EUROPEAN COMMUNICATIONS SATELLITES

electronics today

NOVEMBER 1978 INTERNATIONAL

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STAC TIMER
COMPUTER GLOSSARY
AUDIO POWER METER

CATALOGUE SURVEY

AUSTRALIAN OWNED AND PRODUCED

November 1978, Vol. 8. No. 11

electronics today INTERNATIONAL

Editorial: Les Bell

Managing Editor: Collyn Rivers

Cover: On top, the STAC Timer can just about run your house for you, beneath it is the Audio Power Meter described on page 76, and in the foreground a selection of the mail order catalogues every electronics enthusiast should have.

A Modern Magazines Publication

* Recommended retail price only.

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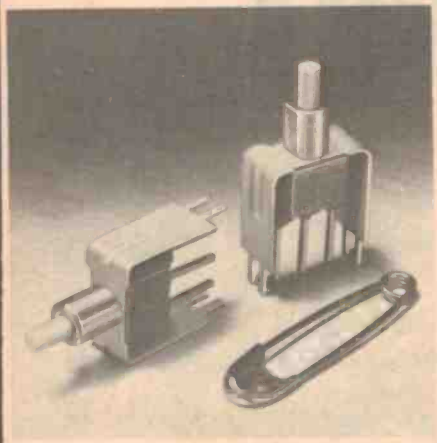
News Digest



PCB Pushbutton

C & K COMPONENTS, U.S.A. have developed single and double pole, double throw momentary snap-acting pushbuttons with anti-stress brackets for vertical mounting.

Excessive force applied to the switch is absorbed by the protective "U" shaped vertical mount and is not transmitted to the switch casing, the pcb terminal, or the pcb tracks, thus preventing malfunction or damage. Electrical specifications for the snap-acting momentary pushbutton switch offer contact rating of 1 A resistive at 120 Vac or 28Vdc or a cheaper version 0.4 VA max. at 20 V max. (ac or dc) – electrical life 60,000 cycles minimum at full load.

Detailed specifications appear in the standard C & K Catalogue or contact:– *C & K Electronics (Aust.) Pty. Ltd., Office 2, 6 McFarlane Street, Merrylands, N.S.W. 2160.*

HP Logging Multimeter

A new autoranging 4-1/2 digit multimeter from Hewlett-Packard includes a four-channel scanner, digital thermometer, math functions and printer with timer in a single instrument. HP's 3467A Logging Multimeter measures dc volts, resistance, true RMS ac volts and temperature. Temperature can be measured simultaneously with voltage or resistance to allow convenient analysis of temperature dependent parameters. Using thermistors, the temperature measurements can be made directly in °C or °F. Built-in math functions can be used to convert measured inputs into units such as deviation, scaling, ratio and dB. HP's 3467A can also automatically scan, measure and print out data at selectable time intervals.

The Logging Multimeter can be used to make a large number of measurements, bacause of its four channel and math capability. Measured values from the first three channels may be automatically subtracted, multiplied or divided by a manually entered constant for fast calculated measurements. Math operations can also be performed on the first three channels with respect to a measured input on the fourth channel. Direct measurements of temperature changes about ambient, frequency response of amplifiers in dB, attenuator flatness, or turns ratio of transformers ar but a few multiple input measurements that can be made. All four inputs are floating and protected from overload.

The built-in thermal printer with timer can automatically or manually record measured data. A manual print command initiates a print out of the selected input channels. The 3467A is easily set up for unattended measurements. It automatically scans, measures and records the selected channels with elapsed time information at selectable scan intervals from one second to three hours over a 24-hour period. A time offset can be entered, via the front panel, to synchronize the timer to the time of day. If a momentary power failure should occur, the 3467A remembers the math constant, elapsed time information, zero offsets and ranges to insure that unattended measurements will continue.

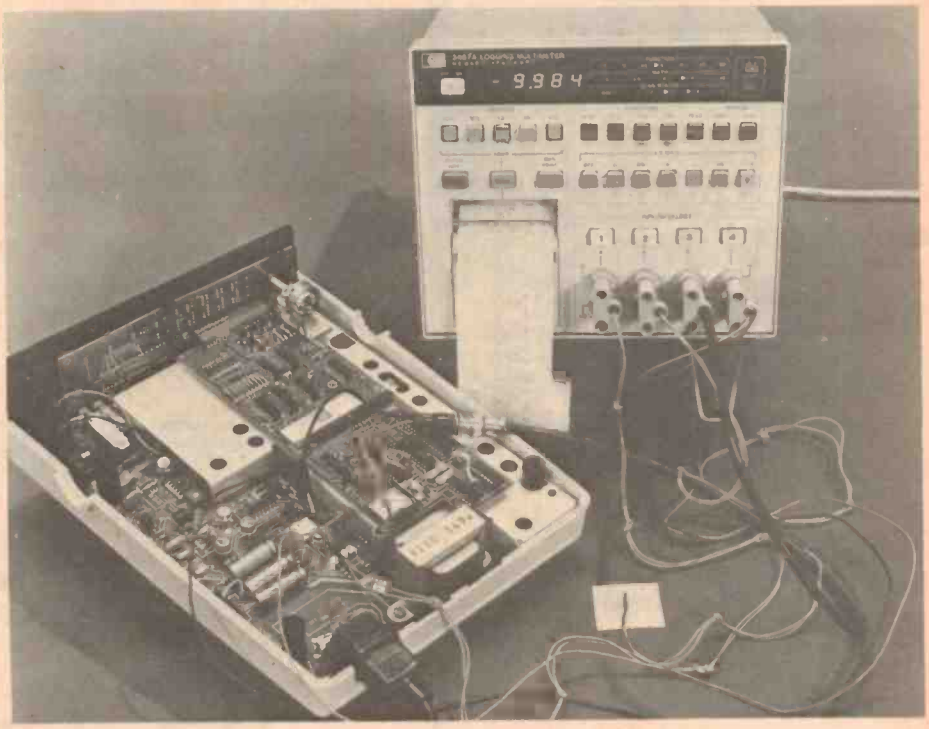
Price of the Hewlett-Packard 3467A Logging Multimeter is $2300. For further information contact *Hewlett-Packard Australia Pty Ltd 31-41 Joseph St, Blackburn, Victoria 3130.*

Protection for Workers' Ears

Simple modifications to safety screens around factory machines would help to protect the hearing of thousands of Australian workers, according to a CSIRO researcher. He is Mr Bill A. Davern, who claims that existing protective plain screens can be modified to provide effective acoustic screens which would cut noise levels significantly.

"Legislation on noise levels which is now being introduced in several States means that factory managers' must look at how they can lower nosie levels, and acoustic screens are one practical and simple way of achieving this," he said.

Mr Davern and another researcher from the CSIRO Division of Building



Research, Mr Ted Lhuede, assessed noise levels in timber mills and concluded that machine enclosures were the best way to overcome the noise problem in many instances. In some cases, the operator work position could be enclosed more readily than the machine. Both forms could be equally effective with either total or partial enclosures.

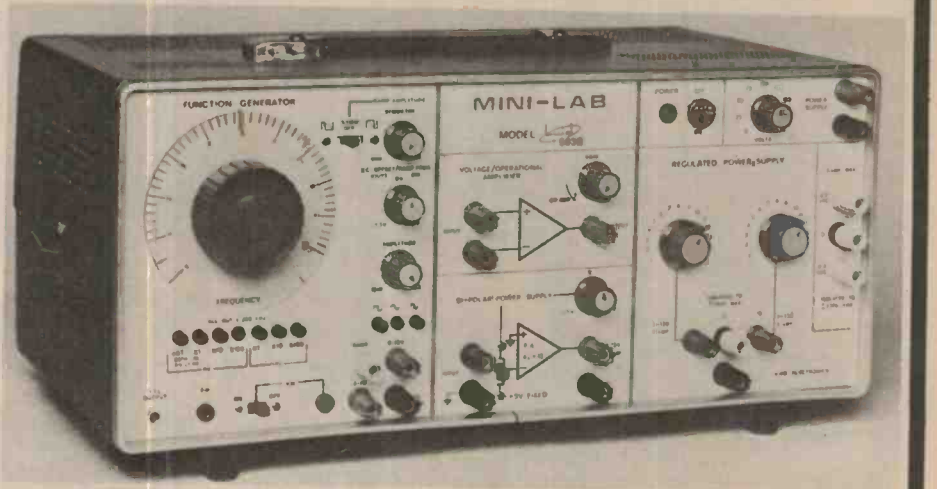
"However, another part of the problem is in educating workers who may find enclosures unacceptable on the grounds that they cannot work the machine in the same way, or hear it properly," Mr Davern said. "Sometimes even management does not appreciate the noise problem, especially if the manager has worked in high noise levels all his life and now has a hearing loss and will not admit it. However, impending legislation makes it necessary for industry to tackle the problem of noise reduction".

Cutting The Risk of Repetition

The long-distance telephone call marred by the speaker's disembodied voice echoing back down the line will be less likely with the introduction of the SP20 echo suppressor introduced by Standard Telephone and Cables Ltd. Designed in folding form to make it more compact, it prevents echoes caused by mismatching in telephone transmission systems. This causes a reflection of part of a signal/voice which is returned to the speaker. If it is sufficiently loud and the delay is excessive, the echo will cause considerable difficulties. Echo suppressors have become essential with the advent of long distance communications and particularly with the increasing use of satellites, which positioned 36000 km above the earth, can create a round trip delay of speech of about 500 milliseconds with a consequent unacceptable degree of distortion.

Comprising a transmission path, a logic circuit to determine the switching of the suppression attenuators and a 'tone disabler' to switch out the compressor when the circuit is used to transmit data, they are intended for service in the 4-wire audio transmission paths at each end of a circuit.

Ideally they should be fitted to the subscriber's equipment, but are effective and more economic when mounted in international switching exchanges directly associated with long distance circuits operating via satellite, long distance h.f. radio, long distance coaxial cable and long distance microwave systems. Further information from: *Standard Telephone and Cables Ltd.* (an ITT company), *136/140 Corporation Road, Newport, Gwent, Wales.*



Versatile Teaching Instrument

A teaching aid which combines the functions of a number of electronic instruments in one compact case is available from BWD Electronics Pty. Ltd. The BWD Model 603B 'Mini-Lab' has proved to be extremely valuable in teaching physics and electronics from high school level through to final university courses. In addition, many industrial and medical laboratories are using it as part of their test equipment for development work and experiments. West German has recently ordered a large number of BWD 'Mini-Labs' to equip their High Schools.

In a single case the 'Mini-Lab' combines a wide-range function and ramp generator, a power amplifier, an operational amplifier and five power supplies.

It is claimed that it is more economical and convenient to use the 'Mini-Lab' than separate instruments. Experiment setting up time is reduced, and students can more easily understand the operation of the various components without being confused by a large number of leads and interconnections. Further details from: *BWD Electronics Pty. Ltd., Miles Street, Mulgrave, Victoria, 3170.*

International Study of Computer Security

Believed to be the first operation of its kind outside the USA, Britain's National Computing Centre (NCC) is undertaking a study of cases throughout West Europe, including Britain, involving breakdowns in computer security. The centre will collect, verify and analyse reports on incidents where computer-based systems have suffered "loss of availability integrity or confidentiality," an NCC spokesman said in London.

The material collected during the study will be used eventually to supplement the centre's recently published book, "Management Handbook of Computer Security," to convince senior management of the need to take computer security seriously.

Computer consultant, Adrian R D Norman, joint author with James Martin of "The Computerised Society," will assist NCC in the project.

The National Computing Centre in Manchester is now asking for information about breaches of computer security due to fire, flood, equipment breakdown, operator error, arson, theft, malicious damage, tampering with files or programs, strikes and industrial action by data processing staff and the unauthorised disclosure of confidential data.

Companies and organisations with information on the subject are being asked to get in touch with John Pritchard at the National Computing Centre in Manchester. Where requested, names of individuals and organisations will not be disclosed in any publication. *National Computing Centre, Oxford Road, Manchester M1 7ED, England.*

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News Digest

Smoke Detector IC

RCA have a new IC out which is a completely self-contained smoke detector (well, almost – it only needs an ionisation chamber and horn alarm). The TA10451 is designed for either battery or line operation. Further details from RCA stockists.

Philips Win Design Award

Winning the Australian Design Award in 1978 for the Philips UHF 320 personal two-way radio means more than superior design, the General Manager of Philips-Telecommunications Manufacturing Company, Mr. Ian McKenzie said last month.

"I believe that this is a small demonstration of the fact that we have an efficient radio communication industry in Australia," Mr. McKenzie said.

This is Philips' second Australian Design Award for radio equipment. The company won it last year for the advanced design of a mobile two-way VHF transceiver, the FM 828.

"We at Philips feel that we got the award not only for the product but for the whole development of an idea to actual manufacture of the world's first 40-channel personal transceiver in such a short time," Mr. McKenzie said.

"The whole UHF project started when CB Radio, or what we call personal communication, started to boom last year, and the problems with 27 MHz (High Frequency) really began to multiply," he said. The 27 MHz band suits long-distance work rather than the requirements of the personal radio-communicator – where thousands of users share a few channels."

"Mobile radios frequently take up to three years to design, let along get into production," Mr. McKenzie said.

Philips had the UHF 320 transceiver on the market by April this year.

Mr. McKenzie said that every resource of the strong project team was required to produce an advanced, reliable radio in the given time.

"The team had to not only design the product but also lay out the factory, purchase and install the machinery, hire and train personnel, program automatic testing equipment, design packaging, co-ordinate publicity and introduce the unit to the retailer. Performance like that comes only from a company which can provide strong project teams."

New NS Computer

National Semiconductor Corporation has announced that it will market, through its subsidiary NS Electronics, a new minicomputer line called the series/200, which is totally software and input/output compatible with the Digital Equipment Corporation PDP 11/34.

According to the Company the Series/200 will be marketed to large OEM customers. Detailed information on the product line, pricing, service and product distribution will be announced prior to the end of 1978. Initial shipments will begin next Spring.

In conjunction with its decision to market the Series/200 minicomputer line, National has filed an action in U.S. District Court for the Northern District of California against Digital Equipment Corporation asking the Court to find that various digital equipment patents are invalid and unenforceable, and that National has not infringed those patents.

New Advanced Calculators

A new series of advanced pocket calculators, featuring liquid-crystal displays, ultra-small size and long battery life, has been released by Toshiba Australia Pty. Ltd. to cover the needs of a wide variety of users from housewives, students, and office staff up to business executives and scientists. The series includes micro-compact models which slip into a small pocket or purse, and slightly larger very sophisticated models which are almost mini-computers.

Smallest in the range are the slim-line Model LC-850M and the thin credit-card size Model LC-581. Battery life on these is 2,000 hours continuous operation. Two other models incorporate digital watches with an alarm; one of these has a calendar and stopwatch facility as well.

The scientific calculator is ideal for engineers, mathematicians and advanced students. It offers 39 functions, with a

12-digit face. For the business executive, the electronic "brain" model includes 30 independent alpha-numeric memories for names, dates, telephone numbers and similar constantly-used data. Battery life is 12,000 hours.

US To Get Viewdata

Britain's Viewdata system, which allows people to acquire information by telephone from a computer and have it displayed on their television sets, is to go into public service in the United States next year.

The system is already planned for introduction in Britain in the first quarter of 1979, and Hong Kong has also announced plans to give it a trial.

Mr Peter Benton, managing director of UK Post Office Telecommunications, said in London recently that the decision to launch the system in the US followed favourable reaction to a series of demonstrations there over the past six months.

He said: "The favourable reaction to Viewdata we have had so far from a wide range of American business interests – including many featured in the top 100 US companies – has exceeded our expectations." Mr Benton said the instant information service will probably be introduced in association with a large US corporation. "It will be a major success," he predicted.

Viewdata, which is being marketed in the UK under the trade name Prestel, was developed by British Post Office engineers.

Under an agreement just reached with the Post Office, Insac Data Systems Ltd will start a Viewdata service from a US computer within six months of the launching of a public Prestel service in Britain. Insac Data Systems, a firm owned by the British Government, was set up to market British computing systems and software overseas.

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News Digest

Mr Benton said foreign interest in the British invention had been intense. He said: "Already we have succeeded in selling the technology to Federal Germany and the Netherlands and we have agreement in principle to sell it to Hong Kong."

The recent demonstrations in the US were staged with the aim of assessing the potential for the system there. With the help of the UK Post Office, Insac set up a special computer store of information about America to give a realistic indication of the system's possibilities for the US.

Viewdata was given its first trans-atlantic demonstration in October last year at an international telecommunications conference at Atlanta in Georgia. The widespread enquiries that followed led to a decision to test the market with a series of further demonstrations on that side of the Atlantic.

Synergistic Beer Drinking

Due to a brilliant piece of timing, last month's issue of ETI appeared on the news-stands on the first Wednesday of the month, so that most, if not all, of you didn't read of the Synergistic Beer Drinking until it was too late. However, you will be glad to know that just in case anybody did turn up, the dedicated ETI staff did go down to the pub, and what's more had a darn good time. Pity you weren't there, really.

However, we've had thousands of phone calls from one or two people about it, and we know they'll be there this month. To refresh your (dynamic) memories, the ETI technical staff will be at *The Bayswater Hotel, Bayswater Road, Rushcutters Bay*, (near the Rushcutter Bowl), on the first Wednesday in every month, for a few beers and a chat with anybody who wants to come along for a laugh. The idea is to find out what you'd like to see in ETI, kick around ideas for projects, design our office robot and generally have a good time – so if you're reading this after the first Wednesday of November, think what you missed, and put a note in your diary for December!

'National' Produces 100 Millionth Radio

The Matsushita Electric Company of Japan, makers of National Panasonic and Technics sound equipment, has become the first organisation in Japan to achieve a production record of 100 million radios, according to Mr. J. Ukita, Managing Director of National Panasonic (Aust.) Pty. Ltd.

Mr. Ukita said that the 100 millionth set, one of the National range of ultra-thin types came off the line on August 11th. He said that while it took 40 years from 1931 to achieve the 50 million mark, the production of the next 50 million has taken only 7 years.

Out of the 100 million, 31 million were sold in Japan and the remainder in more than 130 countries throughout the world, most probably establishing National Panasonic as 'the world's most famous brand name in the electronics field', said Mr. Ukita.

Colour Graphics Printer

Xerox have introduced a colour graphics printer which can print on plain paper and can also make copies of colour documents. The Model 6500, which mixes scanning laser optics with digital electronics, can even make copies of 35 mm slides with a special adaptor.

RC Helicopter

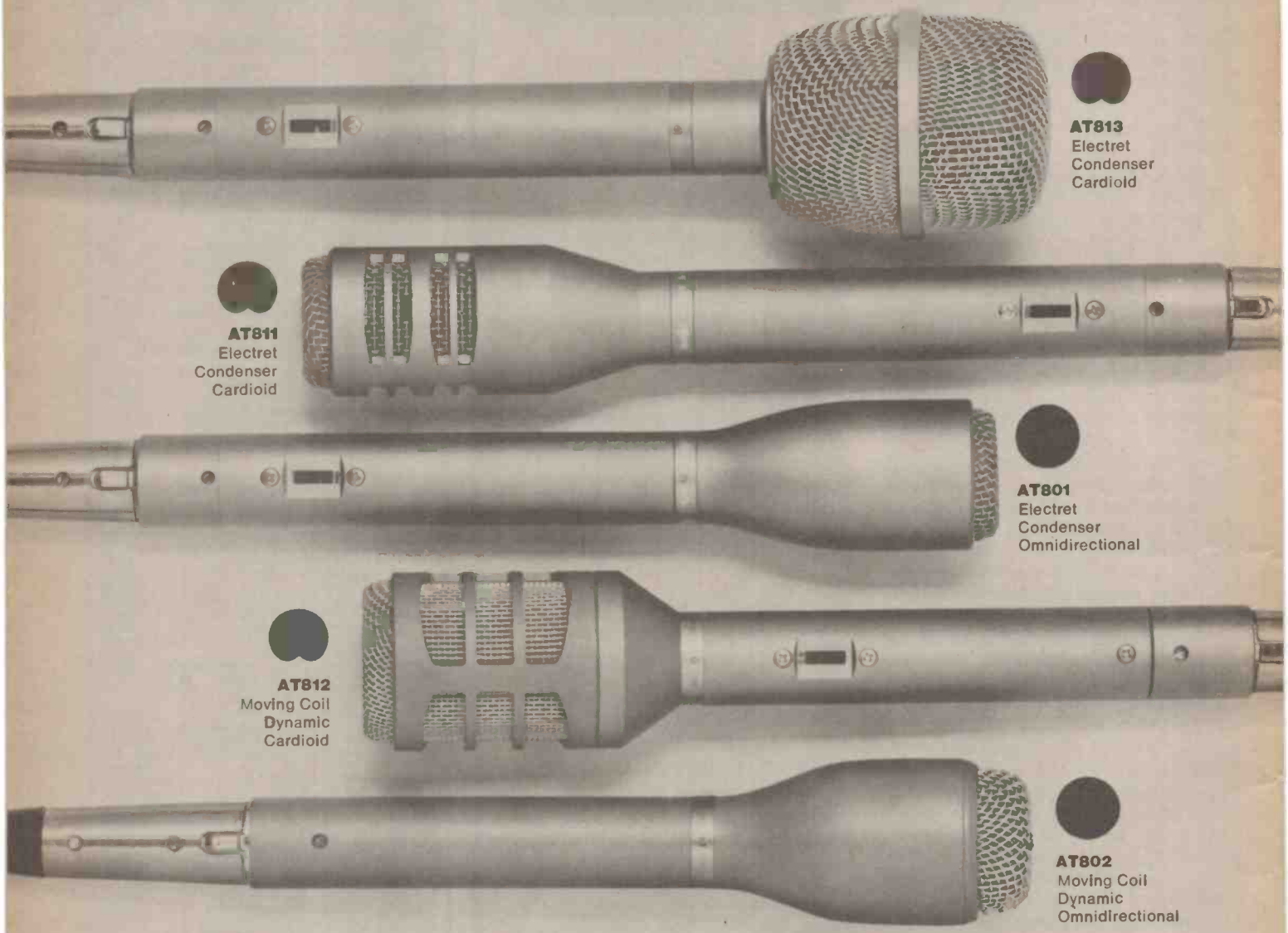
Supervisor is a remote controlled helicopter for use on the modern battlefield which has been developed by Marconi and Westland Helicopters. Standing about as high as a man, Supervisor contains cameras and 'other surveillance equipment'.

ETI/Unitrex Calculator Contest

Well, after shuffling through all the entries in the 'Design a Contest' contest, we are much impressed. Seems some of you out there are smarter than we thought! Our first winner combined a simple maths problem with a cunning twist of logic. Mr S. Campbell of Mill Park, Victoria, asks: An item sold in a hardware store costs 58c for 9, $1.16 for 35, $1.74 for 139 and $2.32 for 1 026. What is the item and how much does one cost?

Seal an empty envelope, write your answer on the back of it, and send it to: Unitrex Calculator Contest (Nov), ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. The closing date is Friday, 8th December.

Audio-Technica announces a creative new start toward better sound.



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22uF	63vw	25c	470uF	10vw	50c
33uF	50vw	25c	470uF	50vw	60c
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European Satellite Communications

Satellite communications is shaping up to be big business, and the Europeans intend to capture some of that market, writes Brian Dance.

WHEN ONE TALKS about satellite communications, one immediately thinks of the US successes with the Intelsat craft (see *New Look for Communications Satellites,* ETI, December 1977) and with various other satellite communications systems. However, the European Space Agency now has an experimental communications satellite in orbit which has been built by the European 'MESH' consortium of manufacturers. It will be followed by the first fully operational proportion of European telephone, telex and television traffic in the 1980's.

The first of the European Space Agency's communications satellites was the ill-fated OTS 1 (Orbital Test Satellite 1) which was lost when the American made Delta 3914 launch vehicle exploded 54 seconds after lift-off in September 1977. However, on May 12th, 1978 a similar vehicle carrying the OTS 2 was successfully launched from the Eastern Test Range at Cape Canaveral, Florida after the scheduled launch on May 4th had been postponed. This satellite, which has a minimum design life of three years, carries a communications payload developed by AEG/Telefunken and Selenia; it will provide pre-operational European traffic capacity until the first fully operational European communications satellite becomes available – probably in 1981. The OTS 2 vehicle will test transmission techniques and will demonstrate the performance and reliability in orbit of on-board equipment rather similar to that which will be used in the fully operational satellites.

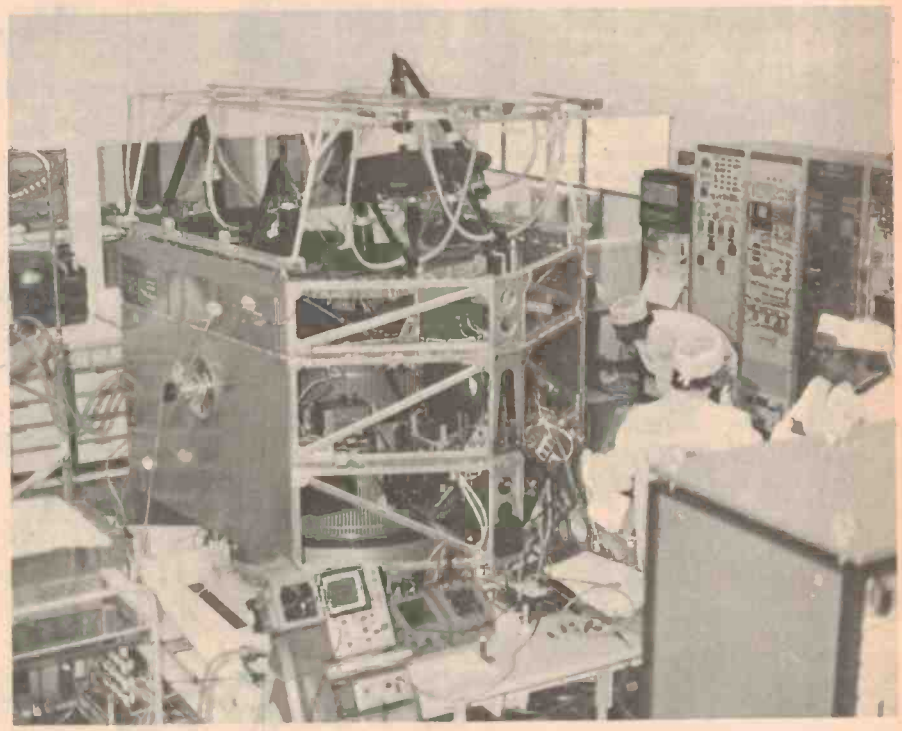
The ESA

The European Space Agency (ESA) came into operation on 1st May 1975 to group into a single agency the complete range of European space activities. Its aim is "to provide for and to promote, for exclusively peaceful purposes, co-operation among European states in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space applications systems". The ten founder members were the original ten members of the former European Space Research Organisation (ESRO)

Belgium	Germany	Spain
Denmark	Italy	Sweden
France	Netherlands	Switzerland
	United Kingdom	

Ireland signed the ESA Convention in 1975, whilst three other countries have observer status in ESA. These three countries, Austria, Canada and Norway each participate in one of the ESA programmes.

Each member state of the ESA pays a contribution to the basic activities of the ESA in proportion to its Gross National Product. The ESA has a space research and technology centre at Noordwijk, the Netherlands and is involved in a wide range of space activities apart from communications satellites; they include the development of a re-usable space laboratory 'SPACE-LAB', the launching of scientific satellites, meteorological satellites MAROTS (Maritime Orbital Test Satellites) and AEROSATS for improving world-wide air traffic control.



Work on an engineering model of the OTS. (Courtesy: Hawker Siddeley Dynamics)

OTS 2

The OTS 2 is a three axis stabilised spacecraft. Unlike the spinning type of space craft which have solar cells on the outside of a cylindrical drum, the OTS 2 solar cells are on extendable arms so that all of the cells can face the sun at all times and maximum power can be obtained from them. The arms carrying the solar panels are flexible and are folded up during the launching stage so that they can be fitted into the available space in the launching vehicle.

The OTS 2 has a modular construction. There are two main modules, namely service module which provides all of the basic service functions and a

communications module which contains the payload. The attitude of the satellite is controlled so as to keep the six SHF antennae pointed towards the earth within 0.2° of their assigned direction. The OTS 2 is one of the first communications satellites using frequencies in the 11 and 14 GHz bands; such high frequencies provide a wide bandwidth, but can bring problems when there is very heavy rain at the earth stations.

The antennae include the spot beam shown in fig. 1 which covers most of the more heavily populated regions of Europe, whilst three Eurobeam 'A' antennae and three Eurobeam 'B' antennae provide coverage of not only the whole of Western Europe, but also of the Middle East, North Africa, the Azores, the Canary Islands, Madeira and Iceland. The Spotbeam antenna provides point-to-point telephone conversation signals over its restricted area, whereas the Eurobeam antennae will transmit television signals which will normally have various destinations.

The early phase of the OTS 2 mission will be devoted to a series of experiments designed to check the up and down link transmission techniques and the full performance of the spacecraft. The high frequencies used have been chosen because because of the heavy traffic in the region and will provide experimenters with the opportunity of testing simultaneously wide-band digital transmissions between large stations and narrow-band signals between small stations. Noise levels are much less critical in narrow-band systems, so much smaller aerials can be employed.

The modular concept of the satellite enables it to be adapted easily and economically for various types of mission. Various payloads can be carried without an expensive re-design of the service module, whilst even the communications module can be adapted to carry alternative payloads without a major redesign. The satellite structure is designed to carry a heavier weight than is required in the OTS, so the system offers a considerable potential for larger future systems.

The modules

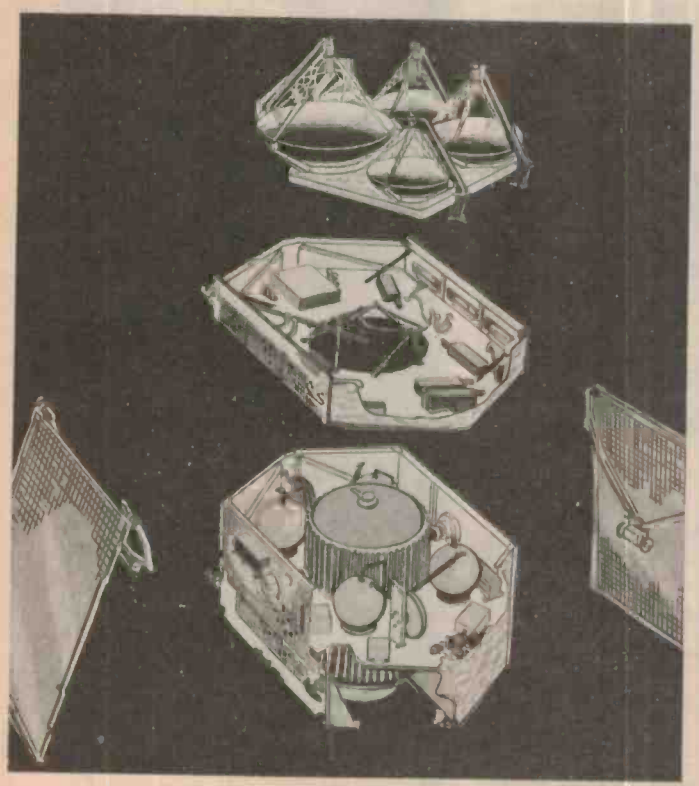
Module A is a smaller version of the payload to be used in the later fully operational satellites. It contains two chains of 40 MHz bandwidth and two chains of 120 MHz bandwidth. Each pair is designed to provide frequency re-use by means of orthogonal linear polarisation (that is, two beams polarised at right angles to one another transmitted over the same frequency bands). The module will provide re-transmission of television and FSK time division multiple access (TDMA) telephony signals. The telecommand receivers which accept command instructions from the earth stations and the telemetry transmitters are also located in module A.

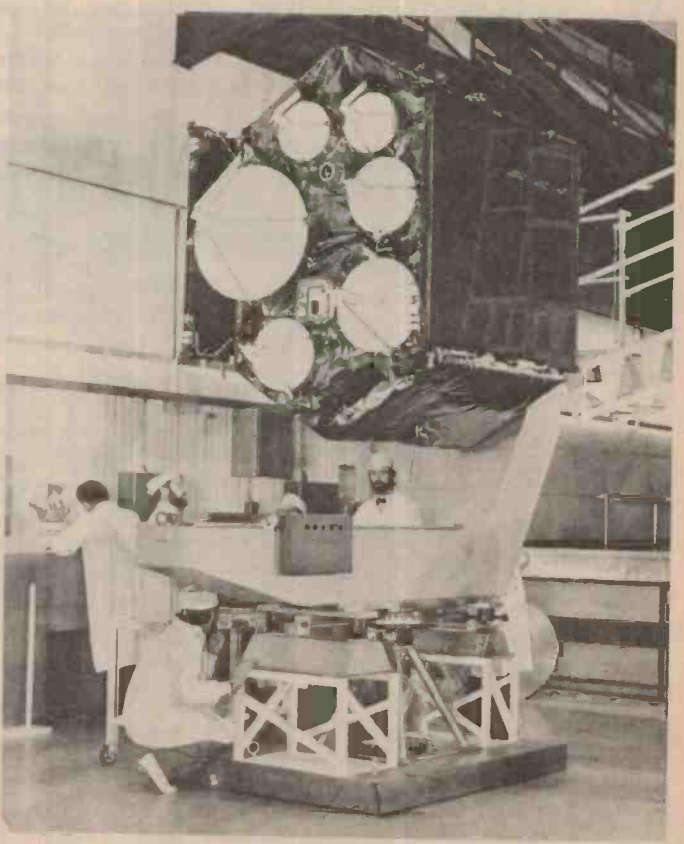
Module B contains two repeater chains of 5 MHz bandwidth designed to perform propagation experiments and narrow band transmission tests. Frequency re-use employing orthogonal circular polarisations can be achieved. The gain of the module B systems is considerably higher than those of the module A systems, so module B can work with small and relatively inexpensive earth stations.

In sunlight electrical power from the solar cells is transferred to the spacecraft via the Bearing and Power Transfer

Engineers measuring the moment of inertia of the OTS 2 satellite. (Courtesy: British Aerospace)

The modules used in the OTS 2 spacecraft. (Courtesy: British Aerospace)





Basic Data on the OTS 2

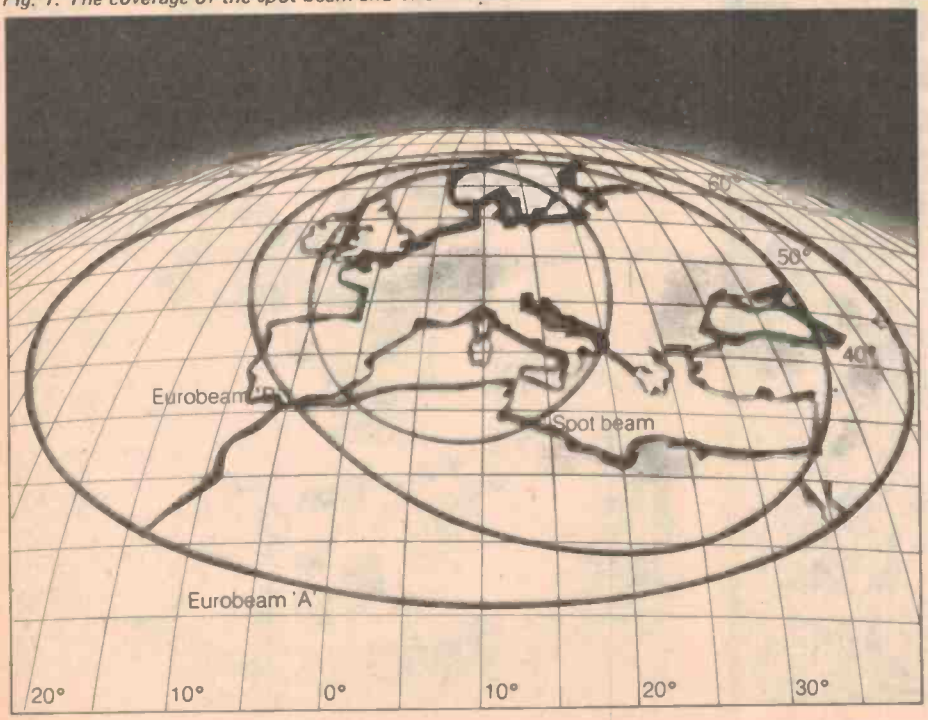
Spacecraft weight	865 kg	
Dimensions: height	2.39 m	
length	2.13 m	
width	1.68 m	
total span with solar panels unfurled		9.26 m
Design life	3 years minimum	
Electrical power:	100 W available during transfer orbit.	
	800 W array power at start of life	
	600 W array power at end of life	
Pointing accuracy:	±0.17° roll and pitch; ±0.45° yar	
Position keeping:	±0.1° for 3 years N/S; ±0.1° for 3 years E/W.	
Launch vehicle:	Delta 3914	
Communications:	Up to 7200 simultaneous telephone circuits (5400 using the high-gain spot beam antenna and 1800 using the Eurobeam antennae.) 6 channels, each 20 W, in the 11 and 14 GHz bands.	

