyst which will tune today's advanced components to each other, to your room and most importantly, tune the music to your ears.

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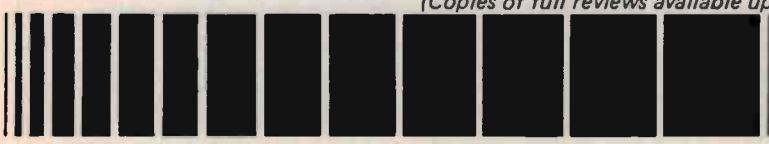
HI-FI & MUSIC, May 1979 – "The Audio Reflex equalizer has been carefully designed for general use in systems owned by audiophiles who require that 'something extra' in hi-fi systems."
CANADIAN STEREO GUIDE, Winter 1979 – "Separation between the two channels was excellent, being better than – 64dB across the range. THD was also exceptionally low, as was equipment generated noise."
THE FM GUIDE (Canadian) 1979 – "Quality, that was only hinted at with the original material, can be brought out through proper use of this well-designed, modestly priced, and simple-to-operate frequency equalizer."
(Copies of full reviews available upon request.)



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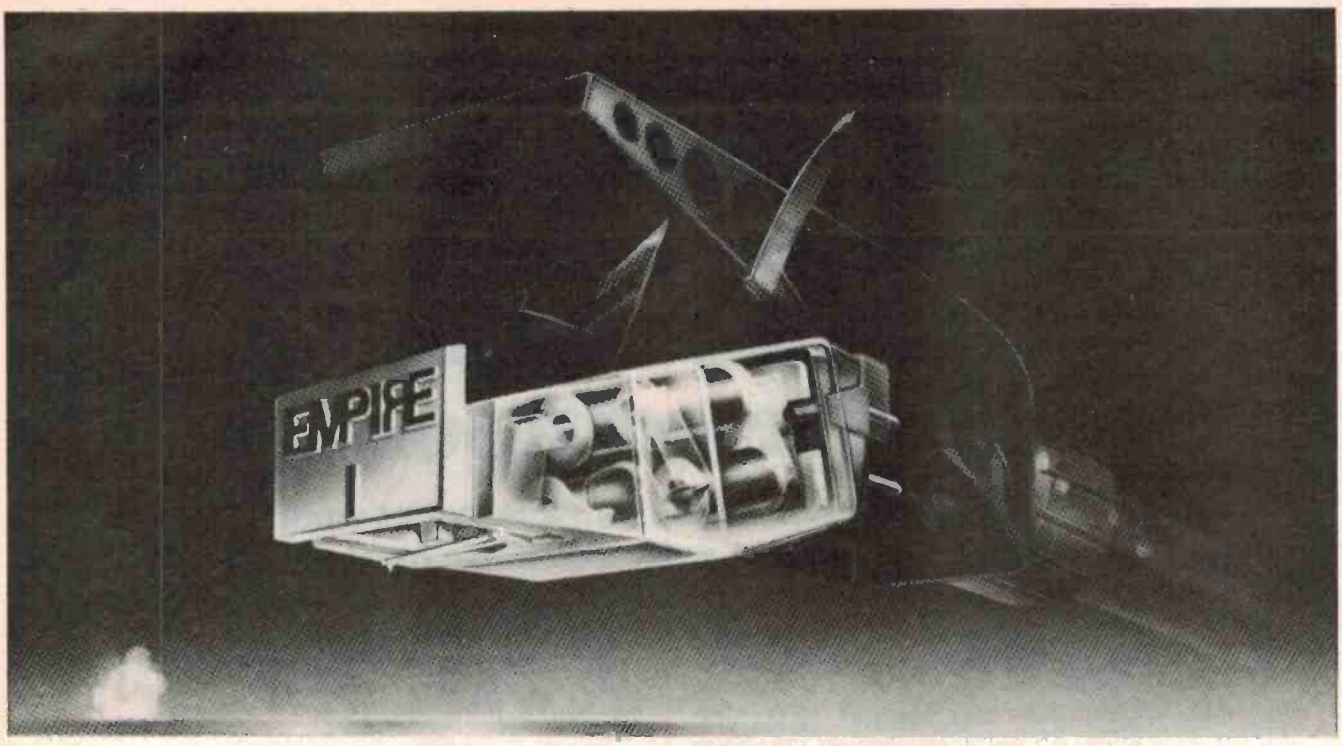


No matter what system you own there's an Empire Phono Cartridge designed to attain optimum performance.

Detail, brilliance, depth.
This is the promise of each Empire Phono Cartridge and although there are many Empire models, each designed to meet specific turntable performance characteristics, every Empire Cartridge contains the following features:

Features	Details	Benefits
Unique Fixed Unidirectional Three-Magnet Structure	Every Empire cartridge uses 3 high energy ferrite magnets in the cartridge body to provide a high level of unidirectional flux.	Higher and more linear output signal, immunity to bi-directional magnetic distortion, and improved hum and microphonic rejection.
Molded Four-Pole Magnetic Assembly	Every Empire cartridge employs a four-pole magnetic assembly that is precisely aligned and locked in place by a high pressure injection moulding process. . .providing a uniform and orthagonal magnetic field.	Improved crosstalk and reduced distortion that is insensitive to tracking force.
Tubular moving Iron Design	By using a tubular high magnetic saturation iron armature we obtain an optimum ratio of output level to effective tip mass.	Improved tracking ability and widened frequency response.
Four Coil Hum Bucking Assembly Plus Electromagnetic Shielding	Using custom designed computer controlled machines, a precision drawn copper wire (thinner than human hair and longer than a football field) is wound onto a symmetrical 4 bobbin structure. By using 2 coils per channel a symmetrical electrical circuit is formed.	Improved rejection of hum and stray noise fields.
Aluminium Alloy Cantilever	The Empire computer designed tubular cantilever provides optimum coupling of the diamond tip to the moving magnetic system resulting in minimum effective stylus tip mass.	Superb low level tracking, reduced tracking distortion. . .plus enhanced wideband separation characteristics.
Precision Ground Oriented Diamond Tips	Empire diamonds are precision ground, polished and inspected in house, using sophisticated television cameras and powerful microscopes to ensure accurate angular orientation.	Reduced tracing phase distortion, together with reduced wear of both the record and the diamond tip.

For the full story on Empire cartridges we suggest you audition one soon at your local Empire dealer. For his name and a copy of the Empire brochure 'How to get the most out of your records', write to:
Concept Audio Pty. Ltd., 13 Rickard Road, Narrabeen. NSW 2101. Ph: 913-2455

Concept Audio Where only the very best is good enough.

The manufacturers claim 0.4% distortion at 400 Hz. Our measurements confirmed this figure both at 500 Hz and 1 kHz. This performance is particularly good as most other machines produce substantially higher levels of distortion at this recording level.

Wow and flutter on this machine is also fairly good being 0.058% weighted RMS on record to replay which is comparable with the manufacturer's claims of 0.05%. The mechanism exhibited no problems in terms of "fouling" up tapes either during normal play of high speed spooling, even with the C120's which many people are hesitant to use because of the problems during high speed operation.

Summary

We found this machine extremely simple to use offering most of the attributes which the manufacturer claims. Our biggest complaint concerns the lack of Dolby replay facilities. Whilst the adres system is very effective many potential owners will be disappointed that pre-recorded Dolby tapes cannot be reproduced satisfactorily by this machine. When used as a stand-alone machine or in conjunction with tapes recorded either by the DBX process or on a machine equipped with a similar adres system, the results are undoubtedly very satisfactory.

Handbook

A rather unusual "Owner's Manual" is provided with the machine. Not only does it not use "Japanese English" but it also uses a comic-book approach with pretty pictures and the minimum of verbiage.

Whilst we found the handbook relatively easy to follow, and it does answer most questions, there were still many that it left unresolved. We would have preferred to have seen these answered in a more conventional handbook which still has much to be said for it, particularly in terms of trouble-shooting and more explicit instructions on the use of special features such as editing.

The most important feature of the PC-X6AD is undoubtedly the adres system, but until such time that there is some compatibility between competing noise reduction systems it would be nice for the intending purchaser to have the attributes of the adres system combined with compatibility with the Dolby system to provide the best of both worlds. ●

TOSHIBA PC-X6AD 'ADRES' STEREO CASSETTE DECK.

In metal cabinet, dimensions: 420 mm wide x 151 mm high x 281 mm deep (includes feet and depth of knobs).
RRP: $539.
Manufactured in Japan by the Toshiba Co.

Louis A Challis and Associates Pty Ltd

Our Ref: E1

MEASURED PERFORMANCE OF THE
TOSHIBA STEREO CASSETTE DECK PC-X6AD, SN. 91570048

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Adres	Lower -3dB Point	Max. Peak	Upper -3dB Point
Hitachi UD C60	Out	22Hz	+2dB (35Hz)	16kHz
Hitachi UD C60	In	27Hz	+2dB (35Hz)	13kHz
Sony Fe Cr	Out	20Hz	+3.5dB (35Hz)	17kHz
BASF chrom. dioxide super	Out	22Hz	+3.5dB (15kHz)	16kHz

SPEED ACCURACY: 0.25% high

WOW AND FLUTTER: 0.058% weighted RMS
0.129% unweighted RMS

TOTAL HARMONIC DISTORTION:

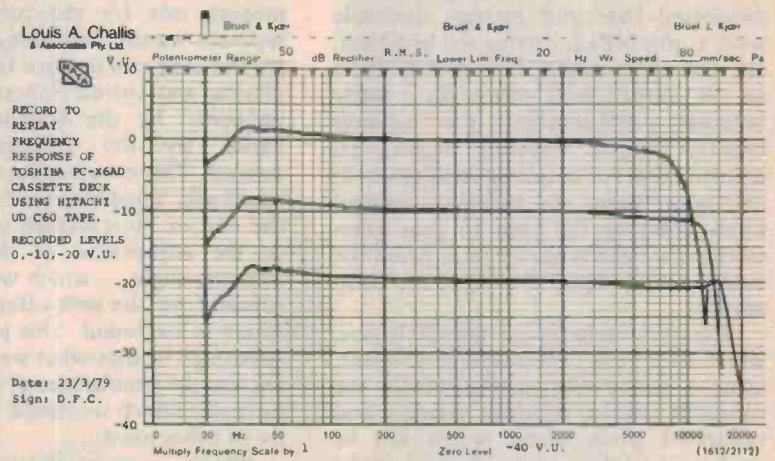
	100Hz	1kHz	6.3kHz
At -6VU	<0.14%	<0.23%	<0.22%
At 0VU	-	0.39%	-

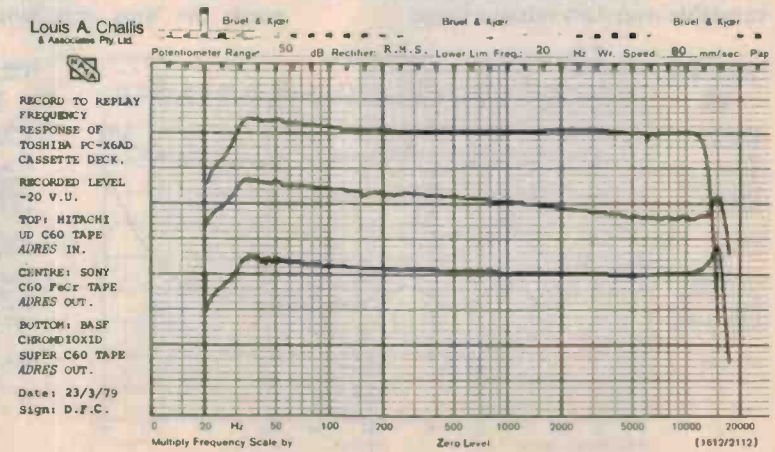
NOISE:

(Re 0VU)			
Adres out	-44dB(lin)	-49dB(A)	
Adres in	-58dB(lin)	-68dB(A)	

MAXIMUM INPUT LEVEL:
(For 3% Third Harmonic Distortion) +8VU

D.F. CRAIG
29th March, 1979.





Pioneer PL560

THE PL560 is an attractive and seemingly well-made unit featuring a heavy, fabricated base and massive turntable with a quartz-PLL driving the brushless, DC hall-effect motor. The unit features an "S"-shaped tone arm with a static balance configuration, the counter balance weight allowing incremental adjustments to 4 grams maximum in half gram steps. An anti-skate control knob covering the zero to four gram tracking weight range is provided on the extreme right hand corner of the turntable.

The unit includes an inbuilt strobe, which functions in the automatic mode, using a strobe ring on the side of the turntable and a separate control and calibrated pitch meter which can be used to alter the rotational speed of the turntable over ±6% relative range.

Unlike the majority of other direct drive turntables this unit features two motors; one for the turntable and a separate motor for lifting and traversing the tone arm to allow fully automatic playing and cut-off functions. We were impressed by the system and, within limits, by the 12-page instruction manual. This covers most questions you might ask. 'Murphy's Law' prevailed and the one we most wanted to ask, relating to the adjustment of the head shell azimuth angle – which was incorrectly adjusted on the unit offered – was nowhere to be found. This put us at a disadvantage in that what we were evaluating was the peculiarities of this particular turntable which we doubt is representative of other units.

Whilst a screw is provided underneath the tone arm which may well allow correction of this problem, we found it impossible to apply a small enough screwdriver into the slot to carry out any adjustment.

In use the controls are delightfully simple, provided that one is positive in the application of the buttons. Timidity can result in only portion of the complete function being carried out. For example, if the cut button is pushed lightly the record player does not necessarily return the tone arm to the rest position.

If the buttons are depressed in the correct manner, however, the system works well and provides relatively smooth, if a trifle noisy, transport of the tone arm onto or off the record.

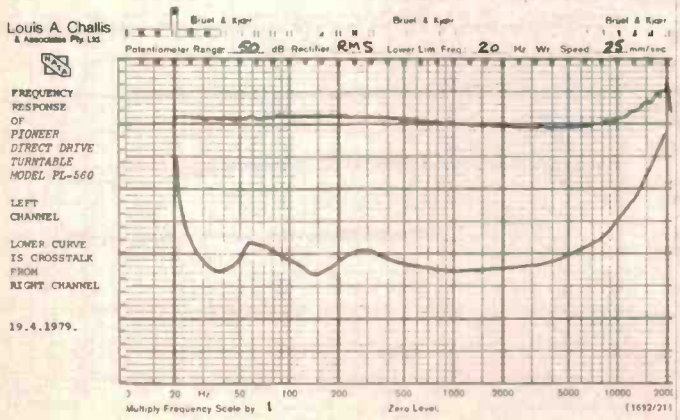
The actual buttons provided are:–

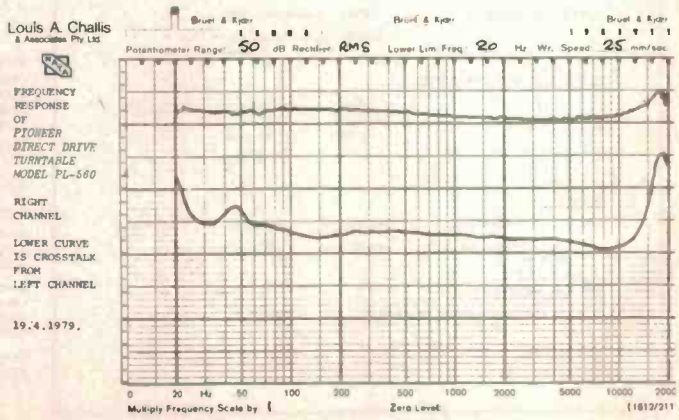
(1) A start button – which turns on the turntable and automatically traverses the tone arm onto the lead-in groove of the record.