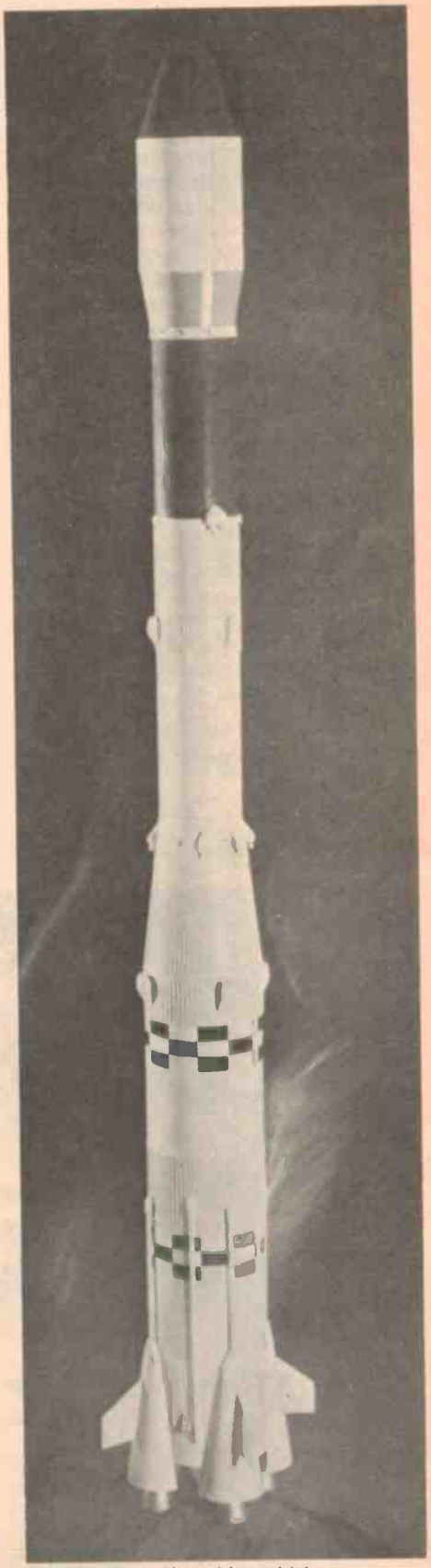
Assemblies (BAPTA's); these are conditioned to give a regulated main bus supply of 50 V ±1% which supplies all of the spacecraft equipment. Each of the solar cell arms consists of three panels. When the spacecraft is eclipsed by the earth, no power is obtainable from the solar cells and the main bus is supplied by nickel-cadmium batteries. These batteries also supply the power required during the launching phase and supplement the regulation of voltage when the spacecraft is spinning and the solar cell arrays are folded. Circuits are included which protect the system against the failure of an individual cell of the battery and reliability of the power subsystem is provided by redundant circuitry.

The Programme

The OTS satellite is the third communications satellite to be developed in Europe, the earlier ones being the French-German 'Symphonie' and the Italian 'Sirio'. However, the OTS has been designed to lead directly to the establishment of an operational system. It has been estimated that there will be a demand for some 5000 telephone circuits for traffic inside Europe over distances exceeding 800 km by 1980,

Fig. 1. The coverage of the spot beam and two Eurobeams of the OTS 2 satellite.





The ESA Ariane launching vehicle. (Courtesy: ESA)

rising to some 20 000 by 1990. It has been recommended that a distance of 800 km is about the minimum over which it will be economically viable to route European calls via a satellite link.

The fully operational European Communications Satellites to follow OTS will be basically similar to the latter, but will each provide twelve 20 W channels in the 11 and 14 GHz bands. As each channel can carry one television signal or 1800 telephone conversations, each satellite will be able to carry about 21 000 telephone conversations at any time. There will be a general coverage Eurobeam and three spot beams; the east spot beam will cover Greece. Italy, Austria and parts of Russia and Germany, the west beam central Europe and the United Kingdom and the Atlantic beam Spain and various islands.

ESA has awarded contracts worth about 57 million Australian dollars to British Aerospace for the development and production of the operational communications satellites. Initially two will be launched, one being a spare, but others will follow to meet the required demand. A number of Maritime communications satellites will also be launched by the ESA, these being of the same general design. Satellite technology is big business (with telecommunications revenue rapidly approaching 10^{11} dollars per year) and the ESA is determined to ensure that it receives a significant part of the satellite communications sales on a world-wide basis. British Aerospace are intending to manufacture spacecraft to be known as "Arabsats" for the league of Arab states. Although rather similar to the European craft, the Arabsats will have twelve channels each in the 6 GHz and 4 GHz bands for telephony and two or four channels with 6 GHz up links and 2.5 GHz down links for community broadcasting services. The satellites will transmit at 50 W or 75 W per channel at 2.5 GHz so as to provide television and sound programmes to small communities using dish aerials of about 3.5 m diameter at the receiver and simple transistor front-end amplifiers.

Broadcasting

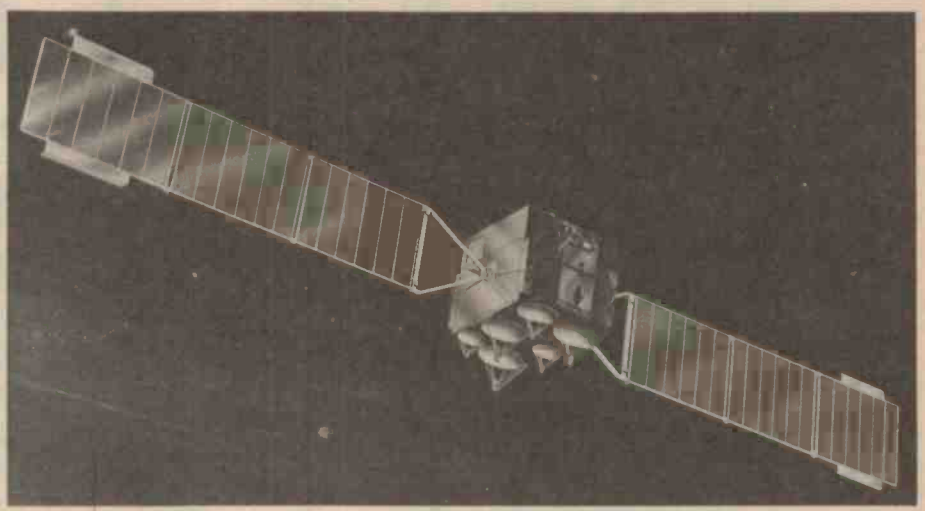
It is expected that experimental television satellite transmissions to the European land mass will commence soon. Frequency modulation is to be employed for the video signal with an overall bandwidth of some 27 MHz with 20 MHz between channels. This provides 40 channels in the 11.7 GHz to 12.5 GHz spectrum. The interference ratios between the FM transmissions must be not less than 35 dB for one interfering signal and a total of 30 dB for all interference in a given channel. Circular polarisation will be used with the down signal having a clockwise rotation of the electric vector looking from the satellite and the up signal an anti-clockwise rotation.

The power flux at a preferred site on the earth is based on the use of a 900 mm diameter receiving dish providing a 3 dB beamwidth at 2°, the overall system noise figure will be about 8 dB. A smaller dish of some 750 mm would provide a noise figure of about 6 dB. Five channels have been allocated per country, either entirely for television use or for mixed uses (such as multiple-channel FM radio, etc.).

The longitude position of 1°W has been allocated to Eastern Europe, 19°W to West European countries, 31°W to Ireland and the UK and 37°W to countries in SW Europe. Problems are likely to occur when transmissions to a small country interfere in neighbouring countries, since it is difficult to obtain very narrow beam widths.

Power considerations seem to make it essential to use wideband FM rather than AM transmission for television signals. AM transmissions would require an effective radiated power of some tens of kilowatts, whereas acceptable FM signals can be sent at a level of a few hundred watts to achieve a similar performance at the television receiver. In addition, FM provides better interference protection.

It is hoped that initial experimental European transmissions will commence from a heavier Ariane satellite in 1979 which will use two transmitters of 450 W and 150 W for television signals. Both will provide direct reception, but the 450 W transmitter will naturally cover a larger area. The two transmitted beams will be independently steerable over the whole of Europe and parts of North Africa and the Middle East, typical examples of the coverage obtained being shown in fig. 2, for the case where the receiver used has a figure of merit of 4 or 6 dB/°K. (These figures of merit of a receiver were explained on page 17 of our December 1977 issue.) The radiation pattern on the surface of the earth is known as the 'footprint' of the satellite! The availability of two steerable beams raises the possibility of using the higher power beam for the vision signal and the lower power beam for sound transmissions with the possibility of the sound being in several languages for pictures simultaneously transmitted to different countries.



The European Space Agency's Communication Satellite which is scheduled for launch in 1981. (Courtesy: British Aerospace)

Multiple Access

It is of vital economic importance that satellite links should be able to handle simultaneous traffic between various stations ('Multiple Access'). One way of doing this is by time division of the channel between various signals; this system of Time Division Multiple Access (TDMA) will be used by the European Communications Satellites for accessing more than twenty earth stations in the 1980's. Experimental TDMA transmissions will start this year between five of the European earth stations using the OTS 2 satellite at 60 and 180 Mb/s.

TDMA is especially attractive for data transmission at rates of some megabits per second. Simple, economical

earth stations can be employed to link high speed computers which need to share out their work load. Normal telephone links cannot operate at such rates, but one wonders whether the post and telecommunications authorities of the various countries will permit computer users to have their own small earth stations.

In the case of telephony signals, Intelsat have developed the only accepted system of TDMA, but the earth stations using this system are extremely costly (over $1M). The alternative Phase Shift Keying with Frequency Division Multiple Access (PSK - FDMA) system may be more economical for the smaller earth stations. However, the trade-offs between TDMA and PSK-FDMA are quite complicated to assess. Digital transmission of speech will be employed in the European satellite systems, since Digital Speech Interpolation (DSI) allows the effective satellite capacity to be doubled.

Ariane Launcher

The United States and Russia are undoubtedly the world leaders in rocket technology, but the ESA is developing its own launcher to be known as 'Ariane'. It is expected that some 200 geosynchronous satellites will be launched between 1980 and 1990 by European and other countries, a high proportion being for communications. The Ariane vehicle will be able to place satellites of up to 970 kg mass in geosynchronous orbits. Developmental launches of this vehicle are scheduled for 1979 and 1980 and it is expected that the rocket will be operational by the end of 1980. Ariane will also be able to launch heavier satellites (up to 2500 kg in weight) into low earth orbits for scientific and earth-resources work or into a sun-sychronous circular earth orbit for scientific work.

Work on Ariane has been mainly in France and Germany. Launches will take place from the ESA's launch facilities in the Guiana Space Centre of the French National Space Agency. This launch centre is located at Kourou which is very close to the equator and is a very favourable location for launching geosynchrous and other spacecraft.

It is intended that the last three developmental flights of Ariane will be used for the launching of payloads, free of charge. The LO2 flight scheduled for December 1979 will carry a Geosari satellite together with an Amsat amateur radio satellite. In May 1980 it is proposed that the L03 flight will carry a Meteosat meteorological satellite and a satellite

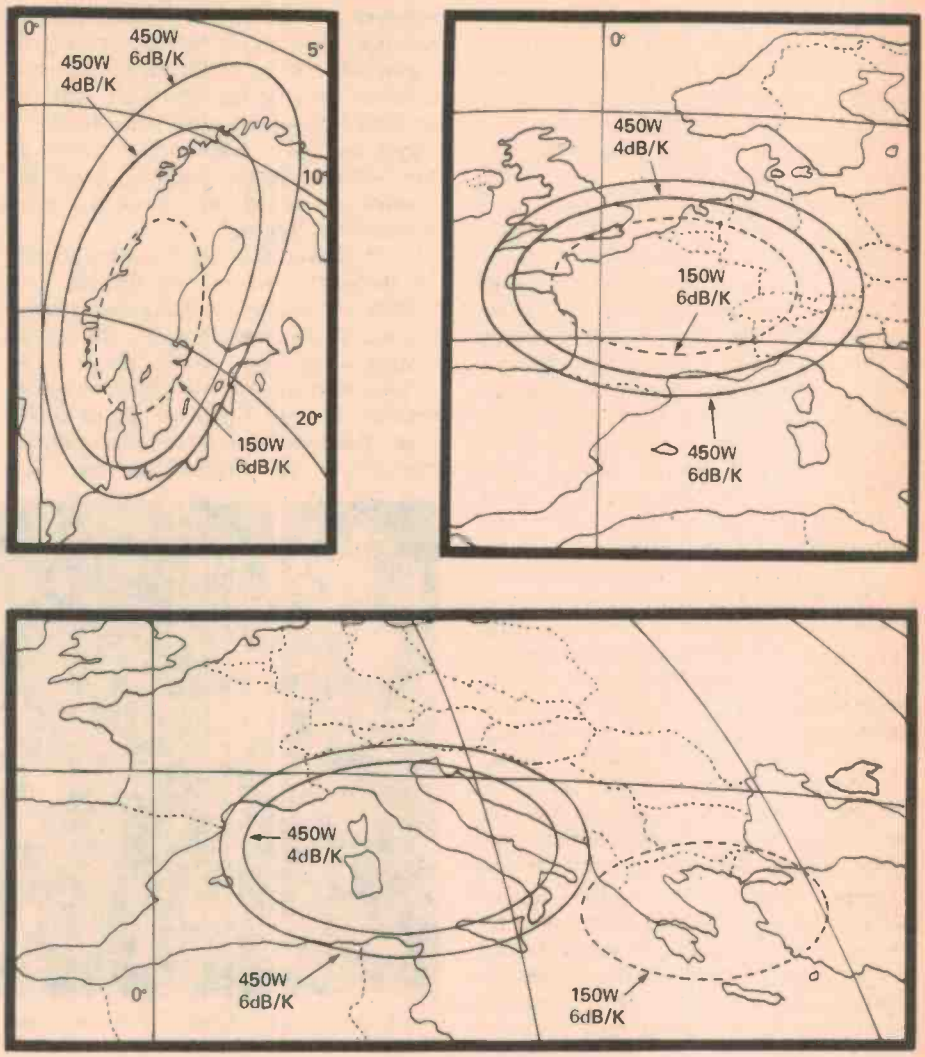


Fig. 2. Television broadcast 'footprints'.

proposed by the Indian Space Research Organisation, whilst the L04 flight in October 1980 should carry the heavy ESA satellite for direct broadcasting to Europe if the programme continues as planned.

It is interesting to note that the European Communications Satellites will be suitable for launching not only by Ariane, but also by a Delta 3194 rocket or by the Space Shuttle, so launching systems are very flexible indeed.

The European countries are determined to be one of the leaders in the space technology race. Although this field is too costly for each individual small country, collectively it makes economic sense to join into a consortium. One may compare the ESA with the collective work of Europe in a similar expensive field, that of very high energy physics at CERN.

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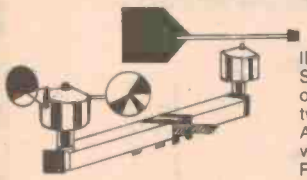

ID-1590E SPECIFICATIONS: Wind Speed: 0-99 in miles per hour, knots or kilometres per hour (choice of two). Response Threshold: 3 mph Accuracy ± 1 digit or ± 10%, whichever is greater. Direction Response Threshold: approx 2 mph. Power Requirement: 240V AC, 50 Hz.

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- Attack Time Control (1.5 msec-2.5 sec)
- Decay Time Control (1.5 msec-8 sec)
- Sustain Level (0-100%)
- Release Time (1.5 msec-8 sec)
- Gate Trigger Selector Switch (Gate + Trig/Gate/LFO)
- ENVELOPE GENERATOR 2
- Attack Time Control (1.5 msec-3 sec)
- Release Time (1.5 msec-8 sec)
- Gate Selector Switch (Gate/LFO)
- Modulator
- Mode Switch (Random / ⊓⊔ / ∿)
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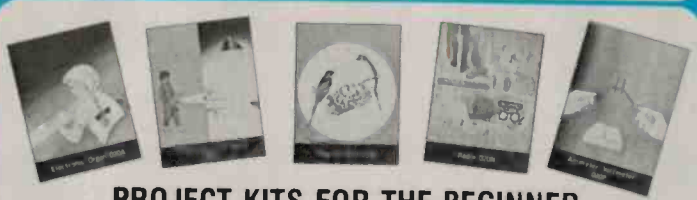

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Type PB3. HARTMAN push-button. Forward & reverse. 1 to 0. BCD. Size: 62mm x 40mm x 12mm. P&P 30c.

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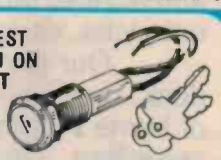

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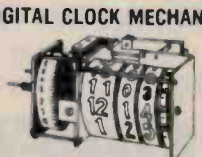

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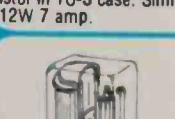

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All kits include cabinets. All kits despatched freight forward by 'Comet'.

We put so much Marantz quality in,

we put the Marantz name on.

Look for the name that says world famous quality—Marantz. Because now you'll find it on all Superscope by Marantz tape products. 21 models in all, for students, businessmen, professionals or anyone who wants to tape anything. Bird-calls to board meetings. Every model is loaded with the features you want most, and priced to fit your budget.

For example, the Superscope by Marantz portable CRS-2200 is an AM/FM one-point stereo radio/cassette with two built-in condenser microphones and a built-in front-load cassette deck with super-hard permalloy record/playback head. Also included are two built-in 2-way speaker systems with 5-inch woofers and 1¼-inch tweeters, total-mechanism shut-off, locking pause control, cue and review, tape counter with reset, line-in and out jacks, sleep timer and two VU meters.

Our portable stereo cassette component deck, the CD-330,* can be used with the finest of home systems. Or, take it on any location recording. There are 3 tape-heads for fully professional tape/source monitoring, complete with double Dolby;** one for record, another for playback. Plus, two fly wheels for on-the-move flutter-free recording.

Superscope by Marantz—as you can see, there's a lot in our name.

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Superscope (A'asia) P/L, PO·Box 604, Brookvale. 2100. Tel: (02) 939-1900.
*Shown as Model CD-320. **Dolby is a registered trademark.

SOUND

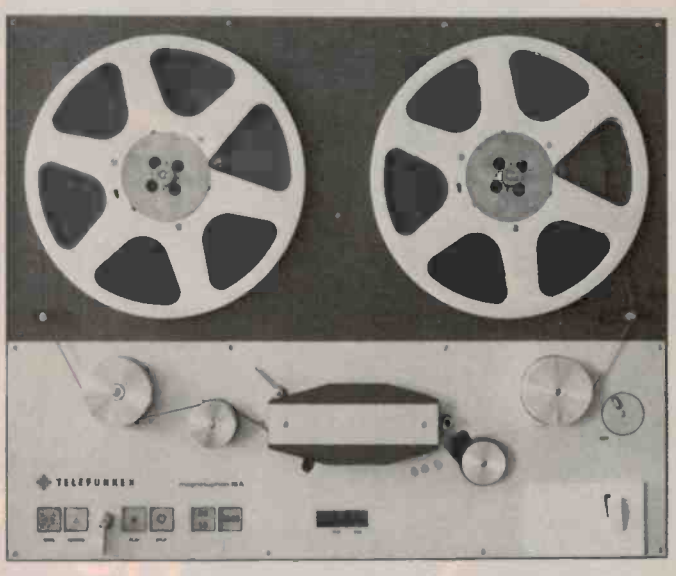
Telefunken M15A studio tape recorder

IN AUSTRALIA, the name *Telefunken* is mainly associated with gramophone records and pre-recorded cassettes. Many readers will know something of the Teldec videodisc while others will have some knowledge of their range of consumer and specialised electronics.

The majority of the world's gramophone records are processed through Telefunken M15A tape decks which have an additional mechanism fitted for previewing the cutting signals. The deck is fitted into a silver grey console which matches the Neumann disc cutting electronics and lathe. Both Neumann and the Telefunken electronics and tape decks are distributed in Australia by Rank Industries. This 6.35 mm deck is only one of several studio machines with a chassis and electronics section common to all.

Disc cutting systems use a standard 6.35 mm tape width and wide guard band heads. Other Telefunken M15A transport accommodate tapes and track formats up to 50.8 mm and 32 tracks resulting in track widths of the order of one millimetre, allowing for guard band requirements.

The M15A received for the preparation of this article is fitted into a standard studio trolley with four roller castors and dress sides of dense laminated timber. Although the overall appearance is rather 'utility' there is no denying the smart efficiency.



Description

The actual tape deck assembly is built upon a rigid cast baseplate which also supports the electronics cabinets and rectangular legs fitted to tubular runners similar to snow sleds. These assist in sliding the deck into the console.

Overall dimensions of the deck are 645 mm wide by 525 mm deep with an overall height of 305 mm, including the runners and the cabinets. Although the deck is not very heavy at 53 kg, two men were needed to carefully load it into the front entry console, the dimensions of which are 920 mm height, 730 mm width and 600 mm front to back. The extra width accommodates control boxes at the right.

European studio practice generally dictates different tape handling and equalising techniques; the M15 series can be supplied with AEG hubs which have a support plate for tape packaged without side plates, or flanges. In addition, the M15 decks can be supplied with tape heads facing away from the operator which necessitates the tape being wound with the coating to the outside of the reel.

Various other standard options include full track (mono) operation, pilot heads and tones, narrow or wide guard band with full track or two half track erase heads, amplifier control within the headblock, switched NAB/IEC equalisation, tape splice marker and cutter and controlled variable tape to erase

Top: the Telefunken M15A deck, and below: the deck in its console with control panel to the right.

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head distance for gradual erasures or drop-ins (a feature recommended to domestic machine designers).

The tape reel centres are some 330 mm apart to accomodate the large European plates leaving some 60 mm clear space between standard 267 mm NAB reels. This is very useful when recording a live performance at high speed, as it is possible (though risky) to overfill the reel thereby prolonging the recording time before reels must be changed. Don't worry about the motor torque – it is more than ample.

The tape path flows from the supply reel around the outside of a 65 mm diameter roller, inside a 45 mm roller, across the tape guides and heads, out of the block and inside the capstan pressure roller which matches the 45 mm diameter of the entry roller. The capstan is a reasonably sized 14 mm. Tape flow is completed by passing inside another 65 mm roller before the take-up spool.

Capstan drive is by belt from an enormous flywheel of about 150 mm diameter, while the reel tables are directly connected to the separate motor drives. Heat build up was not noticed even during extended operation. The reel tables were supplied with a friction clamping plate for cine reels; a choice between a plastic NAB adaptor or use of the solid centre spindle for an alternative adaptor is also offered.

Deck Controls

Under a lightweight cover at the right are a mains power pushbutton matched by another for selection of 19 cm and 38 cm per second tape speed; a third top lit indicator pushbutton controls deck or remote control operation. A total elapsed time meter is also sited in this well.

At the left of the deck top front were the usual array of controls for tape motion and recording operation but with a slight difference. Studios prefer to fast wind tape at a controlled rate, and variable speed spooling is a tapester's delight with the M15A. A long lever controls the tape spooling speed in either direction once the fast button is operated. Minimum fast wind time for a Maxell UDXL 1100 metre tape on the review sample was 133 seconds, while 750 metre lengths of BASF LGR30P and SPR60LH rewound in 95 seconds. These figures can be bettered by one or two other top quality decks but very fast rewind speeds are not recommended – be kind to your tapes.

An electronics minutes and seconds tape counter is located centre front with its associated cancel button.

Remote Controls

The nearer of the two electronic control boxes is a multi purpose remote control and autolocator with nine memories and two distinct readouts, one for the required replay or memory position and the other for actual tape running time. Both are interlinked with the normal deck counter.

Depressing the 'parallel' button permits control of deck functions from both the built-in controls and the remote.

Inserting a required time location on the memory keyboard and actuating 'locate' the machine automatically shuttles backwards or forwards to find the tape position without overshoot. On fast wind the autolocator can be observed causing the tape speed to vary from fast to slower and faster again with a final slow down and dead stop at the required position – very impressive.

The contents of up to nine memories may be recalled and displayed by depressing the required position sequence key. This very useful accessory was used by me not for its intended purpose of building a cutting master but as a repeatable replay source for amplifier and loudspeaker testing with a known set of quality recordings for this purpose.

The variable speed electronics is housed in a narrow compartment at the top right of the control section but is switch bypassed for normal running operation (which is indicated by a green lamp).

Switching to variable mode extinguishes the lamp and lights a red warning indicator. Thumbwheel tuning of required speed is simple, as a continuously variable readout of actual speed is provided. When the transport reaches the chosen (non-standard) running rate the green lamp relights acknowledging correct operation. This useful, though expensive, accessory would certainly benefit the home recording enthusiast wishing to extend the nominal running time of a particular tape.

Before any tape operation with any unknown machine it is definitely advised that the whole transport and head assembly be thoroughly cleansed with pure alcohol and then carefully demagnetised with the Annis demagnetiser, which is available from Klarion (who also supply the specialised and rather low cost test tapes from MRL). Following this procedure, the Telefunken M15A was then subjected to a very quick run through of frequency response and azimuth using the MRL tapes 21J105 and 22A108. The former is NAB equalised and needed referencing to the M15's IEC characteristic as the correct MRL tape, 21J103, was not to hand.

Frankly, the exercise was a waste of time as the machine's replay response was well within the specified ±1½dB in the range 30 Hz to 18 kHz at 38 cm/s.

The M12 is a mono broadcast version of the deck.

Just for the record

The Little River Band tapes with Ampex

The artistry . . . the atmosphere . . . the true and brilliant sounds of the musician . . . In professional recording studios throughout the world the tape used for the original "master" is Ampex. When you've made it with the professionals you'll accept nothing less.

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If it's worth taping it's worth Ampex.

AMPEX the professionals

Azimuth was also exemplary when checked with the special MRL test tape containing repeated tone before and after true azimuth.

Breakthrough of the erase and bias frequency was not in evidence and neither was the signal detectably impaired by any background electronics or tape scrape noises.

Input and output levels are far higher than standard domestic recorder requirements at sensitivities of plus 6 dBm with an overload far in excess of the manufacturer claimed plus 24 dBm and an output to match. All signal connections are balanced and floating with a maximum 40 ohm output impedance requiring up to 200 ohm minimum load at maximum output level. Input impedance is a minimum of 5k ohms from 30 Hz to 16 kHz.

Claimed signal to noise specification is 65 dB at both running speeds with 'A' weighting and referred to 400 nWb/m which is about six decibels about 185 standard NAB level.

Signal input and output connections are via standard three pin Cannon type male and female non interchangeable sockets. Pin one is earth, two is low and three is high.

Operation and Use

The M15A mainframe electronics accommodate the highly acclaimed Telcom c4 noise reduction cards which, although not supplied with this particular sample, I have often used for live recording sessions with perhaps the best results of any noise reduction system.

Tape loading and operation is simple without any hitches or mistaken path loops thereby allowing a necessary medium-fast forward and rewind of virgin tape even when time is at a premium during recording preparations.

As expected with a deck of this calibre and reputation, the signal output quality was exemplary and master tapes revealed far more detail than any domestic and semi professional tape deck. The overpowering realisation with the 15A concerned the lack of background noise even with tapes that occasionally hissed when used on top quality domestic machines of two or three thousand dollars.

Imaging, size, stage width and depth were all presented with an ease and clarity that uncannily reproduced the original live performances recorded in the same fairly large and airy room.

Tape flutter was certainly not in evidence, no doubt due to the superb tape path control and flutter eliminator. Longitudinal vibrations were also reduced or eliminated by the large diameter roller guides.

Although not mentioned in the instruction handbook, I found that the erase head tape lifter was useful in keeping the oxide surface away from the erase and record heads when replaying the fast winding. Perhaps this tape path could result in a measured change in performance but it certainly could not be detected by ear.

This particular tape lifter is used for running drop-ins and, of course, running erase fades of prerecorded material, such as gradually reducing the applause from a recorded direct broadcast.

Other uses of the many facilities included variable speed control allowing recording and replay of 95 mm/s tapes, continued repetition of various selections, and pre-programming a tape for search following these repetitions.

During recording and electrical splicing, the M15A electronics is of great assistance with its graded amplifier switch on response which permits click-free, or 'seamless' programme joins.

During the past weeks the Telefunken M15A has been a silent tutor in tape recording techniques and operation. It will be sorely missed; however, so would the capital outlay. if it was purchased!

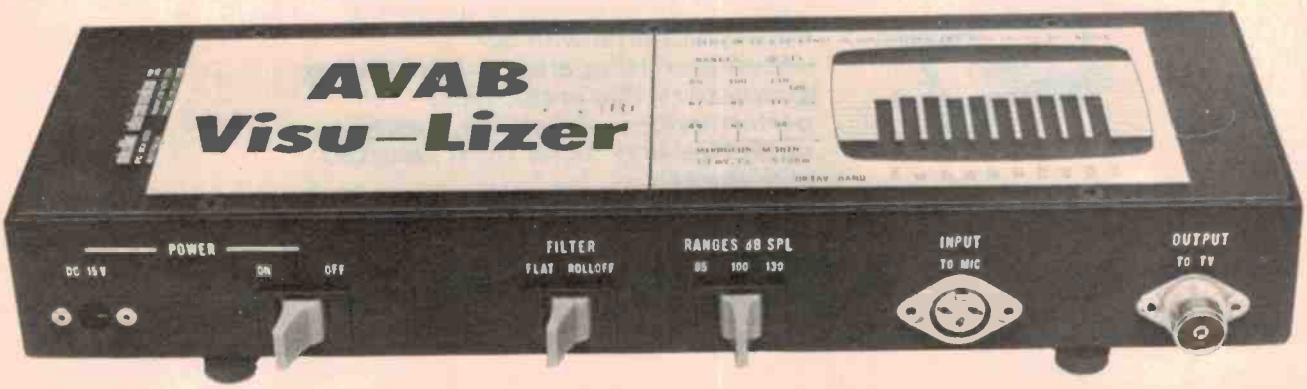
	Duty free	Duty paid	+27½% tax
Telefunken M15A deck	$ 7,487	$9,603	$12,243.83
Matching console	717	920	1,173
Autolocate c/w power supply	3,249	4,170	5,316.75
Varispeed and adaptor	890	1,143	1,457.33
total	$12,343	$15,836	$20,190.91
Telefunken M12 round costing	$5,000	$6,500	$8,287.50

SOUND BRIEFS

AVAB Visu-Lizer

Distributed in Australia by Studio Electronics of Burwood, the AVAB Visu-Lizer is quaintly described by its manufacturers as an **'Oktavbandsanalysator for realtidsmatning av ljudniva'**. Darned if I know what it means, but close inspection of the unit revealed it to be a real-time audio analyser intended for setting up room acoustics and various other uses limited only by one's imagination.

The Visu-Lizer is supplied in an attache case which is fitted with a foam insert to take the main module and its accessories – a pink noise generator, microphone and



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Koss have succeeded in creating a new sensation in the private world of stereophone entertainment. A new era in listening begins with KOSS "PRO 4 TRIPLE A" and "Auditor" Series of Headphones. The supreme feeling of weightlessness and the comfort of contoured earcushions which completely exclude outside noises is only surpassed by the magnificent sound. Whether you enjoy hard rock... Bach...Country Western or easy listening, when the deep, rich lows and crisp highs come through you'll have to agree...with Koss... hearing is believing.

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AE132/FP

Nakamichi T-100 Audio Analyzer

Nakamichi T100 Audio Analyser.

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

SPECIFICATIONS:

OSC: 20-20 kHz. Spot frequencies + pink noise

Level Meter: -80 dB to +30 dB; Average or peak ballistics.

Wow & Flutter Meter: Measures din peak AWTD or UWTD.

Distortion Meter: Measurement frequency 400 Hz; Range 0.01 percent to 3 percent.

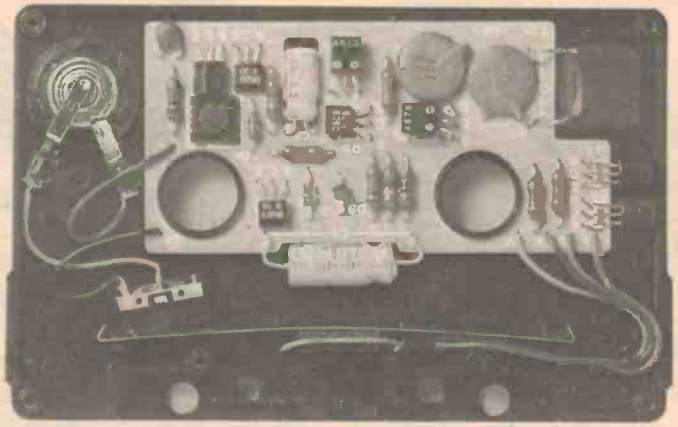
Noise Level Meter: Range -100 dB to -10 dB; 1 HF A Curve; Output impedance: 600 ohms; Input impedance: 50K ohms.

Dimensions: 13½ (W) x 3 (H) x 9½ D inches.

Weight: 4.3 kilograms, 9.5 pounds; Carry case supplied.

TDK Head Demagnetizer

Inside the HD-01 package.



Why you need TDK'S new head demagnetizer

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

How to operate the TDK head demagnetizer

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

Block diagram

For your nearest dealer, brochures and information, contact:

Convoy International PTY LTD
4 Dowling St, Woolloomooloo. 2011. Tel: 358-2088.
Telex: AA23111. Cables: Convoy Sydney.

SOUND BRIEFS

stand and assorted cables. The unit is sensibly designed to plug into a TV receiver rather than an oscilloscope, thus making real-time octave analysis available to the average serious hi-fi nut who doesn't have any spare test equipment lying about.

In order to measure and normalise room acoustics, the white noise source is connected to the amplifier input, and the microphone is connected to the Visu-Lizer, which is in turn connected to the TV set. On switch on, the TV set will display a set of vertical bars which indicate the energy content of ten octave bands. The level of noise is adjusted until the bars reach approximately the middle of the TV screen. This is a sound level of about 82 dB SPL, which is a normal listening level. The amplifier frequency response is now adjusted, one channel at a time, attempting to set all the bars at equal height.

The Visu-Lizer is provided with a switch which tailors its frequency response internally. This enables the user to set up the room acoustics in two ways: flat, which can be rather fatiguing to the 'untrained' ear, or with a roll-off of 3 dB/octave above 1 kHz, which was preferred by most listeners in tests. In any case, since the ultimate objective is to provide pleasure for the listener, the room equalisation should be considered objectively, with a flat or 'rolled-off' response regarded only as a starting point.

Further details are available from Studio Electronics Pty Ltd, PO Box 1055, Burwood North, NSW 2134.

Actilinear Recorders

In our article on the new Tandberg Actilinear recorders in the September issue, we unfortunately omitted to say that further details would be available from Rank Industries Australia, at PO Box 632, Chatswood, NSW 2067. Rank have also pointed out to us that at no time has Tandberg used crossed field heads in their previous models or in their current range, which is not what we said on page 27 under the heading 'New Recorders'. Ah well, we can't be perfect all the time!

New Audiosound Monitor Speaker

Audiosound has extended its speaker range with the addition of the Minuett 8033. The unit is intended for assessing broadcast programme material: it incorporates two small diameter drivers with a phase and impedance equalised cross-over network.

The cross-over uses air-cored coils and polyester capacitors and the bass end, claim Audiosound, is aligned to Thiele-Small computer-correlated parameters.

Fifty 8033s have been supplied under contract to the ABC, a fine achievement.

BBC Breaks Out

The BBC is actively investigating several new broadcasting services.

Firstly there's a proposed 'information' network of low power stations all working on the same frequency but time-division multiplexed to prevent mutual interference. The stations would provide motorists with continuosly updated information about traffic conditions in the area where they are driving. A fixed-frequency tuner/decoder in the vehicle overides the car radio when a message is received.

Next is a proposed inaudible coding signal added to AM broadcasts to provide station ident or other info read-out on an LCD display built into the receivers. As reported in these columns last month, Philips too are working on an FM equivalent.

Thirdly the BBC are investigating stereo AM broadcasting as well as four-channel FM.

Finally the Corporation is studying the feasibility of transmitting data and facsimile signals multiplexed onto the normal audio broadcast programme.

New Amplifier Principle

Not sure if this one's for real or not. We hear from normally authoritative sources that Bob Carver – founder of Phase Linear – has developed a totally new concept in audio amplifiers which he claims 'stores energy in a magnetic field rather than in power supply capacitors' – the technique presumably eliminates the need for a power transformer as well.

According to Bob Carver his new device generates no heat, weighs a mere five kilos for vast numbers of watts, costs just a few cents per watt and lasts for ever!

Seems hard to take seriously – but Bob Carver was the man who produced one of the world's successful super-amps (Phase Linear 400), a very effective albeit misnamed Autocorrelator noise reducer, and the Phase III speaker system which many of our readers will have heard at the recent CES.

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Amazing.

The hottest new name in the speaker business seems to be AR.

Because we've been busy making a few changes. But we haven't forgot what made us famous.

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Yes, we've broadened the AR line. Now it includes 8 models designed to retail from about $100 to about $1250.

Yes, we've improved AR power-handling capacity with an important innovation. The liquid-cooled speaker. All our high-range drivers for '78-'79 will use magnetic fluid (it costs nearly $3000 per gallon) to position and cool voice coils.

Yes, we've refined logos, cabinet styling and several other neat little touches.

We've even up-graded distribution. Henceforth you'll find AR only in quality high-fidelity stores.

What hasn't changed is AR quality and quality control. And that's the reason every AR speaker system is covered by the most impressive warranty on construction *and* performance of any major speaker.

For information and "specs" pick up our new catalogue from your high fidelity dealer or write to us at the address below.

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

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NEW! MULTIMETER AND TRANSISTOR TESTER ALSO MEASURES 'C'

You've probably seen our incredible Multimeter/Transistor Tester. Now it's improved — 3% accuracy, able to measure 50kV or RF to 30MHz with optional probes . . . PLUS it now has an inbuilt oscillator enabling it to measure capacitors from 50pF to 50uF. It could be the handiest piece of test gear you own . . .

Now what did that someone want for Christmas? Cat Q-1140

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Enables your Q-1140 or Q-1136 to be used as an accurate RF voltmeter up to 30MHz — ideal for CB service work!
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Want to measure TV EHT or vehicle ignition HT? Use this probe to extend the capability of your multimeter to 50kV.
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NEW AM/FM STEREO TUNER MODULE
As used by Leo Simpson in the new Playmaster Tuner (EA Nov. '78). Just add 12 volt power supply, switches & tuning dial and you have an AM/FM stereo tuner for about $100 less than a commercial unit with comparable performance. Cat. F-4610 FANTASTIC VALUE AT

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A COMPREHENSIVE TRANSISTOR SPECIFICATION MANUAL FOR $1.45 — NORMALLY $6.50

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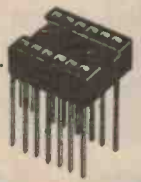
Wire-Wrap IC Sockets FROM 85c ea.



Fantastic NEW wire wrap IC sockets that are ideal for the microcomputer enthusiast — no soldering required so you get a better contact. Use it with our wire wrapping tool Cat. T-3650 @ $4.50 and wire pack Cat. W-4018 @ 65c.
Cat. P-4260 .. 14 PIN ..... 85c ea
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PARTS FOR NEW KITS

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

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

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

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

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

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

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

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

PHOTO TACHOMETER (See August E.A.)
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PCB (only) ... Cat H-8352 .. $1.80
FPT100 phototransistor ... Cat Z-1950 .. $2.00

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

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Sound Components	78 Brisbane Street, Tamworth NSW. Ph 66-1363
Hitel Hi Fi	145 Queen Street, St Marys NSW. Ph 623-4442
Don House Electronics	2 Merriwa Street, Gordon NSW. Ph 498-1398
DGE Sales	44 Brown Road, Newcastle NSW. Ph 69-1222
M&W Electronics	48 McNamara Street, Orange NSW. Ph 62-6491
Double Diamond	18 Russel Street, Goulburn NSW. Ph 21-5440
G.M. Electronics	99 Fitzmaurice Street, Wagga NSW. Ph 21-3044
Rivercom	9 Copland Street, Wagga NSW Ph 21-2125
Brian Bambach Electronics	68 William Street, Gosford NSW. Ph 24-7246
Capital Coast Electronics	11 Comm. Centre, Ford St, Moruya NSW. Ph 74-2545.
GCG Communications	385 Mulgrave Road, Cairns QLD. Ph 54-1035
The Elect Hobby Centre	1045 Gold Coast Hwy, Palm Beach QLD. Ph 34-1248
Premier Sound	239 Musgrave Street, Rockhampton QLD. Ph 27-4004
Sumner Electronics	97 Mitchell Street, Bendigo VIC. Ph 43-1977
Aero Electronics	123A Bathurst Street, Hobart TAS. Ph 34-8232
Devon Electronics	45 Ashburner St, Devonport TAS. Ph 24-4[illegible]6
Advanced Electronics	5A The Quadrant, Launceston TAS. Ph 31-[illegible]075
A.E. Cooling	Town Cntr, Peoples St Bldg, Elizabeth SA. Ph 255-2249
Hutchesson's Communic.	5 Elizabeth Street, Mt Gambier, SA. Ph 25-6404
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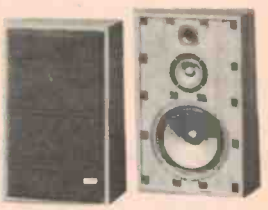

HX10-3W

HX8-2W

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Further Education in Electronics

Many of our readers are contemplating making a career of electronics, or perhaps just want to learn more at night classes. In this article, Susan Holliday, BA(Hons) gives some useful information for the prospective student.

FIGHTING YOUR WAY through the maze of higher and technical education in Australia can be a problem not only for school students, but also for people already in the workforce who are considering gaining further qualifications. Here we offer a summary of the different types of courses available and give some guidelines to help you decide which is the best for you. Because of space limitations we can only give details of some of the courses at the major Universities, Colleges of Advanced Education (CAEs), Institutes of Technology (ITs) and the Colleges of Technical And Further Education (TAFEs).

The first choice is the type of educational establishment. The admission requirements and standards of CAEs, ITs and Universities are basically the same. They differ, however, in the orientation and emphasis. On the whole CAEs and ITs are slanted towards the engineering and industrial world more than Universities. In addition, many of them believe in a multidisciplinary approach where students are advised to study subjects outside their own specialized field – for example, Arts and Humanities for Science and Engineering students.

There has also recently been a development within the Engineering Faculties themselves as they recognised the need for interdisciplinary communication – so that Civil Engineers and Electrical Engineers can actually talk to each other and understand each other as is increasingly necessary in industry. This is often done by having a general 1st year for all Engineering students, with specialization taking place in year two. Obviously this makes for a certain lack of specialized knowledge, but on the positive side, one doesn't have to decide on a career path until late in the 1st year, after sampling other types of engineering.

Another difference between the courses is the number of weeks that students are required to spend in industrial practice. The more industrial experience one has, the better he (or she) is prepared for commercial employment. However this means, again, a proportional loss of time for specialization or theoretical work.

The TAFEs are principally designed for Tradesman and Apprentices. Admission requirements vary from School Certificate, HSC or a previous TAFE course. More on TAFE later.

Admission to CAEs, ITs and Universities is usually dependent on the prospective student having passed the final secondary school examination. However, courses in high demand often restrict their intake to students who show a variety of interests and abilities. To go to a higher education establishment in another State is possible, but your qualifications will have to be assessed by them first. Again, for high demand courses, there can often be a restriction to residents of the State in which the institution is located.

Mature students (i.e. those over 25) fall into a special category. The usual qualifications are not necessary if you can prove you have reached some other post-secondary educational standard at another College or at work. This applies to disadvantaged students too if they can prove the nature and depth of their disadvantage in addition to their ability to complete the course. Everyone must consult the handbooks though as every institution differs in its requirements.

For all courses in Electrical and Electronic Engineering or Computing, a strong mathematical background is essential. The TAFE may not specify any particular requirements but for all their courses in the Electrical/Electronic fields, it's doubtful whether anyone without SC maths could cope with the course. CAEs and Universities stress the need for Physics, Maths and English at Year 12. Also some places, like Caulfield IT, Monash Uni and Sydney Uni require Chemistry. Often bridging courses are available in these subjects. For example, NSW University and Radio University provide a refresher course in HSC Maths, Physics and Chemistry as an introduction to their 1st year studies. This is broadcast in the evening over Radio University, VL2UV, on 1750 kHz. For more info on this, ring (02) 622 2691 or write to *Radio University, University of NSW, PO Box 1, Kensington, NSW 2033.* Programs are broadcast in the evenings throughout February. Also in January to February similar courses are held at the University. A similar scheme is in operation at Swinbourne College of Technology, Hawthorn, Victoria. At Caulfield IT, you can do a 'Tertiary Orientation Program', of year 12 standard but oriented towards engineering, and which can be taken part or full-time.

Electrical and Electronic Engineering Degrees

NSW

At the University of NSW there are two degrees – BE (4 years full time) or BSc (Eng) (6 years part time). Both are

recognised by the Institution of Engineers, the Institute of Radio and Electronics Engineers and the Institution of Electrical Engineers (London). All part time students must undergo three years of appropriate industrial training concurrently. BE students must gain practical experience for at least 12 weeks of their vacation. The 1st year at NSW Uni is a general one, Electrical Engineering specialization starting in year 2.

At Sydney Uni. you can take a BE which is 4 years full time. Their general engineering course lasts for 2 years, with a choice in year 3 of Electrical, Civil, Mining or whatever. Their Department stresses the need for above average competence in Maths, Chemistry and Physics at HSC and expects students to have an aggregate of 330 or over.

Newcastle University also has a general 1st year for basic sciences and engineering fundamentals. They differ in that in year 4 of their B.Eng. various commercially-oriented subjects are available, such as Industrial Law, Economics and Accounting. Throughout the previous 3 years students must also study a certain number of subjects in the Faculty of Arts. 20 weeks of industrial experience is required. Newcastle also offers a B.Eng. in Computing Engineering which shares much with the B.Eng. degree but also includes Information Structures, Programming, Advanced Circuit Analysis, Logic Design and Switching Theory and Electronic Design. This course is also offered part time and 'sandwich'.

NSW Institute of Technology aims at balancing academic University standards with a modern outlook, stressing the needs of industry, commerce and Government. The Institute offers many 'sandwich' pattern courses where students work for a certain time, full time, in industry and study for a certain time. They require English at HSC as well as five units in Maths and Science or a TAFE Certificate in Electrical Engineering or Electronics and Communications. The Institution of Engineers has fully approved the course here (BE) because of the 144 week requirement for industrial training. The course is either sandwich or part time (6 years either way); the latter usually being one day a week. The industrial training can be on a flexible free-lance basis moving to different companies every industrial semester or sponsored by a particular company. NSWIT also have a spring intake of engineering students; applications must be lodged between 2/4/79 and 30/4/79.

ACT

Canberra CAE does not offer a full course in EE, only the 1st year, whereupon you can go to NSW Uni or one of the Victorian ITs. The full course at Canberra (Bach of Applied Science) is mainly for professional physicists.

Victoria

Deakin University offers a 4 year B Eng, a BSC and a Diploma of Technology. The course at Deakin stresses the needs of modern industry and aims at combining the practical concurrent with the academic. However, this course is much more mathematical than most, for example, Matrices and Complex Variables in Year 2. Also part of Year 4 is given over to a study of 18th Century Politics, Morality and Literature! Monash Uni also has a 4 year B Eng but it is much broader in engineering scope. There is a common 1st Year for all Engineering students. In Year 3 or 4 there has to be some study in the Arts or Humanities. Monash teaches Electrical Engineering, Physics, Maths, Fluid Mechanics and Materials Science.

The course at Caulfield IT is also recognized by the I of E. There is a 4 Year B Eng (or 7 years part-time) and a Diploma of Electrical Engineering (3 years full-time, 5 part-time) and a

Diploma of Electrical and Electronic Engineering which is 6 years part-time.

The B Eng provides a broad understanding of the basic sciences of EE with constant emphasis on the needs of modern technology. The course has a strong digital emphasis, study of EDP and Electrical Design. In Final Year there is a choice between communications and Power Engineering or Navigational Electronics. The diploma provides for specialisation in either communications or power. Admission requirements for the Degree and Diploma are identical. Either you can complete their Tertiary Orientation Program mentioned previously or HSC in Chemistry, English, Maths and Physics.

WA

The University of WA offers a 4 Year B Eng. This course is basically an Engineering Science one. There is a general 1st year not specialising in EE until year 3. In 4th year there is also a course in Engineering and Society. The admission requirements are slightly different from usual. Proven ability in Chemistry, Physics, English and Maths is essential as is the completion of some study at Tertiary level.

SA

Adelaide Uni does a BE in Electrical Engineering again with a basic science 1st year, continuing Maths right through the 4 years. Adelaide insists on 16 weeks minimum practical experience in the vacations.

Qld

James Cook Uni does a B Eng in Engineering Science. The 1st year studies are in Engineering and Applied Mechanics as well as the basic sciences. There is also study of computing and systems as well as Electronic and Electrical Engineering. 24 weeks is their required minimum for vacation industrial training.

Colleges of Technical and Further Education

These courses are generally designed for future electricians and tradesmen. The range of courses is immense. Courses are either full-time, part-time (day or evening) or block release. Some are available by correspondence, though it is often necessary to spend sometime at the numerous colleges for the practical experience. Examples from the NSW College of External Studies are (NB there are only slight differences between the states in the courses available):

Electrical Trades, day and evening or block release for 3 years for tradesmen's assistants and apprentices. HSC Maths is essential.

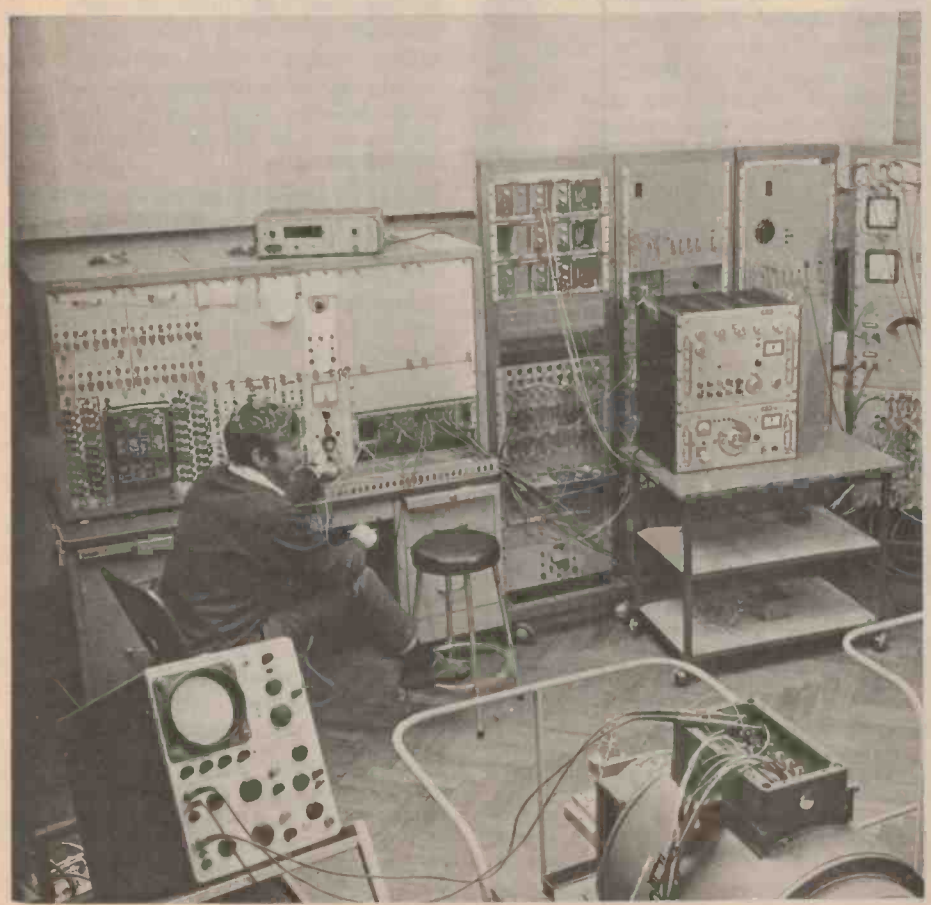
Radio Trades course (same as above).

Consumer Electronics Course (1 year full-time) designed to produce Electronic Technicians for servicing TVs, stereos, etc. The College provides theory and practice for this course but students also work with various participating companies who sponsor them.

The Automotive Electricians Course is 1 year 4 evenings a week but you must have completed the Electrical Fitters Course first.

The Basic Electronics Course of 1 year, 3 hours weekly is open to tradesmen, journeymen and executives in industry, wishing to understand more the recent developments in electronics in industry.

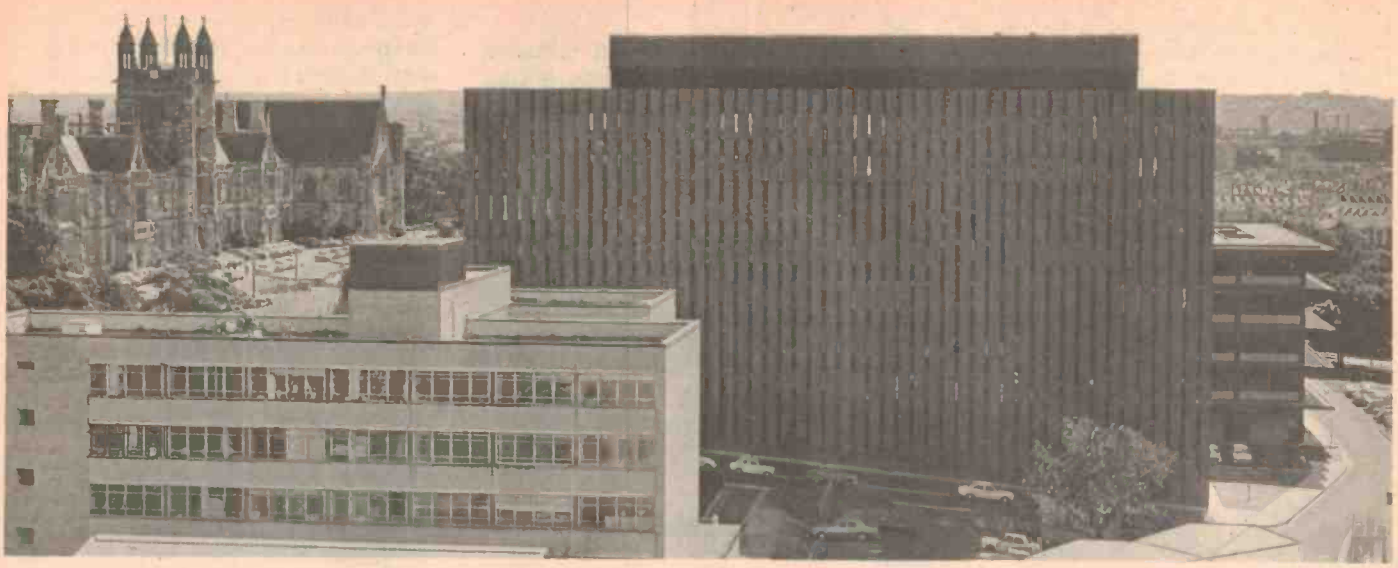
Electronics - The above courses are those offered by the Electrical Department. On the Electronics side there are Post Trade courses for tradesmen and apprentices needing retraining or specialisation. The courses are completely industrially-oriented. Students in the Electronics Post Trade Course choose 216 hours worth of units. The course usually takes one year, but it is not necessary to complete it in that time. The admission to the certificate is by way of one of two previous courses in Post Trades Industrial Electronics or in Post Trade Semi-conductor devices. Students without either of these may take the course but will not be awarded the certificate. There are 15 subject units. One unit equips the student with the ability to install and maintain domestic appliances and home entertainment equipment using semi-conductor devices. Another is basically the same for industrial sound systems. Others train the student to identify and correct minor malfunctions in simple electronic equipment; individual digital components of a larger system; dc power supplies using solid-state devices; dc motor control systems and digital or analog industrial electronic equipment.



Correspondence Courses

For some, full-time or part-time courses are impractical, especially for those on shift work, in the country or who own their own business. Correspondence courses are an excellent answer to this problem. They are normally of a very high standard. Students work in their own time, at their own pace, at any time of year.

ICS offers a wide range of courses in electronics, either in 'Programs' or 'Selected Programs'. The former offers basic training (Phase 1) followed by a choice of specialisation in a particular



field (Phase 2). Phase 1 can be taken on its own. For Phase 2 it is necessary to have completed Phase 1 unless you can prove you have gained similar knowledge elsewhere. The latter covers one particular area in detail. The Television and Electronic Technicians Institute of Australia (TETIA) accepts graduates of ICS courses in TV, electronics and radio technology for Associate Membership if they are employed in an appropriate field. Students may become student members while taking the course. The Electronic Technicians Program is for people who have little or no experience though mathematical ability is essential. First of all you are trained in the fundamentals of electronics, electricity, amplifiers, radio receivers. In Phase 2, you choose one topic from audio, radio and Hi-fi systems; industrial electronics; communications and broadcasting and electronic computer servicing.

There is a selected program in Electronics which specialises in Radio Theory and Industrial Applications of Electronics. Another, for Electronics Technicians, is concerned with industrial instrumentation and control. The selected program in Electronic Technology covers the application and maintenance of electronic equipment in various fields. Radio principles are also covered. Comprehension of introductory algebra and logarithms is vital. Another specialised program is on Telemetering.

ICS also has a variety of courses in teaching the servicing and maintenance of home entertainment equipment. The full program offers a Phase 1 in basic electronics, radio and television. Phase 2 specialises in colour television. There are 3 selected programs also. Television Principles is for people with basic knowledge of electronics. As its title implies it is concerned with the basic principles of television technology (colour and black and white). Television Engineering is for anyone interested in acquiring a broad knowledge of television, not necessarily for a career. Television servicing teaches the maintenance and servicing of television receivers (monochrome), a general introduction to colour receivers and a basic mathematical section.

The Collier MacMillan Schools (incorporating the British Institute of Careers, and the British Institute of Engineering Technology) offer a wide range of courses, of CMS standard or examination standard. They advise taking the Certificate Course first, e.g. in General Electrical Engineering to find the particular side of EE that interests you. Certificate Courses are also helpful refreshers or for those seeking or having just gained promotion. CMS has an Electrical Technicians Certificate for qualified technicians, the 1st step to a full technological certificate and the designation of T Eng (CET). Also you can gain Associate Membership (Engineering) by completing the Society of Engineers certificate. There are special courses in Electronic Design, radio and TV, and Telecommunications. Also there is an 'Electrotech' course which supplies kits to assemble, to augment the theory. CMS charges are not excessive (between $400 and $500) and they can be paid in installments.

TAFE also offer a correspondence course in electrics but not in electronics, e.g. Electrical Trades Course of 3 year duration. Also, there is an Electrical Engineering Course (4 years) for holders of SC (or Trades Course) for technicians, technical offers and beginners. These courses are free to anybody living in Australia (Temporary Visas included) and Australians living abroad.

Computing Courses

There is a whole host of different computer courses. The Australian Computer Society publishes a booklet, listing them and the special topics covered. It costs $1 ($1.20 by mail) and is available from *ACS, PO Box 640, Crows Nest, NSW 2065* or any branch. The examples given here were chosen to show the variety of courses.

Sydney Uni offers BA, BEc, BSc majoring in Computing Science, choosing comp sci as well as other science subjects. The comp sci 2 section contains most of the material needed for associate membership of ACS although further study is necessary to make a career in computing.

NSW IT has a B Appl Sc in computer science providing thorough basic training in all aspects. You have to find full employment in the industry for two semesters.

Newcastle Uni offers a BE in computer engineering (see engineering previously). It has a scientific/industrial basis and lasts for 4 years full-time (7 part-time).

Australian National University - their 3rd Year and 4th Year (Hons) are accepted by the ACS. ANU offers various levels in the subject, but stress the need for Maths, Physics and English at Matriculation standard. It has a mathematical/scientific bias.

Canberra CAE has also the same emphasis as ANU but is more commercially oriented. The BA in Computing Studies requires 2 unit Maths NSW (or equivalent) and the 'Use of English' Test taken at the college. The course is designed to produce professionals to work in Government, commerce and industry in the information systems and computer hardware fields.

Deakin Uni (Vic) offers a broad multidisciplinary 3 year degree (or diploma) with an option to major in computing for people interested in the application of computers and systems design and computer centre management.

A few other courses are worthy of mention principally for their different orientation and emphasis. Both Control Data Institute courses, in computer technology (7 months full-time) and the programming technology courses (6 months full-time), are accepted by ACS. The courses can also be done in the evening - 2 or 3 evenings a week or Saturday morning. CDI courses have more of a commercial emphasis than most traditional university courses. They cost $3,500 but CDI will arrange a students loan for you. They have a reasonably high job placement record but can give no guarantees. It is important to note that on the whole employers looking for Trainee Programmers are reasonably democratic. Whatever your qualifications, you will have to pass their own aptitude test and graduates in Comp Sci from universities and CDI graduates have roughly the same success rate as complete novices.

Another interesting course is the one held by the Post Graduate Open University (NSW): Applying Microcomputers. It is 5 radio lectures, 2 TV sessions plus seminars. The course teaches the capabilities and applications of microcomputer technology with a bias towards small business applications. It costs $16 and fully participating students receive a 'Certificate of Completion'.

Addresses

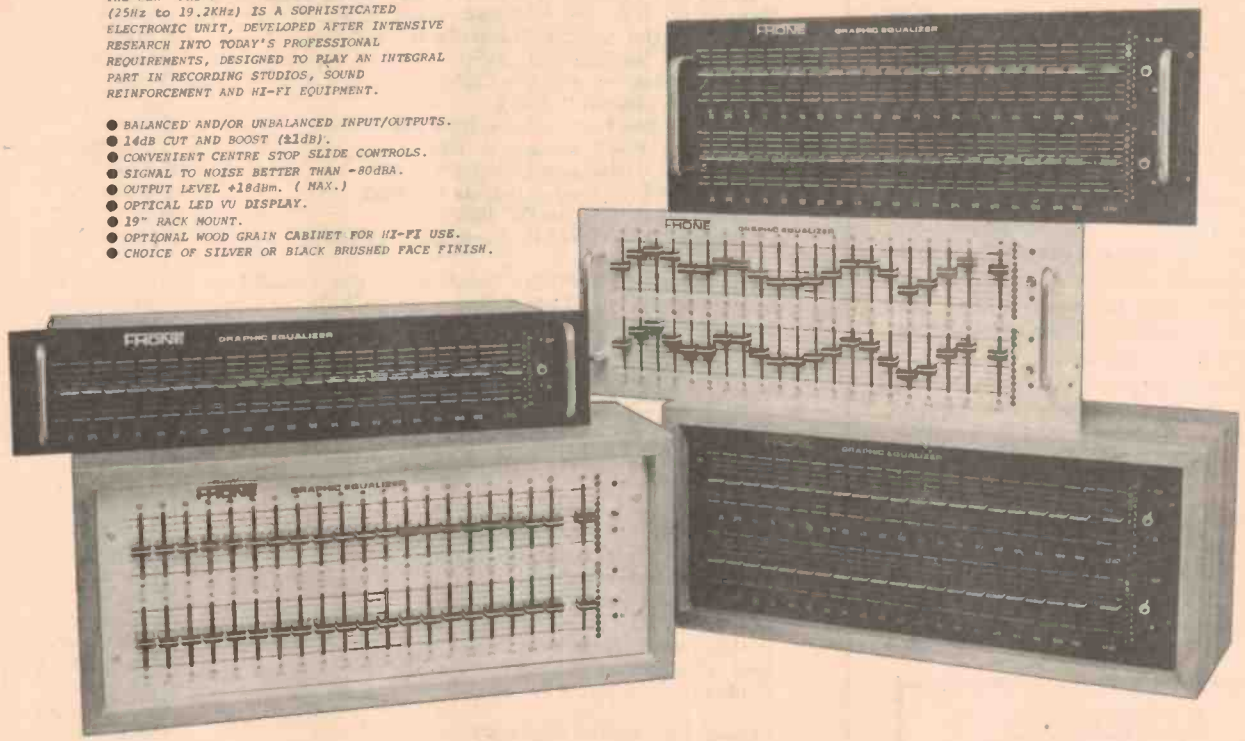
Electrical and Engineering	
Adelaide University, North Terrace, Adelaide 5000	B Eng
Ballarat CAE, Gear Avenue, Mt Helen, Ballarat Vic 3350	Dip Eng
Bendigo, CAE, Edwards Road, Flora Hill, Bendigo Vic 3550	Dip Eng
Capricornia IAE, MS76 Rockhampton Qld 4700	Assoc Dip Eng B Eng
Caulfield IT, 900 Dandenong Road, Caulfied East Vic 3145	B Eng, Dip Eng
Darling Downs, IAE, Darling Heights, Toowoomba Qld 4350	Assoc Dip Eng B Eng
Deakin University, PO Box 125, Belmont Vic 3216	B Eng, BSc
Footscray IT, Ballarat Road, Footscray Vic 3011	as above
Gippsland IAE, PO Box 42, Churchill Vic 3842	as above
James Cook Uni, Douglas, Townsville Qld 4811	B Eng
Latrobe Uni, Bundoora, Vic 3083	B Commun Eng
Melbourne Uni, Parkville, Vic 3052	B Eng
Monash Uni, Clayton Vic 3168	B Eng
NSW IT, PO Box 123 Broadeay, NSW 2007	B Eng
NSW Uni, PO Box 1, Kensington, NSW 2033	B Eng, BSc (Eng)
Newcastle Uni, Newcastle NSW 2308	B Eng
Preston IT, Plenty Road, Bundoora Vic 3083	Dip Eng
Queensland Uni, St Lucia Qld 4067	B Eng
Queensland IT, PO Box 246, North Quay, Qld 4000	Assoc Dip Eng B Eng
Royal Melbourne IT, PO Box 2476V, Melbourne Vic 3011	Dip Eng, B Eng
South Australia IT, PO Box 1, Ingle Farm SA 5098	Assoc Dip, B Eng
Swinbourne CT, John Street, Hawthorn Vic 3122	Dip Eng, B Eng
Sydney Uni, Sydney NSW 2006	B Eng
Tasmania Uni, GPO Box 252C Hobart Tas 7001	B Eng
Tasmania CAE, Newnham Campus, Launceston	B Eng
Western Australia Uni, Nedlands 6009	B Eng
Western Australia IT, Haymans Road, Sth Bentley 6102	B Appl Sc, B Eng
Wollongong Uni, PO Box 1144, Wollongong NSW 2500	B Eng
Computing	
Adelaide Uni (see above)	Major in BSc/BA
ANU, PO Box 4, Canberra 2600	Major in BSc/BA
Canberra CAE, PO Box 1, Belconnen 2616	BA Comp Studies
Capricornia IAE (see above)	Major in B Appl Sc
Caulfield IT (see above)	Major in B Appl Sc and in Dip Appl Sc
Darling Downs (as above)	Assoc Dip (Maths)
Deakin Uni (as above)	Major in Dip Sc
Footscray IT (as above)	EB Sc Dip Bus (EDP)
Flinders Uni, Bedford Park 5042	BSc/BA (Hons) Numerical Analysis & Comp Sc Option
Griffith Uni, Kessels Road, Nathan Qld 4111	Maths & Systems Major BSc
Latrobe (see above)	BA,BSc,BEC, Dipl
Macquarie Uni, North Ryde, NSW 2113	Major in BA
Melbourne Uni, (see above)	Major in BA/B Comp,BSc
Mitchell CAE, Bathurst NSW 2795	Assoc Dip Arts
Monash Uni, Clayton Vic 3168	Info Sci major BA/BSc
Newcastle Uni, (see above)	BE Comp Eng
New England Uni, Armidale NSW 2351	Major in BSc
NSW Uni (see above)	B Com BSc, Comp Sci
Queensland IT (see above)	Major in B BUS and B App Sc
Queensland Uni (see above)	Major BSc or BA
Royal Melbourne IT (see above)	Dip Appl Sci, B App Sc
South Australia IT (see above)	B App Sc (Assoc Dip proposed)
Swinbourne IT (see above)	Major B Appl Sc
Sydney Uni (see above)	Major BA,BSc, BECONS
Tasmania Uni (see above)	Information Sc Major in BA,BSc and BCom
Western Australia Uni (see above)	Major in BSc
WA IT (see above)	Major in BBUS
Wollongong Uni (see above	Major in BA,BSc
Others	
ICS, 400 Pacific Highway, Crows Nest NSW 2065	
CDI, 221-223 Miller Street, North Sydney NSW 2060	
Collier Macmillan, Bank House, Bank Place, Melbourne 3000	

FHONE PROFESSIONAL AUDIO EQUIPMENT

FHONE MONO/STEREO GRAPHIC EQUALIZER

THE NEW 'FHONE' 20 ELEMENT ⅓ OCTAVE EQUALIZER (25Hz to 19.2KHz) IS A SOPHISTICATED ELECTRONIC UNIT, DEVELOPED AFTER INTENSIVE RESEARCH INTO TODAY'S PROFESSIONAL REQUIREMENTS, DESIGNED TO PLAY AN INTEGRAL PART IN RECORDING STUDIOS, SOUND REINFORCEMENT AND HI-FI EQUIPMENT.

- *BALANCED AND/OR UNBALANCED INPUT/OUTPUTS.*
- *14dB CUT AND BOOST (±1dB).*
- *CONVENIENT CENTRE STOP SLIDE CONTROLS.*
- *SIGNAL TO NOISE BETTER THAN -80dBA.*
- *OUTPUT LEVEL +18dBm. (MAX.)*
- *OPTICAL LED VU DISPLAY.*
- *19" RACK MOUNT.*
- *OPTIONAL WOOD GRAIN CABINET FOR HI-FI USE.*
- *CHOICE OF SILVER OR BLACK BRUSHED FACE FINISH.*



FHONE DELUXE DISCO

DESIGNED FOR RELIABILITY, APPEARANCE AND GUTSY PERFORMANCE, WITH UNIQUE ACOUSTIC FEEDBACK ELIMINATING CHARACTERISTICS.