(2) A cut button – which switches off the turntable returning the tone arm to the rest position.

(3) A repeat button – which, if depressed either before or during a record playing cycle, will cycle the record over and over again for the full side. If a smaller record size than that used is selected on the record size selector switch then an appropriately smaller segment is played.

The turntable uses a micro-switch in the signal path. This only operated after the first 1½ to two grooves on many of the records. This problem was readily overcome by a simple screwdriver adjustment provided next to the tone arm spindle.





full auto turntable

PIONEER PL560 FULLY AUTOMATIC TURNTABLE, S.N. Y113960

Dimensions: *440mm wide x 145mm high x 365mm deep*
Weight: *10.5kg*

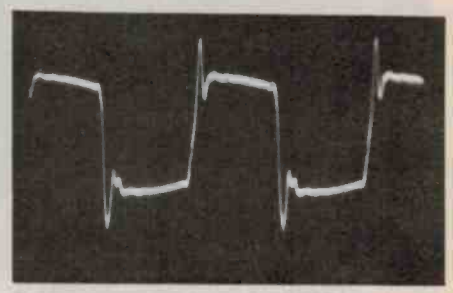
Fitted with AC inlet type plug with separate power cord on the rear of the plinth and acrylic dust cover fitted onto quick release hinges. The unit comes with a Pioneer Cartridge, type PC400, as supplied. Manufactured by Pioneer Electric Corporation, Tokyo, Japan.

The quartz crystal phase locked loop capability proved, in general terms, to be up to the task but we could still detect incipient wow and flutter and considered that although the unit nearly meets its stated specification it falls short of the professional performance that the manufacturer may be seeking to achieve. The usefulness of the variable pitch capability is questioned in the domestic scene but could well be very practical commercially. The pitch meter proved to be reasonably accurate and seems a worthwhile feature.

The turntable base is mounted on four large spring and rubber isolator mounts. We evaluated their isolation performance on a large shaking table, applying a constant level of measured velocity to the supporting structure to determine the isolation efficiency. The electrical output from the cartridge, related to our standard reference level, thus provides a direct assessment of the system's performance.

The isolation mounts perform well in minimising the structural vibration from the supporting surface and the resonance at 13 Hz is a good compromise between some soft mounts and the more conventional low deflection mounts.

Whilst they are not the best we have evaluated, they come very close to it.
The head shell did not perform as well as we would have liked, because of its mal-adjustment, but the tone arm showed definite attributes. The fundamental resonance of 6 Hz would allow it to perform very well on most complex and difficult recordings, particularly those with significant low frequency

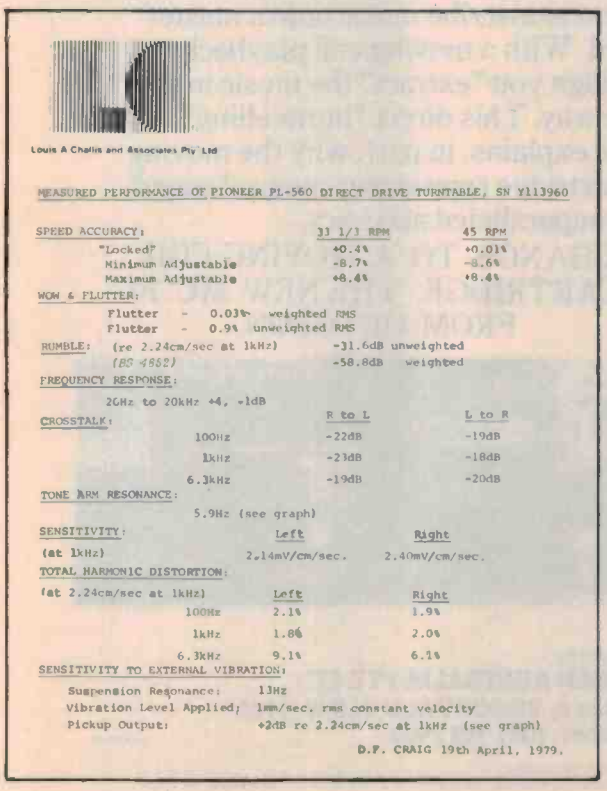


Square wave output of PL560 at 1 kHz recorded at an equivalent sinusoidal velocity of 7 cm/sec RMS.

content. The ruggedness of the tone arm bearings impressed us and they would obviously accept considerable abuse from either the domestic or commerical fields.

We subjected the complete system to exhaustive tests prior to embarking on the instrumental investigation. The first factor that disturbed us was the rising high frequency response which we could detect on most programme material that we played. This was particularly noticeable on directly recorded discs such as Sheffield Volumes 2 and 3. Although

– continued page 163. ▶



Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF PIONEER PL-560 DIRECT DRIVE TURNTABLE, SN Y113960

SPEED ACCURACY:	33 1/3 RPM	45 RPM
"Locked"	+0.4%	+0.01%
Minimum Adjustable	-8.7%	-8.6%
Maximum Adjustable	+8.4%	+8.4%

WOW & FLUTTER:
Flutter - 0.03% weighted RMS
Flutter - 0.9% unweighted RMS

RUMBLE: (re 2.24cm/sec at 1kHz) -31.6dB unweighted
(BS 4552) -58.8dB weighted

FREQUENCY RESPONSE:
2GHz to 20kHz +4, -1dB

CROSSTALK:	R to L	L to R
100Hz	-22dB	-19dB
1kHz	-23dB	-18dB
6.3kHz	-19dB	-20dB

TONE ARM RESONANCE:
5.9Hz (see graph)

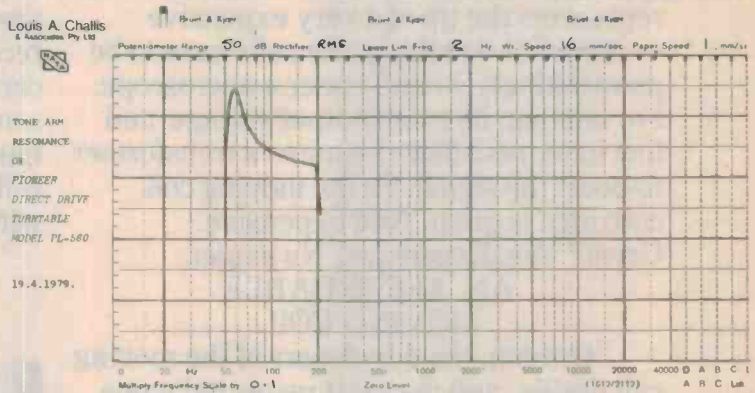
SENSITIVITY:	Left	Right
(at 1kHz)	2.14mV/cm/sec.	2.40mV/cm/sec.

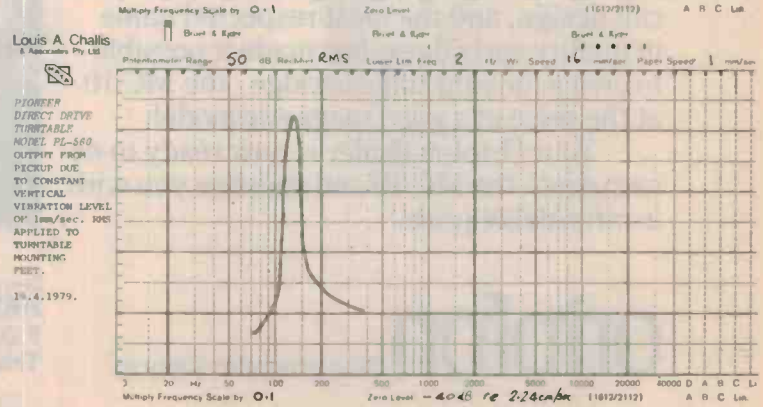
TOTAL HARMONIC DISTORTION:

(at 2.24cm/sec at 1kHz)	Left	Right
100Hz	2.1%	1.9%
1kHz	1.8%	2.0%
6.3kHz	9.1%	6.1%

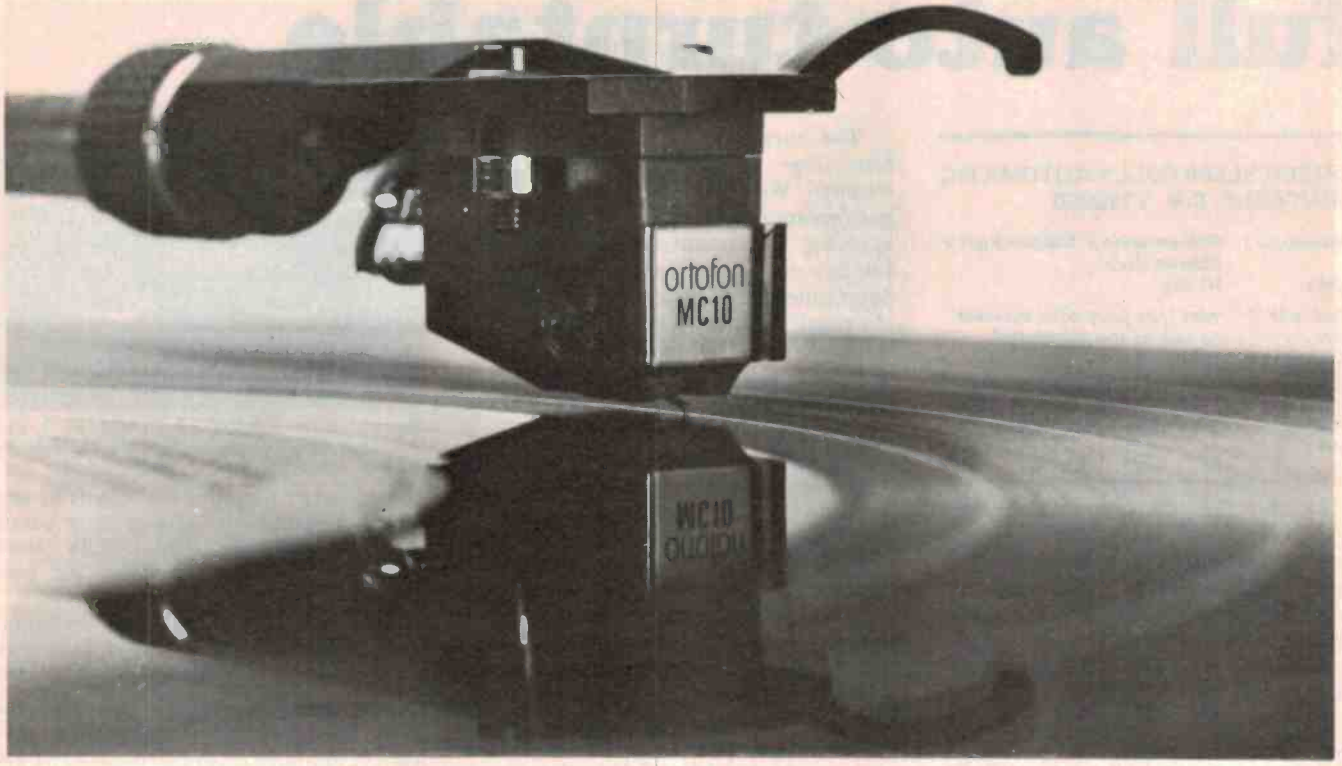
SENSITIVITY TO EXTERNAL VIBRATION:
Suspension Resonance: 13Hz
Vibration Level Applied; 1mm/sec. rms constant velocity
Pickup Output: +2dB re 2.24cm/sec at 1kHz (see graph)

D.F. CRAIG 19th April, 1979.





A MOVING COIL CARTRIDGE AT A PRICE YOU CAN AFFORD.



The experts agree. A moving coil cartridge reproduces music more accurately than any other design. But such a cartridge represents the tip of a very expensive system. For one thing, the coils have to be painstakingly wound under a microscope. For another, its small output voltage and low inner resistance requires a transformer to boost the signal. So the moving coil cartridge is great. And expensive. Great? Yes. Expensive? No longer.

AN AFFORDABLE MOVING COIL.

Ortofon, the developers of the moving coil design, and the most respected name in quality cartridges, has made it possible to own a moving coil cartridge - the MC 10 - at the price of a good magnetic model.

Your Ortofon dealer is now ready to demonstrate the MC 10 and surprise you with its affordable price.

THE RECORD CUTTERHEAD AND THE MOVING COIL.

A cutterhead uses a moving coil system to inscribe music onto a master record. With a moving coil playback cartridge you "extract" the music in the same way. This direct "unravelling" of the music explains, in part, why the moving coil cartridge reproduces musical sound with unparalleled accuracy.

CHANGE TO A MOVING COIL CARTRIDGE. THE NEW MC 10 FROM ORTOFON.

ortofon accuracy in sound

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P.O. Box 6, BROOKVALE, N.S.W. 2100
Telephone: (02) 939 2922

HA119/78

Distributed in New Zealand by—
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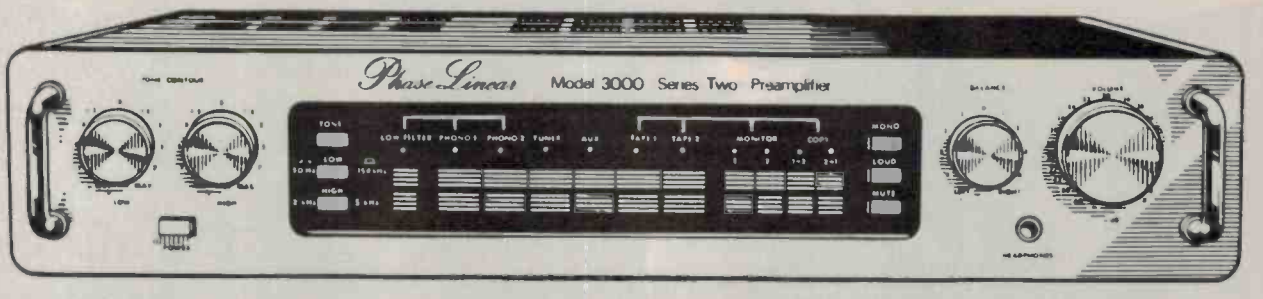
A new preamp for the perfectionist who can appreciate the difference.



Phase Linear 3000 Series Two.

The new Phase 3000 Series Two was designed for the music-lover who has a passion for accurate sound, an eye for elegant, yet functional design, a feel for craftsmanship, and an unfailing determination to maximise return on investment.