- *250W RMS POWER AMPLIFIER.*
- *2 x 3 WAY EXTENDED 45/60 VERTICAL OR HORIZONTAL SPEAKER UNITS, EACH CONTAINING 1 x 15" RCF SPEAKER, 1 x 100W 90° HORN, 2 x HIGH FREQUENCY RADIATORS.*
- *3 WAY INTERNAL MUSIC MODULATED LIGHT SHOW.*
- *OUTLETS FOR EXTERNAL LIGHT SHOW (600W PER CHANNEL).*
- *RAP AROUND CONSOLE.*
- *3 CHANNEL AUDIO MIXER - CHANNEL A, CHANNEL B, MICROPHONE.*
- *INPUT FOR AUX. SOURCE, e.g. TAPE DECK, CUEABLE ON CHANNEL A OR B.*
- *LED VU DISPLAY ON MIXER OUTPUT.*
- *HEADPHONE CUE PROVISIONS.*
- *2 x 4W RMS HEADPHONE CUE AMPLIFIER.*
- *CROSS FADE SLIDE CONTROL.*
- *CROSS FADE BYPASS SWITCHES.*
- *FITTED WITH SHURE M55E MAGNETIC CARTRIDGES.*
- *HEAVY DUTY BLACK VINYL DESK TOP.*

(4 WAY ELECTRONICALLY CROSSED UNITS ALSO AVAILABLE)

FOR FURTHER INFORMATION CONTACT :

FHONE AUDIO Pty. Ltd.
20 MAIN St. UPWEY Vic. 3158
03 754 2572 03 754 6268

AGENT :

ZEPHYR PRODUCTS
70 BATESFORD Rd. CHADSTONE Vic. 3148
03 568 2922

SUPER SPECIALS

BD 139 — 50c ea.
BD 140 — 50c ea.
BC 547/8/9 — 15c ea.
20 555 Timers for $5
MJ2955 — 80c.
2N3055 — 75c.
T03 Mounting Kits — 5c ea.
20 741 Op Amps for $5

CANNON CONNECTORS

XLP-3-11	$2.30
XLP-3-12c	$3.25
XLP-3-31	$3.25
XLP-3-32	$3.00
XLR-LNE-11c	$3.05
XLR-LNE-32	$4.30

Weller cordless soldering iron kit, model WC100DKW — includes batteries, solder, 4 interchangeable tips, battery charger and instructions for only $29.50.

TTL

7400	.28
7401	.28
7402	.28
7403	.28
7404	.37
7405	.37
7406	.50
7407	.50
7408	.34
7409	.34
7410	.30
7411	.37
7413	.54
7414	1.03
7416	.60
7417	.60
7420	.30
7422	.30
7426	.45
7427	.45
7430	.30
7432	.43
7437	.50
7438	.50
7440	.30
7441	1.50
7442	.70
7447	1.25
7448	1.25
7450	.35
7451	.35
7453	.35
7454	.30
7460	.35
7470	.65
7472	.45
7473	.60
7474	.65
7475	.65
7476	.45
7480	1.25
7483	1.25
7485	1.45
7486	.65
7489	1.20
7490	.75
7491	1.00
7492	.75
7493	.75
7494	1.10
7495	.95
74100	2.45
74107	.65
74121	.60
74123	1.10
74132	1.25
74150	1.80
74151	1.10
74153	1.10
74154	1.70
74157	1.10
74160	1.55
74164	1.55
74165	1.55
74173	2.75
74175	1.65
74180	1.35
74192	1.40
74193	1.40
74221	1.50
74367	1.40

74LS

74LS00	.30
74LS01	.30
74LS02	.30
74LS03	.30
74LS04	.35
74LS05	.35
74LS08	.30
74LS09	.30
74LS10	.30
74LS11	.30
74LS12	.30
74LS14	1.20
74LS20	.30
74LS21	.30
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.33
74LS37	.45
74LS38	.45
74LS40	.30
74LS42	1.20
74LS73	1.20
74LS74	.50
74LS75	.70
74LS78	.50
74LS85	1.50
74LS86	.50
74LS90	1.20
74LS92	1.20
74LS93	1.20
74LS95	1.50
74LS109	.50
74LS113	.55
74LS114	.55
74LS138	1.20
74LS151	1.20
74LS154	1.60
74LS157	.90
74LS163	1.20
74LS164	1.30
74LS174	1.00
74LS175	1.00
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	1.20
74LS196	1.20
74LS221	1.20
74LS253	1.85
74LS279	.65
74LS365	.80
74LS367	.80
74LS368	.80

CMOS

4000	.25
4001	.25
4002	.25
4006	1.40
4007	.25
4008	1.25
4011	.25
4012	.25
4013	.55
4014	1.35
4015	1.20
4016	.50
4017	1.40
4018	1.40
4019	.75
4020	1.60
4021	1.40
4022	1.60
4023	.25
4024	.90
4025	.40
4027	.80
4028	1.25
4029	1.90
4030	.40
4040	1.30
4041	1.25
4042	1.25
4043	1.50
4044	1.50
4046	1.95
4049	.60
4050	.60
4051	1.20
4052	1.20
4053	1.20
4060	2.65
4066	1.00
4068	.40
4069	.35
4070	.40
4071	.40
4072	.40
4073	.40
4074	.40
4076	1.85
4077	.40
4078	.40
4081	.40
4082	.40
4510	1.50
4511	1.50
4518	1.50
4520	1.45
4528	1.20
4555	1.20
14553	7.50
14584	1.25
74C00	.40
74C02	.40
74C04	.40
74C08	.40
74C10	.40
74C14	1.90
74C48	2.55
74C73	1.20
74C75	1.20
74C76	1.35
74C90	2.25
74C93	2.25
74C175	1.85
74C192	2.25
74C193	2.25

LINEAR

301	.40
307	.65
308	1.35
311	.85
324	1.35
339	.90
349	2.25
356	1.65
380	2.00
381	2.00
382	2.00
386	1.95
555	.35
556	.85
565	1.95
566	2.50
567	2.65
709	.75
723(VR)	.55
741	.35
747	1.25
3900	.90
3909	1.25

VOLTAGE REGS.

309	2.25
317	3.50
323	8.25
325	2.60
723	.55
7805	1.30
7806	1.30
7808	1.30
7812	1.30
7815	1.30
7818	1.30
7824	1.30
7905	2.25
7912	2.25
7915	2.25
78L05	.50
78L12	.50
78L15	.50
79L05	.85
79L12	.85
79L15	.85

OPTO

FND507 C/A	1.70
FND 357C/C	1.40
FND 500C/C	1.50
Red LED	.22
Green LED	.35
Yellow LED	.35

DIODES

IN4148	6c — 5c/100
IN4004	9c
IN5625 5A 400V	45c

I.C. SOCKETS

8 PIN DIL	.25
14 PIN DIL	.30
16 PIN DIL	.33

Also in stock Multimeters, relays, veroboard, solder, solderwick, soldering irons, transformers. All components brand new by top companies. Prices current till end of December.

ROD IRVING ELECTRONICS

Shop 499, High Street, Northcote. Vic. 3070. Ph (03) 489-8131. Open Mon-Thurs 8 am — 5.30 pm, Fri 8am — 7 pm. Sat 9 am — 1 pm. Mail Orders: PO Box 135, Northcote. Vic.3070. Minimum 75c post and pack. Send 30c stamp for free condensed catalogue.

ETI SPECIAL OFFER

Here's a calculator that's different

LOTS OF CALCULATORS have inbuilt memories — but with very few exceptions data in memory is totally lost the instant the unit is switched off.
Here's a calculator that's different! Put data into memory and that's where it stays — until you deliberately erase it or the batteries go flat (and that takes some 2000 hours of use).

The ability to store data is extraordinarily useful — one can hold a telephone number indefinitely — or a stage in an intricate calculation whilst you go to lunch — we use one ourselves and constantly find applications where the memory store is invaluable.

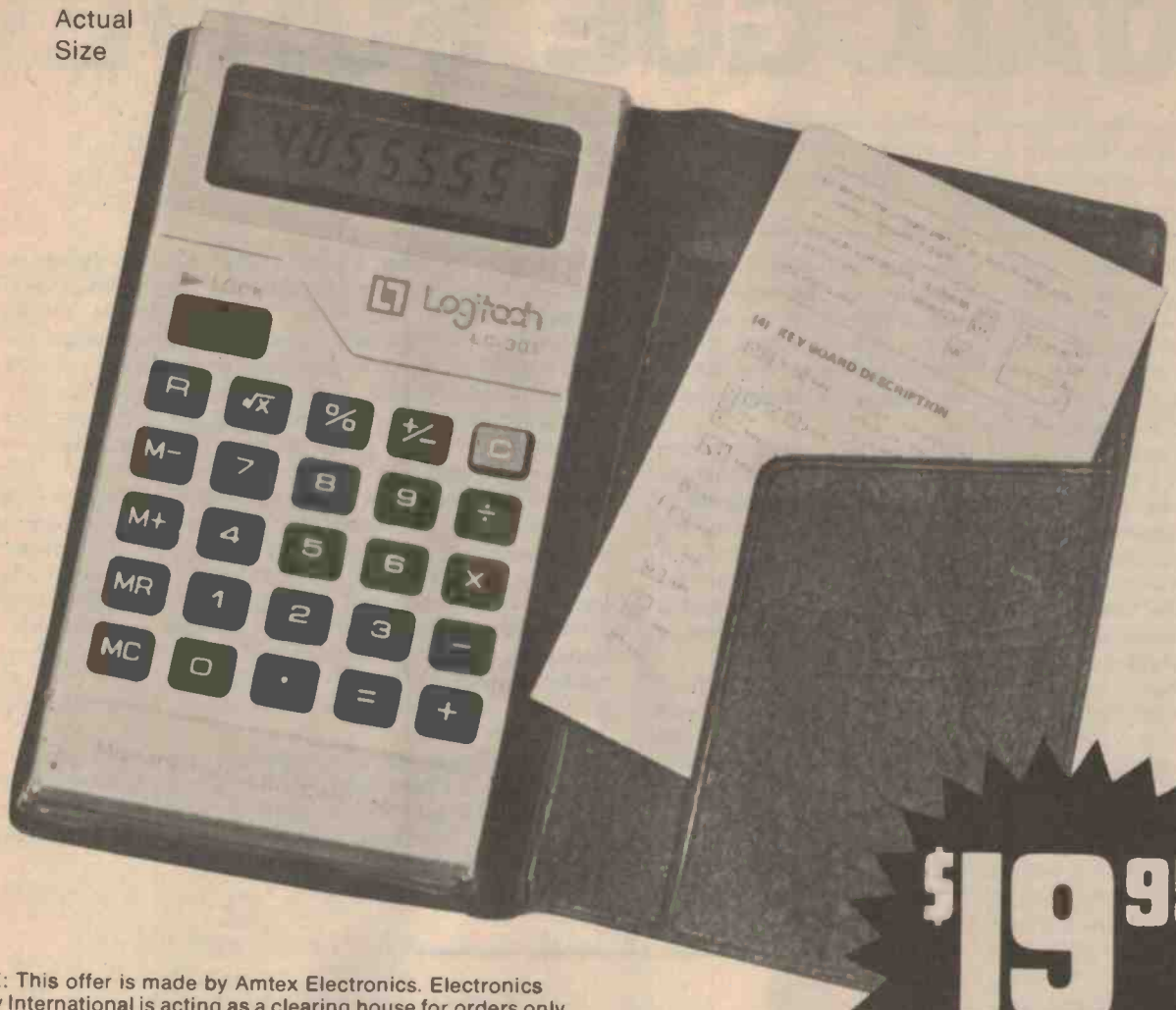
We are very pleased that Amtex Electronics have arranged to supply these units to ETI readers at the most attractive price of $19.95 each (plus $1.20 post & packing).

Amtex currently have 400 units in stock and have arranged to obtain further supplies at the same price if demand requires.

FEATURES

- Full eight-digit liquid crystal display.
- Four arithmetic functions plus square root, percentages, inverse operation, memory, correction facility.
- Memory hold.
- Ultra-thin diary type construction.
- Automatic battery saver circuit.
- Battery failure does not introduce errors.
- Disposable silver oxide batteries
  — approx. 2,000 hours continuous use.

Actual Size



$19.95

(plus $1.20 post & packing)

NOTE: This offer is made by Amtex Electronics. Electronics Today International is acting as a clearing house for orders only. Cheques should be made out to 'Amtex Offer' and sent together with the order to — Amtex Offer, Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW, 2011.
ETI will process orders and send them on to Amtex who will then send out goods by certified mail. Please allow approximately four weeks for delivery.

CALCULATOR OFFER

Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW. 2011.
Please supply (state quantity)

☐ Memory-hold LCD Calculators at $19.95 each ..... $

Plus $1.20 post & packing per unit..... $

TOTAL $ _____

Please make cheques/money orders payable to 'Amtex Offer'. Offer closes December 31st, 1978.

NAME.....

ADDRESS.....

..... POSTCODE.....

CATALOGUE SURVEY

Whenever you want to buy a component, do you find yourself making lots of phone calls or trudging around the stores? The answer could, and should be on your bookshelf.

APART FROM data books provided by manufacturers, probably the most important books on an electronics hobbyist's bookshelf are catalogues provided by the various distributors of electronic equipment and components. Often these do not only complement the data books, they replace them, containing, as they do, large quantities of data about the components itemised in them.

By far the bulk of enquiries we get at ETI are of the form of 'Where can I get such and such?'. While we often know the answer since we have perhaps recently bought the particular component ourselves, we don't always have the information that is required. We simply do not know what each distributor or retailer has in stock — this is something that each reader has to find out for himself, by writing or phoning the potential supplier, or better still, by referring to the catalogues that he has on his well-stocked bookshelf.

Australia has a history of mail-order supply arising from its large agrarian population who live in and around small country centres. Consequently, many firms depend on mail order business, and produce quite comprehensive catalogues. In other cases, the complexity of electronic equipment and components dictate that considerable data must be critically examined before a choice as to purchase can be made. In this case, such catalogues may almost be called datalogues, as they contain tremendous amounts of information about the products listed.

It is hard to know, however, just which catalogues will be of most use to the home constructor, the professional circuit designer or the technician. In an attempt to provide information that will help users select the catalogues that are most helpful to them, a 'catalogue of catalogues', if you like, we circulated a letter to all the electronic component suppliers we could think of asking for their current catalogues and information on their product lines. With the catalogues and info we got back, we prepared this survey of the catalogues that are available, and a rough indication of who sells what.

When writing to suppliers for catalogues, it may be a good idea to enclose a large stamped self-addressed envelope with a goodly amount of postage on it. It costs companies a fair bit just to print some of these catalogues, let alone post them out. Companies produce catalogues to assist and inform their customers, not potential customers, and if thousands of ETI readers suddenly write in requesting catalogues, it could cause all kinds of problems, especially if you never buy anything from them.

We apologise for any omissions from this survey; any companies who have been left out should send us two copies of their catalogue and we will do our best to rectify the situation in a future issue. We could have the beginnings of an Australian 'Whole Electronics Catalog'!

Scalar Industries Pty. Ltd.

Perhaps you want an HF multichannel Helical Dipole or a Band Reject Duplexer for close frequency spacing, or just an ordinary ground plane. Whatever antenna you're after it's in the Scalar catalogue, with full technical and installation information. Their catalogue is definitely one of the best, very easy to use with more than just the usual product listing. Essential for those professionally involved in radio communications, or interested in antennas and accessories.
Scalar Industries Pty. Ltd., 20 Shelley Ave, Kilsyth, VIC, 3137.

Pennywise Peripherals

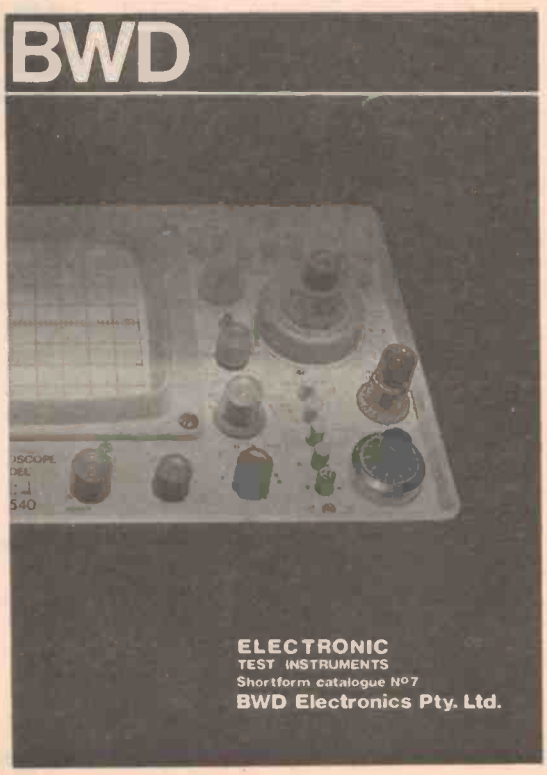
Short form catalogue and data sheets, free with SSAE

Pennywise Peripherals specialize in boards for the Motorola EXORciser bus — an EPROM programmer, memory boards, etc. They also supply a fast audio cassette interface which can control two recorders. The boards are described and illustrated in the short form catalogue and a separate data sheet gives full details of the cassette interface.
Pennywise Peripherals, 19 Suemar St., Mulgrave, VIC 3170.

BWD Electronics Pty. Ltd.

Test Instruments Shortform Catalogue No. 7.

Everyone who is into electronics seriously will sometime want to buy a power supply, signal generator or oscilloscope. BWD Electronics is a wholly Australian owned company with a high share of the test equipment market, their catalogue contains all their equipment with full technical information, and is a must if you are considering an equipment purchase.
BWD Electronics PO Box 325, Springvale, VIC, 3171.



Weller (Cooper Tools Group)

A brochure describing Weller soldering products can be obtained from:
The Cooper Tool Group Ltd., PO Box 366, Nurigong St., Albury, NSW 2640.

Blob Boards

Blob Boards are cropping up everywhere, especially in our series 'Digital Logic by Experiment'. A brochure describing the various types available can be had by writing to:
Blob Board Associates, rear 139 Union Road, Surry Hills, VIC 3127.

Plessey Australia Pty. Ltd. Components Division

Brochures, free

Plessey have two main product lines of interest to audiophiles; The Plessey Foster range of speakers and Fostex speaker systems. The Foster speakers are described in a leaflet which gives essential information, including frequency response curves, and the Fostex equipment is described in a comprehensively illustrated brochure.
Plessey Australia Pty. Ltd., Components Division, Christina Road, Villawood, NSW 2163.

Dick Smith Electronics Pty Ltd.

1978 – 79 Catalogue, 100 pages, 75c

If you haven't heard of Dick Smith, you must have just woken up from 20 year's sleep or been in the jungle! Dick's eighth catalogue is bigger and better than ever before, with everything from ¼W resistors to the famous heated toilet seat! Eight pages of data at the back of the cat. are very useful for reference on common component equivalents etc.

The catalogue starts off with a range of hi-fi equipment, and goes on to list auto accessories, microphones and PA equipment, speaker components and kits, electronic kits, test equipment, books, burglar alarm equipment, tools, hardware and components of all kinds, CB gear and amateur radio equipment. With such a wide range of products most electronic enthusiasts' needs can be met from the Dick Smith catalogue, and in fact, when designing simple projects for ETI, we use Dick's catalogue as a guide to component availability – unless we have to choose a particular component because it's the only one that will do the job, we try to choose only types that Dick and similar stores will have in stock. This catalogue is one that no hobbyist can really do without; we refer to it ourselves, constantly.

Dick Smith Electronics, PO Box 747, Crows Nest, NSW 2065.

Ferguson Transformers Pty. Ltd.

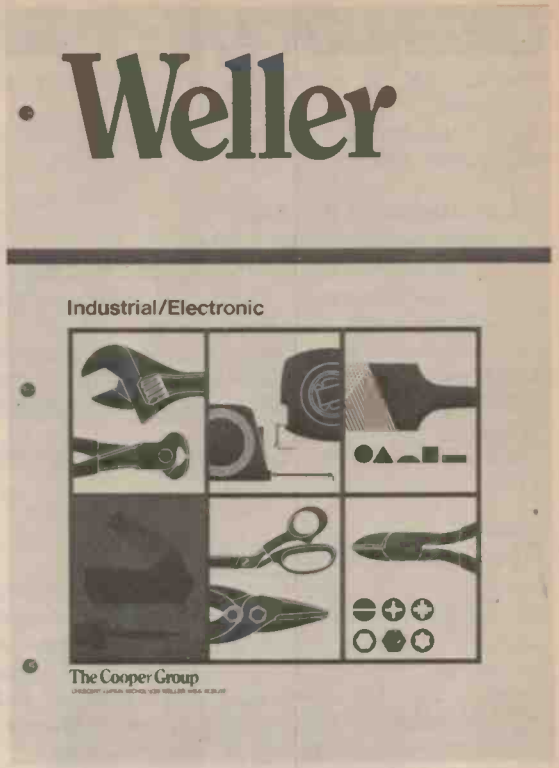
Catalogue, free

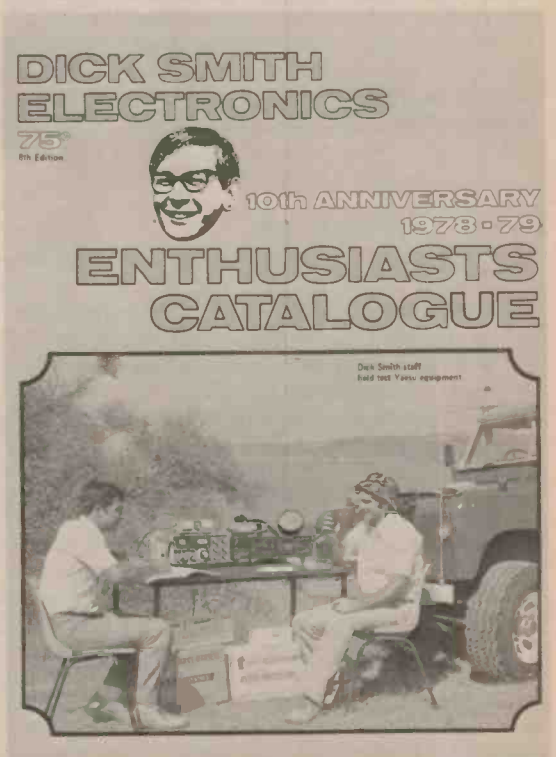
The Ferguson organisation has been associated with the manufacture of wound iron-cored components for many years. Their catalogue contains listings of all their current products, with full technical data. This catalogue would be very useful to the designer; however Ferguson don't give them away easily, preferring to forward individual data sheets on receipt of a stamped addressed envelope.
Ferguson Transformers, 331 High St, Chatswood, NSW, 2067.

R.H. Cunningham Pty. Ltd.

Various catalogues, free

R.H. Cunningham are agents in Australia for several companies including Watkins-Johnson Company who specialise in microwave and RF components and equipment. Three of the catalogues RHC set us were of Watkins-Johnson products – it looks like they're the people to contact if you're in that line. Also represented are Sennheiser, for headphones and microphones, and Panduit wiring components such as cable ties and





mounts. All the catalogues were beautifully produced and illustrated.
R.H. Cunningham Pty. Ltd., 493-499 Victoria St., West Melbourne, 3003.

Swann Electronics Pty. Ltd.
Catalogue and brochures, free

Swann are best known for their range of hardware, particularly switches and indicators. Their catalogue gives details of a wide range of products, including switches, connectors of all kinds, neon indicators, transistor pads, heat sinks, buzzers and motor accessories. Particularly useful for Isostat switches. Plenty of useful illustrations. If you're looking for a switch it's probably in here.
Swan Electronics Pty. Ltd., PO Box 350, Mt. Waverley, VIC 3149.

Heathkit
Winter 1978 Catalouge 819, 104 pages, free.

Heathkit is one of the worlds leading kit suppliers, concentrating mainly in kits for the radio amateur, experimenter and computer hobbyist. Their kits offer a high standard of performance and finish and their catalogue is extremely comprehensive, with full information about each kit and mail ordering information. This catalogue is good to browse through and maybe you will decide to build rather than buy.
Heathkit is represented in Australia by *Warburton Franki Pty Ltd 199 Parramatta Rd, Auburn, NSW, 2144.*

Instant Component Service
1978/79 Catalogue, 400 pages, $7.50 post free

The latest catalogue from Instant Component Service is now at the printers, and by the time this magazine gets to you the reader, it should be available. ICS are a major component supplier with a very broad range of first-class components, so their catalogue should be worth getting. ICS's range of components is available from several distributors in most states, and enquiries should be directed to local offices first — they will probably have what you need in stock.

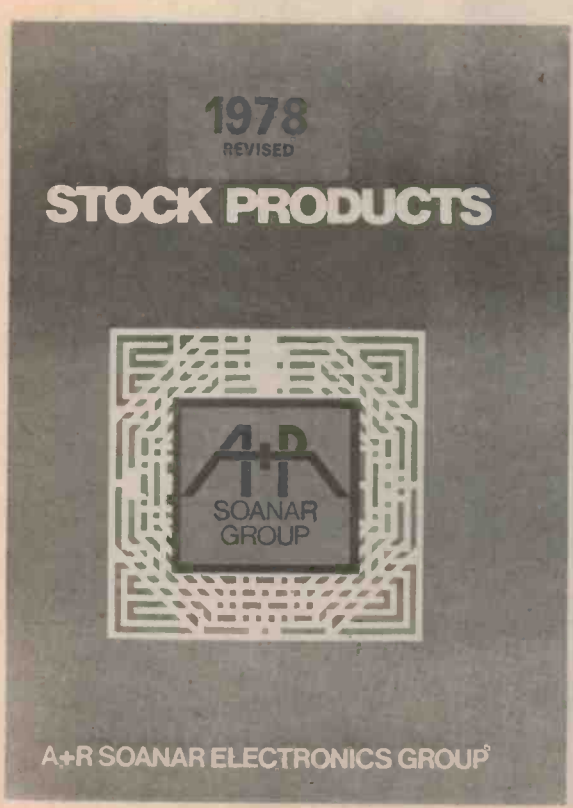
ICS can also supply brochures dealing with the specialised ranges of connectors they carry, as well as electronic test accessories from Pomona.
Instant Component Services, PO Box 632, Moorabbin, VIC 3189.

M.R. Acoustics
Product List, 4 pages, free

M.R. Acoustics specialize in high quality recordings and audio accessories. Their product list includes test records, Audio Lab recordings, QED audio accessories, the Staticmaster record cleaning brush and Nightingale speakers. Customers on M.R.'s mailing list receive product information bulletins whenever new products are added.
M.R. Acoustics, PO Box 110, Albion, Brisbane, 4010.

David Reid Electronics Pty. Ltd.
1978-79 Catalogue, 48 pages, free

David Reid (Davred) are one of Sydney's best known hobby electronics companies. Their catalogue is well organised and well printed, with a very good index page. It is full of the essential components you always need, as well as interesting items such as photoelectric door minders, breadboard sockets and amateur radio gear. This is definitely an 'essential' catalogue. For mail order customers, the minimum order is $5.00 excluding post and packaging. Davred also have a separate booklet listing their range of 'Electrokits'.
David Reid Electronics, 104-106 King St., Newtown, Sydney.



Data Aids
Brochure, 4 pages, free
Data Aids are the Australian agents for the Infinite UC1800 microcomputer, which is based on the RCA CDP1802 microprocessor. Their brochure describes the UC1800 and its documentation, as well as listing the software that is available in the user library.
Data Aids, 100a West Street, Crows Nest, NSW 2065

Amalgamated Wireless (Australasia) Limited
Various brochures, free
AWA are agents for Coral speaker system kits and Tannoy drive units in Australia. The Tannoys are top line units and although expensive, are a feasible proposition for the enthusiast who is able to build his own enclosure. AWA can supply details on cabinet construction for these speakers, as well as details of the drivers and Coral kits, free of charge.
Amalgamated Wireless (Australasia) Ltd, Ashfield Division, 554 Parramatta Road, Ashfield, NSW 2131.

General Electronic Services
General Electronic Services don't have a complete catalogue as such, although they do have available individual catalogues and data on most of their products. The two they sent us described EZ-Hook test leads and Mini-Circuits RF Components. They would be happy to send either of these, or information on their range of products on receipt of 45 cents postage.
General Electronic Services Pty. Ltd., PO Box 579, Crows Nest, NSW 2065.

Emona Enterprises
1978 Catalogue – 7 pages plus loose data sheets
Emona Enterprises is a Sydney based company mainly dealing in audio, instrumentation and amateur radio equipment. They have two catalogues, one for amateur equipment, of which they have a very comprehensive range, and the other for the rest of their products. Both are in the form of folders with full data sheets inside. The amateur catalogue is recommended if considering a purchase of some new gear. The other catalogue is probably designed as a service to customers with a particular piece of equipment in mind.
Emona Enterprises, Room 208/661 George St., Sydney and PO Box 188, Coogee, NSW, 2034.

C & K Components Pty. Ltd.
43 pages plus 17 loose data sheets
C&K is a name that has become synonymous with quality miniature and microminiature switches, but they have some other interesting products as well. Their catalogue is colourful, comprehensive, and well laid out. It contains their full range of switches, including reed and thumbwheel switches, with complete data and individual pictures. This catalogue is highly recommended for the equipment designer.
C&K Electronics Aust. Pty Ltd, PO Box 101, Merrylands, 2160.

A&R Soanar Electronics Group Pty Ltd
1978 revised catalogue 43 pages free
A&R Soanar have been in the electronics importing business for a long time and supply a wide range of components and instruments to the trade. They also have one of the best and most colourful catalogues around containing full data on their products in sections which are colour coded for quick access. The data sheets are removable. This catalogue is a must for people working in the electronics business.
A&R Soanar, Head Office, 30-32 Lexton Rd. Box Hill, VIC, 3128. And numerous distributors in all states.

CATALOGUE SURVEY

Tandy Electronics
1979 Catalogue, 132 pages, free

The 'McDonalds' of the electronic component industry, Tandy stores are springing up everywhere. Their catalogue is profusely and colourfully illustrated and covers a wide range of products. The cat starts with hi-fi gear and accessories, proceeds to power supplies and other bits and pieces, books and then components, finishing off with radios, calculators, CB radios and finally the TRS-80 computer.

Tandy operate a mail order service from any store or dealer, or from their head office in Rydalmere, NSW. Minimum order is $2.50 and further details can be found on page 67 of the catalogue.

Tandy Electronics, PO Box 229, Rydalmere, NSW 2116.

Diggerman Electronics
Price List No. 7, free

Diggerman put out a duplicated price list covering a stack of the most commonly used components — R's, C's, etc. Good prices and a handy source of SCRs and triacs. Definitely a list worth having. Neat order form, too.

Diggerman Electronics, PO Box 33, Coramba, NSW 2466.

Abacus EDP Services Pty. Ltd.
Various brochures, free

Abacus, as their name suggests, are involved with computer equipment and have three main lines — Soroc terminals and Sord and Century computers. The Sord computers are of particular interest to hobbyists — they are Z-80 based and S-100 compatible. The Century computer is commerically oriented, and the Soroc IQ120 terminal may be of interest to both market groups.

Abacus EDP Services Pty. Ltd., 66-68 Albert Rd., Sth. Melbourne, VIC 3205.

Auditec Australia Pty. Ltd.
Price List, brochures, free

Auditec supply a wide range of audio modules, amplifiers and components. Their price list gives brief details of an enormous range of items for the serious audio enthusiast, who probably should not be without it. As well as the price list, they also have a number of brochures giving more complete details of power amplifier modules, mixers, preamps and tone control modules from which one could apparently mix and match the ideal system for his requirements.

Auditec Australia Pty. Ltd., PO Box 228, Hornsby, NSW 2077.

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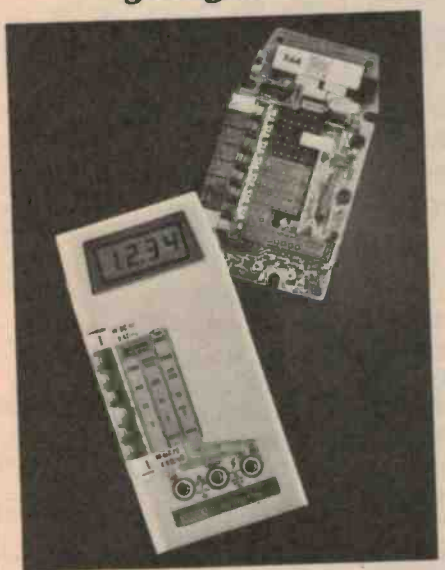

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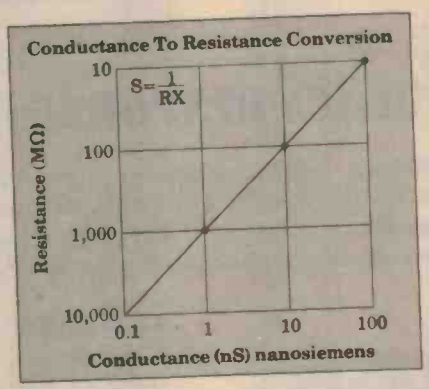

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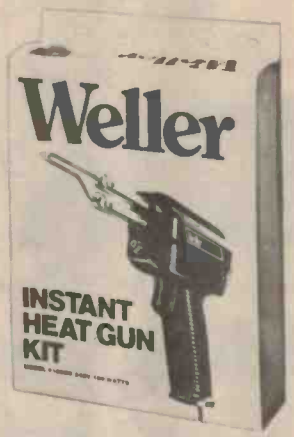

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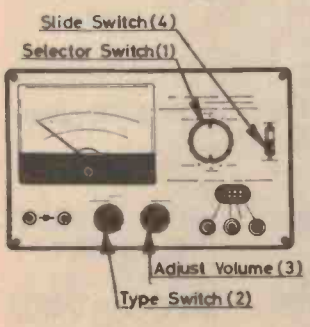

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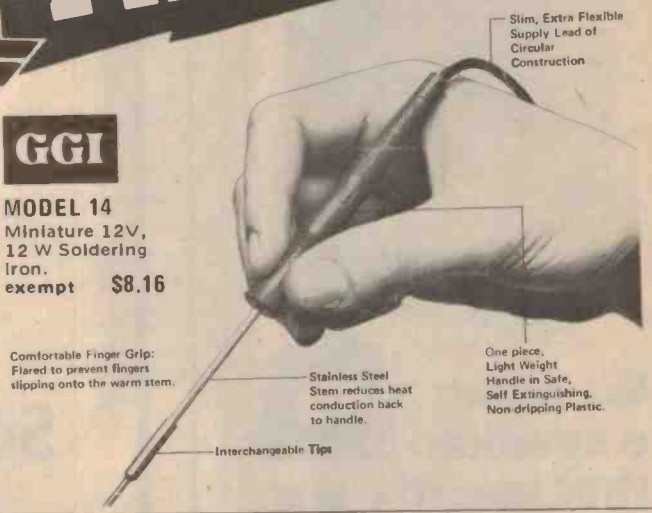

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Project 650

STAC timer

THE NAME OF this project is derived from that given by the manufacturer to the IC around which it is built. STAC stands for Standard Timer And Controller and the device is part of National's COPS (Calculator Orientated Processor System) group, a series of what are, in effect, dedicated microprocessors.

The STAC provides a 24-hour clock with four digit display, much as any clock IC, but has four control outputs which may be programmed to turn on, turn off, or to retain their current status at any one of four preset times during the day. STAC also has the facility to "skip" certain selected days within its seven or eight day (selectable) cycle.

The IC is thus a perfect basis for many control applications from air conditioning installations to fish tanks and hi-fi systems. The STAC's outputs operate four relays with hormally open contacts, which can switch 240 volts at up to five amps.

A row of LEDs below the readout shows the condition of the outputs, and is also useful for checking a program.

Programming

Setting up the STAC is quite straightforward and rather like using a programmable calculator. At switch-on the clock is set to 0000, all set points are zero and all outputs are off, all days are valid with the present day set to one. The display will show the clock output.

Setting the clock follows the usual procedure adapted with any digital clock. Pressing SET HOURS or SET MINUTES will advance the digits at a rate of four per second.

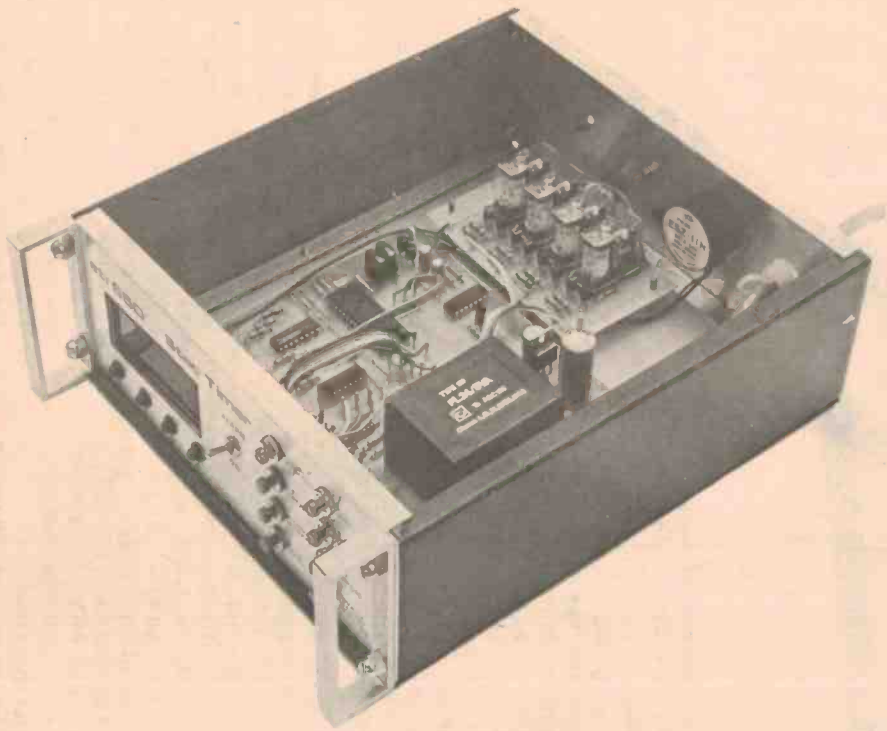
To enter the program mode the DATA ENTRY key is pressed momentarily. Upon activation, the first set programmed. After setting four program point time will be displayed, and its output status will be shown by the decimal points of the display. To set the time of an operation, the SET HOURS and SET MINUTES keys are operated until the desired time is displayed on the readout.

If it is desired to switch an output on at this time, the SET STATUS key is pressed to light up the decimal point corresponding to the output. Each time the key is pressed the decimal point will move one place to the right. If a combination of outputs is required at this time, the HOLD STATUS key is used to hold the decimal point on, before moving on with the SET STATUS key to the next decimal point required to be on. Using the SET STATUS and HOLD STATUS keys, any combination of the outputs can be set up.

If an error is made in programming, using the SET STATUS key from the fourth point will clear all data and the proper information can be re-entered.

So far we have only programmed one of the four set point times. By pressing the ADVANCE SET POINT key the display will go to 0000, can again be set to a time, and the output conditions set up. Once this has been done four times, pressing ADVANCE SET POINT will return to the first set point time.

Programming can be verified by using



The completed timer. Output connections are made by a terminal strip on the rear panel.

the MANUAL OPERATION key which transfers the decimal point information to the outputs. By pressing the DATA ENTRY key a second time the STAC is returned to the clock mode.

Day Status

Valid and invalid days can be set up by pressing the DAY MODE key, which displays the current day on the left of the readout and the day status on the right. When the SET DAY key is pressed the STAC advances to the next day, while the SET STATUS key changes the validity of the day as seen by a one or zero on the right of the readout. As the timer steps through a week the programmed conditions occur only on valid days. A second operation of the DAY MODE key returns the STAC to the clock mode.

The programming is now complete. Operating the DEMO key will rapidly cycle through the program sequence at a rate of one hour per second.

Pressing the RESET key in the clock mode will reset the clock to zero as well as the valid day information.

Construction

The timer consists of three separate single sided pcb's. The relay board can be left out if not required, the outputs of the STAC being active low and capable of sinking 20 mA. Either our display board, or any common cathode multiplexed display can be used for the readout. Output connections from the relay contacts are taken to a nylon terminal strip mounted on the back panel together with the alarm.

Our prototype was built into a Horwood instrument case type 93/h/v, available from Dick Smith Electronics or Radio Dispatch Service, although any suitable case will do equally as well. The LED displays we used were Sanken SEL 521 from Sheridan Electronics, Davred or Radio Dispatch Service.

Operation from 60 cycle mains is possible by removing link 1 from the pcb, and an eight day cycle is achieved by connecting a link from pin 27 to pin 15 of IC1. When this link is in, the SET STATUS and SET MINUTES keys have the same function.

How It Works – ETI 650

The power supply for the STAC timer is comprised of the full wave rectifier, D1 and D2 and the regulator IC3. D3 raises the output voltage of the regulator by about 0.7V.

Some AC from the transformer is fed to IC2a and IC2b, via R3. These act as both a schmitt trigger and a monostable to clean up the waveform and to ensure that any transients on the mains are not counted by the timer. The 50 Hz pulses are then fed to IC1 to provide the mains synchronised timing pulses. A soft start is provided by R4 and C5 to ensure proper initialization.

The operation of the STAC IC is described in the text, the programming being done by the pushbuttons PB1 - 8. Link 1 changes the circuit from 60 to 50 Hz operation.

The multiplexed display is driven by the buffers IC4 and IC5. Outputs from the STAC are active low, and drive the LEDs via buffer inverters, IC6, to provide an indication that a particular output is on. Output 1 can be fed, via SW1, to an astable formed by IC2c and IC2d. When the output goes low it enables the oscillator, which is then inverted by Q2 and fed to an emitter follower, Q1. The piezo alarm will pulse at a frequency determined by C6, C7 and R5. The two capacitors C6 and C7 are back to back and form a non-polarised capacitor.

The outputs from the STAC are fed to inverter and relay driver stages to provide a contact closure capable of switching 240 volts.

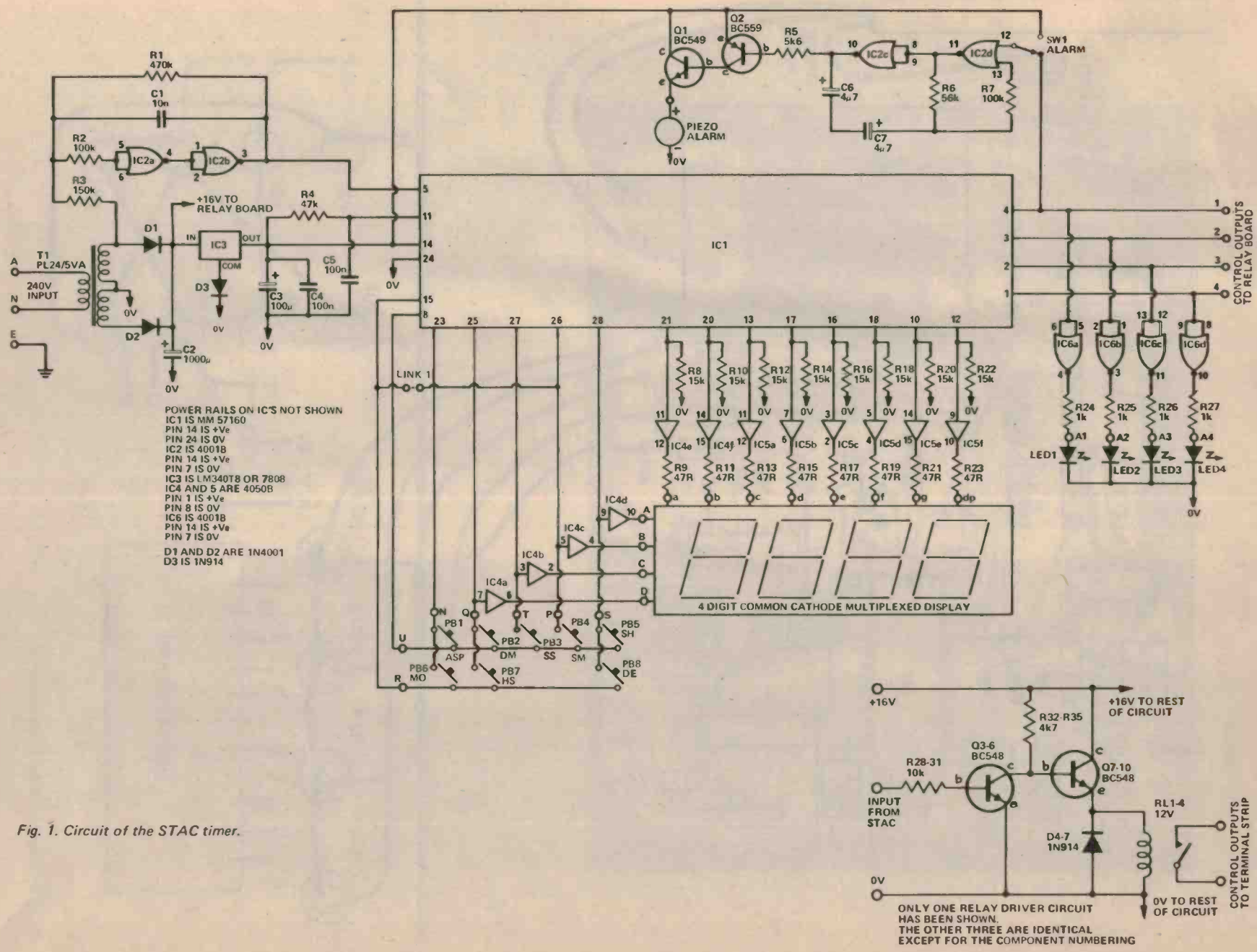


Fig. 1. Circuit of the STAC timer.

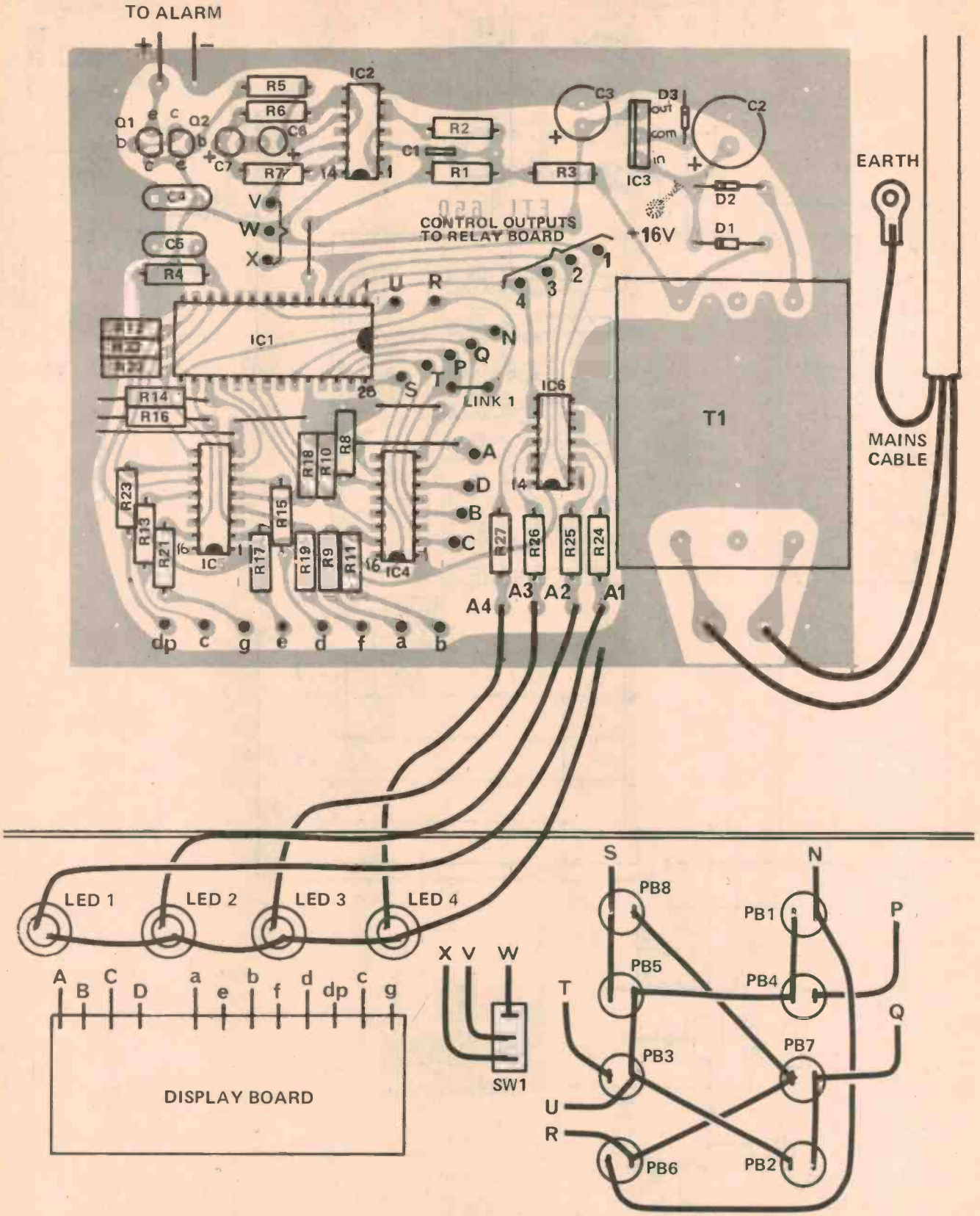
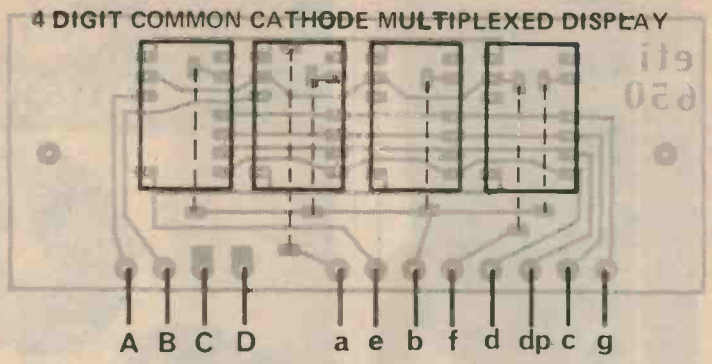
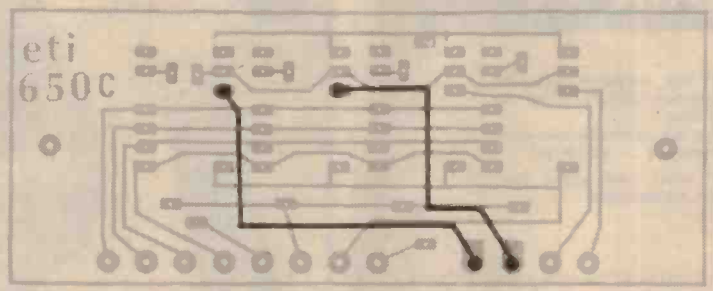
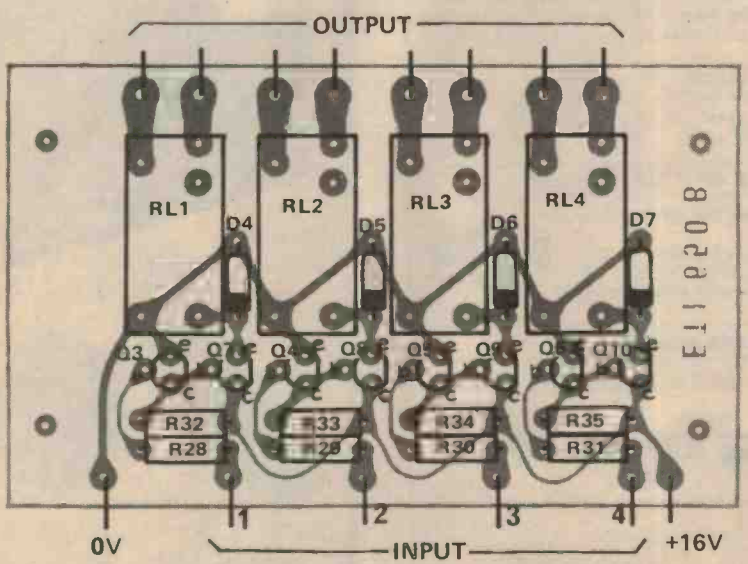


Fig. 2. Component overlay of the main pcb.







PARTS LIST – ETI 650

Resistors all ¼W 5%

R1	470k
R2	100k
R3	150k
R4	47k
R5	5k6
R6	56k
R7	100k
R8, 10, 12, 14, 16, 18, 20, 22	15k
R9, 11, 13, 15, 17, 19, 21, 23	47R
R24 – R27	1k

Capacitors

C1	10n greencap
C2	1000µ 25 VW electro
C3	100µ 16 VW electro
C4, 5	100n greencap
C6, 7	4µ7 16 VW electro

Semiconductors

IC1	MM57160 STAC IC (National)
IC2	4001B
IC3	LM340T-8.0
IC4, 5	4050B
IC6	4001B
Q1	BC548 or similar
Q2	BC558 or similar
D1, 2	1N4001 or similar
D3, 4	1N914
LED1 - LED4	red light emitting diode

Displays

DS1 - DS4	Senken type 512 common cathode 0.5" displays

Switches

PB1 - PB8	miniature momentary push button switches
SW1	SPDT min. toggle

Miscellaneous

ETI 650 pcb, Ferguson PL24/5VA pcb mounting transformer, piezo electric alarm type ESZ-11N or similar, case to suit (see text), display filter, nylon terminal strip, molex pins, 28 pin IC socket or molex pins, nuts, bolts, etc.

Parts For Relay Board

R28 – R31	10k ¼W 5%
R32 – R35	4k7 ¼W 5%
Q3 – Q10	BC548 or similar
D4 – D7	1N914
RL1 – RL4	mini PC heavy duty 12V relay

Fig. 3. Component overlays for the readout and relay boards. Note the wires solded on the rear of the readout board.

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D. Electronic touch switch $4.50	K. Morse code practice set $4.90	R. Electronic mosquito repeller $4.50
E. Electronic decision maker $4.50	L. Electronic siren $4.50	S. Electronic police car siren $4.90
F. Electronic sleeping bell $4.50	M. Electronic water purity tester $4.50	T. Electronic fan and colour wheel $4.50
G. Electronic magic touch $4.50	N. Transistor radio $4.50	U. Watch kit, 5 functions $11.50

See July or August '78 ETI for full details. ***Batteries not included in kits A to T.***

KIT BITS DEALERS:

NSW: Electrocraft Pty. Ltd., Whiting St, Artarmon. **Kits Sets Aust.**, Pittwater Rd., Dee Why. **Gordon Toy Shop**, Moree St, Gordon. **Edmunds Moir & Co**, 186 Parry St, Newcastle, and 94 Manning St, Taree. **Madjenk Electronics**, 5.246 Princes Hwy, Dapto. **Lindfield Electrical** Pacific Hwy, Lindfield. **Bergs Hobbies**, 223 Church St, Parramatta. **Allied Communications**, 2 Locklnvar Place, Hornsby. **Kurri Electronics**, Kurri Kurri. **Unique Electronics**, 383 Merrylands Rd, Merrylands. **Manly Toy World**, Shop 5, 74 The Corso, Manly. **Lloyds Hobby Centre**, 24 Railway Ave, Liverpool. **Custom Communications**, Orchardfield St, Yennora. **C.B. Centre**, The Corso, Manly. **Red Ballon Toy World**, 192 Barru Ave, Griffith. **The Toy Box**, Florence St, Hornsby. **In Electronics & Co, 84 Ramsey St, Haberfield. Bladen Brooke Electronics**, 111 Bridge St, West Tamworth. **Sale by Junk**, 282 The Entrance Rd, Erina. **Sheridan Electronics**, 166 Redfern St, Redfern. **Sprint Electronics**, 167 Forest Rd, Hurstville. **Go Electronics**, Hotel Car Park, Bexley.

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ETI data sheet

ICM7555 INTERSIL

The 7555 is in most cases a direct replacement for the 555 timer. Because the 7555 does not produce large crowbar currents in the output driver, it is not necessary to decouple the supply lines with a large capacitor close to the device. Secondly the control voltage decoupling capacitors are not necessary. Thus for many applications two capacitors can be saved by using the 7555.
The output driver is a CMOS inverter capable of driving two TTL loads.

MONOSTABLE OPERATION

Initially the external capacitor (C) is held discharged. Upon application of a negative trigger pulse to pin 2, the voltage across the capacitor increases exponentially. When the voltage across the capacitor equals 2/3 ($V^+ - V^-$), the comparator resets which discharges the capacitor rapidly and drives the output to its low state.

CONTROL VOLTAGE

The CONTROL VOLTAGE terminal permits the two trip voltages for the THRESHOLD and TIRGGER internal comparators to be controlled. This provides the possibility of oscillation, frequency modulation in the astable mode or even inhibition of oscillation, depending on the applied voltage. In the monostable mode, delay times can be changed by varying the applied voltage to the CONTROL VOLTAGE pin.

RESET

The RESET terminal is designed to have essentially the same trip voltage as the standard bipolar 555/6, i.e. 0.6 to 0.7 volts. It presents an extremely high input impedance. The mode of operation of the RESET function is, however, much improved over the standard bipolar 555/6 in that it controls simultaneously the state of the OUTPUT and DISCHARGE pins.

ASTABLE OPERATION

The circuit can be connected as a multivibrator. The external capacitor charges through R_A and R_B and discharges through R_B only. Thus the duty cycle may be precisely set by the ratio of these two resistors. In this mode of operation, the capacitor charges and discharges between 1/3 and 2/3 ($V^+ - V^-$). As in the triggered mode, the charge and discharge times, and therefore the frequency, are essentially independent of the supply voltage.
The frequency of oscillation is given by:

$$f = \frac{1}{t} = \frac{1.46}{(R_A + R_B)C}$$

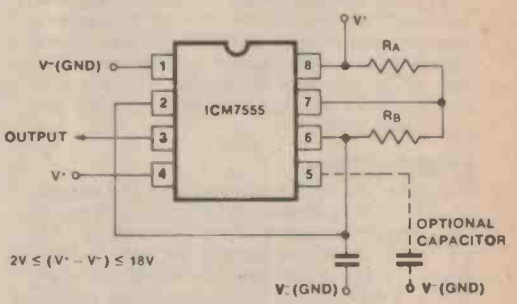


Fig. 3. Astable operation.

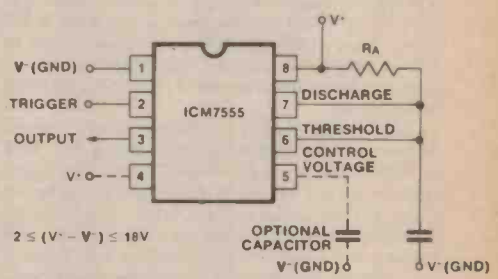


Fig. 4. Monostable operation.

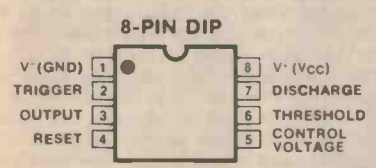


Fig. 1. Pinout of the 7555 is identical to that of the NE555.

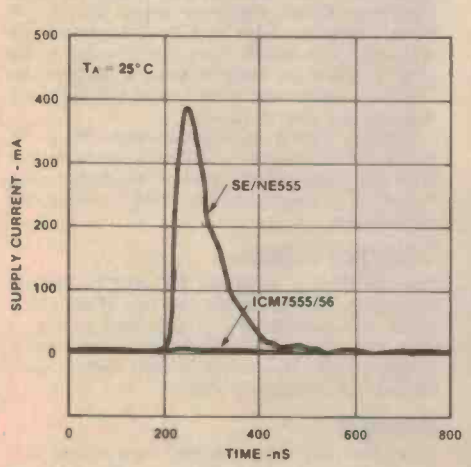


Fig. 2. Power supply transients of the 555 and 7555 compared.

OPERATING CHARACTERISTICS (T_A = 25°C, V^+-V^- = +2 to +15 Volts unless other specified)

PARAMETER	TEST CONDITIONS			VALUE MIN	VALUE TYP	VALUE MAX	UNITS
Supply Voltage	−20°C ≤ T_A ≤ +70°C			2		18	V
	−55°C ≤ T_A ≤ +125°C			3		16	V
Supply Current (Note 4)	ICM7555	V^+-V^- = 2V			60	200	µA
		V^+-V^- = 18V			120	300	µA
Supply Current (Note 4)	ICM7556	V^+-V^- = 2V			120	400	µA
		V^+-V^- = 18V			240	600	µA
Timing Error (Note 5)	R_A, R_B = 1k to 100k						
	C = 0.1µF						
Initial Accuracy					2.0		%
Drift with Temperature					50		ppm/°C
Drift with Supply Voltage	V^+-V^- = 5V				1.0		%/Volt
Threshold Voltage					2/3		X(V^+-V^-)
Trigger Voltage					1/3		X(V^+-V^-)
Trigger Current	V^+-V^- = 18V				50		pA
	V^+-V^- = 5V				10		pA
	V^+-V^- = 2V				1		pA
Threshold Current	V^+-V^- = 18V				50		pA
	V^+-V^- = 5V				10		pA
	V^+-V^- = 2V				1		pA
Reset Current	V_{RESET} = V^-	V^+-V^- = 18V			100		pA
		V^+-V^- = 5V			20		pA
		V^+-V^- = 2V			2		pA
Reset Voltage	V^+-V^- = 18V			0.4	0.7	1.0	V
	V^+-V^- = 2V			0.4	0.7	1.0	V
Control Voltage Lead					2/3		X(V^+-V^-)
Output Voltage Drop	Output Lo	V^+-V^- = 18V	I_{SINK} = 3.2mA		0.1	0.4	V
		V^+-V^- = 5V	I_{SINK} = 3.2mA		0.15	0.4	V
	Output Hi	V^+-V^- = 18V	I_{SOURCE} = 1.0mA	17.8	17.25		V
		V^+-V^- = 5V	I_{SOURCE} = 1.0mA	4.0	4.5		V
Rise Time of Output	R_L = 10Mohms	C_L = 7pF	V^+-V^- = 5V		40.0		nS
Fall Time of Output	R_L = 10Mohms	C_L = 7pF	V^+-V^- = 5V		40.0		nS
Guaranteed Max Osc Freq	Astable Operation			500			kHz

ETI data sheet

NATIONAL MM57160
Standard Timer And Controller (STAC)

The standard timer and controller chip is a preprogrammed member of National's Controller Oriented Processor (COP) family. The device is designed for use in repetitive timing application where 1 to 4 outputs are to operate at 4 user-programmed times. Minimal external hardware is needed for complete system implementation due to direct display drive capability and a key-switch interrogation feature. Strap selection for 50/60 Hz input and 7-day/8-day mode has been included for added versatility.

Initialization

Power for the device is a single power supply of 7V9 to 9V5. Proper initialization will occur internally if the supply rise time is between 11 µs and 1 ms. If the supply rise time to final value exceeds 1 ms, an external RC network with a time constant in excess of the supply turn-on time should be placed on the Power On Reset (POR) pin. This delays initialization until the power supply voltage is within specifications. Initialised conditions are: (a) time (real-time clock) at 00:00, (b) all set point times to 00:00 and all outputs off, (c) all days valid, (d) present day counter to day 1, and, (e) real-time clock mode.

Setting the time is performed in the normal real-time clock mode by depressing the SET HOURS (10) or SET MINUTES (9) keys. Each depression will cause an increment of the hours from 0-23 or minutes from 0-59, respectively, holding the appropriate key depressed will cause the numbers to roll (slew) at a 4/second rate. Normal operation is to slew the value close to the desired setting and then "bump" it to the final value.

OPTION SELECTION

Strap switches can be used to implement key functions. Figure 1 illustrates "strapping" of keyswitch functions 1-5.

Programming

For proper operation, the system must have 1 or more of its set point times loaded. To load (or program) set points, the DATA ENTRY key (5) must be depressed momentarily to take the system from the normal real-time clock mode to the data entry mode. Upon activation, 1 of the set point times will be displayed and its output status will be shown on the decimal points of the display. After power-up, this will be 00.00 and the decimal points will be off. To examine or go to another set point, the ADVANCE SET POINT key (6) is depressed in the data entry mode for each new time. The 4 values are held in a revolving stack (similar to a calculating stack) and each advance causes it to roll 1 position. Four advances returns to the original position.

To activate a set point, the hours and minutes will be loaded with the same SET HOURS (10) and SET MINUTES (9) keys used in setting the real-time clock. In addition the SET STATUS (8) key is activated and is used to load the output(s) to be activated at the programmed time. Depresssion of the SET STATUS key causes the 1st decimal point to turn on (which will correspond to output 1 turning on at run time). If this output is the only one to be used at this programmed time, one can go to the next set point by using the ADVANCE SET POINT key. If, however, the desired output is to be either output 2, 3 or 4, the set status key should be pressed again to advance to number 2, 3 or 4. Each advance turns off the previous decimal point.

If a *combination* of outputs is designed (such as numbers 2 and 4), the HOLD STATUS key (2) is used to hold the number 2 decimal point on *before* the SET STATUS key advances through 3 to number 4. With the use of the HOLD STATUS key and the SET STATUS key, any combination of the 4 outputs can be programmed at each set point. If an error in programming occurs, using the SET STATUS key from position 4 will clear all data (including that set by the HOLD STATUS) and the proper information may be re-entered by following the proper sequence.

If conditions permit, the programming can be verified on the actual outputs by using the MANUAL key (1). This key, when depressed in the data entry mode, transfers the decimal point set-status data to the output latches; thus, the motor, solenoid, valve, or whatever is being controlled will be activated. When all 4 times and their respective output conditions have been programmed, the system is returned to the real-time clock mode by another depression of the DATA ENTRY key. If the valid day information is not used, the system is ready to operate.

Depression of the DAY MODE key (7) enables setting and display of the current and valid day information. The current day is displayed in the left-ost digit of the display and the validity of the day in the right-most digit with a "1" for a valid day, and "0" for an invalid "off" day. As the clock steps through the week, the programmed conditions occur on all valid days and do not occur on invalid days. The SET DAY key (10), when depressed in the day mode, advances to the next day upon each depression. The SET STATUS key (8), in the day mode, is used to change the validity information. Another depression of the DAY MODE key will return the system to the real-time clock mode.

Closure of the HOLD STATUS/DEMO key (2) will provide a means to rapidly cycle through the programmed sequence or set up an "in store" display. With this key closed in the real-time clock mode, time is advanced at the rate of 1 hour per second; thus, a 24-hour day requires 24 seconds to verify and a 7-day week requires less than 3 minutes.

Closing key 6 during the real-time clock mode (either normal or demo operation) will reset the clock time to zero without changing the set point timing but will reset the valid day information.

Features

- 24-hour real-time clock with 4-digit display
- 60 Hz (50 Hz option) timing derived from the power line
- 4 Control outputs at each set point time
- 4 set point times may be programmed with repeat every 24 hours
- Valid day programming to "skip" certain days
- Manual mode to verify programming
- Transducer input to force to a preset condition
- Time of day reset to ease time setting or to allow use as a sequence timer
- High speed "demonstration" mode for verification of capability
- Single 9V power supply

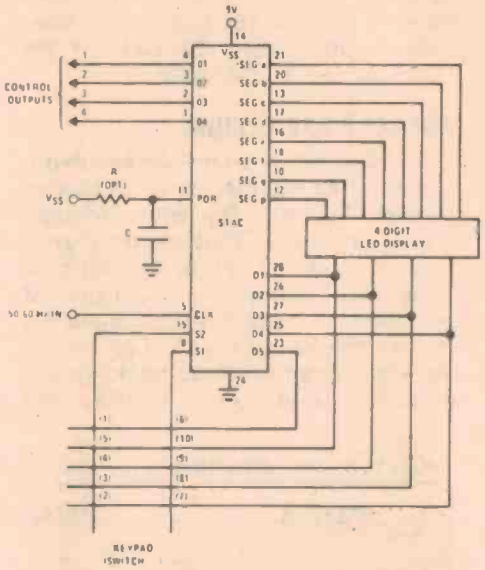


FIGURE 1. Typical STAC Connection

Dual-In-Line Package

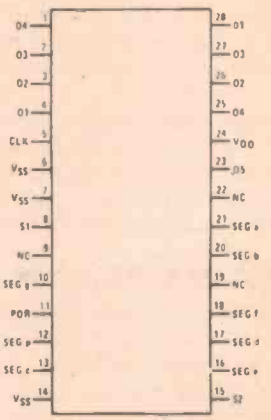


FIGURE 2: Pinouts

External Inputs

The MANUAL / REMOTE TRANSDUCER key (1), when depressed in the real-time clock mode, will override any time-related programming and immediately force output 1 on and 2 through 4 off. This condition will remain until the next valid set point occurs.

Using It

A table of key functions and an example program are given on the next page, the permutations are endless!

KEY NO.	KEY SWITCH NAME	FUNCTION		
		REAL-TIME CLOCK MODE	DATA ENTRY MODE	DAY MODE
1	MANUAL/ REMOTE TRANSDUCER	Remote transducer input; forces output 1 ON, outputs 2–4 OFF until next valid set point after switch is off	Manual verification mode; allows data to be transferred to outputs 1–4	(None)
2	HOLD STATUS/ DEMO	Allows rapid demonstration of sequence by advancing clock at rate of 1 hr/sec	Holds output N ON while programming advances to output N+1, N = 1–4	(None)
3	8 DAY	Specifies 8-day cycle in lieu of 7-day	Specifies 8-day cycle in lieu of 7-day	Specifies 8-day cycle in lieu of 7-day
4	50 Hz	Specifies 50 Hz line frequency input	Specifies 50 Hz line frequency input	Specifies 50 Hz line frequency input
5	DATA ENTRY	Places unit in the data entry mode	Returns unit to the real-time clock mode	(None)
6	ADVANCE SET POINT/ RESET TIME	Resets time of day to 00:00 without changing set points but resets all days to valid	Advances display to the next set point so that it may be verified or altered	(None)
7	DAY MODE	Places unit in the day mode	(None)	Returns unit to the real-time clock
8	SET STATUS	(None)	Controls programming of outputs; resets output N to "0" (unless preceded by HOLD key) and advances to output N+1	Alternate action key; changes day from valid ("1") to invalid ("0") and vice-versa
9	SET MINUTES	Advances minutes display of real-time clock	Advances minutes display of selected set point	(None)
10	SET HOURS/ SET DAY	Advances hours display of real-time clock	Advances hours display of selected set point	Advances display to next day—must be set to current day before returning to real-time clock mode

Programming Example

1. Output 1 should turn on at 2:00 a.m., and turn off at 4:00 a.m. each valid day.
2. Output 2 should turn off at 2:05 a.m. and turn back on at 4:00 a.m. each valid day.
3. Output 3 should turn on at 2:00 a.m. and turn off at 2:05 a.m. each valid day.
4. Output 4 should turn off at 3:01 a.m. and turn on at 4:00 a.m. each valid day.
5. Monday through Friday are valid days – Saturday and Sunday are invalid.
6. It is now Monday, the time is 1:00 a.m.

Given these conditions, it is now advisable to construct an "output truth table":

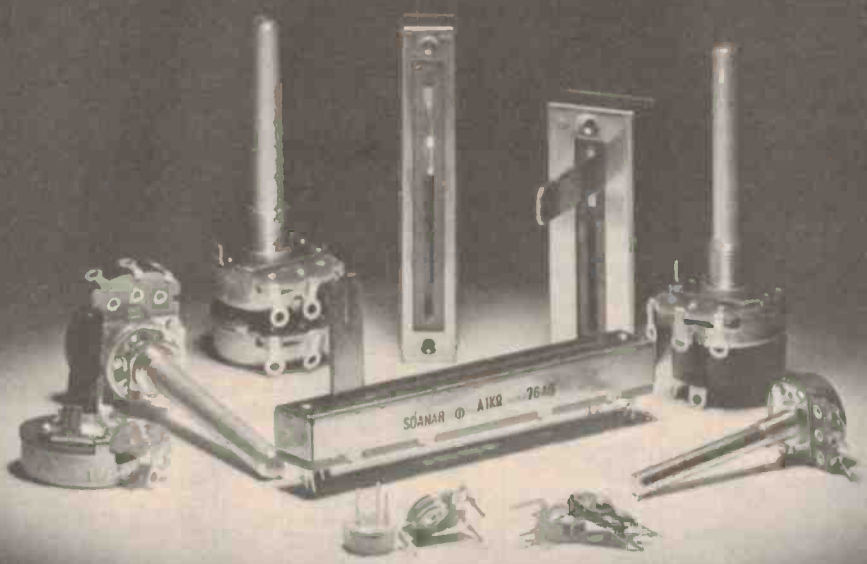
TIME/OUTPUT	O1	O2	O3	O4
2:00 AM	ON	ON	ON	ON
2:05 AM	ON	OFF	OFF	ON
3:01 AM	ON	OFF	OFF	OFF
4:00 AM	OFF	ON	OFF	ON

The following key sequence may be used to load the preceding program into the STAC memory.