The Phase 3000 incorporates the latest technological advancements in preamp design. Transient overloading that plagues preamps has been virtually eliminated, whether amplitude, frequency, or slew induced. Now you can enjoy the flexibility, performance and features that are priced substantially higher in other equipment.

CMOS Logic Memory System.

Most preamps use dated mechanical switching devices that force signals to travel long, noisy, circuitous routes from the inputs to the front panel, then back to the outputs. Ours doesn't. The Phase 3000 uses CMOS-digital logic to energise switching relays located where they belong, at the input jacks. This shortens critical signal paths. Noise, hum, and the "crosstalk" that's characteristic of mechanical switching is virtually eliminated.

Want more?

A listening session with a pair of headphones will convince you just how much of a difference a true headphone amp makes. Turn the 3000 around, and see how easy it is to patch in your noise reduction unit. Two complete taping circuits allow you to copy between decks while listening to another source.

If you're serious about state-of-the-art performance it's time for you to do some listening.

Hear the difference at your audio specialist's, or write for complete information.

Distributed in Australia by Acoustic Monitor Co Pty Ltd (Member of the Thomas & Coffey group), 12-18 Gould Street, Enfield, NSW 2136. Phone: (02) 642-7888. Telex: 26778. Cables: "Tomcoffy" Sydney.

Phase Linear®

THE POWERFUL DIFFERENCE

Phono Cartridge Flexibility

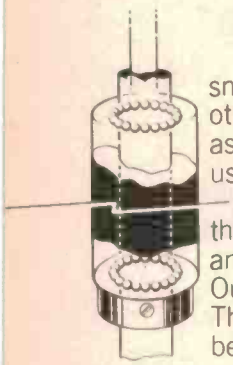
The two independent RIAA phono stages eliminate all low-level switching. As a result, noise is reduced to theoretical limits.
Phono 1 is designed for moving-magnet cartridges and has three selectable capacitance values.
Phono 2 is used with moving-coil cartridges and has three selectable resistance values. The expensive outboard head amp usually required for a moving-coil cartridge is already built into the 3000.

SMA/AM5

Take the Pioneer to pieces to find what makes it unique.

On the surface, most turntables appear to be very much the same.

That's why we suggest you should look at the PL-560 in more depth.



First, take our arm.

Our tone arm moves smoothly and silently. Where other makes rely on as few as 3 ball bearings, Pioneer uses 40.

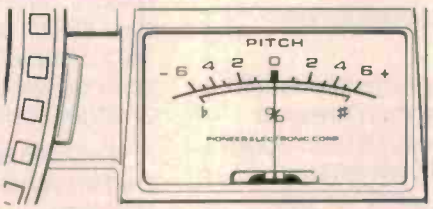
Some turntables mount their arms on cheap plastic and piano wire that vibrates. Ours floats on pivot bearings This explains why we sound better.

Accuracy at every turn.

By using our own Quartz locked DC Hall motor just to power the platter, Pioneer give you accuracy and reliability for the life of the turntable.

The Hall motor assures the PL-560 turns silently. Any vibration or radiation is also eliminated.

Moreover, if you keep delving, every piece of Pioneer engineering you reveal will be backed by precision componentry.



A feature that's obvious.

While you're finding out how the PL-560 compares on the inside, look up for a minute. Note the Analogue Pitch display meter next to our strobe.

Use it expressly for tuning your music by 6% up or down.

A second motor. Just for moving our arm.

Many automatic turntables don't hesitate to put strain on one motor by asking it to perform extra functions.

However, Pioneer prefer to use a Warren gear motor to move their tone arm, which in turn takes the load off the primary drive.

The extra power gained makes "Arm drag" on the PL-560 non-existent.

At this point, please continue the examination at your own speed. You'll find we're much more turntable than we appear to be.

All the turntables illustrated offer the excellence synonymous with Pioneer.

PL-560 $559.00*

— PL560 turntable

the background noise on these records is relatively low, the non-linear high frequency response provided a significant increase in the background noise to the detriment of the recorded content. This characteristic response was later substantiated by our objective measurements.

The cartridge's performance on the Shure TTR 101 test record "Audio Obstacle Course" was only modest and the "orchestral bells" and "drums and cymbals" only reached level three before exhibiting distortion. The instrumental testing showed a 5dB rise in the frequency response at 20 kHz.

The onset of the rise started at 9 kHz and was obviously intended to expand the frequency response to the 30 kHz region. This approach has resulted in less than acceptable performance in the critical top end of the frequency spectrum. Whilst the lower end of the frequency response is quite smooth, a rising frequency response of this type can be partially obviated through the use of the tone controls. This approach cannot, however, correct for subsequent ringing and distortion that may be produced on transients.

Whilst a channel separation test is obviously unfair with the cartridge misaligned in the head shell, it did nonetheless show that the cartridge is capable of reasonable channel separation between the left channel and the right channel. With proper adjustment, this would normally lie at least 25 decibels down in the mid-frequency region.

The wow characteristic of 0.3% peak-to-peak swing is high, particularly after the build-up in the handbook on 0.2 u machining tolerances. The flutter characteristics approached the manufacturer's figure, being 0.03% weighted RMS. The rumble is also good at −59dB weighted whilst the signal-to-noise ratio is typically 62dB. The ability of the motor to cope with various levels of stylus drag, as well as its ability to bring the turntable up to speed, is impressive. This it does in less than 0.7 seconds.

The absolute speed accuracy was 0.01% fast at 45RPM and 0.4% at 33 1/3 RPM. This is obvioulsy bad alignment as the control is not user accessible.

The PL560 is a reasonably well designed system having good mechanical attributes with a rugged and well designed tone arm structure. We must presume that the unit we received had suffered an inadvertent abuse in transit. With a better cartridge than the PC400 this unit would perform exceptionally well as the tone arm resonance and other operational characteristics are better than many other direct drive turntables that we have previously evaluated. ●

AN EVENT THAT WILL CHANGE YOUR WHOLE PROFIT PICTURE!

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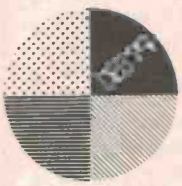

THE 4TH AUSTRALIAN CONSUMER ELECTRONICS SHOW.

Read the list below carefully. Here are some of the exhibitors at the 4th Australian Consumer Electronics Show. If your suppliers are listed here, if you'd like to meet new suppliers, if you'd like to see and have demonstrated the latest in electronics equipment at the one place at the one time — you must attend! After all, your competitors will be there. A.G.S. Electronics, Aiwa, Akai, Acoustic Monitor, Acoustic Research, Audio Engineers, B.J.D. Electronics, Communications Power, Maurice Chapman, Computerland, Concept Audio, Convoy, Casio, Electro Voice, Electronics Today International, Falk, Farrell, Futuretronics, Graham Audio, H.M.V., Hagemeyer, Hanimex, Hitachi, Hoskins, Kriesler, National Panasonic, Nipper, Peterson, Philips, Pioneer, Pye, Radio Rentals, Rose, Roland, Sanyo, Sharp, Superscope, Teac, Tokyo Boeki, Trio-Kenwood, Union Carbide and Van Fi.

The biggest consumer electronics show ever — over 80,000 square feet!

These suppliers will be exhibiting over 100 brand names. They'll be offering special show deals to get you off to a flying start for the peak selling Christmas period. Remember over 25,000 consumers who attended last year's show were seeking direction on outlets stocking the new products. So make sure you're right up to date and see these products from Europe, Asia, America and Australia. Cassette decks, turntables, receivers, amplifiers, tuners, speakers, tapes, equalizers, three in ones, car radios, professional sound equipment, musical instruments, microwave ovens, batteries, lighting, electronic toys, audio accessories, CB equipment, personal computers, calculators, digital watches, radios, televisions (including closed circuit), computerized games, video cameras, video cassette recorders, TV games.

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Trade Cocktail Party — meet and talk with your fellow retailers at the Boulevard Hotel, Wed., July 18, 6.30 – 8.00 pm.

Informal BBQ and country and western night. Wind up the show at a real 'wing ding'! At the Showgrounds. Sun., July 22nd from 7.00 pm.

Show open to trade only.
Wed., July 18. 12 noon – 5.00 pm.
Thur., July 19 – Sat., July 21. 10 am – 1 pm.
Sunday, July 22. 9 am – 12 noon.

Public admitted
Thur., July 19 – Sat., July 21. 1 pm – 10 pm.
Sunday, July 22. 12 noon – 7 pm.

Your competitors will all be there. Can you afford not to be! Post this coupon *immediately.*

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RP374

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He's a fully qualified electronics engineer.

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The problem is, that our equipment is also among the best in Australia. Because before it gets here it must undergo a series of stringent quality control checks.

Consequently, Yamaha equipment rarely needs repairing.

Which means Keith rarely has any work to do.

Still, turning the pages of Playboy can be quite strenuous!

YAMAHA

RM 186

Pioneer CT-F900

THE VIRTUES of standard VU metering have been under attack from cassette deck users for quite some time. To meet operational requirements many cassette decks now offer peak responding LED displays, optional peak hold and instantaneous response indications in an attempt to obviate the insidious problems of average reading meters. These meters do not have the speed to respond to the peak signals which can so easily send the recorded signal into saturation level. Pioneer's new unit overcomes such problems.

Features

The most striking feature of the CT-F900 is the fluoroscan metering system with its bright blue display along with large digital tape counter with a similar appearance.

The heart of this cassette deck is a complex control system based on the use of a microprocessor. This provides the memory capacity for the automatic re-cycling to a marked spot on the tape which allows multiple replay and automatic replay facilities.

The microprocessor is also used to control the digital indication of record and play-back levels on the fluoroscan display. These cover the range −20 dB to −4 dB in 2 dB steps and −4 dB to +7 dB in 1 dB steps. The display can be set to provide the normal response of a VU meter, to follow instantaneous peaks or hold the peak level and display it simultaneously with the signal level. The first two are of use to the amateur. The peak hold capability offers a new flexibility that no other industry or VU metering system can even approach in terms of usefulness.

The deck incorporates an excellent three-head two-motor tape transport system which is smooth, effective and simple to use. The appearance of the unit is to say the least striking although, by its size, it appears to be aimed at the American market where "big is beautiful".

The frontal appearance of the deck is radically different compared to other units as it does not incorporate a standard cassette well nor a conventional cassette mounting system. Instead the cassette is inserted onto the drive spindles in the vertical plane. There it latches onto its supporting mechanism over a compact three-head drive system. When not in use this is hidden behind a hinged cover which may protect it from dirt etc, if one remembers to close it.

The drive system is solenoid controlled and offers one of the smoothest performances of any cassette deck that we have evaluated. The mechanical features could not be faulted (and we did try) and it is obvious that Pioneer have devoted considerable effort into perfecting a system which hopefully will now chew up tape the way some of their competitors' systems have in the past.

The only deficiency that we could find with this section of the deck was the thermal dissipation of the solenoids themselves. This may be a factor underlying the use of the large metal case. The mechanical drive section of the system is quite different to other manufacturer's systems and the three-head section is neat and claimed to be very rugged. The latching system for holding the cassette in position is simple and positive and, based on our testing, is very practical. The removal of the ubiquitous plastic cover over the cassette seems to be a positive advance in the design of cassette decks.

One useful and essential feature of the two-motor drive system is the automatic control which takes up the "tape slack" before the system starts to operate. One could ask the obvious question "Why didn't somebody do it before?".

Pioneer are quick to point out that, with excessive slack, even this feature may be inadequate and hand tightening of the tape may be necessary.

Under such circumstances, if excessive slack is not eliminated, there is a strong possibility that a good cassette could be chewed up in the drive. Notwithstanding these warnings, we experienced no problems and Pioneer must get full marks for this innovative feature, whose absence has caused problems in many other two-motor drive systems.

stereo cassette deck

The front panel of the CT-F900 features a number of conventional controls laid out in a significantly different manner to other cassette decks on the market.

The first difference relates to the stacking levels of the touch controls for the drive mechanism, each of which features an indicating LED.

The second difference relates to the front bias control which features positive and negative bias adjustment (which is intended to be adjusted by ear) for flattest frequency response. In practise, whilst such a control may be advantageous, reference to the data given in the handbook for normal commercial tapes we believe would prove more satisfactory. Our frequency response tests were carried out using this more pragmatic approach.

The controls inset with the fluoroscan display and digital tape counter are interesting. The tape counter, which is electronically triggered by impulses from the tape drive, has some "fancy" memory facilities. The counter re-set button zeroes the digital tape counter and interacts with the memory and repeat functions in the following manner: If the memory stop button is selected, then the tape can be automatically stopped at a pre-determined position (000). If the "play" switch is selected then, on coming to the end, the tape rewinds automatically to the spot marked "000" on the tape counter and goes into the "play" mode.

In the counter repeat mode, the tape rewinds to the pre-set position whenever the end of the tape is reached and then starts replaying from "000". In the repeat "end" mode, the machine automatically rewinds the tape and starts playing it from the beginning for endless listening.

These features would seldom be used by even the serious amateur, but could be a distinct advantage for commercial or background music purposes.

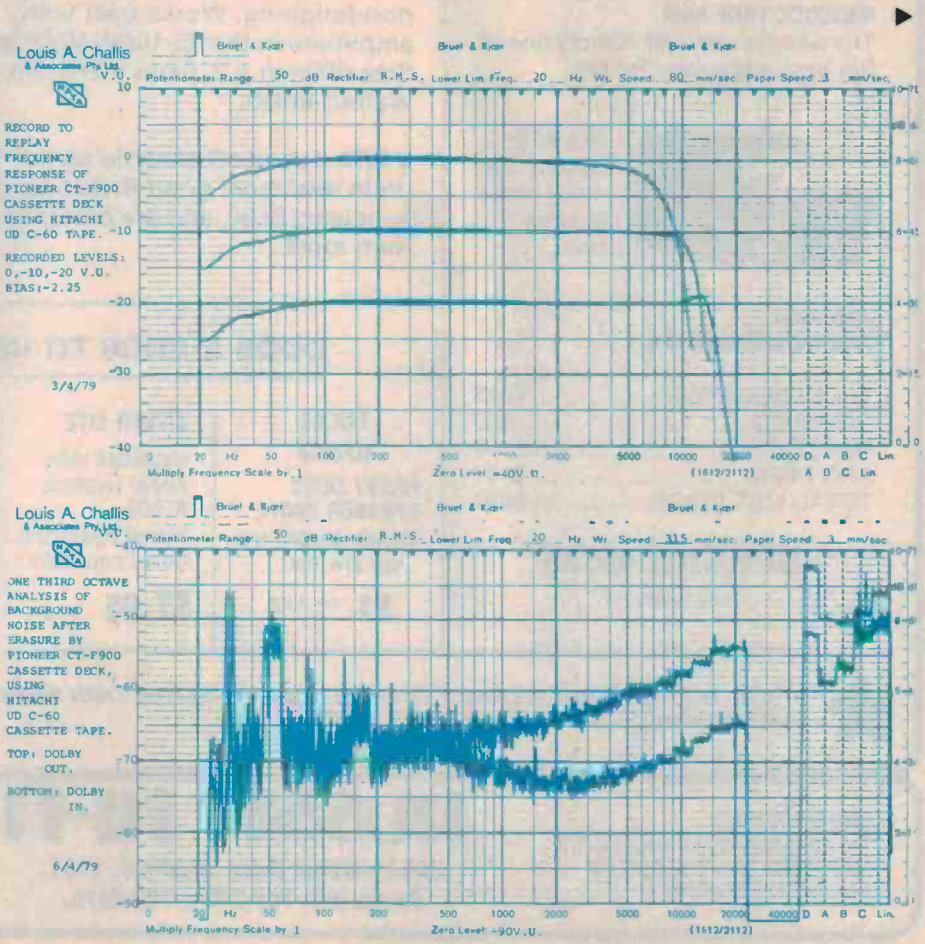
Three other controls are provided for use with an external timer which will allow the unit to be turned on at one or more pre-determined times to record specific programmes whilst the user is away from the machine.