KEY DEPRESSED	DISPLAY	NOTES
	0000	Initial display
Data Entry	0000	
Set Hours	0100	
Set Hours	0200	
Set Status	0.200	Set point 1 at 2:00 a.m.; output 1 ON
Hold Status	0.200	Hold output 1 ON
Set Status	0.2.00	Output 2 ON
Hold Status	0.2.00	Hold output 2 ON
Set Status	0.2.0.0	Output 2 ON, output 3 ON
Hold Status	0.2.0.0	Hold output 3 ON
Set Status	0.2.0.0	Output 4 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Minutes	0201	
Set Minutes	0202	
Set Minutes	0203	
Set Minutes	0204	
Set Minutes	0205	
Set Status	0.205	Set point 2 at 2:05 a.m.; output 1 ON
Hold Status	0.205	Hold output 1 ON
Set Status	0.2.05	Output 2 ON
Set Status	0.20.5	Output 2 OFF, output 3 ON
Set Status	0.205.	Output 3 OFF, output 4 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Hours	0300	
Set Minutes	0301	
Set Status	0.301	Set point 3 at 3:01 a.m., output 1 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Hours	0300	
Set Hours	0400	
Set Status	0.400	Set point 4 at 4:00 a.m., output 1 ON
Set Status	04.00	Output 1 OFF, output 2 ON
Hold Status	04.00	Hold output 2 ON
Set Status	04.0.0	Output 2 ON, output 3 OFF
Set Status	04.00.	Output 3 OFF, output 4 ON
Data Entry	0000	Present time
Day Mode	1 1	Day 1, valid
Set Day	2 1	Day 2, valid
Set Day	3 1	Day 3, valid
Set Day	4 1	Day 4, valid
Set Day	5 1	Day 5, valid
Set Day	6 1	Day 6, valid
Set Status	6 0	Day 6, invalid
Set Day	7 1	Day 7, valid
Set Status	7 0	Day 7, invalid
Set Day	1 1	Return to current day
Demo	(Running)	Run thru at least one 24 hour cycle intermittently (use Hour & Minute keys to "nudge" display to set points) to verify output settings. After passing set point just prior to present time, release Demo key
Set Hours	0100	Present time

Programming of the STAC is now complete. The program will continue in 24-hour, 7-day cycle until manually altered.

Potentiometers for industrial and consumer electronics.



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Project 719

Field strength – power meter

Versatile unit indicates transmitter tune-up.

TWO PIECES OF equipment which are almost essential to the CB'er, novice, or amateur alike, are a field strength meter and a power meter. This design combines the two in a simple easy to construct circuit comparable to equipment many times its cost.

Measurement of field strength is useful for antenna tuning, especially where an antenna tuning unit is used, or for checking the radiation pattern of a directional antenna. If the meter is left in a fixed position well away from but at the same height as the antenna, and the antenna rotated, a circular plot of the antenna radiation pattern can be drawn up. When tuning an antenna the meter should be placed in a convenient position where it can be seen and the tuning adjusted for maximum reading.

The power meter is used to tune the output of a transmitter, or can be left in the transmission line as a monitor of power output. The reading on the meter will only be accurate if the antenna has low VSWR. For accurate power measurement, and for transmitter tuning, a dummy load should be connected to one of the power sockets. If only the 20 watt range is used a small CB dummy load is suitable, a larger load of course being necessary for the 200 watt range. Table 1 gives the power calibration for both ranges for a 50 μA meter or the scale can be cut from page 118.

Construction

Figure 2 shows the wiring layout for the unit. This layout should be strictly adhered to, otherwise performance may

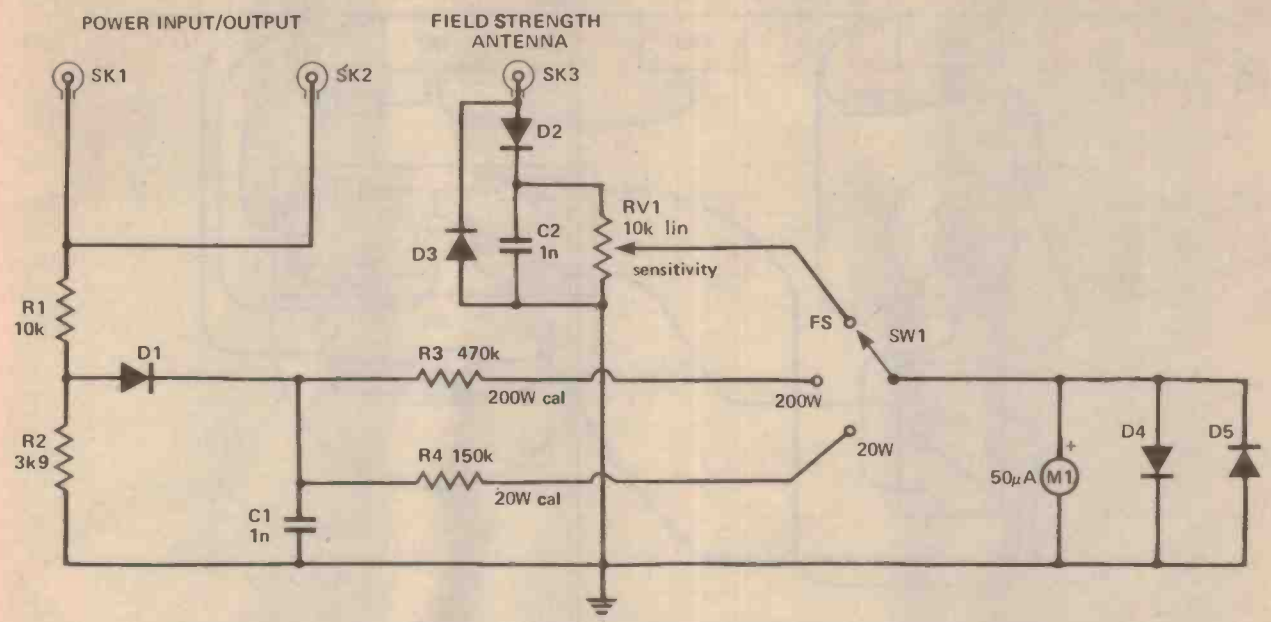


Fig. 1. Circuit of the Field Strength/Power meter.

be affected. All leads, especially the earth leads, should be kept short.

Components for the power meter are assembled on a small piece of matrix board, which is then held in place by the meter terminal screws.

We used a Horwood instrument case type 32/2/D, available from Radio Dispatch Service or Dick Smith Electronics, which measures only 75 mm x 100 mm x 50 mm deep. A C&K type 7211 toggle switch is used for the function switch, although any suitable switch which will fit into the constraints of the box will do equally as well.

A whip antenna for the field strength meter was made by soldering a length of brazing rod into a PL259 UHF plug and filling the space with Araldite. The sensitivity of the meter will increase with the length of the antenna.

How It Works – ETI 719

Let's look at the field strength meter first.

Some signal is picked up by the whip antenna and is detected by D2 and C2. The capacitor, C2, charges to a voltage proportional to the field strength of the signal. A return path for the charging of C2 is provided by D3. The sensitivity control, RV1, varies the current fed from C2 to the meter, via the function switch SW1. The meter will give a reading proportional to the field strength of the signal. The diodes D4 and D5 provide meter overload protection by conducting when the voltage across the meter terminals exceeds about 0.7 volts.

Power Meter

The power meter is similar in operation to the field strength meter, but instead of taking the signal from the antenna it measures the voltage on a 50 ohm transmission line. R1 and R2 form a voltage divider to reduce the voltage to be measured and to provide isolation between the measuring circuit and the transmission line. The RF signal is then detected by D1 and C1, the voltage across the capacitor being proportional to the voltage on the transmission line. The power in the line is then proportional to the square of this voltage ($P = V^2/R$ and $R = 50\Omega$). This voltage is measured by a dual range peak reading voltmeter formed by R3, R4 and M1. The meter is calibrated for 20 watts and can also be used for the 200 watt range. The voltmeter gives an accurate reading for both carrier power (AM), and peak envelope power (PEP).

METER CALIBRATION

Power	Scale		
0.5	8	9	33.5
1	11	10	35
2	16	11	37
3	19	12	38.5
4	22	14	42
5	25	16	44.5
6	27.5	18	47.5
7	29.5	20	50
8	31.5		

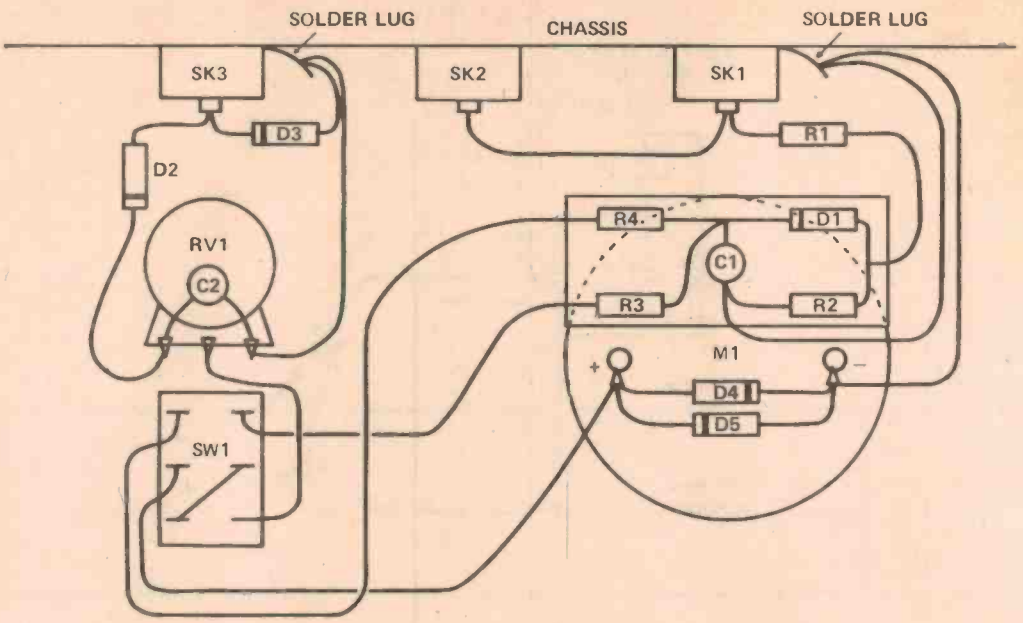
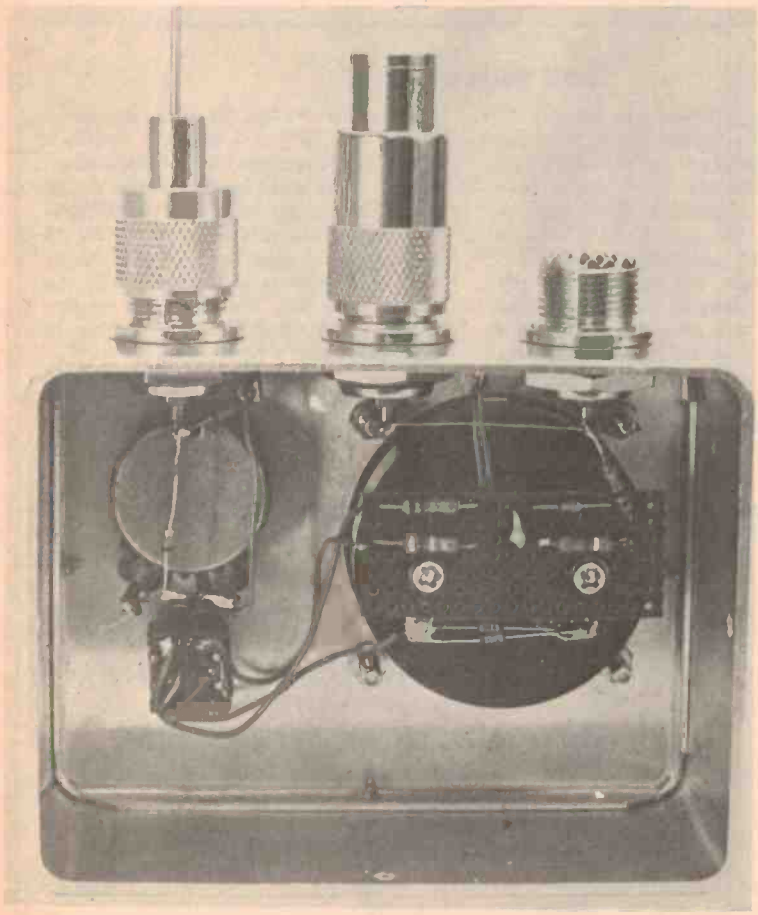


Fig. 2. Wiring layout of the unit. Matrix board is used to mount the components for the power meter.



The completed meter. All leads, especially the earth leads, should be kept as short as possible.

PARTS LIST – ETI 719

Resistors all ¼W 5% except R1
R1 . . . . . .10k 5% ½W
R2 . . . . . .3k9
R3 . . . . . .470k
R4 . . . . . .150k

Potentiometer
RV1 . . . . . .10k lin.pot.

Capacitors
C1, 2 . . . . . .1n ceramic

Diodes
D1 – D5 . . . . . .1N914

Miscellaneous
SW1. . . . . .C&K 7211 (see text)
SK1 – SK3 . . . .S0239 UHF socket
M1 . . . . . .50 μa 50 mm meter
Horwood instrument box 34/2/D (see text)

Accessories
50ohm CB load
PL259 UHF
C2. . . . . .1000u 25VW electro
SW1. . . . . .SPDT min. toggle

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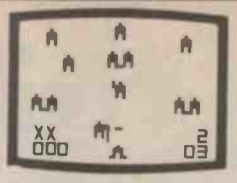
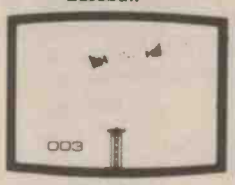

Baseball


Maze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DESERT FOX Cat. X-1203
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MAZE Cat. X-1204
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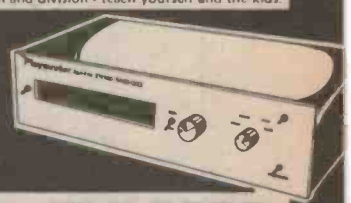

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2.7	NP02P7	N7502P7
3.3	NP03P3	N7503P3
3.9	NP03P9	N7503P9
4.7	NP04P7	N7504P7
5.6	NP05P6	N7505P6
6.8	NP06P8	N7506P8
8.2	NP08P2	N7508P2
10	NP010P	N75010P
12	NP012P	N75012P
15	NP015P	N75015P
18	NP018P	N75018P
22	NP022P	N75022P
27	NP027P	N75027P
33	NP033P	N75033P
39	NP039P	N75039P
47	NP047P	N75047P
56	NP056P	N75056P
68	NP068P	N75068P
82	NP082P	N75082P
100	NP0100P	N750100P
120	NP0120P	N750120P
150	NP0150P	N750150P
180	NP0180P	N750180P
220	–	N750220P
270	–	N750270P
330	–	N750330P
390	–	N750390P
470	–	N750470P

Value	Bag Qty	Price	+ Tax
N.P.O. 1-82PF	10	0.60	0.12
N.P.O. 100-120PF	10	0.90	0.18
N.P.O. 150-180PF	10	1.20	0.23
N750 2.2-220PF	10	0.60	0.12
N750 270-390PF	10	0.90	0.18
N750 470PF	10	1.20	0.23

MINIATURE CERAMIC PLATE

100 VOLT 10% (H1.K)

P.F.	Part No.	Bag Qty.	Price	+ Tax
180	MPC180	10	0.60	0.12
220	MPC220	10	0.60	0.12
270	MPC270	10	0.60	0.12
330	MPC330	10	0.60	0.12
390	MPC390	10	0.60	0.12
470	MPC470	10	0.60	0.12
560	MPC560	10	0.60	0.12
680	MPC680	10	0.60	0.12
820	MPC820	10	0.60	0.12
1000	MPC1000	10	0.60	0.12
1200	MPC1200	10	0.90	0.18
1500	MPC1500	10	0.90	0.18
2200	MPC2200	10	0.90	0.18
2700	MPC2700	10	0.90	0.18
3300	MPC3300	10	0.90	0.18
3900	MPC3900	10	0.90	0.18
4700	MPC4700	10	0.90	0.18

100 VOLT (TUNING)

0.68	TP100P68	–	–	–
0.82	TP100P82	–	–	–
1	TP1001P	–	–	–
1.2	TP1001P2	–	–	–
1.5	TP1001P5	–	–	–
1.8	TP1001P8	TNP01P8	–	–
2.2	TP1002P2	TNP02P2	–	–
2.7	TP1002P7	TNP02P7	–	–
3.3	TP1003P3	TNP03P3	–	–
3.9	TP1003P9	TNP03P9	TN1503P9	TN7503P9
4.7	TP1004P7	TNP04P7	TN1504P7	TN7504P7
5.6	TP1005P6	TNP05P6	TN1505P6	TN7505P6
6.8	TP1006P8	TNP06P8	TN1506P8	TN7506P8
8.2	TP1008P2	TNP08P2	TN1508P2	TN7508P2
10	TP10010P	TNP010P	TN15010P	TN75010P
12	TP10012P	TNP012P	TN15012P	TN75012P
15	TP10015P	TNP015P	TN15015P	TN75015P
18	TP10018P	TNP018P	TN15018P	TN75018P
22	TP10022P	TNP022P	TN15022P	TN75022P
27	–	TNP027P	TN15027P	TN75027P
33	–	TNP033P	TN15033P	TN75033P
39	–	TNP039P	TN15039P	TN75039P
47	–	TNP047P	TN15047P	TN75047P
56	–	TNP056P	TN15056P	TN75056P
68	–	TNP068P	TN15068P	TN75068P
82	–	TNP082P	TN15082P	TN75082P
100	–	TNP0100P	TN150100P	TN750100P
120	–	TNP0120P	TN150120P	TN750120P
150	–	–	TN150150P	TN750150P
180	–	–	–	TN750180P
220	–	–	–	TN750220P
270	–	–	–	TN750270P
330	–	–	–	TN750330P

Value	Bag Qty.	Price	+ Tax
P.100 0.68-10PF	10	0.60	0.12
P.100 12-22PF	10	0.90	0.18
N.P.O. 1.8-39PF	10	0.60	0.12
N.P.O. 47-82PF	10	0.90	0.18
N.P.O. 100-120PF	10	1.20	0.23
N150 3.9-47PF	10	0.60	0.12
N150 56-100PF	10	0.90	0.18
N150 120-150PF	10	1.20	0.23
N750 3.9-47PF	10	0.70	0.14
N750 55-100PF	10	1.00	0.20
N750 OVER 100PF	10	1.30	0.25

ELECTROLYTIC CAPACITORS

6.3 VOLT (SINGLE ENDED)

UF	Part No.	Bag Qty.	Price	+ Tax
22	22RB63	10	0.80	0.16
33	33RB63	10	0.95	0.19
47	47RB63	10	0.95	0.19
100	100RB63	10	1.15	0.22
220	220RB63	5	1.05	0.20
330	330RB63	5	1.05	0.20
470	470RB63	5	1.05	0.20
1000	1000RB63	5	1.10	0.21
2200	2200RB63	2	0.90	0.18
10 VOLT (SINGLE ENDED)				
0.47	RB4710	10	0.80	0.16
1	1RB10	10	0.80	0.16
2.2	2RB10	10	0.80	0.16
3.3	3RB10	10	0.80	0.16
4.7	4RB10	10	0.80	0.16
10	10RB10	10	0.80	0.16
22	22RB10	10	0.80	0.16
33	33RB10	10	1.00	0.20
47	47RB10	10	1.10	0.21
100	100RB10	10	1.30	0.25
220	220RB10	5	0.95	0.19
330	330RB10	5	1.00	0.20
470	470RB10	5	1.00	0.20
1000	1000RB10	3	0.95	0.19
2200	2200RB10	2	0.90	0.18
16 VOLT (SINGLE ENDED)				
10	10RB16	10	0.80	0.16
22	22RB16	10	0.95	0.19
33	33RB16	10	1.00	0.20
47	47RB16	10	1.15	0.22
100	100RB16	5	0.75	0.15
220	220RB16	5	0.80	0.16
330	330RB16	5	1.00	0.22
470	470RB16	4	1.00	0.22
1000	1000RB16	2	0.90	0.18
2200	2200RB16	1	0.80	0.16
25 VOLTS (SINGLE ENDED)				
4.7	4RB725	10	0.80	0.16
10	10RB25	10	0.80	0.16
22	22RB25	10	1.00	0.20
33	33RB25	10	1.15	0.22
47	47RB25	5	0.65	0.13
100	100RB25	5	0.85	0.17
220	220RB25	5	1.00	0.20
330	330RB25	5	1.20	0.23
470	470RB25	4	0.90	0.18
1000	1000RB25	2	1.00	0.20
50 VOLT (SINGLE ENDED)				
.47	RB4750	10	0.80	0.16
1	1RB50	10	0.80	0.16
2.2	2RB250	10	0.80	0.16
3.3	3RB350	10	0.80	0.16
4.7	4RB750	10	0.80	0.16
10	10RB50	10	1.15	0.22
22	22RB50	5	0.75	0.15
33	33RB50	5	0.75	0.15
47	47RB50	5	0.85	0.17
100	100RB50	4	1.00	0.20
220	220RB50	2	0.90	0.18
330	330RB50	2	1.15	0.22
470	470RB50	1	0.85	0.17
4 VOLT (DOUBLE ENDED)				
15	15PT4	4	1.05	0.20
47	47PT4	4	1.05	0.20
100	100PT4	4	1.05	0.20
220	220PT4	3	0.90	0.18
330	330PT4	3	0.90	0.18
1000	1000PT4	1	0.75	0.15
4700	4700PT4	1	1.20	0.23
6.3 VOLT (DOUBLE ENDED)				
10	10PT6	4	1.05	0.20
33	33PT6	4	1.00	0.20
68	68PT6	4	1.05	0.20
150	150PT6	4	1.10	0.21
470	470PT6	3	0.90	0.18
680	680PT6	1	0.70	0.14
1500	1500PT6	1	0.85	0.16
2200	2200PT6	1	1.20	0.23
3300	3300PT6	1	1.20	0.23
10 VOLT (DOUBLE ENDED)				
6.8	6PT810	4	1.05	0.20
22	22PT10	4	1.00	0.20
47	47PT10	4	1.05	0.20
100	100PT10	3	0.90	0.18
220	220PT10	3	0.90	0.18
330	330PT10	3	0.90	0.18
470	470PT10	1	0.70	0.14
1000	1000PT10	1	0.80	0.16
1500	1500PT10	1	0.95	0.19
2200	2200PT10	1	1.20	0.23
16 VOLT (DOUBLE ENDED)				
4.7	4PT716	4	1.05	0.20
15	15PT16	4	1.00	0.20
33	33PT16	4	1.00	0.20

OUR STORES

Silicon Valley Stores
SYDNEY:
23 Chandos Street, St. Leonards
Tel: (02) 439 2965

Shop 4, PO Arcade, Joyce Street,
Pendle Hill
Tel: (02) 636 6566

BRISBANE:
22 Ross Street, Newstead
Tel: (07) 52 1339

MELBOURNE:
380 Bridge Road, Richmond
Tel: (03) 429 4780

ADELAIDE:
170 Sturt Street, Adelaide
Tel: (08) 51 4080

NEW ZEALAND:
AUCKLAND:
7-9 Kirk Street, Grey Lynn,
Tel: 76 1169

Mail Orders to Box 898, Crows Nest, NSW. 2065.

THIS MONTH'S SPECIALS

2716/2708 x 2 $26.52 including tax
Pack of 2. 741-8/industry standard $0.75 including tax
TMS 4045-45/Direct replacement 2114 $11.96 including tax

68	68PT16	4	1.05	0.20
150	150PT16	3	0.90	0.18
220	220PT16	3	0.90	0.18
330	330PT16	1	0.70	0.14
680	680PT16	1	0.80	0.16
1000	1000PT16	1	0.85	0.17
1500	1500PT16	1	1.20	0.23
25 VOLT (DOUBLE ENDED)				
3.3	3PT325	4	1.05	0.20
10	10PT25	4	1.00	0.20
22	22PT25	4	1.05	0.20
47	47PT25	4	1.05	0.20
100	100PT25	3	0.90	0.18
150	150PT25	3	0.90	0.18
220	220PT25	1	0.70	0.14
470	470PT25	1	0.85	0.16
680	680PT25	1	1.00	0.20
1000	1000PT25	1	1.00	0.20
40 VOLT (DOUBLE ENDED)				
2.2	2PT240	4	1.05	0.20
6.8	6PT840	4	1.00	0.20
15	15PT40	4	1.00	0.20
33	33PT40	3	0.90	0.18
47	47PT40	3	0.90	0.18
100	100PT40	3	0.90	0.18
150	150PT40	1	0.70	0.14
220	220PT40	1	0.85	0.16
470	470PT40	1	0.95	0.19
680	680PT40	1	1.20	0.23
63 VOLT (DOUBLE ENDED)				
.47	PT4763	4	1.00	.20
1	1PT63	4	1.00	.20
1.5	1PT563	4	1.05	.20
2.2	2PT263	4	1.00	.20
3.3	3PT363	4	1.00	.20
4.7	4PT763	4	1.00	.20
6.8	6PT863	4	1.00	.20
10	10PT63	4	1.00	.20
15	15PT63	3	0.90	.18
22	22PT63	3	0.90	.18
47	47PT63	3	0.90	.18
100	100PT63	1	0.80	.16
150	150PT63	1	0.80	.16
220	220PT63	1	0.85	.17
330	330PT63	1	1.20	.23

GREEN CAP POLYESTER

100VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.001	GC0010PT63	5	0.60	.12
.0012	GC0012	5	0.60	.12
.0015	GC0015	5	0.60	.12
.0018	GC0018	5	0.60	.12
.0022	GC0022	5	0.60	.12
.0027	GC0027	5	0.60	.12
.0033	GC0033	5	0.60	.12
.0039	GC0039	5	0.60	.12
.0047	GC0047	5	0.60	.12
.0056	GC0056	5	0.60	.12
.0068	GC0068	5	0.60	.12
.0082	GC0082	5	0.60	.12
.01	GC010	5	0.60	.12
.012	GC012	5	0.60	.12
.015	GC015	5	0.60	.12
.018	GC018	5	0.60	.12
.022	GC022	5	0.60	.12
.027	GC027	5	0.60	.12
.033	GC033	5	0.60	.12
.039	GC039	5	0.60	.12
.047	GC047	5	0.70	.14
.056	GC056	5	0.70	.14
.068	GC068	4	0.70	.14
.082	GC082	4	0.70	.14
0	GC10	4	0.85	.17
.12	GC12	4	0.85	.17
.15	GC15	4	1.00	.20
.18	GC18	3	0.90	.18
.22	GC22	3	1.00	.20
.27	GC27	3	1.00	.20
.33	GC33	2	0.95	.19
.39	GC39	2	1.00	.20
.47	GC47	1	0.60	.12

METALISED POLYESTER

250 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
01	250FF01	5	0.75	0.15
.012	250FF012	5	0.75	0.15
.015	250FF015	5	0.75	0.15
.018	250FF018	5	0.75	0.15
.022	250FF022	5	0.75	0.15
.027	250FF027	5	0.75	0.15
.033	250FF033	5	0.75	0.15
.039	250FF039	5	0.75	0.15
.047	250FF047	5	0.75	0.15
.056	250FF056	5	0.75	0.15
.068	250FF068	5	0.75	0.15
.082	250FF082	5	0.90	0.18
.1	250FF1	5	0.90	0.18
.12	250FF12	5	1.10	0.21
.15	250FF15	5	1.15	0.22
.18	250FF18	4	1.00	0.20
.22	250FF22	4	1.05	0.20
.27	250FF27	3	1.00	0.20
.33	250FF33	3	1.05	0.20
.39	250FF39	3	1.05	0.20
.47	250FF47	2	0.80	0.16
.56	250FF56	2	0.90	0.18
.68	250FF68	2	1.00	0.20
.82	250FF82	1	0.70	0.14
1.0	250FF10	1	0.70	0.14
1.2	250FF12	1	0.80	0.16
1.5	250FF15	1	0.90	0.18
1.8	250FF18	1	1.00	0.20
2.2	250FF22	1	1.10	0.21

400 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.01	400FF01	4	0.85	0.17
.012	400FF012	4	0.85	0.17
.015	400FF015	4	0.85	0.17
.018	400FF018	4	0.85	0.17
.022	400FF022	4	0.85	0.17
0.027	400FF027	4	0.95	0.19
.033	400FF033	4	0.95	0.19
.039	400FF039	4	1.05	0.20
.047	400FF047	4	1.05	0.20
.056	400FF056	3	0.95	0.18
.068	400FF068	3	1.00	0.20
.082	400FF082	2	0.70	0.14
.10	400FF10	2	0.75	0.15
.12	400FF12	2	1.00	0.20
.15	400FF15	2	1.05	0.20
.18	400FF18	2	1.10	0.21
.22	400FF22	2	1.20	0.23
.27	400FF27	1	0.70	0.14
.33	400FF33	1	0.80	0.16
.39	400FF39	1	0.90	0.18
.47	400FF47	1	1.00	0.20
.56	400FF56	1	1.10	0.21
.68	400FF68	1	1.20	0.23
.82	400FF82	1	1.30	0.25
1.0	4001FF0	1	1.45	0.28

NON-METALLISED POLYESTER

100 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.015	100PPC015	4	0.80	.16
.018	100PPC018	4	0.80	.16
.022	100PPC022	4	0.80	.16
.027	100PPC027	4	0.80	.16
.033	100PPC033	4	0.80	.16
.039	100PPC039	4	0.90	.18
.047	100PPC047	4	0.90	.18
.056	100PPC056	4	1.00	.20
.068	100PPC068	4	1.00	.20
.082	100PPC082	3	0.90	.18
.1	100PPC10	3	0.90	.18
.12	100PPC12	3	0.90	.18
.15	100PPC15	3	1.05	.20
250 Volt				
.0082	250PPC0082	4	0.80	.16
.01	250PPC010	4	0.80	.16
.012	250PPC012	4	0.80	.16
400 Volt				
.0047	400PPC0047	4	0.80	.16
.0056	400PPC0056	4	0.80	.16
.0068	400PPC0068	4	0.80	.16
630 Volt				
.001	630PPC001	4	0.80	.16
.0012	630PPC0012	4	0.80	.16
.0015	630PPC0015	4	0.80	.16
.0018	630PPC0018	4	0.80	.16
.0022	630PPC0022	4	0.80	.16
.0027	630PPC0027	4	0.80	.16
.0033	630PPC0033	4	0.80	.16
.0039	630PPC0039	4	0.80	.16

RESISTORS

Part No.	Bag Qty.	Price	+ Tax
CR25 10HM – 10M	10	0.40	0.08
CR37 10HM – 10M	10	0.50	0.10
CR52 10HM – 10M	10	0.80	0.16
MR25 5.6 – 270K	5	0.60	0.12
EH05 to 3K6	2	0.70	0.14
EH05 from 3K9	2	0.80	0.18

VERTICAL TRIM POTS

OHM	10mm	18mm
100	10TP100	18TP100
220	10TP220	18TP220
330	10TP330	18TP330
470	10TP470	18TP470
1K	10TP1K	18TP1K
2.2K	10TP2K2	18TP2K2
4.7K	10TP4K7	18TP4K7
10K	10TP10K	18TP10K
22K	10TP22K	18TP22K
47K	10TP47K	18TP47K
100K	10TP100K	18TP100K
220K	10TP220K	18TP220K
470K	10TP470K	18TP470K
1M	10TP1M	18TP1M
2.2M	10TP2M2	18TP2M2
4.7M	10TP4M7	18TP4M7
10M		18TP10M

Part No.	Bag Qty.	Price	+ Tax
10TPXX	3	0.70	0.14
18TPXX	3	0.80	0.16

RESELLERS

N.S.W.
Pre-Pak Electronics
718 Parramatta Road, Croydon
Tel: (02) 797 6144

In-Electronics
84 Ramsey Street, Haberfield
Tel: (02) 799 3331

Kit-Sets
657 Pittwater Road, Dee Why
Tel: (02) 982 7500

Applied Technology
109-111 Hunter Street, Hornsby
Tel: (02) 476 4758

Martin De Launay
270 Kiera Street, Wollongong
Tel: (042) 28 6020

Serve-U Appliance Centre
107 George Street, Bathurst
Tel: (063) 31 1356

Rendell Research
Ringwood Road, Exeter

A.C.T.
Diacom
29 Colbee Court, Philip
Tel: (062) 82 3581

QLD.
Kit Sets
293 St. Pauls Terrace, Fortitude Valley
Tel: (07) 52 8391

Hunts Electronics
P.O. Box 546, Toowoomba
Tel: (076) 32 9677

VIC.
Rod Irving Electronics
499 High Street, Northcote
Tel: (03) 489 8131

South West Electronics
119 Hopkins Street, Footscray
Tel: (03) 689 3819

Stewart Electronics
240b Huntingdale Road, Huntingdale
Tel: (03) 543 3910

S.A.
Ktronics
260 Wright Street, Adelaide
Tel: (08) 212 5505

W.A.
Atkins Carlyle
1-9 Milligan Street, Perth
Tel: (09) 321 0101

Project 555

LIGHT ACTIVATED TACHO

This tachometer measures rotational speed without physical contact, by picking up reflected light.

THE USE OF a non-contact method of measuring RPM is not only convenient but sometimes the only method possible. Some motors used for model aircraft have a capacity of only 0.15cc yet run at speeds in the 25000 RPM region. The power required to turn a mechanical tacho would be many times the power of such a motor. Also on some machines there is no convenient place a normal tacho can be fitted.

SPECIFICATION – ETI 555

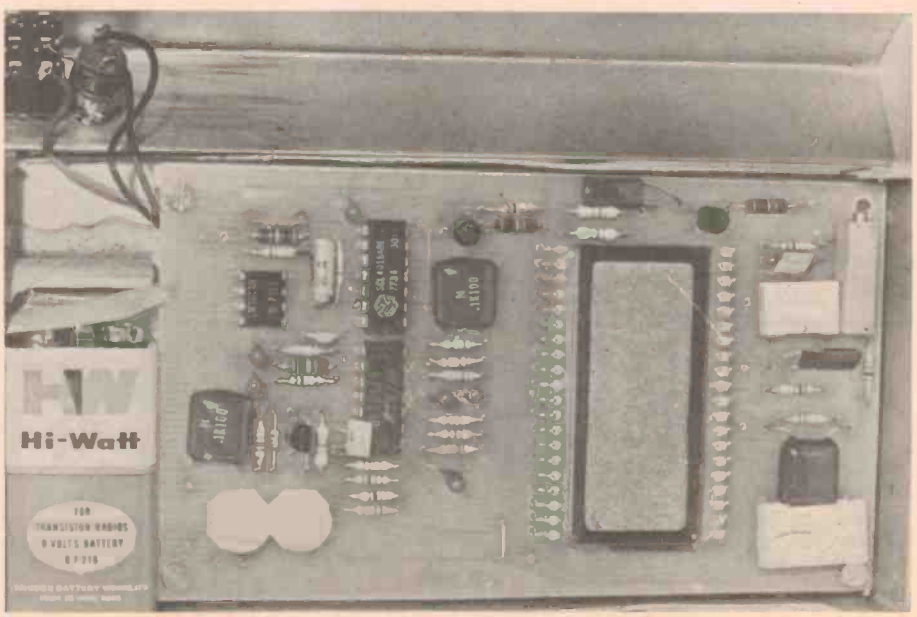
RPM range	
Low	0 – 20000
High	10000 – 30000
Resolution	10 RPM
Display	12mm LCD
Detection method	reflected light
Power	9V dc @ 4mA
Battery life (216)	about 150 hours

Design Features

As the main application for this unit was to be outdoors it was decided that an LCD display would be preferable to an LED and more easy to read than an analogue meter. Unfortunately LCDs are not yet readily available, and nor are the ICs needed to drive them.

However the Intersil Evaluation kit which we have used in the past is fairly easy to get hold of, and so we based the design around this unit. This meant converting the pulses from the sensor into a voltage. This however has another benefit in that a greater resolution can be obtained more quickly. To have a resolution of 10 RPM with a two bladed propeller a sample time of three seconds would be necessary.

The use of the BPW34 photodiode in the photovoltaic mode, ie actually generating a voltage, simplifies the biasing otherwise needed.



Construction

All the electronic components are mounted on a single pc card with the exception of the photodiode. To save on real estate the main voltmeter IC is mounted under the display.

Initially, assemble all the components apart from the ICs and the display, taking care not to bridge between the tracks with solder. Also note that some of the capacitors have to be laid on their side to give a low height.

The ICs can now be added being careful to polarize them correctly. Due to the display being mounted over the main IC it is not posible to use a socket. A socket can be used for the display if desired however it will have to be modified by cutting it into two strips.

As there are no polarity marks on the display it is necessary to hold it at the light and look for the outline of the digits. A link for the decimal point should be added as shown in the diagram.

We mounted our unit in a metal box we made with the photodiode mounted about 25mm from the end of a 75mm long tube in front of the box. This narrows the field of view of the diode as well as giving a little more clearance between high speed propellors and the fingers!

Calibration

Switch on the unit and cover the photodiode to prevent any light reaching it. Now adjust RV1 until the display reads zero.

Uncover the diode and point it at a fluorescent light. It will now give a reading and RV3 should be adjusted to indicate 3000 RPM.

Again cover the diode, then press the high range button and adjust RV2 to give a reading of −10000 RPM. Under fluorescent light it should read −7000 RPM

Operation

This unit relies on a changing light level for its operation. For use with a model aircraft, holding the unit near the propeller enables detection of the changes in the reflected light level. To measure the speed of other rotating equipment it may be necessary to paint a series of white lines to give the sensor something to 'see'.

However the unit cannot be used under fluorescent lights as it will see the 100 cycle flicker (see calibration section) . In cases where this has to be done, and places where the ambient light is low, a small incandescent globe can be used to shine on the spot looked at by the sensor.

The unit, as described, is scaled to read up to 20000 RPM with a 10 RPM resolution, assuming two input pulses per revolution. If a different number of input pulses is to be used, e.g. a three or four bladed propeller, the value of R1 can be changed. (R1 ≈ 360k / number of pulses). The use of more than four pulses per revolution is not recommended on this range. If 2000 RPM is more than is needed for your application the value of R1 can be increased by a factor of 10, preferably with more .than ten pulses per revolution.

Unlike a frequency meter, overranging this unit will cause the display to blank and greater resolution cannot be obtained simply by using a lower range. However an offset of a fixed number of RPM can be used as described in the 'How It Works' section. Using the values given, when the high range button is pressed, 10000 RPM must be added to the reading.

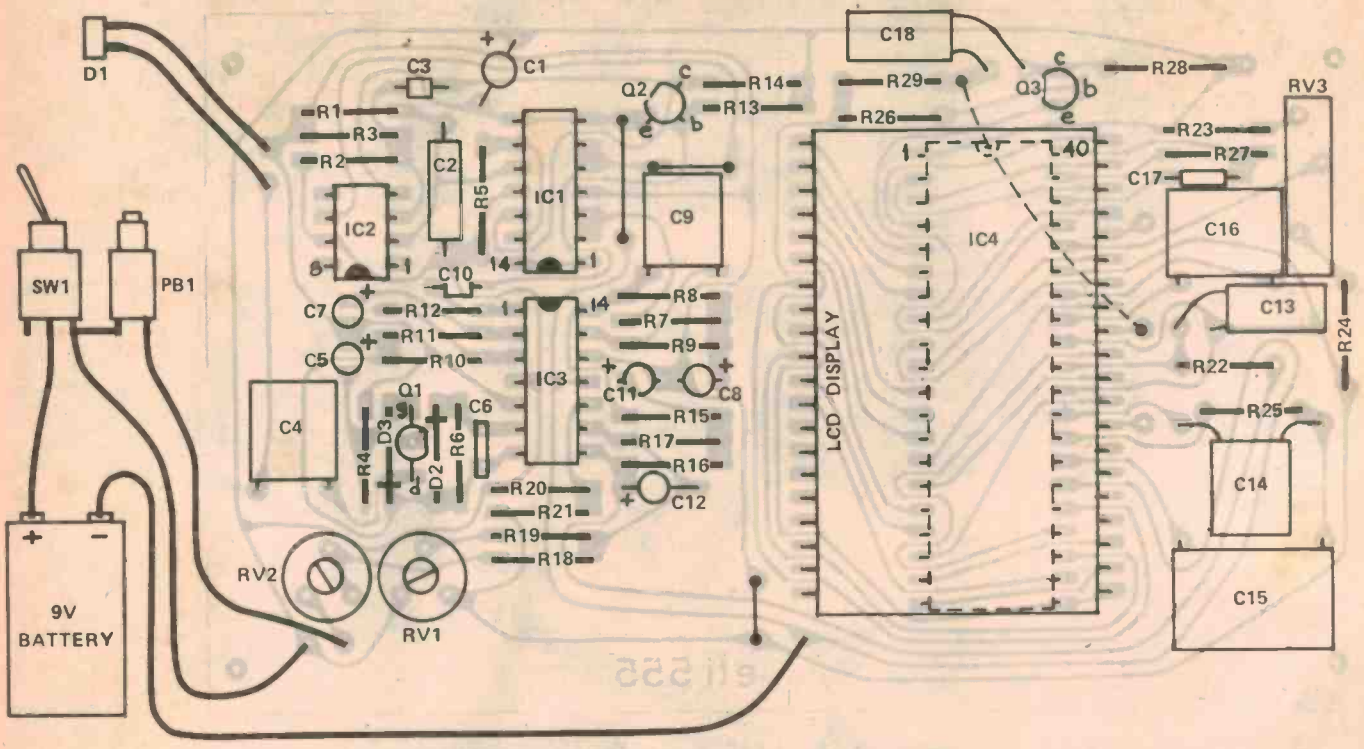


Fig. 1 The component overlay and wiring diagram of the tacho. Note that the polarity of the sensor diode, D1, is not important.

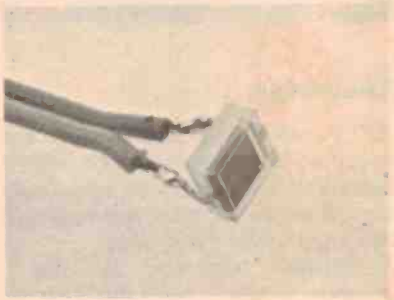
HOW IT WORKS – ETI 555

When using this unit to measure RPM, be the application a model aircraft motor or some other rotating object, the propeller or the white line (see operation section) gives rise to a changing light level. D1 which is a photo diode used in the photovoltaic mode, sees this light level and gives out a voltage proportional to the light. As this is only a small signal it has to be amplified before it can be used. This is done by IC3a. The transistor Q1 is included to provide some gain control allowing the unit to be used in differing light conditions without the need for any adjustment. The output of the amplifier is rectified by D3 to provide a negative voltage on the gate of Q1. When the output of the amplifier is small the gate to source voltage will be near zero and the FET will appear as a low value resistor giving high gain to the amplifier. If the light change is such that the output of the amplifier is large, the rectified voltage on the gate of Q1 will cause the resistance of the FET to increase decreasing the amplifier gain. In this way the output of the amplifier is held relatively constant irrespective of the light level. Diode D2 is necessary to prevent the amplifier from saturating on the positive swing.

The output is then squared up by IC3b where the positive feedback provided by R12 ensures that the output switches quickly. The output from this IC then triggers the monostable formed by Q2. What we have now is a pulse about 50μs long every time the propeller blade passes the light sensor.

Before continuing, you may have noticed that besides the +9V and 0V we also have a line marked Vref. This is derived from IC4 which is a voltmeter chip and is a stable voltage of about 2.8 volts below the +9V line.

The output of the monostable (Q2) turns on IC1a for 50μs, discharging C2 which is then allowed to recharge to Vref. This voltage is compared (by IC2) to the voltage set by R2 and R3. The output of IC2 is a negative pulse of about 900μs. As it is on a stable voltage supply, variations in battery voltage will have very little effect on the output pulse width. Capacitor C3 is used to force the positive input of IC2 above the negative one for the 50μs pulse ensuring that this time is not included in the output pulse. IC1b is used to invert this pulse and its output, and the output of IC2, control IC2c/IC2d. The output of IC2c/IC2d is a positive pulse switching between Vref. and the +9V line.



This is then filtered by two 2 pole active low pass filters, IC3c and IC3d. As these have a cutoff frequency of around 10 Hz the output for most applications will be the dc voltage component only. This is measured by IC4 which is a complete voltmeter.

As offset voltages and currents can cause the output of the filters not to be exactly zero with no input, the positive input of IC3d is biased up about 30mV and then by injecting a current into the negative input (by R19 and RV1) correction can be made. For measuring RPMs above 20000 and below 30000 a current is injected into the negative input via R18 and this subtracts 10000 RPM from the reading.

PARTS LIST – ETI 555

Resistors all ¼W, 5%

R1	180k
R2	150k
R3	100k
R4	1M
R5	47k
R6	4M7
R7,8	180k
R9	12k
R10	10k
R11	100k
R12	330k
R13	100k
R14	10k
R15	33k
R16	15k
R17	4k7
R18	120k
R19	1M
R20	150k
R21	1k
*R22	1M
R23	10k
R24	2k2
R25	220k
R26	4M7
*R27	100k
R28	100k
R29	4M7

Potentiometers

RV1,2	50k VTP trim
*RV3	1k, 10 turn trim

Capacitors

C1	1µ 35 V tantalum
C2	4n7 polystyrene
C3	1n5 polyester
C4	100n "
C5	1µ 35 V tantalum
C6	100p ceramic
C7,8	1µ 35 V tantalum
C9	100n polyester
C10	820p ceramic
C11	3µ3 16 V tantalum
C12	1µ 35 V tantalum
C13	10n polyester
C14	100n "
*C15	220n "
*C16	100n "
*C17	100p ceramic
C18	10n polyester

Semiconductors

IC1	4016 (CMOS)
IC2	301A
IC3	324
*IC4	ICL7106
Q1	2N5485
Q2,3	BC548
D1	BPW34
D2,3	iN914

Miscellaneous

PC board ETI 555
toggle switch
pushbutton switch
*3½ digit LCD
case to suit
battery clip
9 V battery

* Note; These components are supplied with the Intersil ICL7106EV evaluation kit.

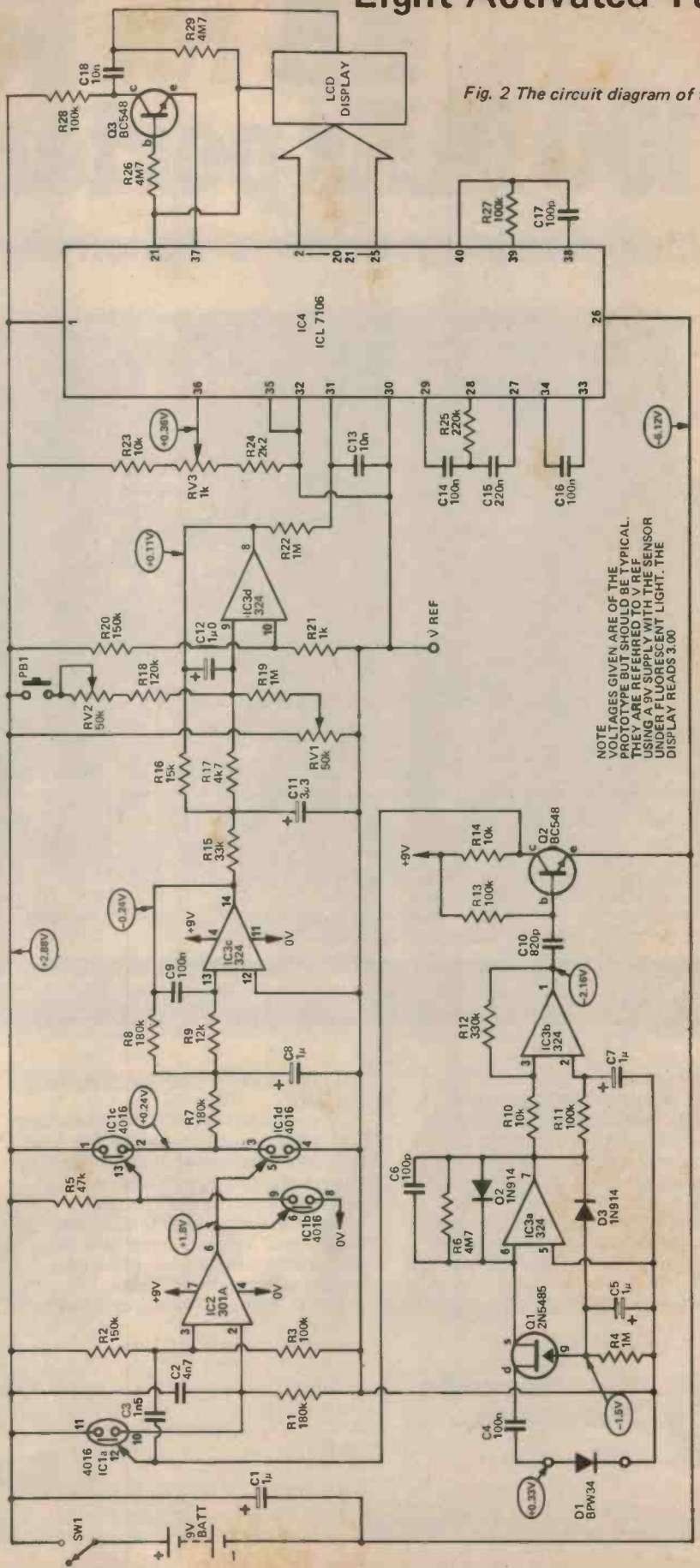


Fig. 2 The circuit diagram of the tacho.

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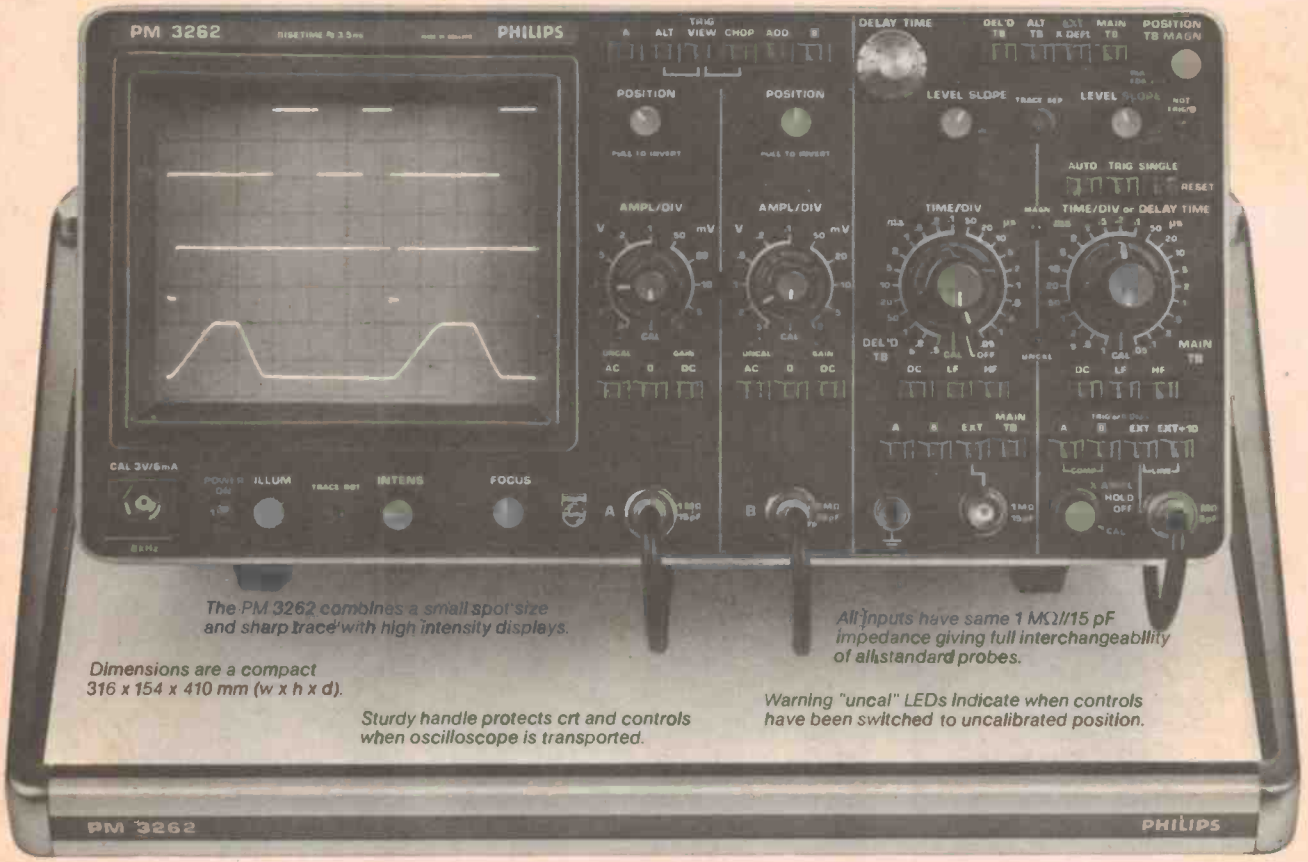

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HRME-132-0030

Project 138

AUDIO POWER METER

This design multiplies voltage and current to come up with the correct value of power, using an analogue multiplier IC.

POWER IS PROBABLY the least understood and most misrepresented quantity in the electrical measurement system. This is especially so in the area of audio amplifier and speaker specifications when terms like peak, peak to peak, music and RMS are related to power.

Power is simply the rate at which energy is being used. It is expressed in watts and the value may vary from femtowatts (10^{-12} W), as in the input power of a FET, to thousands of megawatts in the power generation field. The term thousand megawatts is generally used in preference to the more correct term, gigawatts.

Power can be calculated simply by multiplying voltage and current:

$$P = EI$$

In a dc circuit where both voltage and current remain constant no problem arises. However in an ac or a dc circuit where the voltage is not constant with time, this formula only holds for instantaneous power as the power varies with time. Power as we usually use the term is the time average of this. If the load is resistive, i.e. contains no inductance or capacitance, and we can measure the RMS value of the voltage, we can still use this simple formula. However measuring the RMS voltage is not easy as most voltmeters measure the peak or average rectified voltage with a suitable scaling factor built in to give a correct result when measuring a sine wave signal.

If the load is reactive the current and voltage will no longer be in phase, i.e. the peaks do not occur at the same point in time. The difference can be expressed either by the phase angle in degrees or by the cosine of this angle (known as the power factor). The current waveform can either be ahead of the voltage (leading) or behind it (lagging). Capacitive circuits give rise to a leading power factor while inductive circuits lag.

If working with a sine wave, and if the power factor is known, the formula for power can be expressed as:

$$P = EI \cos \phi$$

where ϕ is the phase angle. In a dc circuit $\cos \phi$ is unity so the formula holds for this case as well. An example is a 40 W fluorescent light which takes 430 mA from the 240 V mains. At first sight, this implies a power consumption of over 100 W, until it is realised that its power factor is about 0.45 lagging. The formula above, using $\cos \phi = 0.45$, thus gives a power consumption of only 46.4 W. (The additional 6 odd watts is dissipated in the ballast). The product of voltage and current is known as the VA rating and is used when calculating the currents in a circuit. If a capacitor is connected across a sine wave ac circuit the current taken can be calculated by dividing the voltage by the reactance of the capacitor. While this circuit draws current, it has a power factor of very near zero (90° phase lead) and therefore takes no power! By adding the correct amount of capacitance to an inductive circuit (i.e. the fluorescent light) the power factor can be altered, reducing the current drawn (but not the power).

Confused yet?

Getting back to audio amplifiers and their ratings, the problem lies in the complex nature of the music waveform and how to specify the amplifier's rating. As the waveform is far from a constant sine wave with the peak power being anything up to 20 times the average, numerous methods such as peak power, peak to peak power, music power, etc. evolved. However, for a long time there was no set standard, and one amplifier advertised with a 50 W (music) rating was in fact a 5 W stereo amplifier. The situation got so out of hand that the US Government brought down legislation on how amplifiers were to be tested. This is with a continuous sine wave signal with level set so that the distortion is at a specified level and power calculated from the RMS output voltage: hence the term RMS power. Note however that the term RMS refers to the method of measurement, i.e. the use of RMS voltage, and it is not the RMS value of the power waveform. It is, in fact, the average of the power waveform.

Speakers are just as confusing. They are normally specified not in terms of the power they can dissipate, but the maximum power of amplifier they are suitable for. This is due to the fact that music is never (well, rarely) a

SPECIFICATION – ETI 138

Power range	30 mW – 3000 W FSD in eleven ranges
Input impedance	
1 V	47 k
3 V–300 V	100 k
10 A	0.1 ohm
3 A	0.32 ohm
1 A	1 ohm
0.3 A	3.2 ohm
0.1 A	10 ohms
0.03 A	32 ohms
Overload capability	
Voltage ranges	RMS – 200% peak – 300%
Current ranges	RMS – 100% peak – 300%
Accuracy	< 5%
Frequency range	dc to 100 kHz

continuous sine wave and the average power in the speaker may be only 10% of the RMS rating of the amplifier, even with the amplifier clipping.

To measure the power actually being delivered to the spaeker under music conditions, a wattmeter must be used.

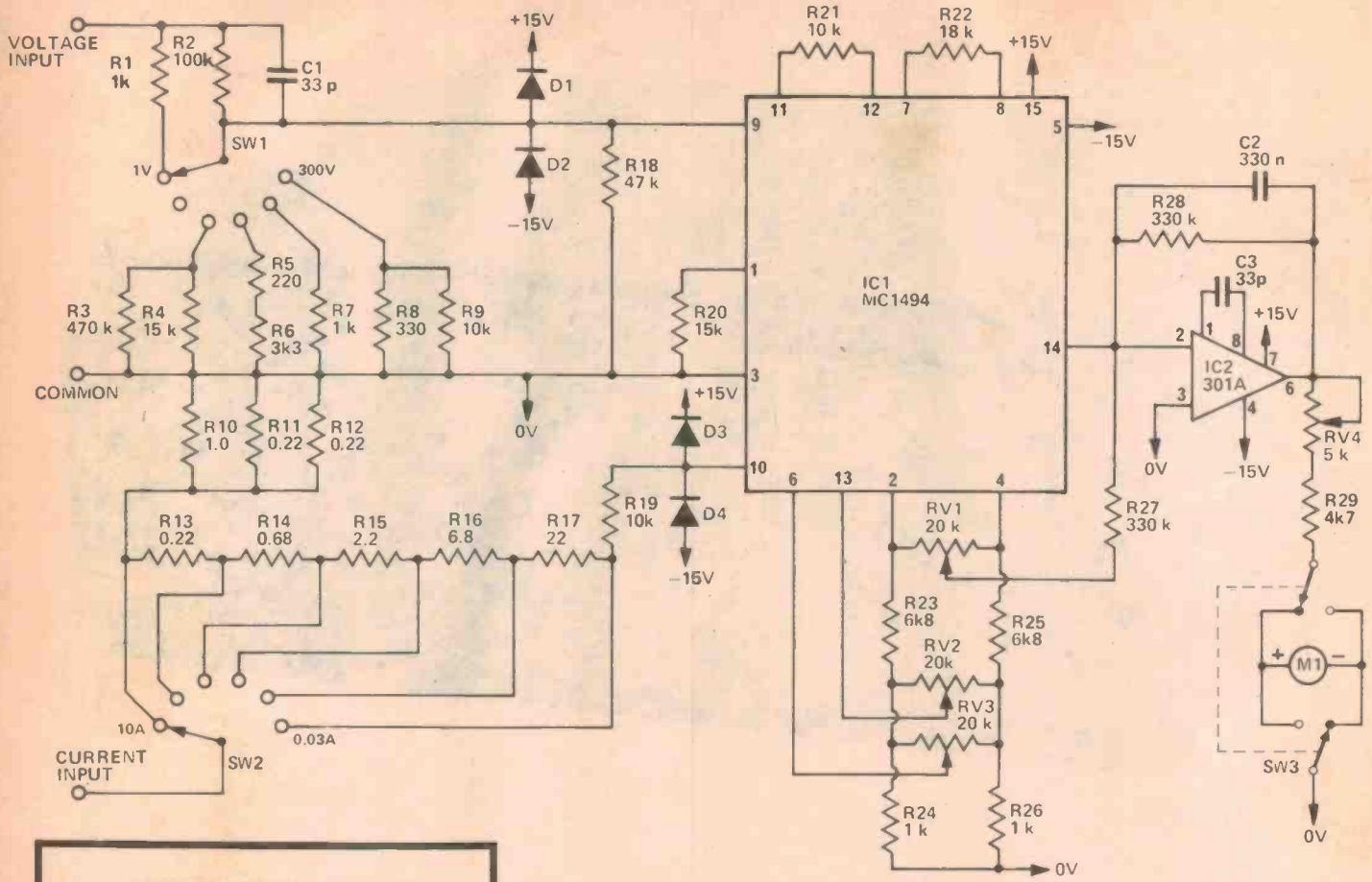
Design Features

To multiply current and voltage together we had the choice of analogue or digital techniques. Unfortunately while digital is the 'in' thing, offering versatility and accuracy, it is not fast enough to calculate the instantaneous power on high frequencies. We therefore chose the analogue method.

Looking around for ICs, the only ones with reasonable price and availability were the MC1494, 1495 and 1496. The 1496 (or 796) is the cheapest and most readily available, but has the disadvantage of not being able to multiply dc signals or ac signals with a dc offset. The 1494 and 1495 are about the same price (around $7.00), and of the two, the 1494 was more linear and easier to use.

We chose not to use any input buffer on the voltage input but had to pay the penalty of having a lower input impedance than normal with voltmeters.

Project 138



HOW IT WORKS – ETI 138

Power is the product of current and voltage. This holds irrespective of the nature of the load, provided you are talking about instantaneous power. By multiplying current and voltage together and then taking the average of these instantaneous values we find the true power. Again this works irrespective of the load.

In this circuit the multiplying is done by IC1 (MC1494), the output of which is a current proportional to the product of the inputs. For more detailed notes on this IC, see the separate section. The current output of this IC is converted to a voltage by IC2 with C2 providing the averaging. The meter is then simply wired across the output of this IC with a meter reversing switch provided. This reversing switch is needed not to measure negative power, but to correct for reversed readings due to differing external connections.

The power supply is a full wave bridge with a centre tap giving about ∓20 V dc which is then regulated to the ∓15 V required by IC1.

Adjustments for zeroing the voltage and current inputs are provided by RV2 and RV3 while RV1 compensates for offsets in the output. These are supplied by a stable ∓4 V reference in IC1. Range switching is done by SW1 and SW2. Protection against overvoltaging the IC is provided by D1 – D4.

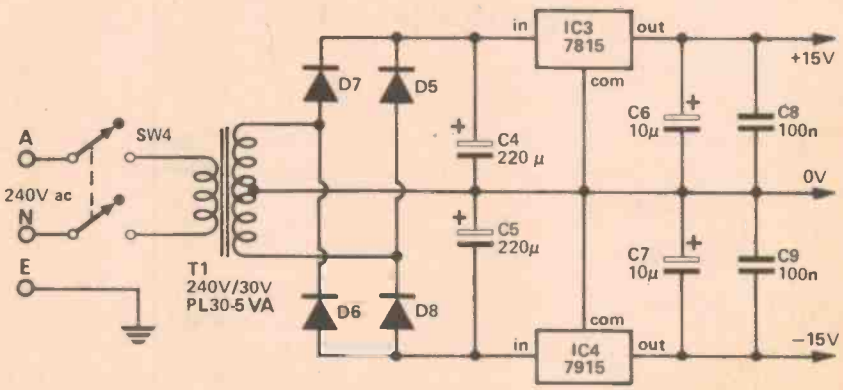


Fig. 1 The circuit diagram of the audio power meter.

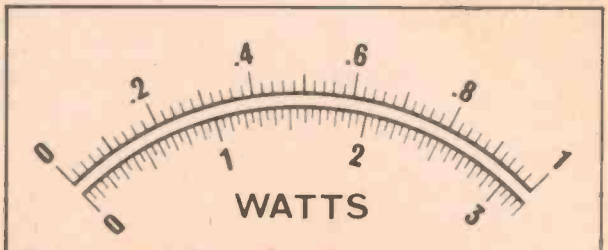


Fig. 2 The meter scale used. It is designed for the TD86 meter.

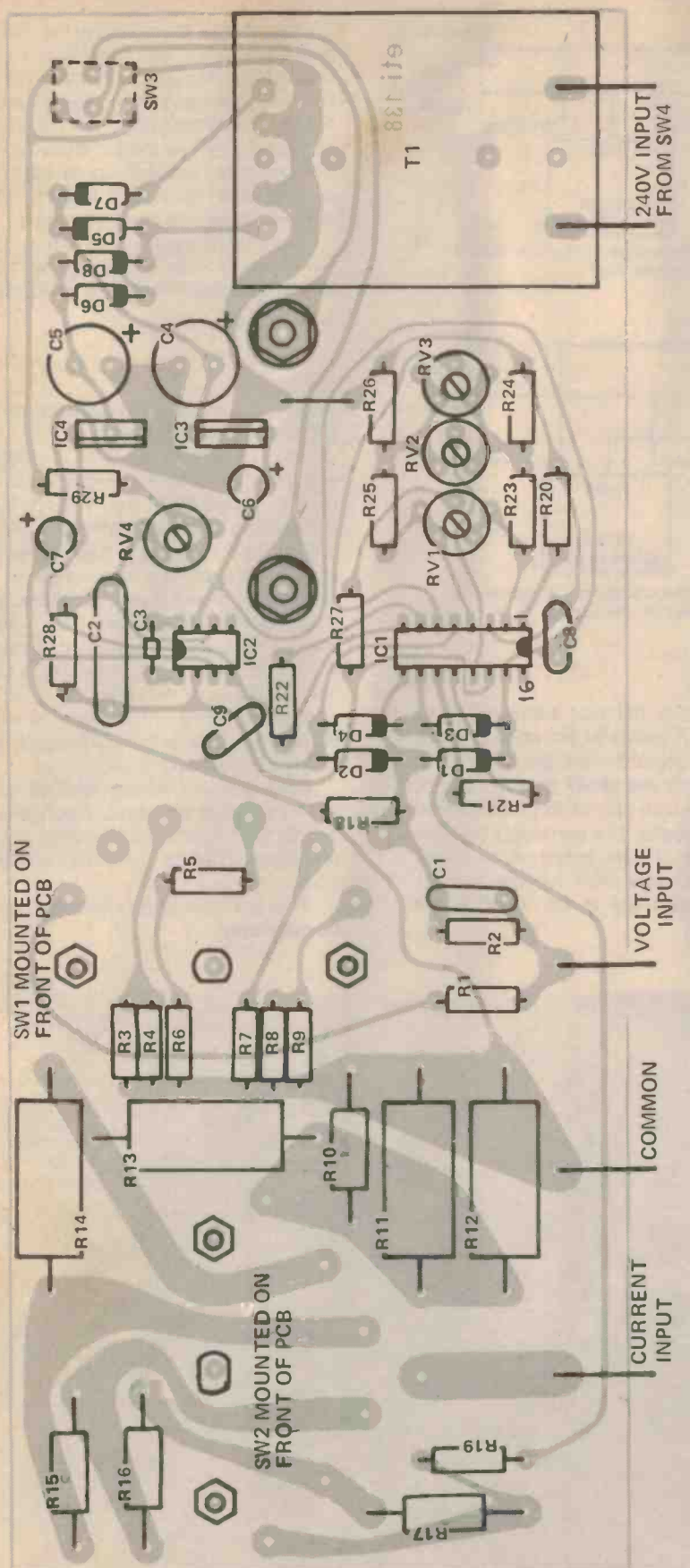


Fig. 3 The component overlay of the power meter.

PARTS LIST – ETI 138

Resistors all ½% 5W unless stated

R1	1k
R2	100k
R3	470k
R4	15k
R5	220R
R6	3k3
R7	1k
R8	330R
R9	10k
R10	1 ohm 1W
R11–R13	0.22 ohm 5W
R14	0.68 ohm 5W
R15	2.2 ohms 1W
R16	6.8 ohms 1W
R17	22R
R18	47k
R19	10k
R20	15k
R21	10k
R22	18k
R23	6k8
R24	1k
R25	6k8
R26	1k
R27, 28	330k
R29	4k7

Potentiometers

RV1–RV3	20k trim
RV4	5k trim

Capacitors

C1	33p 500V ceramic
C2	330n polyester
C3	33p ceramic
C4, 5	220µ 35V electro
C6, 7	10µ 25V electro
C8, 9	100n polyester

Semiconductors

IC1	MC1494
IC2	301A
IC3	7815
IC4	7915
D1–D4	1N914
D5–D8	1N4004

Miscellaneous

- PC board ETI 138
- SW1, 2 two pole 6 position 10A rotary switches (Paton Electrical)
- SW3, 4 two pole toggle switches
- Transformer PL30/5VA
- Meter 1mA FSD (TD86)
- Three binding posts
- Instrument case 255x100x205mm
- Power cord and clamp
- Two knobs
- Front panel

Using the Power Meter

To use the meter we must measure both voltage and current. There must be a common point for these measurements. The current connection can be in either of two ways as shown in the drawings below. One measures the power out of the supply and the second the power into the load. The difference? The current shunt in the wattmeter drops one volt when working at the full range value and this may or may not affect the reading. At 10 A this accounts for 10 W which, if the power being measured is only 100 W, is a 10% error – although if the measured power is 2400 W the error is only 0.4%.

The range of the meter is the product of the individual ranges, i.e. on 30 V and 1 A the fsd is 30 W, while 30 V and 3 A gives 100 W fsd. To help give a reading reasonably high on the scale, the voltage range can be overvoltaged by a factor of 2. Due to power dissipation problems this should not be attempted on the current ranges. The peak voltage or current can be as high as three times the range value.

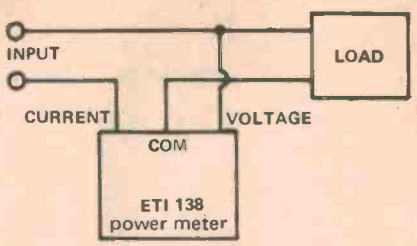


Fig. 4 This connection measures the power into the load.

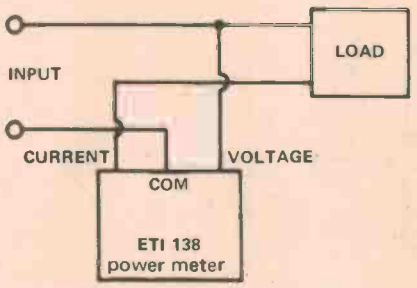


Fig. 5 This connection measures the power out of the supply.

Construction

We mounted all the components associated with the meter and the switches on a single pc board and if the same or similar case is to be used this is recommended.

Except for the meter and the switches the components are mounted on the 'normal' side of the pc board. These should be mounted first with the only critical part of the assembly in the area of the range switches. Here the high powered resistors should be spaced at least 5 mm from the pc board as they run hot at maximum current. Also the leads of all the resistors in this area should be cut off close to the pc board after soldering. This is to give adequate clearance to the rotary switches. We used two self tapping screws into the plastic of the transformer case to help fix it onto the board. We have made allowance for either the cermet (VTP) or the normal carbon trim potentiometer.

The switches used are made by Paton Electrical Pty. Ltd of 90 Victoria St., Ashfield, NSW, and were chosen as they are rated for 10 A 240 V operation. If desired the voltage switch may be the normal type rotary switch which will reduce the cost a little. As supplied, these switches have a bakelite brace at the rear to give support. We undid the nuts and removed this piece (carefully as the switch may spring apart) and then fitted it to the copper side of the board, retained by the nuts. The pc board then acts as the the rear support for the switch. A glance at the photographs of the unit should make this clear. Rotate the switch and check that the contacts do not touch any of the solder joints on the PC board. The contacts can now be wired to the pc board using heavy tinned copper wire for the current switch as there is up to 10 Amps flowing.