Performance

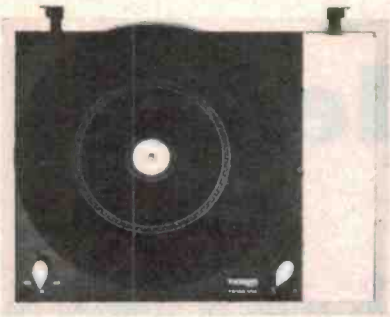
The first series of tests related to record/replay frequency response and showed that, whilst capable of reasonable performance, the 3 dB frequency response with typical ultra-dynamic tape, ferrichrome or chromium dioxide falls short of what we would have expected. The measured 3 dB upper frequency response for gammaferric oxide was 13 kHz, 14 kHz for ferrichrome and 16 kHz for chromium dioxide. Whilst a 16 kHz bandwidth is reasonable for a good machine, it is below the level which we would expect from a machine featuring the technological advances of the CT-F900.

The replay frequency response using Hitachi UD C-90 was only 3 dB down at 19 kHz. On TDK SA tape, however, the 3 dB point was 11 kHz!, as shown on the curve.

The speed accuracy was good at +0.05%. The wow and flutter figures ▶



*KARISMATIC KOMBINATIONS



THORENS TD160 MK11B WITH SPECIAL MAT DISK SE22
Correctly set up, this basic unit offers a level of performance that is almost unbeatable.

HADCOCK TONE ARM
The reviews say it all. Simply one of the best, especially for the:

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Quality that rivals many moving coils.

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THORENS TD160	$323
DISK SE22	$29
HADCOCK	$169
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TOTAL LIST PRICE	$647

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Advt. Price $450

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SPECIAL OFFER!

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MODEL 621 AMPLIFIER
A very conservative 40W per channel. Read the full review in HI-FI REVIEW, March 1978. To quote in part: "The amplifier sounded far larger than it looked. Particularly impressive was the well maintained bass . . . seemed to suffer no strain and tackled transients with a confident ease."

THE MODEL 602 LOUDSPEAKER

Fully imported. Three way system using AUDAX drive units. Typically British sound — nicely detailed and non-fatiguing. Works best with amplifiers in the 25-100W RMS range. Size 600mm x 270mm x 284mm. Walnut finish.

• When used on suitable stands these units rival most good British speakers to at least $600, and are better finished than most.

Advt. Price $698 pr.

SPECIAL $498 pr.

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LUCAS HF2000 HEAVY DUTY SPEAKER CABLE
Ribbon shaped low cap low res.
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Permanently removes static from records. Does not impair fidelity in any way.
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UNDERGROUND
The new underground newsletter THE AUDIOPHILE issue No. 1 is now available from Russin Hi-Fi.

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Visit our stand on the 5th floor Chevron Hilton, Kings Cross, Sydney. June 22-24, 1979.

were typically 0.05% to 0.06% weighted at the start of the tape; 0.04% to 0.045% at the middle of the tape; and 0.05% to 0.045% at the end of the tape.

The total harmonic distortion figures were only fair. At 0 VU the distortion was 2.2%, which is not particularly good, but at 1 kHz it was 0.33%. At +7.5 VU, just above the top range of the fluoroscan meter, the unit developed 3% total harmonic distortion at 1 kHz. This performance is reasonable but is not representative of the distortion components produced at lower frequencies. At higher frequencies, the saturation characteristics of the recorder would tend to mask the distortion components produced.

The Dolby noise reduction system works very well providing a genuine 11 dB signal to noise improvement between 3 kHz and 20 kHz, whilst the A-weighted signal to noise improvement is 9 dB. The double Dolby feature proved very convenient in monitoring the programme content being recorded off tape.

Inside the case the electronics in the unit is well laid out and the multiplicity of integrated circuits enables the bulk to be kept to reasonable proportions. The deck is designed for ease of servicing. The fluoroscan system and solenoid controls get rather hot and the case ventilation system falls short of what we would like to see for Australian conditions. This is particularly important as the unit is designed for stacking or rack-mounting other equipment immediately above it.

The machine is designed for rack mounting by the addition of a set of brackets.

Summary

The most attractive features of this unit are its first class mechanical drive, its easy level setting with the fluoroscan system and its visual impact.

We were disappointed with the record and the record/replay frequency response curves. This may relate only to this particular machine and may or may not be generally indicative of the response of the CT-F900 in general.●

Louis A Challis and Associates Pty Ltd

Our Ref: E2

MEASURED PERFORMANCE OF THE

PIONEER STEREO CASSETTE DECK CT-F900, S.N. ZB 8402106

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Dolby	Lower -3dB Point	Max. Point	Upper -3dB Point
Hitachi UD C60	Out	30Hz	+0.8dB (12kHz)	15kHz
Hitachi UD C60	In	35Hz	+0.8dB (6kHz)	13kHz
BASF Ferrochrom C60	Out	35Hz	+0.2dB (350Hz)	13kHz
BASF Chromdioxid C60	Out	30Hz	+0.8dB (250Hz)	16kHz

SPEED ACCURACY: 0.05% High

WOW AND FLUTTER: .048% Weighted RMS
.126% Unweighted RMS

TOTAL HARMONIC DISTORTION:

	100Hz	1kHz	6.3kHz
AT -6VU	0.7%	0.13%	0.32%
AT 0VU	2.2%	0.33%	-

NOISE:

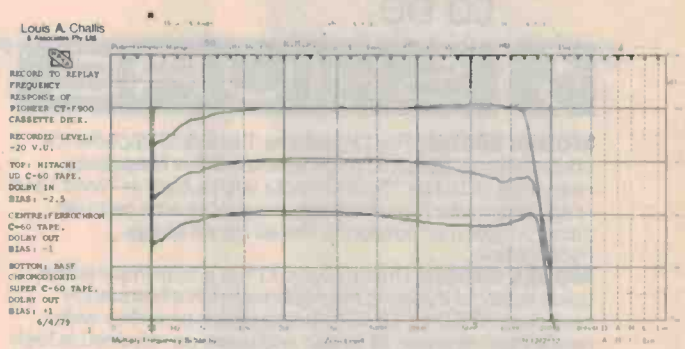
(re 0VU)	Dolby Out	-46dB(lin)	-50dB(A)
	Dolby In	-50dB(lin)	-59dB(A)

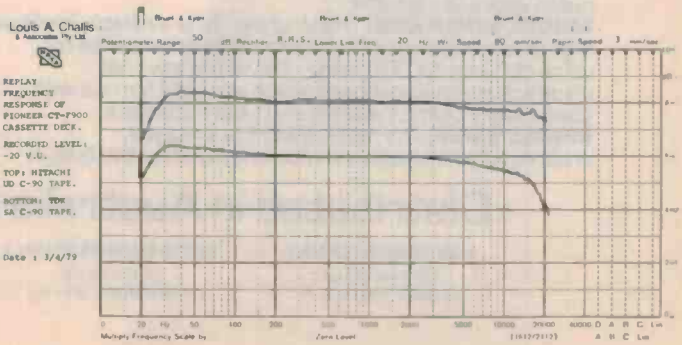
MAXIMUM INPUT LEVEL:

(For 3% third harmonic distortion at 1kHz) +7.5VU.

PIONEER STEREO CASSETTE TAPE DECK, MODEL CT-F900, S.N. ZB8402106

Dimensions: 420mm wide x 187mm high x 374.5mm deep
Weight: 10.1 kg
Complete with stereo cords, separate DIN mains plug-in lead and comprehensive operating instructions. Double Dolby processing featured.
Manufactured in Japan by the Pioneer Electric Corporation.





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Professional microphones

MODEL 565SD: The Unisphere 1 is a dual impedence unidirectional dynamic microphone with a frequency response of 50 to 15,000 hertz with a built in "wind" and "pop" filter which enables the microphone to be used either indoors or outdoors. An all round stage microphone.

MODEL 545SD: The Unidyne 111 is a dual impedence unidirectional dynamic microphone with a frequency response of 50 to 15,000 hertz which provides wide range reproduction of music and voice as required in high quality theatre—stage sound systems as well as critical public address systems.

MODEL 515SA &SB: The Unidyne "B" is available in either high or low impendence with a frequency response for voice of 80 to 13,000 hertz. These are low cost unidirectional microphones which are ideal for use with good quality sound systems and tape recorders.

MODEL SM58: The model SM58 is a rugged, unidirectional microphone with a highly effective built in "wind" and "pop" filter and a frequency response of 15 to 15,000 hertz. The SM58 is suited to studio vocal music recording and is possibly the best popular vocal microphone available at the present time for stage use. It's rejection of feed-back is also excellent.

MODEL SM57: The model SM57 is a slender dynamic microphone built to provide wide range reproduction of music and voice. They feature an exceptional uniform and effective unidirectional pick-up pattern with a frequency response of 40 to 15,000 hertz and makes this ideal for use in studio broadcasting recording and critical sound reinforcement applications.

MODEL 588SA & SB: The Unisphere "B" series is available in either high or low impedence with a frequency response for voice of 80 to 13,000 hertz. It has a built in "wind" and "pop" filter which makes it ideal for use as a vocal microphone with orchestras, small combos and tape recording where cost is a factor. A good allround performer.

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AE140/FP

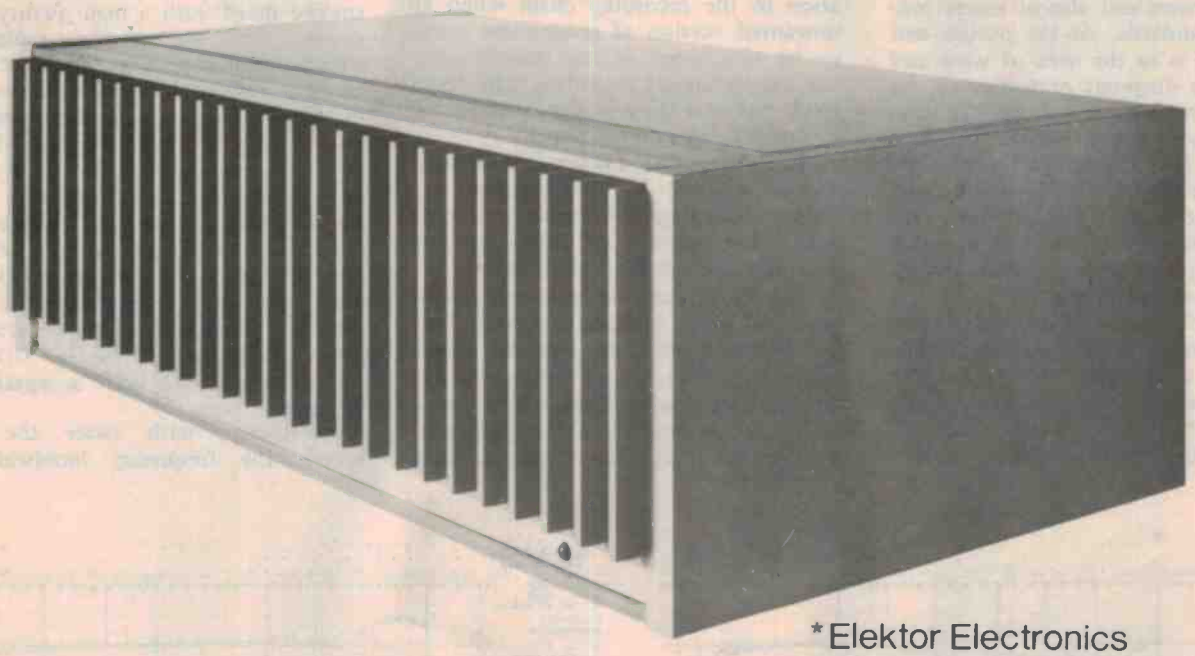
Not a win on the pools, a trip to a Pacific paradise, or a reduction in income tax, but distortionless "current dumping".

Z's 1 to 4 are the four passive components which interconnect the current dumpers, (the output transistors which supply the power), to the small high quality amplifier which provides the error signal, so that when the above condition is met the current in the load, the loud-speaker, is independent of the current in the dumpers and hence distortion is solely dependent on the quality of the error amplifier, which because it is small can be very good.

Wonderful indeed.

For further details write to Audioson International Pty. Ltd. 64 Winbourne Road, Brookvale, N.S.W. 2100.

"Something wonderful happens when $Z_1Z_3=Z_2Z_4$" *



*Elektor Electronics Magazine No. 8. Dec. 1975

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B.I.C. T-2 dual-speed

JUST WHEN we start to think there are unlikely to be many more state of the art advances in cassette decks, one or another of the manufacturers pulls some new form of hat out of his bag. The BIC T-2 cassette deck is an example. This machine not only features the standard tape speed but also offers a double speed mode of 9.5 cm/sec which provides an improved frequency response as well as improved overall performance characteristics.

We have always believed that, within stated limits, the standard compact cassette can provide a performance that is adequate in most respects for consumer purposes and almost meets professional standards. As the purists will tell you, it is in the area of wow and flutter, tape drop-out performance and the upper frequency limit that the standard compact cassette generally suffers limitations. It is for this reason that the Japanese developed the look-alike but larger Elcasette system which operates at 9.5 cm/sec and consequently provides performance that is on a par with standard reel-to-reel machines.

The BIC T-2 is thus a combination of the economical and practical performance of a standard speed compact cassette machine yet still offers, at the expense of half the tape time, many of the capabilities of the Elcasette system.

In terms of its general external appearance and the primary features that it offers, the BIC T-2 is a fairly conventional machine. The most significant variation is in the VU meters which cover a 45 dB range (i.e.: 0 to −40 and +5 VU peak). It also incorporates a memory switch to enable one to return to a pre-set tape position using the "000" re-set button of the tape counter. Another unusual feature is the three-level recording control switch with positions for "safe" — to avoid accidental recording, "ready" to provide normal recording and a spring loaded "mute" to allow instantaneous attenuation in the recording chain when an unwanted section of programme needs to be obstructed or for erasure without superimposed recording. The ready mode for recording is clearly indicated by an LED light on the panel.

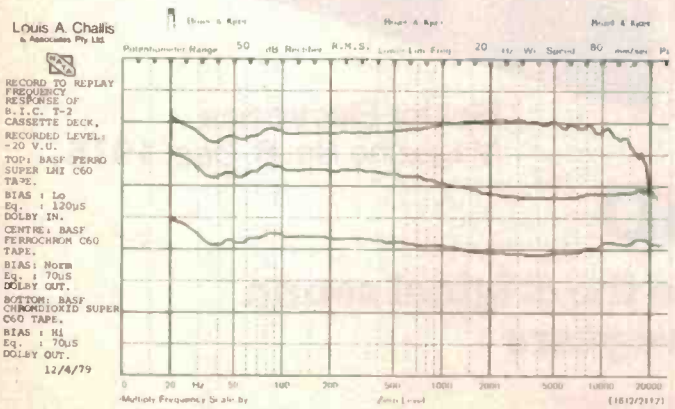
The only visible feature is a separate volume control for headphones — a distinct advantage for anybody wanting either to monitor or listen to programmes through the headphones.

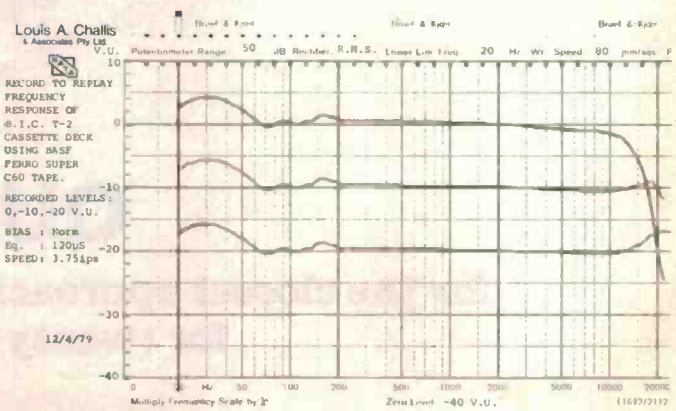
The mechanical drive is fairly conventional being operated by lever control switches which are positive, simple and inexpensive. In all other respects the machine is a medium cost cassette deck with a good visual impact provided by the satin black aluminium facia and simulated rosewood case. The cassette door cover can be removed for routine cleaning or de-magnetisation of the heads and even this is now becoming a standard feature on most cassette decks.

Performance

We were intrigued as to the necessity or even virtue of the two-speed operation and subjected this machine to very exhaustive tests. The frequency response at normal speed was better than we would have hoped for considering the manufacturer has added the 9.5 cm/sec speed with a high quality ferrichrome tape, the record to replay frequency response was within ±3 dB to 17.5 kHz and the overall shape of the record replay frequency response was as flat as could be desired. The replay frequency response exhibited a fairly significant low frequency boost at the bottom end of the spectrum (+5 dB at 20 Hz) but was flat between 200 Hz and 5 kHz slowly dropping to the −3 dB point at 19 kHz (TDK SA at −20 VU). Even with a standard grammoferric oxide tape, Hitachi UD, the −3 dB point was still acceptable at 10 kHz.

Obviously, with twice the tape speed, the frequency bandwidth is





cassette deck

extended and whilst we were unable to conduct a conventional replay test (in that there are no pre-recorded standard compact cassettes available at 9.5 cm/sec) the record to replay frequency response was truly excellent and almost up to professional standards.

Summary

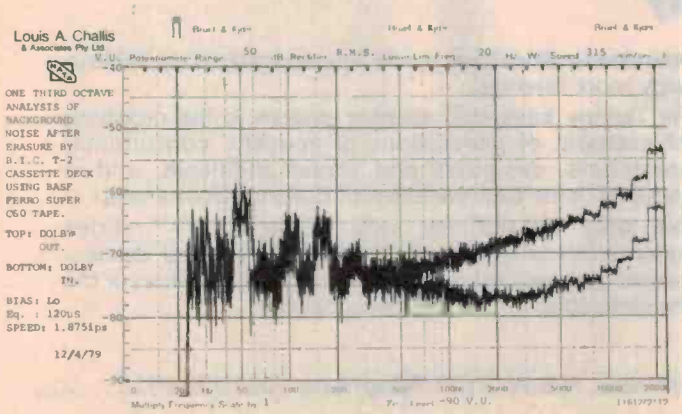
In simple terms, this machine exhibits some of the best features of professional reel-to-reel recorders in the high speed mode. The 3 dB points extend to 24 kHz and, although the low frequency performance is modified by a peak at 30 Hz, the performance was nonetheless fully acceptable.

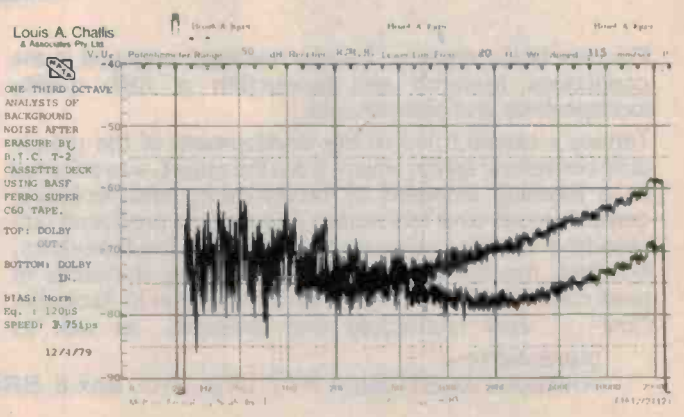
Whilst the frequency response was good, some of the other characteristics were not quite as outstanding. In particular, the 3% total harmonic distortion at 1 kHz occurs at + 2VU limiting the useful operating range of the equipment. At 0 VU the total harmonic distortion is −35 dB at 100 Hz, and at −6 VU it is −52 dB. At 6.3 kHz the total harmonic distortion is −40 dB and this is, in part, limited by the saturation characteristics of the recording tape.

The erase ratio is quite acceptable at 69 dB with grammo-ferric oxide tape and better than 70 dB with a chromium dioxide tape. At the 9.5 cm/sec tape speed there is a typical 4-6 dB improvement in the signal to noise ratio and fortunately, a significant reduction in the total harmonic distortion as well.

The wow and flutter of the machine at standard speed is quite acceptable considering the cost of the unit, being typically 0.04 and 0.05% at the start

▶





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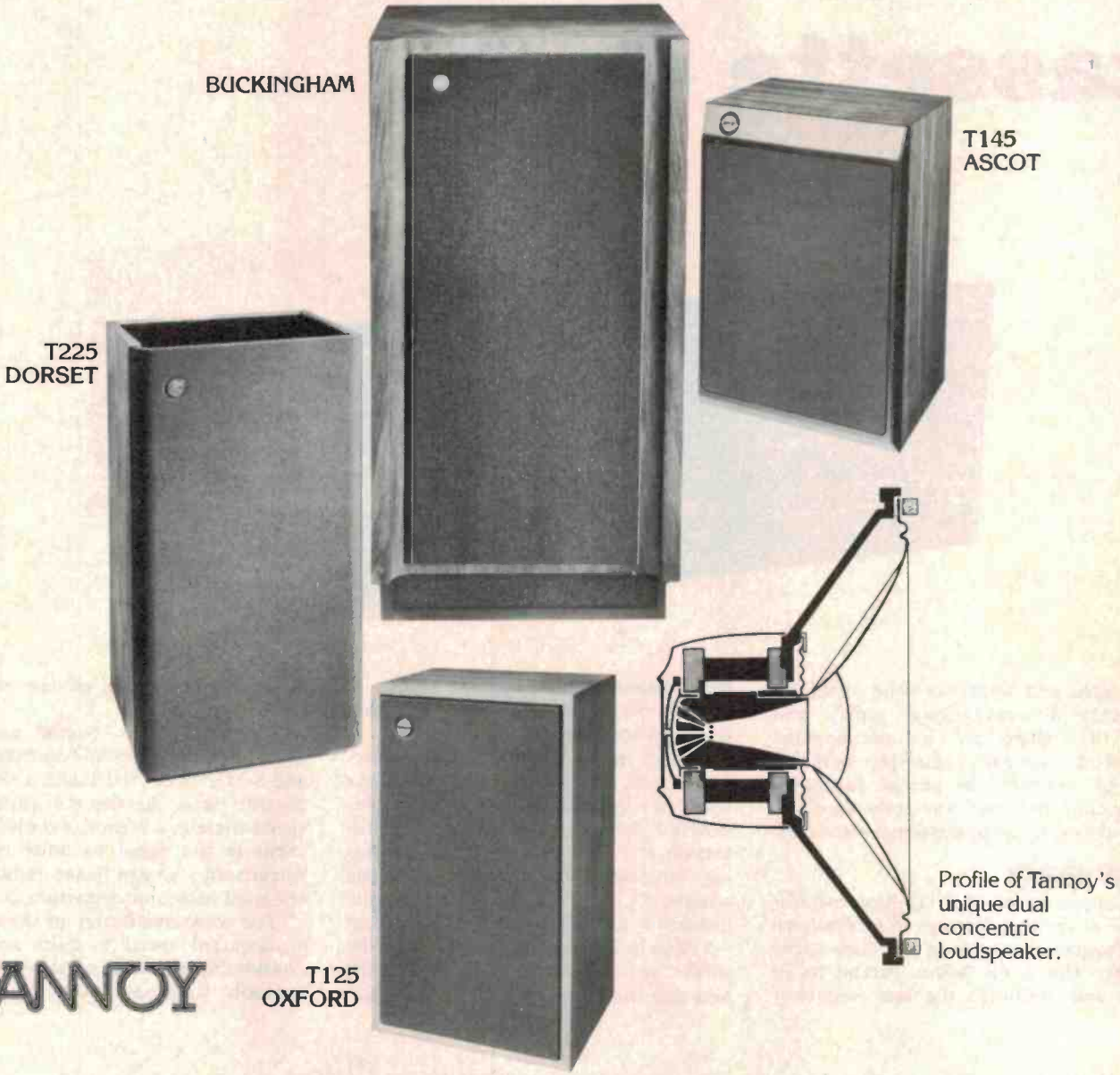

Profile of Tannoy's unique dual concentric loudspeaker.

For over half a century, Tannoy has been engaged in the continuous research and production of high quality loudspeakers and components.

Tannoy's research led to the development of the unique dual concentric driver, which, from the outset, was adopted as a listening standard by broadcasting and recording companies all over the world. This system produced outstanding results when applied to hi-fi loudspeakers. However, modest facilities and painstaking standards of production permitted only limited distribution in Australia. Now . . . new techniques and materials, as well as expanded facilities have made Tannoy systems available to many more listeners.

The Tannoy integrated speaker system is the crowning achievement of generations of acoustic consultants, researchers, designers and sound engineers, and is produced in the best traditions of British craftsmanship.

This truly magnificent new range of "T" series loudspeakers is now available through selected dealers. Contact your nearest specialist for a demonstration of the new generation of Tannoy loudspeakers.

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of the tape; 0.04 and 0.05% in the middle of the tape; and 0.045 and 0.055% at the end of the tape. At 9.5 cm/sec this drops to less than 0.035% weighted, whilst the peak flutter is almost halved.

The BIC T-2 proved to be extremely simple to use and we must admit that the record control switch, with its mute control in particular, is a functional advantage that few other machines offer. The single motor drive whilst conventional, is robust and should offer reasonable life and reliability.

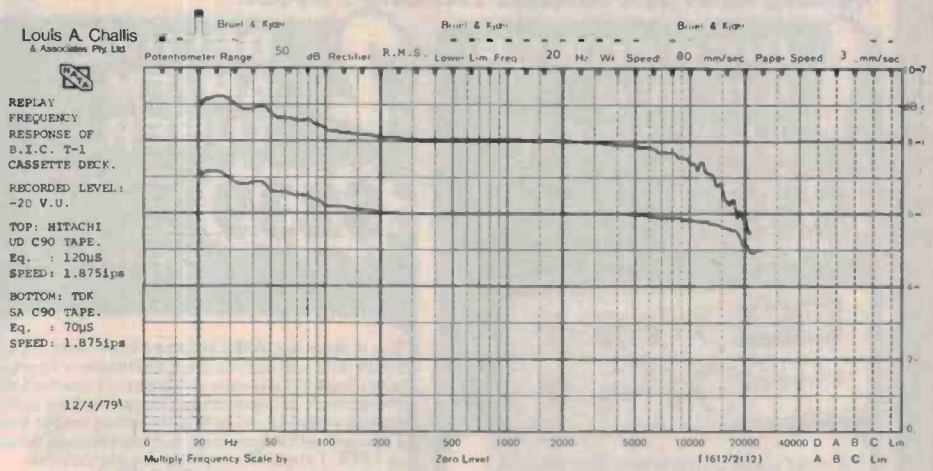
Considering the excellent record-to-replay response of the machine at 4.75 cm/sec we are not firmly convinced that the double speed mode is warranted. It is interesting to note that the manufacturer does not provide details of recommended bias and equalisation settings. More significantly, our testing and subjective evaluation showed that some abnormal equalisation settings with normal bias settings, can provide extremely flat, extended frequency response which the manufacturers would do well to document.

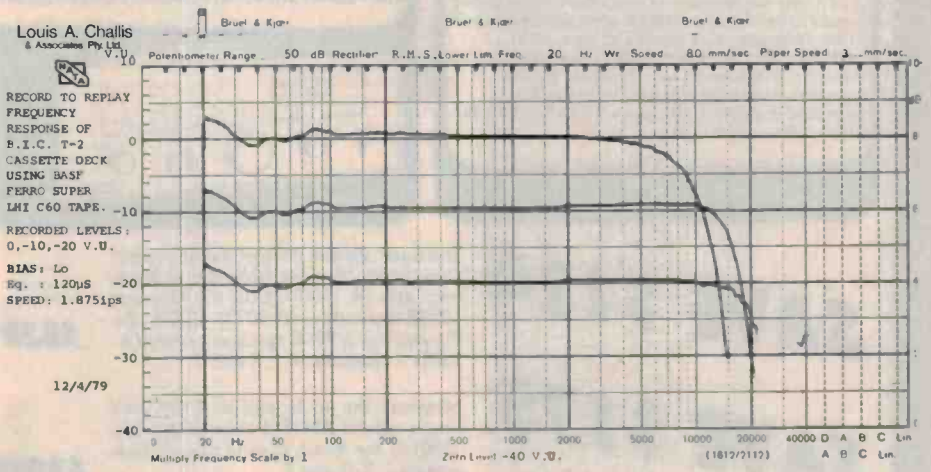
We played the machine over a long weekend and were impressed that the machine is just about as good as the manufacturer's claim. Whilst we did record and replay tapes at 9.5 cm/sec (C60's and C90's) it is a pity that none of the other machines that we review are compatible with the tapes.

Our overall evaluation of the BIC T-2 is that this is particularly well designed machine. It provides useful facilities that no other machine currently offers. Whether or not the intending user wants to utilise these facilities is very much a personal matter but this is one cassette deck that can virtually duplicate the essential characteristics of reel-to-reel machines. It provides the serious amateur with professional class recording performance (with Dolby) a price advantage less than half that of most other semi-professional (let alone professional) machines. ●

BIC T-2 TWO-SPEED CASSETTE DECK, S.N. 295405

Dimensions: 426mm x 152mm x 235mm, Weight: 5.8kg; Price: $448 Complete with stereo cords, 6 page Owner's Manual. Manufactured by B.I.C./Avnet, Westbury, New York, U.S.A.





Louis A Challis and Associates Pty Ltd

Our Ref: E4 17 Apr 79

MEASURED PERFORMANCE OF
BIC T-2 TWO SPEED CASSETTE DECK, S.N. 295405

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Speed	Dolby	Lower -3dB Point	Max. Point	Upper -3dB Point
BASF ferro super LH I C60	1 7/8"	Out	<20Hz	+3dB (20Hz)	19kHz
BASF ferro super LH I C60	3 3/4"	Out	<20Hz	+4dB (30Hz)	>20kHz
BASF ferro super LH I C60	1 7/8"	In	<20Hz	+0.5dB(20Hz,2.5kHz)	15kHz
BASF ferrochrome C60	1 7/8"	Out	<20Hz	+4.5dB (20Hz)	>20kHz
BASF chromium dioxide C60	1 7/8"	Out	<20Hz	+4.5dB (20Hz)	>20kHz

SPEED ACCURACY:
1.875 ips: 0.55% slow
3.75 ips: 0.68% slow

WOW & FLUTTER:
1.875 ips: 0.048% weighted RMS
: 0.15% unweighted RMS

TOTAL HARMONIC DISTORTION:
(1.875 ips)

	100Hz	1kHz	6.3kHz
At -6VU	0.12%	0.46%	0.97%
At 0VU	1.72%	2.01%	-

NOISE:
(re 0VU)

	1.875 ips	3.75 ips
Dolby Out	-50dB(lin) -54dB(A)	-52dB(lin) -56dB(A)
Dolby In	-56dB(lin) -63dB(A)	-56dB(lin) -64dB(A)

MAXIMUM INPUT LEVEL:
(For 3% third harmonic distortion at 1kHz) 1 7/8" +2VU 3 3/4" +5VU

We make no exotic claims for our Hi Fi . . .
. . just a superb sound & outstanding value

YES, you reap the benefit! Dick Smith introduces this range of Hi Fi units that offers our usual remarkable value for money BUT THATS NOT ALL . . . . .
. . . . Buy these units as a complete system AND YOU'LL SAVE EVEN MORE!!

Dick Smith Hi Fi will become a force in the Hi Fi market — don't delay be the first to own quality Hi Fi at a DIRECT IMPORT PRICE!!

1 HIGH POWER STEREO AMPLIFIER

$299 OR $30 dep. and less than $15 per month over 24 months.

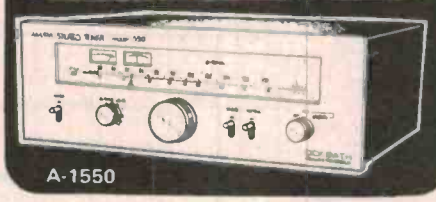
The super power amplifier from Dick Smith. A tremendous 55 watts RMS per channel into 8 ohms plus a truly superb array of controls. An outstanding feature of this amplifier is the midrange control a part of the audio spectrum ignored on most other amplifiers. The circuitry is direct coupled OCL and there are 37 transistors and 30 diodes PLUS a separate power supply for each channel for increased stability. Dimensions: 420(w)x150(h)x352(d)mm. Net weight 10.5kg.

A-1350

2 DELUXE AM/FM TUNER

$239 OR $24 dep. and less than $12 per month over 24 months.

Top of the range AM/FM Stereo Tuner from Dick Smith. This unit has a superb performance coupled with complete user control. Muting of noise between FM stations, hi-blend of high frequency for a more mellow sound plus a control for setting output level. Excellent performance is maintained through the use of 1 FET, 1 stage RF amplifier, 3 gang variable capacitor, 5 stage limiter, PLL MPX, 9 transistors and 7 diodes. Dimensions: 420(w)x150(h)x352(d)mm.



A-1550

3 INTEGRATED STEREO AMPLIFIER

$249 OR $25 dep. and less than $13 per month over 24 months.

A fabulous 30 watts RMS per channel from this very modern looking Dick Smith Integrated Stereo Amplifier. Visual power meters lets you know what power is being applied to your Playmaster speakers. Use more than one pair of speakers, have tape dubbing, low filter and many more controls for you to contour your sound. Frequency response 30Hz to 20kHz. Semiconductors: 35 transistors and 12 diodes. Dimensions: 400(w)x135(h)x290(d)mm. Net weight 4.6kg.

A-1300

SAVE $124

The basic system comprises the superb Dick Smith 55 watts RMS per channel amplifier (A-1350) PLUS the Garrard 125SB turntable (A-3070) PLUS the Playmaster 3/75LC speaker system (A-2364) — Reference 1, 6 and 7.

Normal separates price ~~$823~~

$699 OR $70 dep. and less than $22 per month over 48 months.

SAVE $175

Move up the scale and add the Dick Smith deluxe AM/FM stereo tuner (A-1550) to the basic system above. Reference 1, 2, 6 and 7.

~~$1062~~

$887 OR $89 dep. and less than $28 per month over 48 months.

SAVE $211

Top of the line system incorporates all of the above components PLUS the Dick Smith Dolby™ stereo cassette deck (A-3500). Reference 1, 2, 5, 6 and 7.

~~$1261~~

$1050 OR $105 dep. and less than $33 per month over 48 months.

SAVE $104

The second basic system incorporates the Dick Smith 30 watts RMS per channel stereo amplifier (A-1300) PLUS the Garrard 125SB turntable (A-3070) PLUS the Playmaster 3/53LC speaker system (A-2362). Reference 3, 6 and 8.

~~$703~~

$599 OR $60 dep. and less than $19 per month over 48 months.

SAVE $143

Take the basic system and add the matching Dick Smith AM/FM stereo tuner (A-1500) for increased performance. Reference 3, 4, 6 and 8.

~~$892~~

$749 OR $75 dep. and less than $23 per month over 48 months.

SAVE $183

Add the Dick Smith Dolby™ stereo cassette deck for a complete package. Reference 3, 4, 5, 6 and 8.

~~$1091~~

$908 OR $91 dep. and less than $28 per month over 48 months.

For more information on specifications of the equipment shown on these two pages, please check out the **Dick Smith 1979 Jumbo Catalogue** available from all Dick Smith stores at 75¢ each or send in your remittance to our Mail Order Centre (address below) and we will post you a copy.

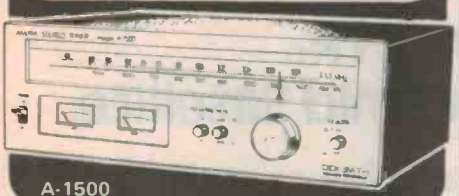
Take advantage of our **BELOW COST FREIGHT** to anywhere in Australia — the charge of **$6.00** covers individual items or if you purchase a complete system we will charge you only **$6.00** for freight on the complete system.

TERMS shown are approximate due to varying stamp duty in different states. Terms are only applicable to approved applicants and apply to personal shoppers only.

4 STEREO TUNER

$189 OR $19 dep. and less than $12 per month over 18 months.

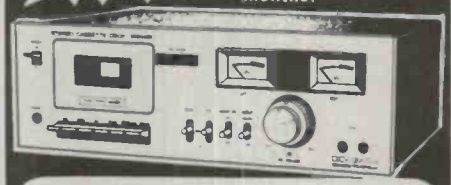
Switch on your Dick Smith AM/FM stereo tuner and enjoy the delightful world of quality FM stereo broadcasts plus the normal range of local AM stations. Built-in signal and tuning meters enables you to put the correct amount of signal into your amplifier and for it to be precisely in tune. Smooth flywheel type tuning control takes all of the effort out of finding stations.
Semiconductors: 1 FET, 3 IC's, 5 transistors, 3 diodes and 1 LED. Dimensions: 400(w)x135(h)x290(d)mm. Net weight 4.6kg.



A-1500

5 DOLBY CASSETTE DECK

$199 OR $20 dep. and less than $13 per month over 18 months.



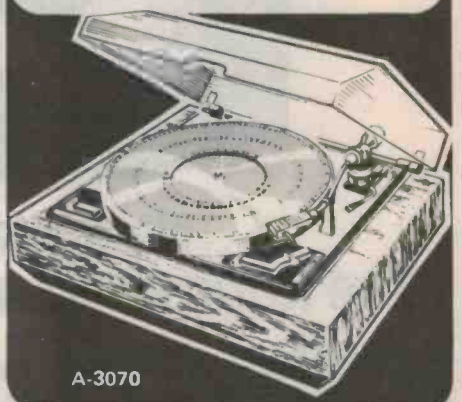
This excellent Dick Smith Dolby ™ Stereo Cassette Deck complements all of the Dick Smith audio units and the front loading design enables stacking of units to be easily accomplished.
The frequency response of 40Hz to 12.5kHz and wow and flutter figure of 0.12% WRMS means superlative performance from your tapes. Bias and equalisation are adjustable for Chrome, Ferrichrome and normal tapes. Complete fingertip control gives total satisfaction.
Semiconductors: 13 transistors, 2 diodes, 1 Zener diode, 1 bridge rectifier, 2 Dolby™ IC. Dimensions: 400(w)x135(h)x290(d)mm. Net weight 5kg. Power supply 240V AC.

A-3500

6 GARRARD TURNTABLE

$129 OR $13 dep. and less than $9 per month over 18 months.

The craftsmanship of a British product — belt drive stability — superb magnetic cartridge with diamond stylii — deluxe modular base and cover with fitted audio leads — The Complete Turntable System. Dimensions: 163(h)x364(w)x325(d)mm.



A-3070

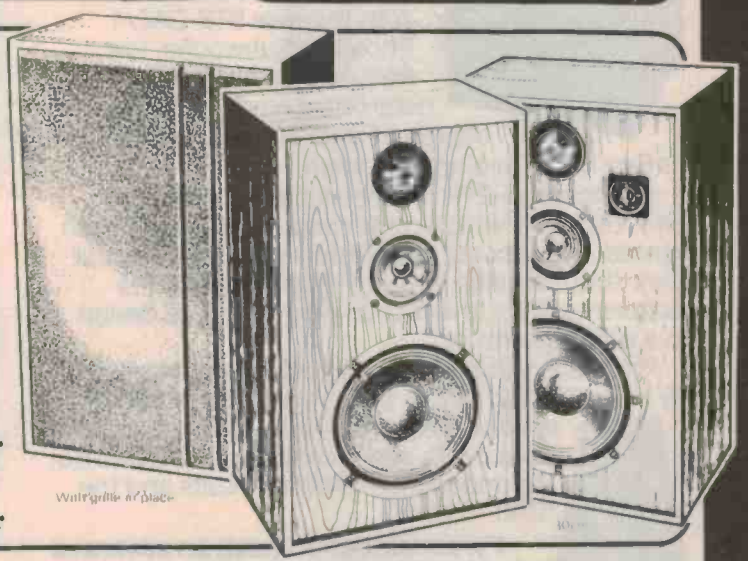
Playmaster

The Sound Of Excellence

Dick Smith offers you the QUALITY of PLAYMASTER in ready made form PLUS a five year warranty on the driver units and crossovers.
Two systems are available: the 30cm three way system, model 3/75LC, with built-in fader controls for the midrange and tweeter levels and a power handling capability of 80 watts peak into 8 ohms. Size: 71.7(h)x47.5(w)x29.3(d)cm.
The second system, model 3/53LC, is also a three way system utilizing a 24cm woofer with a power rating of 60 watts peak into 8 ohms. Size: 62(h)x39.3(w)x29.3(d)cm.
Both systems have a superior simulated walnut vinyl veneer finish, including the front baffle board, and a removable deluxe foam grille.
Complement the Dick Smith audio units with the Playmaster excellence.

7 Playmaster 30cm System
Cat. A-2364 OR $40 dep. and less than $20 per month over 24 months **$395 per pair**

8 Playmaster 24cm System
Cat. A-2362 OR $33 dep. and less than $17 per month over 24 months **$325 per pair**



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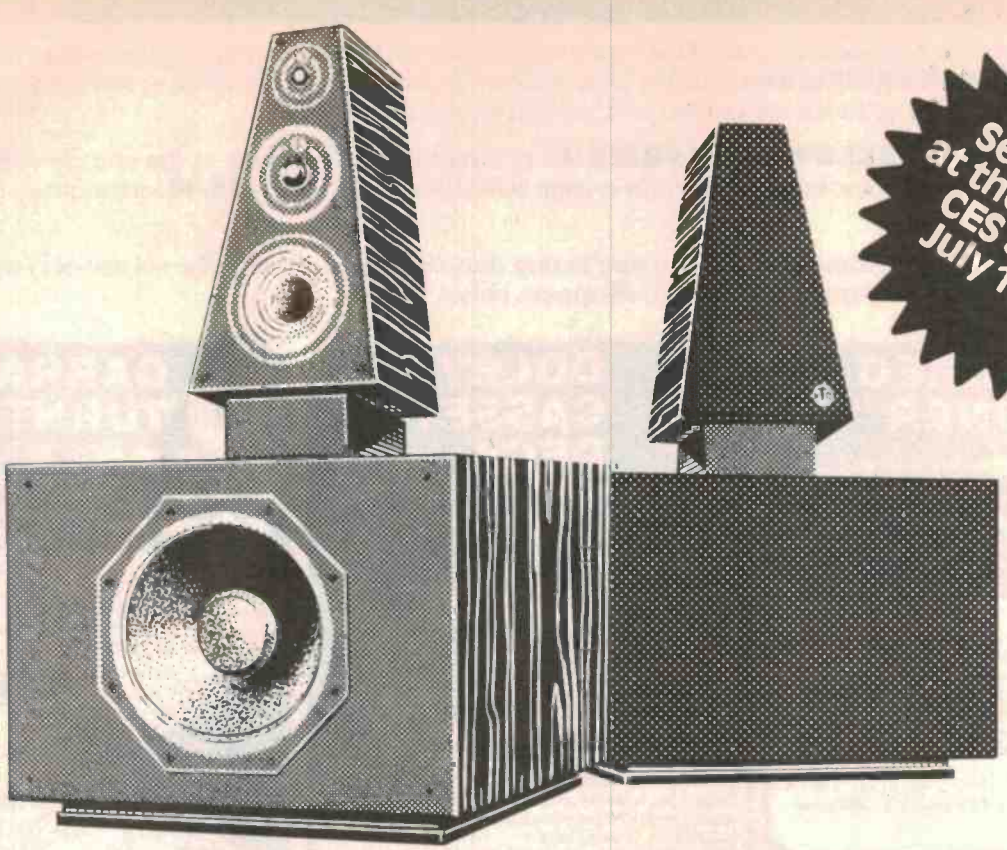

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New shapes of sound from RTR: The Rhombus Subwoofer...The Pyramid Satellite.

Now your speaker system can reproduce true bass. With the new RTR DAC/1 Rhombus Subwoofer, low frequency instruments and deep tones emerge with a degree of undistorted realism never before heard in a home system.

In Rhombus, RTR engineers have created the *only* enclosure which combines advantages of both vented and acoustic suspension systems – without their shortcomings. This is the Differential Area Coupler* system, the first all-new enclosure design in a quarter century.

Rhombus delivers flat frequency response from 16 Hz to 150 Hz. Below 16 Hz, the system cuts off rapidly to eliminate modulation distortion. Bass peaks and resonances are wiped out by impedance leveling circuits and the DAC* format.

Pyramidal design yields an advanced small speaker. The RTR PS/1 Pyramid Satellite loudspeaker solves most problems inherent in small speakers.

Geometrically, pyramid form follows function better than rectangular enclosures. Space for a major woofer in a minimal package facilitates lower frequency response and higher, undistorted output levels. Non-parallel sides smooth bass reproduction and curtail internal resonance.

Capitalizing on this format, the RTR Pyramid Satellite incorporates an array of RTR components in a dynamic 3-way speaker system. A new total-immersion-damped woofer cone reduces sonic coloration and eliminates breakup. Carbon fiber impregnated soft dome midrange and soft dome tweeter offer superlative response with wide dispersion. All told, these are live performance audiophile speakers in a package destined to become classic.

New shapes combine into a formidable system. Match Rhombus Subwoofers and Pyramid Satellites. Be rewarded with hauntingly realistic sound reproduction. Attack and dynamics of actual performance reproduce with smoothness, accuracy and superb detail. This system defines new standards of performance for *all* sonic parameters. Equally startling, the price is well below other state-of-the-art contenders. Audition it soon at your RTR dealer...and believe your ears.

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Listen... you'll be hearing more from RTR.

SMA/AM1

– from p. 149.

Following some initial music evaluations I had to turn the complete boxes inward to gain a solid centre image. Perhaps this was due to the wide open spaces either side of the speakers; the nearest walls were about 2.5m away and did not reflect interfering sound patterns onto the listening area.

Now the drivers started to come alive! Further adjustment to the head assembly on each, proved to me, with my listening seat height, that they should be perfectly horizontal and this was eventually set with the aid of a right angle spirit level.

Although there could be a hot seat with certain disc sources, the precise imaging was fascinating and foolproof. Foolproof in that faked recordings were immediately noticeable and the old reliable crossed mikes I have used for recording small ensembles again proved the best. With the system precisely aligned all music came vibrantly to life with an immediacy and focussed depth that illuminated actual stage positioning to a degree not previously found with many commercial loudspeakers. It was as if the whole original scenes were visually reproduced in front of me. Naturally, I tried all favourite, well-recorded discs as well as several 380 mm/sec master tapes with Dolby 'A' encoding. In virtually all instances live opera and orchestral recordings using crossed-pair mikes produced the best results and only a few skilfully engineered modern discs produced similar results.

As you can see, I became very interested in listening 'through' the recorded performances during these initial trials and, when it was obvious that the KEF's would reveal all, I settled down to listen to the best possible source material at hand.

It became readily noticeable that, with the majority of programme material, each company produced not only its well known characteristics but it was often possible to recognise similarities in unknown monitor speakers. Of course, we can all guess that the majority of studios use professionally engineered JBLs, Tannoys, Klein and Hummels and, of course, Quad electrostatics. I definitely believe that changes within mixdown suites could be readily identified through these 105s.

In general, the majority of high quality disc and tape sources were noted for their subtle blooms and timbres and it was obvious that naturalness in a given system leans very heavily on the programme selections played when evaluating any combination of sound equipment.

Comparisons with my own reference speakers occasionally favoured my own custom-built columns; but, again, these are not a commercially viable proposition.

Low frequency propagation could be bettered by certain other systems, although they always give the feeling of a lumpy or woollen bass after listening to the clean transients of the 105s. Fundamentals are generally toned down by recording engineers at the disc cutting stage and, in any case, studio monitors rarely produce frequencies below about 40 Hz so just what is down there is an educated guess with the exception of the newer, specialist cuts.

On these direct and half speed cut discs the 105s produced a clean, unruffled bass response. There was no muddiness to cloud the clear and detailed middle and high frequencies.

For my money, these KEF 105 reference monitors are one of the few best bets for high quality music reproduction and I will not be a bit surprised to see them used in monitoring applications.

Finally, to judge any speaker, let alone these superbly engineered 105s, without complete knowledge and understanding of the acoustic environment is a suicidal venture at any price tag. ●

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SMA/AM11

sound business

ONE OF the problems plaguing speaker designers nowadays is resonance – both in the drive unit diaphragms and in enclosures.

Recent research, particularly in the UK where speaker companies buy computer analysis facilities as soon as they get rich, has begun to reveal the magnitude of the resonance problem. Before launching into the subject of the resonances themselves, it's worth pondering just how a flat measured frequency response would look if the resonances were removed; and then again we can also ponder the demands of music and its relation to test signals.

with
Richard Timmins

One of the great obstacles in equipment measurement is the inability to gather meaningful information on what really happens when a complex music signal is being handled. Measuring techniques have improved out of all recognition in the past few years so one can confidently expect further improvements and possibly some breakthroughs before too long.

Enclosure resonances can be reduced by using more rigid materials and ones with improved internal self-damping. Particle board is an excellent material because it has good uniformity with minimal grain, and for its weight, has excellent rigidity.

The way to stop enclosure resonances is to make panels more rigid by laminating two or more thicknesses of material, by bracing or by reducing panel size. Stressing the enclosure can also be of benefit, especially for the bass system. If the frequency of resonances is placed in some region well above the range of the drive unit within the chamber it is less likely to give trouble.

Large speakers are always a problem from the panel vibration aspect, and this seems to be good enough reason in itself to reduce size as far as possible. Miniature loudspeakers, epitomised by designs like the BBC LS3/5A, are well able to demonstrate the virtues of rigid, non-resonant enclosures. Unfortunately, most of these smaller speakers are very definitely restricted in terms of bass output and power handling, and for good bass extension add-on bass-bins are assets, though one's bank manager might think otherwise!

Computer analysis of speaker designs is being increasingly used by speaker manufacturers. Here, an engineer loads a Fourier analyzer machine at the British factories of KEF Electronics.

Good bass can be obtained from a smallish box, of course; Acoustic Research have been demonstrating this for years. Compact designs like the Spendor BC1 and Rogers Export Monitors, both derived from the superb BBC LS3/6 design, can have quite remarkable bass performance, and the controversial Linn Isobariks have a more extended bass response than just about any commerical design currently available, regardless of size. The Linns are relatively small and are interesting in a number of areas, including panel vibration – they are very heavy, indicating thick, well-braced walls made of dense, weighty material.

To achieve good bass performance from a small box demands the use of a very long throw, low resonance drive unit. Most small speaker designs are either sealed boxes or, less frequently, reflexes. The former type need not only a long-throw low-resonance drive unit but also one with a diaphragm capable of withstanding the very high pressures within the enclosure. In addition, and linking with the previous point, the overall system resonance (which effectively defines the low-frequency cutoff point) needs to be kept as low as possible.

Both requirements are met by using a massive diaphragm, implying reduced efficiency amongst a few other nasties. Some manufacturers, including Acoustic Research, have used 'overdamped' systems, in which a drive unit is mounted in a box rather too small for it. This gives a very predictable characteristic for the resonance, and by fitting a resonance suppression LCR network in the appropriate section of the crossover a smooth and extended response, diminishing gently toward the lowest frequencies, can be obtained.

The type of long-throw drive unit employed in systems of this sort uses a relatively large diaphragm – at least, compared to many reflex systems of similar enclosure size. The main problem with a large diaphragm is, once again, rigidity; radiating surface area is large compared with the point of drive area, where the diaphragm is

Turn to page 186

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Continued from page 182

bonded to the voice coil. This is one reason for using massive diaphragms, ensuring that all the radiating surface moves the same way at the same time. But there is a limit to the amount of mass that can be tolerated in this situation, and the compromise in practice must be determined by the efficiency/power handling and frequency response requirements; the more massive a diaphragm, the more restricted its high frequency response will be. So the usual compromise sacrifices rigidity to some extent and the penalty is resonances.

Depending on the specific characteristics of the drive unit involved, resonance can continue for some considerable time (relative to the duration of one cycle of the frequency in question) after the signal has ceased, due to stored energy in the diaphragm. If the diaphragm were totally rigid, movement due to stored energy would be transferred to the voice coil and (hopefully) damped by the amplifier in the normal way. The duration of delayed resonances is minimised by using low-mass diaphragms for low inertia but we then come back to the rigidity problem, in which we could, by using a light flimsy cone, end up with a host of high-energy resonances of short duration at various frequencies rather than a small number of low level, long duration ones.

Probably the best solution is to use large numbers of very small drive units. A shining example of such an approach is the Bose 901, which returns a superbly defined bass (though leaves something to be desired in other frequency ranges and performance areas). The justification is that the ratio of radiating area to point of drive area is dramatically reduced with advantages virtually across the board. Smaller diaphragms can be low mass yet nevertheless rigid, making them more efficient, more responsive to transients and high frequencies, and less prone to delayed resonance. The problem isn't confined just to bass drivers though; midrange units and tweeters also suffer (sometimes to a greater extent) and use of multiples can be awkward because of problems connected with dispersion and interference effects between individual drive units.

The most effective use of multiple drive units, at least for high frequencies, seems to be as plane-wave radiators, the array being a long, narrow strip, effectively a single strip diaphragm not unlike the tweeter in the Quad electrostatic speaker as far as its dispersion characteristics are concerned. However, a large number of drivers are needed to give a reasonable coverage of the listening area and the problem of cost begins to raise its ugly and inevitable head.

Several recent commercial speaker designs, mainly from the US and UK, have adopted the use of plane-wave midrange and treble arrays using multiple drive units and their high cost seems justified by the purity and definition they provide. Lack of colouration due to minimisation of resonances seems well worth paying for, and there are useful by-products such as improved transient response, greater power handling and efficiency and simplification of crossover network design. This in turn helps to improve damping and provides an 'easy' load for the power amplifier, the main reactive element being, presumably, the inductance of all those voice-coils!

It seems most likely that speaker systems, as long as they are based on conventional moving-coil drive units, will be developed along these lines more in the future and we can expect to see a whole new generation of drive units emerging for the specific purpose of building multiple arrays. ●

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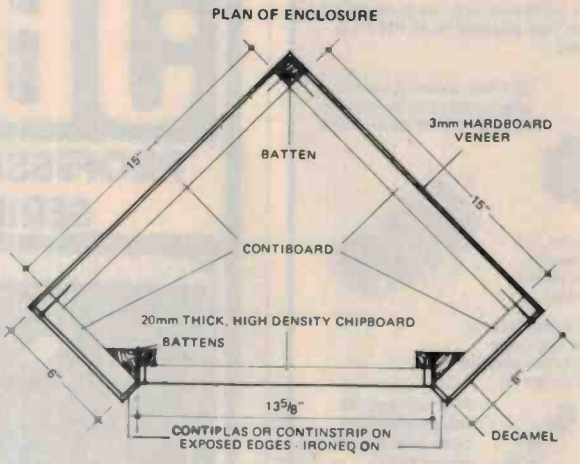

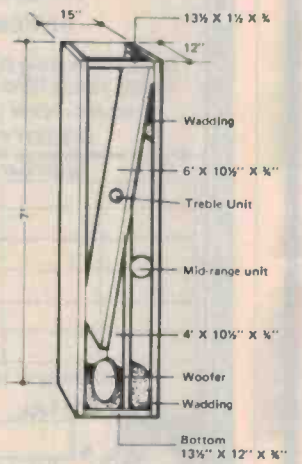

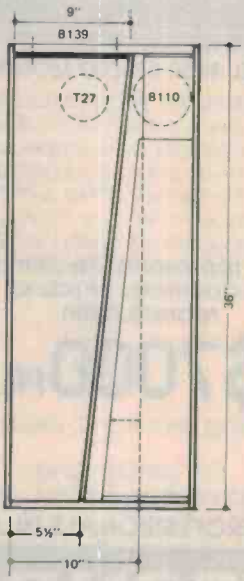

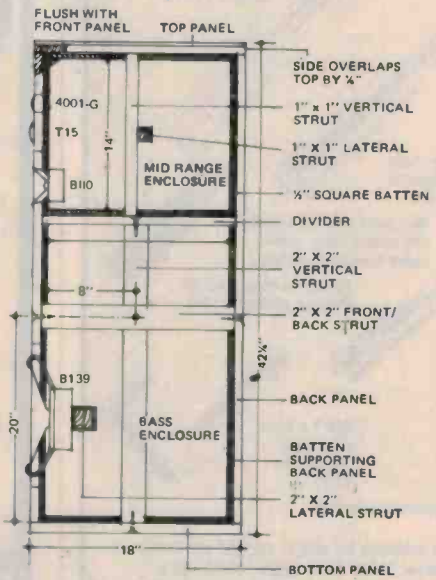

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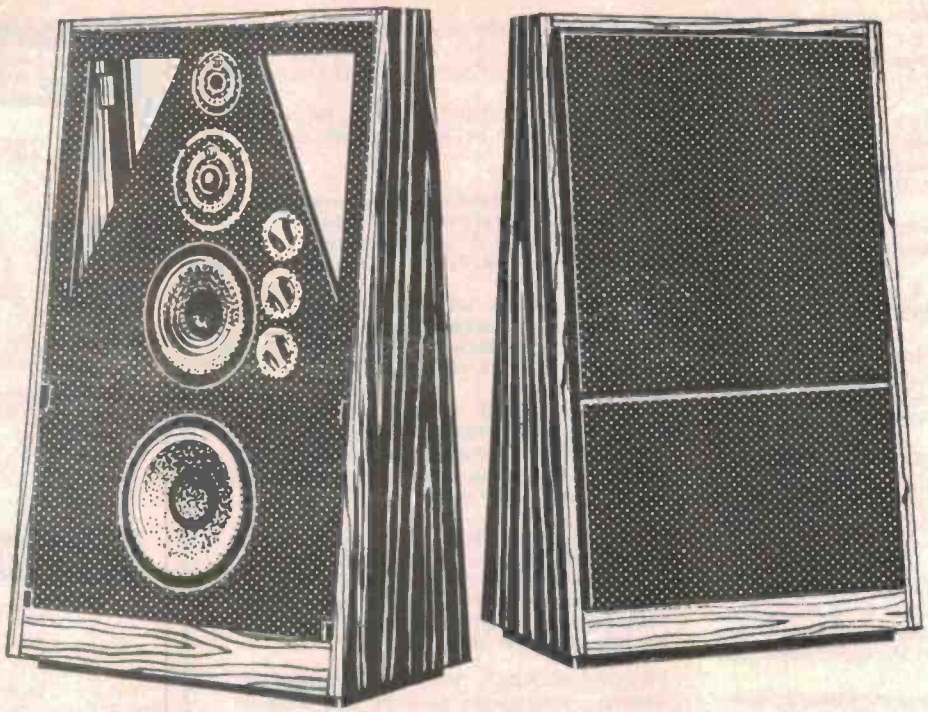

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An incredible performance you must hear to appreciate.

The 800D 4-way system

1 A 10" woofer specifically designed for accurate low bass response, from 30Hz to a cut-off at only 190Hz. With 1½"high-temperature voice coil assembly and 4 lb. magnet structure, it employs special fibre cone and foam surround impregnated with damping and sealing fluid for better air seal, greater resistance to break-up and optimum energy absorption.

2 The 8" upper bass/lower mid driver is of similar construction, and covers the range from 190 to 1900Hz.

3 The 1½" soft dome midrange radiator employs a unique carbon-fluid damping and sealing compound applied to the dome for greater longitudinal and torsional rigidity for true piston action and high power operation. Covers the range from 1900 to 9500Hz.

4 The new 1" soft dome tweeter for performance from 9500Hz to well beyond audibility at 25,000Hz perfectly complements the midrange.

Significant achievements

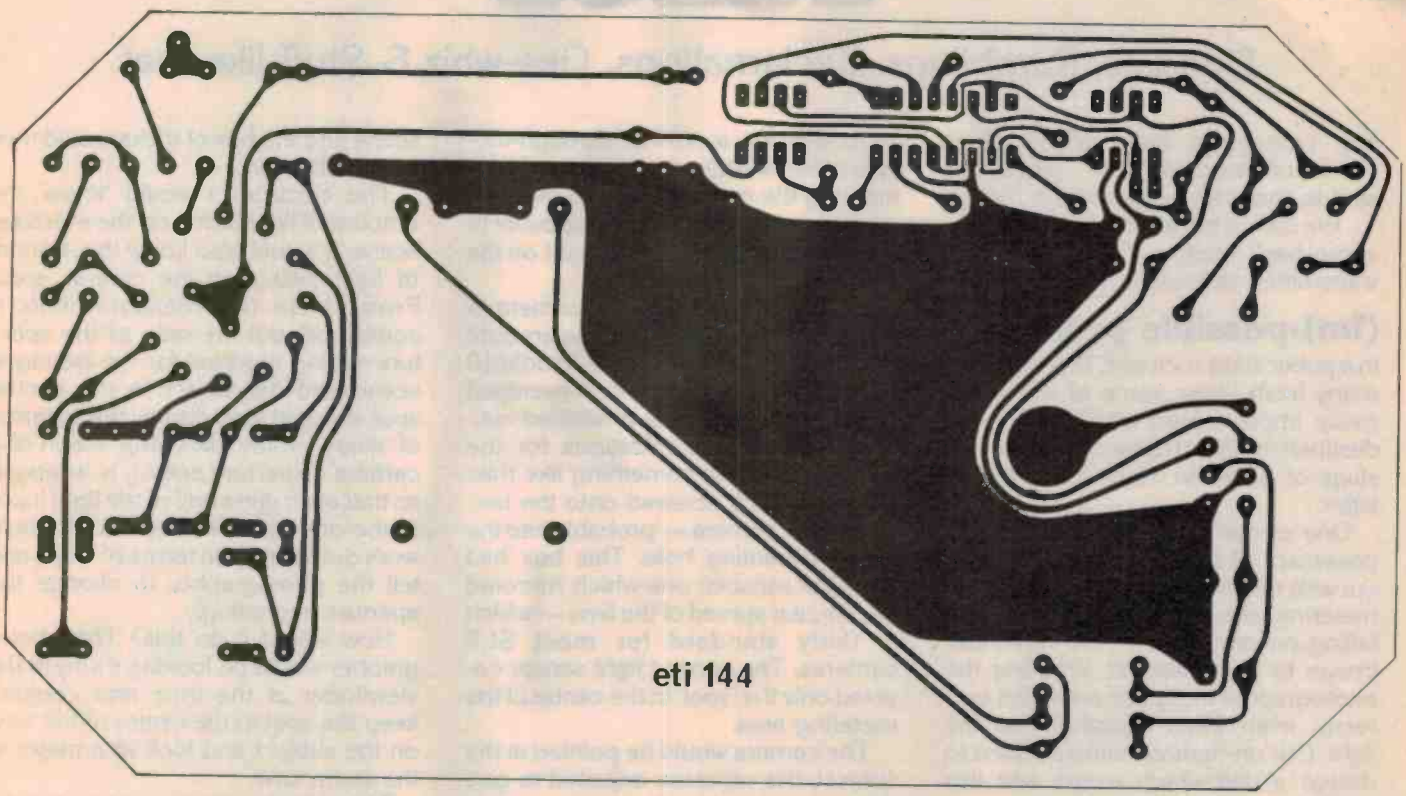
The high efficiency and ruggedness of the 800D permits it to be driven by 25 watts, yet it takes 125 watts with ease. Lightning fast transient response combines with wide dynamic range to respond to sudden changes in programme level without clipping or distortion. Bass is smooth, tight and accurate without muddy or boxy sound. A new, sophisticated crossover has virtually no transient or IM distortion, with driver parameters precisely determined. Level control on 8" upper bass/lower midrange permits compensating from room response.

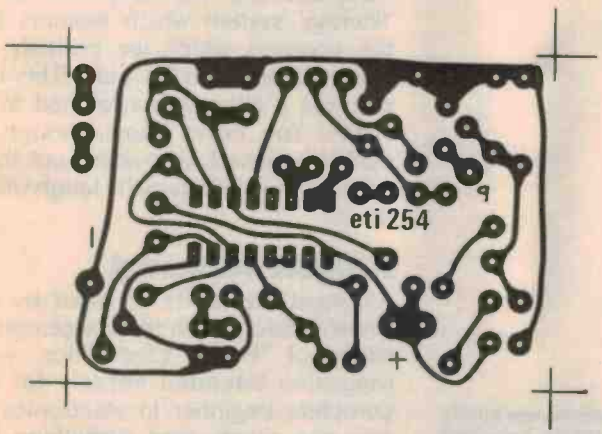
Hear the RTR 800D difference at your specialist dealer, or write for specifications.

Distributed in Australia by Acoustic Monitor Co Pty Ltd (Member of the Thomas & Coffey Group) 12-18 Gould Street, Enfield, NSW 2136. Phone: (02) 642-7888. Telex: 26778. Cables: "Tomcoffy" Sydney.

Listen... you'll be hearing more from RTR.

SMA/AM2





Using ETI PCB Artwork

This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007 which is UV sensitive and can be used under normal subdued light.

Cut a piece of film a little larger than the PC board and expose it to UV light through the magazine page. The non emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner - it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

Further information on Scotchcal and PCB manufacture can be found in the September and December 1977 issues of ETI. Please note also, that occasionally pressure on space may unfortunately prohibit the printing of blue type behind all PCB's, in which case the reader must resort to more conventional photographic techniques for PCB manufacture.

"DREGS"

Doodles, Ramblings, Exclamations, Gee-whiz & Stuff like that

Our typesetters have an excellent sense of humour. One piece we sent to them for setting which read, ". . the data is transmitted serially . . . ", came back reading " . . . the data is transmitted seriously . . ."

(Im)-possible projects

In a publication such as ETI, we publish many fresh ideas, some of which are easily implemented while others are destined for the 'circular file' at an early stage of gestation. Here is one of the latter.

One of our staff is the once-proud possessor of a single lens reflex camera with no spot metering facility. Spot metering allows the amount of light falling on one point of the viewfinder image to be measured, enabling the photographer to expose an object correctly, even when shooting into the light. Our un-named staffer decided to design a unit which would add this facility.

To explain, a normal through-the-lens meter will take the amount of light entering the camera through the lens, average it and work out the exposure to give the correct amount of light on the film.

With a spot meter, the camera is pointed at the subject and the amount of light coming through tne middle 10 percent or so of the lens is averaged and the correct exposure worked out.

The design specifications for the add-on unit went something like this:

A box which screwed onto the bottom of the camera — probably into the tripod mounting hole. This box had two light sensors: one which mirrored the angular spread of the lens — which is fairly standard for most SLR cameras. The second light sensor covered only the 'spot' in the centre of the metering area.

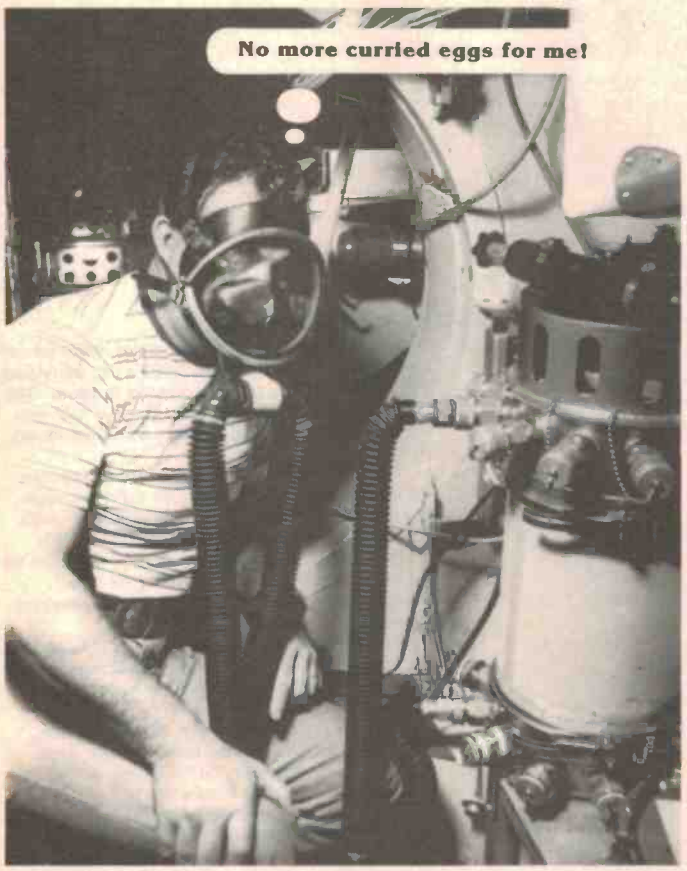
The camera would be pointed at the subject, the exposure adjusted to give the correct reading for the 'averaged' scene and the box of tricks would then be switched on.

The electronics would 'know' the amount of light falling on the averaged scene. It would also know the amount of light falling on the central 'spot'. From these two measurements it could work out the ratio of the aperture setting required for the averaged scene and the object in the central spot. It would then display this in terms of 'stops' — the click-stop action of a camera's aperture setting is arranged so that each gives half of the light input of the one below it. The circuit would work out the ratio in terms of stops and tell the photographer to change the aperture accordingly.

How would it do this? The photographer would be looking through the viewfinder at the time and couldn't keep the spot in the centre of the view on the subject and look at a meter at the same time.

The answer was to arrange for the box to sound a series of bleeps at one of two frequencies — the higher frequency would indicate that the aperture had to be opened a certain number of stops, the lower that it required to be closed a number of stops. The number of bleeps would tell the photographer how many stops were required.

Like so many of the ideas generated here, this one has fallen foul of the 'filtering' system which ensures that the projects which we publish are workable and can be built. This one was just a little too far-fetched to be viable. You never know, though — perhaps some bright spark out there will build one and then the laugh will be on us!



No more curried eggs for me!

This photo was kindly donated by Lockheed (it was originally intended to publicise the fact that their new submersible life support system could provide air for four people for up to 39 hours).

Reader Request

Amongst the letters received by our British edition when they began publication of "Hobby Electronics" — a magazine intended entirely for the complete beginner in electronics — was one which went something like this: "Having read your stereo amplifier project, I find that I could not possibly afford the parts necessary to build it. Could you therefore send me the prototype. I would be pleased to refund any postage necessary . . .

The competition don't like the sound of this at all.

For quite some time, other manufacturers have been trying to produce tape with the qualities of the Maxell UD-XL. At the same time, Maxell have been quietly perfecting an even better series.

The UD-XL I and UD-XL II tapes are designed to attain maximum performance at the ferric and chrome position on your tape deck. Whichever tape position you choose, Maxell can give you a better performance.

UD-XL I TAPE, FOR FERRIC (norm.) POSITION (120*us*)

UD-XL I offers an excellent sensitivity of 1 dB higher than even UD-XL. MOL performance is also 1 dB higher over the entire audio frequency spectrum. The result is a new standard in ferric tape, with wider dynamic range and less distortion than ever before.

How does the UD-XL I compare then, with ordinary low-noise tapes?

Sensitivity is higher by 2.5 dB, and MOL performance by as much as 6 dB.

Yet, for all this UD-XL I requires no special bias or equalization. Simply set your tape selector as you normally would at the ferric position – but there the comparison ends.

UD-XL II TAPE, FOR THE CHROME POSITION (70*us*)

UD-XL II tape is such a dramatic improvement on most other tape that can be used in this position, that comparison is really unfair.

For example, if you're familiar with conventional chromium-dioxide tape, you'll know of the associated problems of poor output uniformity – plus low maximum output level and rather high distortion.

UD-XL II tape offers you excellent MOL, sensitivity, and an output improvement of more than 2 dB over the entire frequency range.

Maxell's unique 'Epitaxial' process gives you absolute sensitivity and stability, and no drop-out problems. What's more, the shells are moulded in diamond cut dies, and made to tolerances 5 times greater than the Philips standard. And, like all Maxell tapes, UD-XL II has the 5-second cleaning leader.

In short, if you're recording in the chrome position, you can now achieve all the advantages – with none of the drawbacks.

A prospect we think you'll find very exciting – even if the competition don't.

maxell®
simply excellent

For details on all Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT3/79

TECHNICS AMPLIFIERS MEET THEIR MATCH... TECHNICS TUNERS.

With the same clean, attractive styling and performance standards found throughout the range of Technics amplifiers, Technics tuners are the perfect companion.

Shown above is the SU-8044 integrated DC amplifier and ST-8044 tuner. The amplifier delivers 38 watts per channel output — plenty of power for dynamic sound.

Technics renowned waveform fidelity — the accurate reproduction of musical waveforms — has been achieved by eliminating coupling capacitors. The result is distortion-free amplification over a wide and flat frequency range with total harmonic distortion a mere 0.02%.

On the SU-8044 model highly accurate, easy-to-read FL (fluorescent) meters replace conventional needle-type meters for peak power indication.

The matching ST-8044 AM/FM Stereo tuner features five LED's to indicate signal strength in a linear progression. When all are lit then the best possible reception has been achieved. You are then able to utilise the active servo lock to eliminate frequency drift.

You can write to Technics Advisory Service for further facts and figures but the real test is listening . . . at your nearest Technics dealer.

For a National Technics catalogue, please write to:
Technics Advisory Service, P.O. Box 278, Kensington, N.S.W. 2033

National Technics hi-fi

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