Mount the meter onto the front panel along with the two toggle switches and the binding posts. Remove the nuts from the voltage switch, leaving one on the current switch and then mount the pc board onto the meter. Run the nut on the current switch up to the back of the front panel and then fit the second nut on the the front side.

The toggle switches can now be wired along with the power wiring, fitting the knobs ready for calibration.

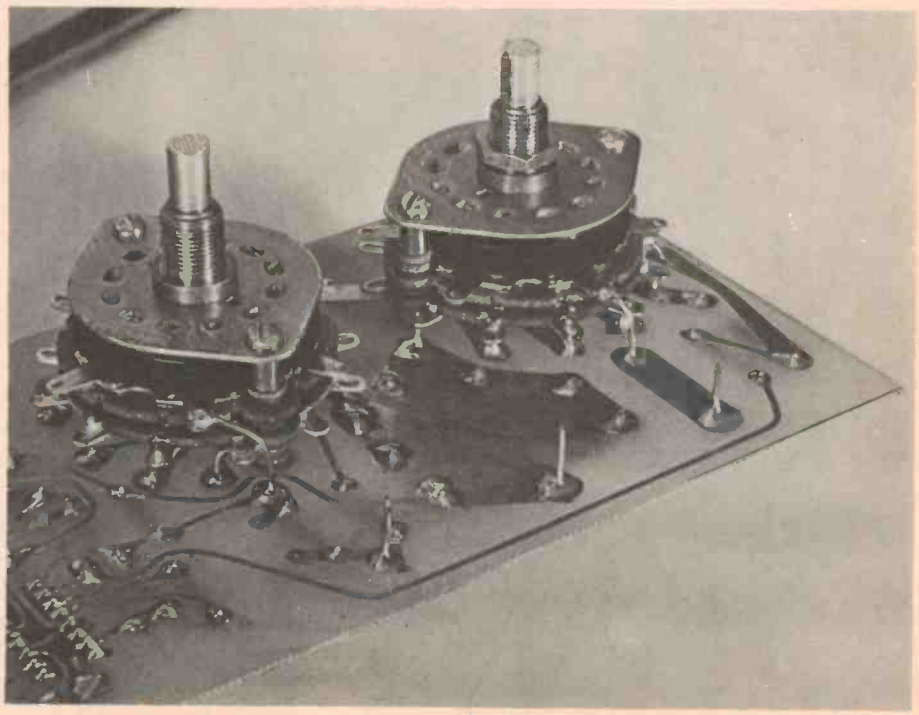
Calibration

Four adjustments are required, which are performed as follows:

Select the 1 V and 0.03 A ranges and switch on. If the meter reads in reverse, toggle SW3. Don't worry about the reading unless it is off scale. If it is, adjust RV1 to bring it back towards zero. Now apply a voltage of about 1 V dc to the voltage input and note the meter deflection. Adjust RV2* until there is no deflection when this voltage is applied. Now apply the voltage to the current input (it will take about 30 mA) and adjust RV3 until there is no deflection. Recheck the voltage input and readjust if necessary.

Now with no voltage applied adjust RV1 to give zero output. Apply exactly 1 V to both current and voltage inputs and adjust RV4 to make the meter read FSD.

This is all the calibration that should be necessary.



About the 1494

The 1494 is a variable transconductance multiplier with a bidirectional current source output. What this means is that it looks at the voltage on the two inputs and gives an output current proportional to the product of the two. Typical applications include: multiply, divide, square, square root, phase detection, frequency doubling, balanced modulation/demodulation and electronic gain control. An internal circuit diagram is given below for those interested.

Values and Limitations

1 For best temperature coefficient R1 (pin 1 to 0V) should be 16k(we used 15k as it is easier to obtain). This sets the value of all the current sources inside the IC (I1 = 8/R1)
2 The value of Rx (pin 11 to pin 12) should be≥3x peak input voltage(X) expressed in k ohms.
3 The value of Ry (pin 7 to pin 8) should be ≥6x peak input voltage(Y) expressed in k ohms
4 Choose the scaling factor required ie Vout = K.Vx.Vy
5 Load resistance (pin 14 to 0V) can be calculated by RL=(K.Rx.Ry.I1)/2
6 If RL is connected between pin 14 and 0V without an inverting amp. the frequency response is limited by the output capacitance of 10pF.
7 For best temperature coefficient the load between pins 2 and 4 should be 8.6k.

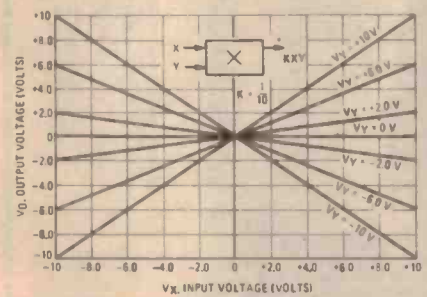


Fig. 6 Transfer charachteristics of the IC.

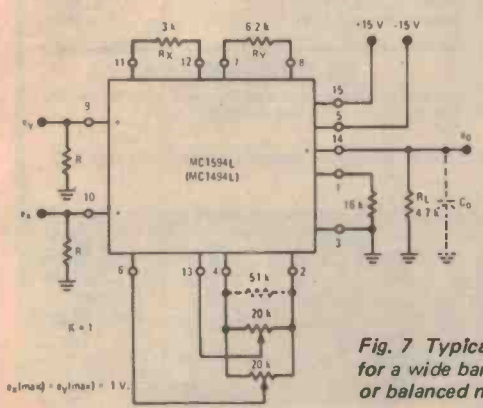


Fig. 7 Typical connections for a wide band multiplier or balanced modulator.

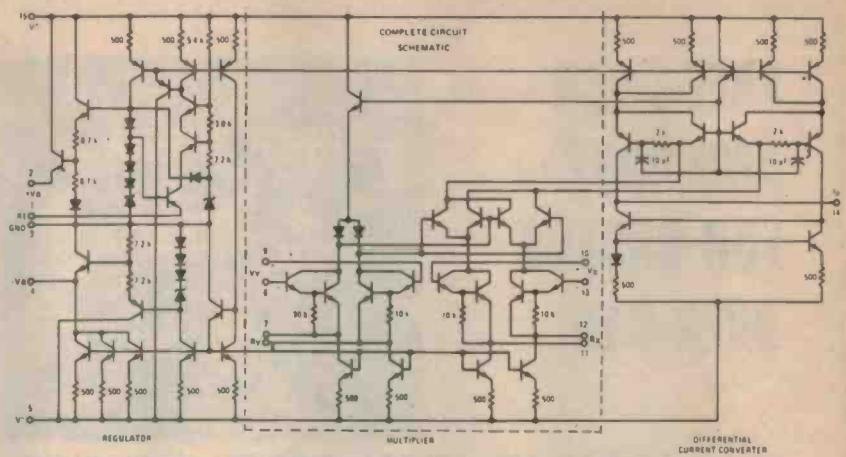


Fig. 8 The internal circuit diagram of the IC.

Fig. 9 Typical connection of a low frequency multiplier, For a squaring circuit simply parallel the two inputs. In this case pin 6 can be connected to 0V and P1 deleted.

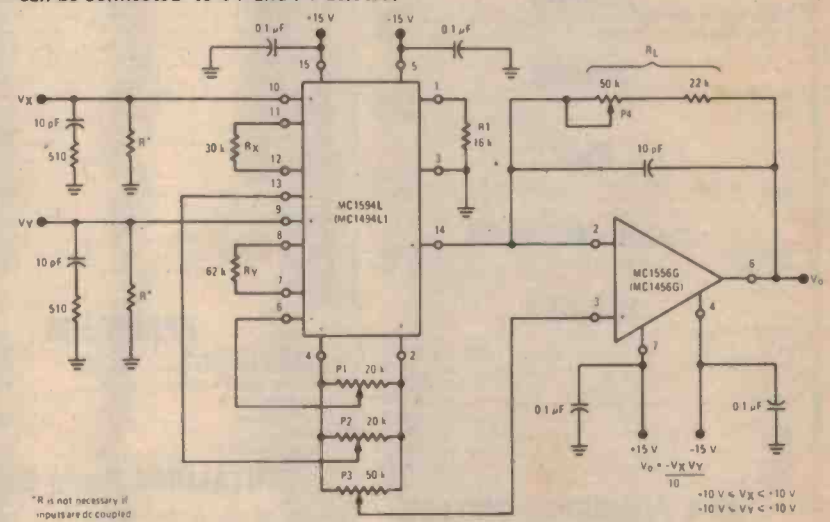
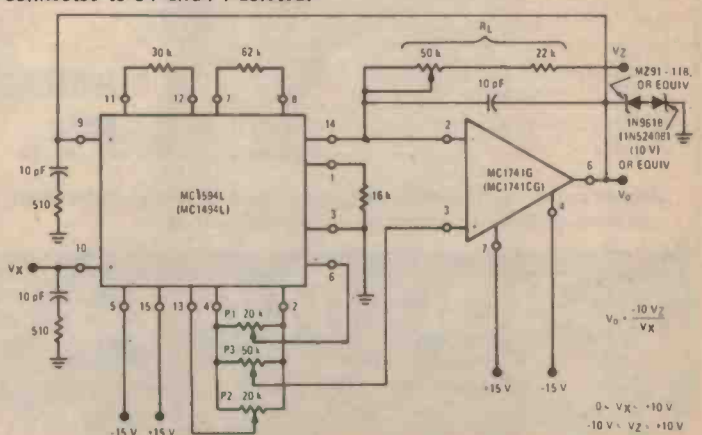


Fig. 10 Typical connection of a divide circuit. For the square root joins pin 9 and 10. Like the squaring circuits pin 6 can be connected to 0V and P1 deleted.



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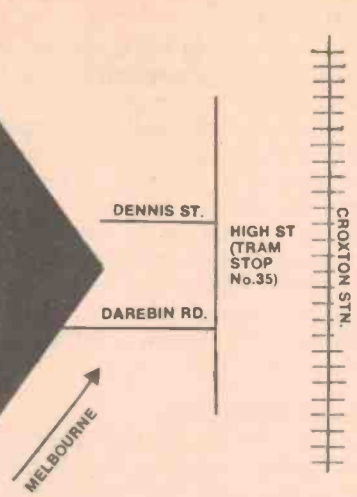

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47 uF	16v	PCB	0.10	0.09
47 uF	35v	PCB	0.12	0.11
100 uF	10v	PCB	0.11	0.10
100 uF	16v	PCB	0.12	0.11
220 uF	25v	PCB	0.15	0.14
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DIGITAL ELECTRONICS BY EXPERIMENT PART 9

Ian Sinclair adds it all up.

Arithmetic Units

SO FAR, THE WORK which we have carried out on the blob-board has covered gating, flip-flops, counter and display stages and the use of a register. Within the limitations of 8 IC's, we cannot, of course, hope to cover every possible principle of digital electronics, and the IC's which were selected for the board were designed to reflect the applications of digital electronics most often seen in published circuits.

The two important topics of arithmetic and memory have not been specifically mentioned, partly because small projects seldom need arithmetic or memory (and large projects can make use of the more flexible facilities of a microprocessor, particularly if this incorporates a memory) and partly because the building blocks of arithmetic units (gates) and some types of memory (flip-flop) have been covered.

A0	B0	S0	C0
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

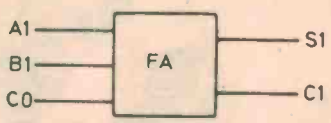
Fig. 1. Half-adder symbol and truth table.

Nevertheless, in this last part we shall look at some of the circuitry we have not covered previously, and also at some systems which can be tried out in the board. In addition, it is useful to note that the board can now act as a very useful intermediate unit for experimental work on more advanced systems, since it can provide up to six clock oscillators, four flip-flops, four NAND gates, one register, and a complete counter circuit and display for one set of BCD digits.

Adding

Binary addition can be *serial* or *parallel*, of which parallel addition is more common. The *half adder* has the truth table in fig. 1 and is used for the least significant digits of two numbers. Its output will be the sum (the digit which will appear in the final figure) and the carry which will be added to the next significant figure. The *full adder* circuit is used for all the next stages of the adder unit and has three inputs and two outputs; its truth table is shown in fig. 2. The inputs to the full adder are the two digits A_1, B_1, and the carry C_o from the previous half-adder stage. The outputs once again are the sum and another carry C_1 which is taken to the next stage. The total number of adding stages which will be needed must equal at least the total number of binary digits in the sum of the numbers.

Half-adders and full adders can be made up using gates (fig. 3) but once the principles have been checked it is easier to use IC's made for the job. The 7482 is a two bit full adder, whose internal circuitry, with truth tables, is shown in fig. 4. From the diagram, we can see that the inputs are C_o from the previous half-adder (which would be either an integrated full adder with no carry input, or made up from gates) and the second significant digits A_1 and B_1. The sum of this stage is obtained at the terminal marked S1, and the carry is internally connected into the second stage of the adder, whose inputs are B_2 and A_2 with outputs sum S_2 and carry C_2. The next step up is the 7483, which is a four-bit adder and any requirement greater than this is dealt with by arithmetic units of much greater complexity.



A1	B1	C0	S1	C1
0	0	0	0	0
1	0	0	1	0
0	1	0	1	0
1	1	0	0	1
0	0	1	1	0
1	0	1	0	1
0	1	1	0	1
1	1	1	1	1

Fig. 2. Full adder symbol and truth table.

In general, if more than a simple addition is needed, it is more economic to use LSI arithmetic units.

Memories

Memory units which are used in digital work come in several varieties. One class of memory is the volatile memory, based on flip-flops, which is cleared wherever power is switched off; this type could be used in pocket calculators. Non-volatile memories are the types using pre-set registers (such as read-only memories or ROMs) or which use magnetic tapes or cores or other types of storage which are not erased when power is switched off. A simple type of volatile memory is a SISO shift register with its output connected back to its input so that the information is read back in after one complete set of clock pulses; this type of memory can only deliver its contents in the order in which they are stored. If the register has parallel outputs with gates, however, it becomes possible to find which digit (0 to 1) is stored in each flip-flop so that, in the language of computing, random access is possible. This is simple random access memory (RAM).

At this point it is worth pointing out that most memories in general use permit random access. The type of memories which we refer to as RAM are random access memories which can be written as well as read when suitable inputs are applied. They should properly be called random access read/write memories. Read only memories are usually also random access, but the information which is stored has been put there either by the manufacturer (in the design stage) or by the user (as with PROM) when the memory is first used.

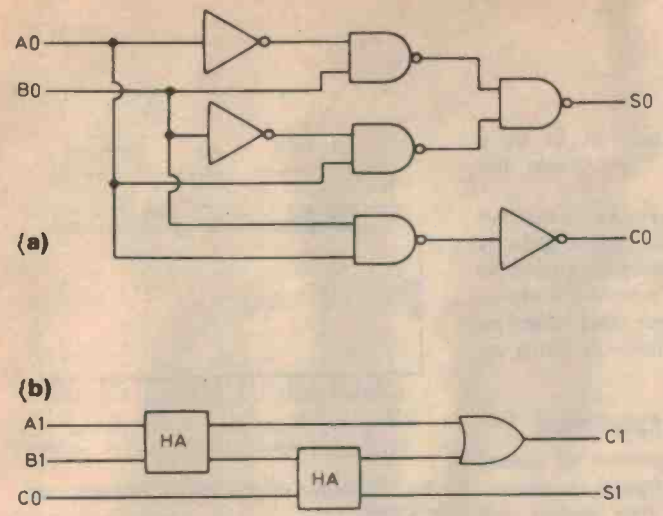
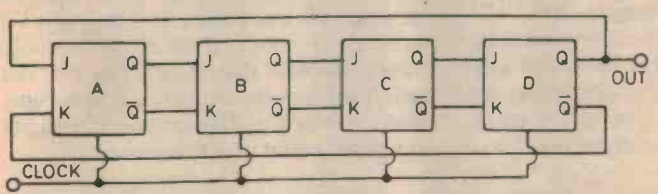


Fig. 3. Above: Adders (a) Half-adder circuit, using NAND-gates and inverters. (b) Full adder, using half adders and OR-gate.

Fig. 4. Right: (a) Schematic of 7482 two-bit full adder. Note again the advantages of medium scale integration. (b) Truth table.

Fig. 5. Below: SISO shift register connected as a memory — the information must be read out in serial form.



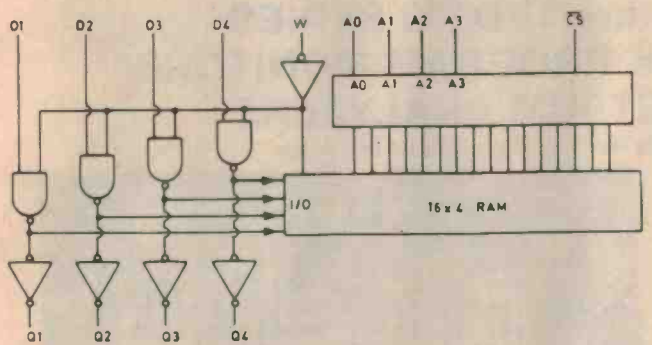
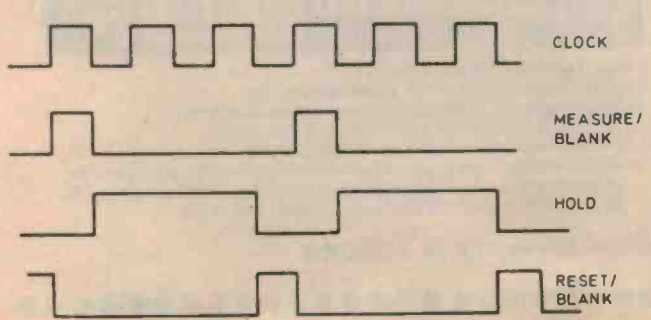
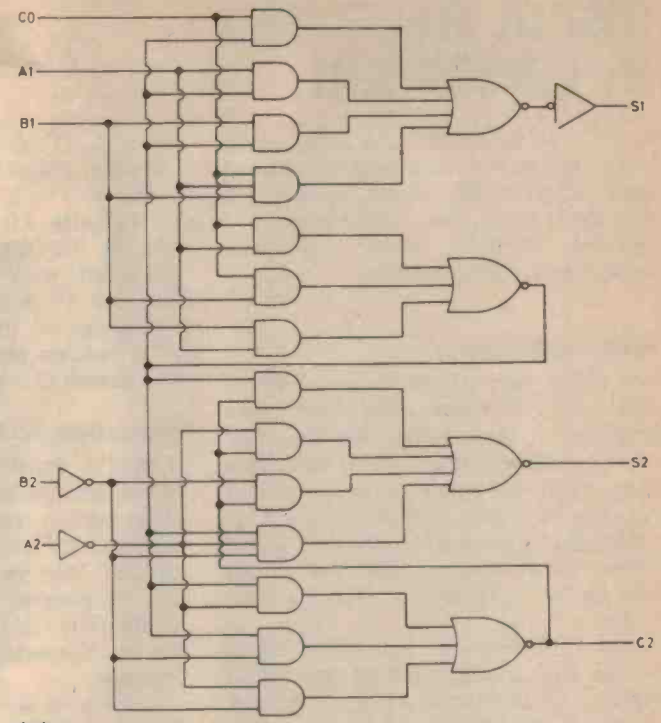


Fig. 6. Above. 7489 RAM schematic, showing addressing system for 16 4-bit words.





(b) TRUTH TABLE

INPUTS				OUTPUTS					
				C0 = 0			C0 = 1		
A1	B1	A2	B2	S1	S2	C2	S1	S2	C2
0	0	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1	0
1	1	0	0	0	1	0	1	1	0
0	0	1	0	0	1	0	1	1	0
1	0	1	0	0	1	0	1	1	0
0	1	1	0	1	1	0	0	0	1
1	1	1	0	0	0	1	1	0	1
0	0	0	1	0	1	0	1	1	0
1	0	0	1	1	1	0	0	0	1
0	1	0	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	0	1
0	0	1	1	0	0	1	1	0	1
1	0	1	1	1	0	1	0	1	1
0	1	1	1	1	0	1	0	1	1
1	1	1	1	0	1	1	1	1	1

Fig. 7. Below left: Pulses in a frequency meter. During the measure/blank cycle, the input frequency being measured is gated to the counter, but the display is blanked out. During the hold cycle, the display is on, showing the count, but the input frequency is gated out, so that the reading is steady. On the reset/blank cycle, the counter is reset and the display is blanked. If the repetition rate is more than 50 Hz or so, there is no flicker.

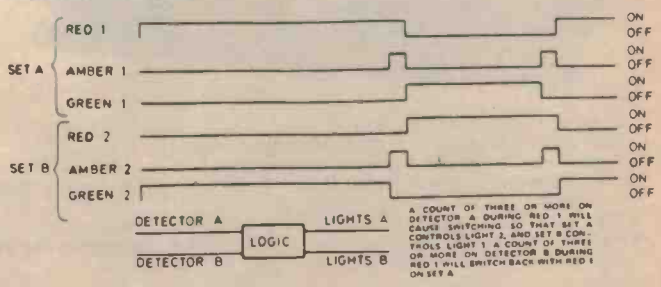


Fig. 9. Above: Priority traffic lights problem. This scheme gives priority (long term period) to the longer line of traffic, as measured by the pulses from the detector pads.

DIGITAL ELECTRONICS BY EXPERIMENT

In the older types of PROM, using fusible links, the memory cannot be altered once programmed, except by fusing a few more links. The more modern UV erasable PROM's permit complete erasure and re-programming.

RAM and Address

For either type of memory, the inputs will consist of address lines which locate positions in the memory. We can think of these address lines as grid lines on a map, with each pair of crossing lines locating a point. When a point is addressed by voltages on the lines which 'cross' at that point, then the output will be the digit, 0 or 1, stored at that point.

As an example of addressing, fig. 6 shows the arrangement of the 7489 RAM, a 64 bit memory which uses four rows of 16 columns of storage. The rows are addressed by the inputs D_1, D_2, D_3, D_4, so that a four bit word can be read into each of sixteen columns. The columns are addressed by another four-bit word which is decoded (1011 = column 11; 0110 = column 6) by a decoder stage which then drives the column.

To write, a four-bit word is placed on the D inputs, and the write gate is activated, with the appropriate column selected by A_0–A_3. To read, no signal is present on the D lines, and selection of a column places a four-bit word on the output Q1–Q4.

Suggestions for Future Board Work

Figure 7 shows the sequence of pulses which are needed by a frequency meter. The system here is that pulses are counted for one unit, count is held on display, then cleared so that the system can be cleared for another (updating) count. The ICs on the board enable you to try this sytem out for one digit of counter.

Figure 8 shows the pinout of the 74141 BCD-decimal decoder. This IC, not used on our board, can be connected to the BCD output of the 7490 and will give outputs on ten pins, according to the state of the count. The active state is represented by a *zero* output on a pin,

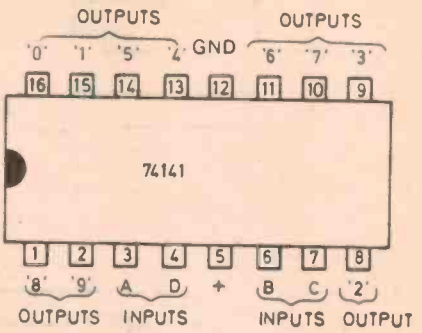


Fig. 8. Pinout of the 74141 BCD-decimal decoder.

so that a zero output on the '7' pin (pin 10) represents a count of 7, and so on. Using this, could you design a ten-note jingle player?

Finally, fig. 9 shows the operation of priority traffic lights. These lights operate with a longer red phase on one set than on the other, but this can be reversed if more than three vehicles cross a detector strip during the long red period on one set of lights. This scheme needs a clock pulse, counters, register and gates, could you make one?

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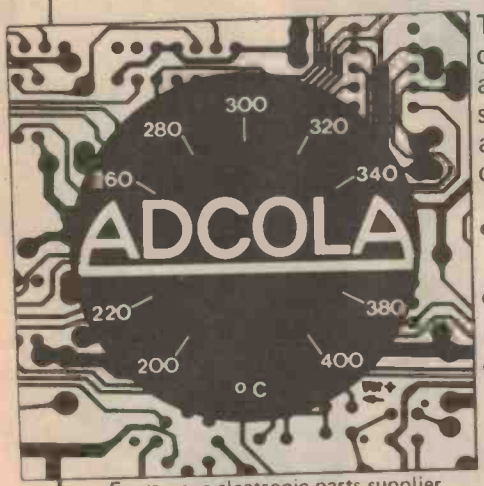

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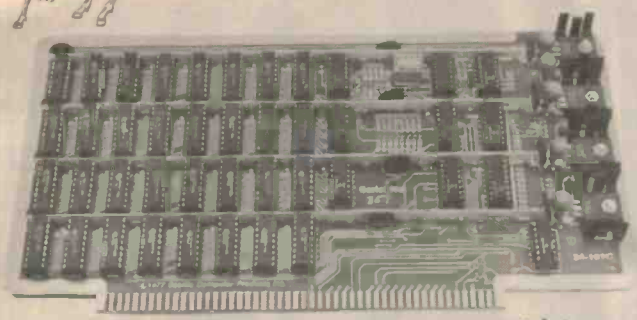

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COMPUTER GLOSSARY

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A computer is a machine for performing complex processes on information without manual intervention. Analogue computers perform this function by directly measuring continuous physical quantities such as electrical voltages. The best-known analogue computer is a slide rule. Digital computers represent numerical quantities by discrete electrical states which can be manipulated logically and hence arithmetically. Digital computers are sometimes referred to as electronic data processing machines, EDP, or processors. In order to distinguish the actual physical equipment from the programs which extend its usefulness, the former is called hardware.

The central processing unit (CPU) or mainframe is the portion of the computer which performs the calculations and decisions; the memory or storage is the part in which the data and programs are stored. The core memory is the main memory of many large machines; it is normally the only memory directly accessible to the CPU. Its name derives from its composition: small ferrite rings called cores. The computer may have additional memory devices; information is transferred between these and the core memory. The most usual such memories are magnetic drums (spinning cylinders with a magnetizable recording surface) and magnetic discs (flat spinning discs with magnetizable surfaces).

The capability of memory devices is measured in capacity and speed of access. The storage capacity of a memory is measured in words (also called cells or registers) which are usually of fixed length, consisting of 12 to 48 bits. This number is called the machine's word length. A bit (binary digit) is the minimum unit of information storage and has only two possible values. Capacity can also be measured in bytes, units of eight bits, each capable of representing one alphabetic or numeric symbol.

Access speed of a memory is the time it takes for the processor to obtain a word from memory. Core memory is called random access when any word can be obtained at any time without regard to its serial order. Drum, tape, and disc memories are serial access, because the words pass one at a time as they move past the station where they may be accessed. Speed is usually spoken of in terms of milliseconds (msec) (thousandths of a second), microseconds (μsec) (millionths of a second), or nanoseconds (nsec) (billionths of a second). One nanosecond is the time required for light to travel almost 300 mm.

The central processor and the memory constitute the computer per se; to get data and programs into the machine and the results out are the role of the input/output equipment or I/O.

Input devices convert information to a form in which it can be stored in the computer's memory. The commonest form of input is the punched card or Hollerith card (after its inventor). Input devices which accept cards are called card readers and the function they perform is commonly called reading, as is that of all input devices. Cards have 80 columns with 12 possible punch positions; normally, each column is used to represent one character. A set of cards is called a deck. Another form of input is punched paper tape — continuous tape approximately 25 mm wide, with holes punched across its width to represent characters or numeric quantities. Magnetic ink character readers have come to be used for input, particularly in banking; they can interpret characters printed with a special ink. More recently, optical scanners have appeared, which can read clearly printed or typed material of given type fonts.

Output devices usually include a **card punch** (which converts the characters stored in memory to punched holes in a card), a **tape punch** (which performs the same function for punched paper tape), and a **line printer** (which prints numerals, letters, and other characters of conventional design on continuous rolls of paper). When it passes information to these devices, the computer is writing. Recent additions to the output family include the **display device** which exhibits readable characters or graphic information on the face of a **cathode ray tube** or CRT. These images must be read at once, of course, since they are not permanent.

Information which can be taken away in permanent form (such as the output of a line printer) is called **hard copy**. A **plotter** is an output device which, under computer control, can draw continuous lines or curves on paper, thus producing graphs, maps, etc., in hard copy. **Magnetic tape** is widely used both as a form of memory and I/O. It can be stored conveniently away from the machine and can be read or written by the computer if it is put on a tape drive attached to the computer. It is the fastest type of I/O and the slowest type of memory except when used for serial reading.

I/O devices connected directly to the computer memory and under control of the CPU are spoken of as being **on-line**. They are placed **off-line** when they are used to perform independent functions. For example, it is common to exchange information between punched cards and magnetic tape off-line. Some devices are always off-line. They are **peripheral equipment** and are generally called collectively **electromechanical accounting machines** or EAM. These are frequently used independently of the computer and in fact antedate computers by many years. The most common are the **keypunch**, used to punch cards, the **reproducer**, which makes copies of decks of cards, and the **sorter**, which places cards in different bins as a function of which holes are punched. In some recent systems, another on-line I/O device has been added, the **console** or **terminal**. These are intended for the user to interact directly with the machine, and usually consist of a typewriterlike keyboard, and either a typewriterlike printing mechanism or another display device for output.

Information is stored in the computer's memory in the form of the presence or absence of a magnetic field. A collection of such 'yes or no' physical states is usually thought of as a **binary number** (a number whose only possible digits are 0 and 1). Depending on context, such numbers can have many meanings; in a sense, the numbers are **coded**. They can be interpreted as numeric quantities, **characters** (letters, digits, punctuation marks) or **instructions** or **commands** which will direct the computer to perform its basic functions (add, compare, read, etc.).

A set of instructions to perform a specified function or solve a complete problem is called a **program**. The computer performs such instructions sequentially. However as the computer can modify the data in its memory, it can also modify its program. This capability to modify its own directions is a case of the engineering principle called **feedback**, the modification of future performance on the basis of past performance. It is because of this distinctive feature that modern digital computers are sometimes called **stored program computers**. Parts of programs are sometimes called **routines** or **subroutines**. Subroutines which perform generally useful functions are sometimes combined into a subroutine **library**, usually on magnetic tape. Copies of relevant subroutines will be added to a program automatically and hence need not be developed by hand. Single instructions in a program are sometimes called **steps**. When a sequence of program steps is operated repeatedly, the process is called a **loop**. Certain instructions compare two quantities and select either of two program paths on the basis of the result: these are called **branching instructions**.

The data on which a program acts are usually structured into **tables**. Individual values which control the operation of programs or subroutines are **parameters**. An organized collection of information in the computer or on tape is called a **file**, like the organized set of papers in a file cabinet. A **data base** or **data bank** is a large and complex set of tables which describe some aspect of the world outside the computer (a library catalogue, a student record file, a budget). 110

A **programmer** is a person who converts a problem into a set of directions to a computer to solve it. The function is sometimes broken down into several parts, particularly if the problem is very complex. The task of stating the problem in a clear and unambiguous form is performed by an **analyst** or **system analyst**. The technique of specifying methods of solution for mathematical problems is **mathematical analysis** or **numerical analysis**. A specific procedure for solving a problem is an **algorithm**. The process of writing the detailed step-by-step instructions for the computer to follow is **coding** done by a **coder**. 120

After a program is written, it is tested by letting it perform its function in the computer on test data to which the proper solution is known. This process is **code checking** or **debugging**. The coder will also produce some descriptions of this program and how it operates so that others may understand how it works, in case at a future date it is necessary to modify it. This **documentation** may include a **flowchart**: a graphic description or diagram of the various paths and branches followed by the program. 130

The repertory of instructions available to the programmer for a specific computer is that computers' **machine language**. Other **higher-order languages** have been developed to help the programmer by simplifying the tedious aspects of writing machine language; these are called **procedure oriented languages** or **problem oriented languages** or POL. Commonly used POLs are **Fortran, Algol,** and **Cobol**; the first two were devised mainly for scientific computation and the latter for business data processing. A new type is represented by **list processing languages**; because of greater flexibilities in dealing with data, these languages are particularly useful in non-numeric computations such as are frequently involved in research. Their particular virtues are most apparent in **heuristic processes**: methods where the precise method of solution is not spelled out but is discovered as the program progresses and as it evaluates its progress toward an acceptable solution. (Because this use of the word 'language' is somewhat misleading, human languages such as English are distinguished as **natural languages**). 140

Programs which convert higher-order languages into machines language are called **compilers**; programs which perform similar functions but at a much simpler level are **assemblers**. The term **translator** is used sometimes for compiler, but it is used less frequently because of the possible confusion with programs which perform translation between natural languages. **Interpreters** do not compile the entire program but translate and perform one statement of the program at a time; effectively, they perform both functions – compiling and running a program. 150

Software is the term used to refer to the totality of programs and procedures available on a computer; sometimes it is used more specifically to mean those programs of general usefulness (such as compilers) which are available to all users. These are sometimes called **utility programs**. All machines today have **operating systems** to aid the user (and the operator) in sequencing jobs, accounting, and calling up other utility programs. Operating systems or programs are also called **control programs, supervisors,** or **executives**. 160

Applications are the problems to which a computer is applied; the names for most common applications are self-explanatory, but some are not. A

simulation is the representation of a real or hypothetical system by a computer process; its function is to indicate system performance under various conditions by program performance. **Information retrieval** is the name applied to processes which recover or locate information in a collection of documents. An **information management system** helps a user maintain a data base, modify it, and get reports from it. It is usually defined as a **general purpose device**; this means that it can accommodate a large range of applications. A **management information system** supplies to the management of an organization the data that it requires to make decisions and to exercise control. A **report generator** is a program which allows the user to specify in some simple way the content and format of reports which the computer is to produce.

To **run** a program is to cause it to be performed on the computer. Running a program to solve a problem or produce real results (as opposed to debugging) is called a **production run**. Installations in which the user runs his own job are called **open shops**. Installations which have a **computer operator** who runs the program for the user are **closed shops**. Computers are usually operated in **batch processing mode**; the operator assembles a batch of programs waiting to be run and puts them serially into the computer; output from all the programs is returned in one batch. **Turnaround time** is the time between the user's delivering his job to the centre and his receipt of his output. **Time sharing** is a method of operation by means of which several jobs are interleaved, giving the appearance of simultaneous operation. In many timeshared systems, users have individual terminals which are on-line. Such terminals may be located far from the computer; this is **remote access**. This allows users to interact with the computer on a time scale appropriate for human beings — on the order of a few seconds between responses. This capability is called **operating in real time**. Using the computer for frequent interaction with the user in this way is called an **interactive or conversational** mode of computing.

Like all electronic devices, computers sometimes break down. The prevention and correction of such situations is **maintenance**. **Preventive maintenance** finds failing components before they actually break down. **Reliability** is the measure of the frequency of failure of the computer. During **downtime** the machine is being maintained or repaired; during **uptime** it is available for normal productive use.

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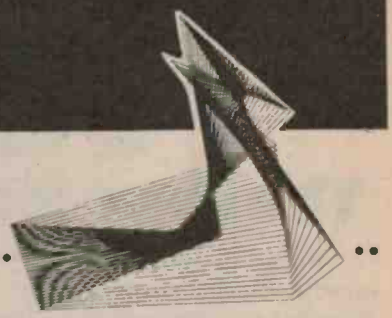

NEWS

Rockwell AIM65

New from *Ampec Engineering*, of *1 Wellington St., Rozelle 2039*, is the Rockwell AIM65, a single-board computer of considerable interest to the hobbyist. Based on the 6502 microprocessor, the AIM65 is supplied fully assembled and tested and features a fully alphanumeric keyboard and twenty character alphanumeric display as well as a twenty column dot matrix printer. The on-board cassette interface offers both KIM-compatible and binary formats and the edge connectors are KIM-compatible.

The basic AIM65 is supplied with a Debug/monitor program in ROM, but additional ROM can be plugged in to give a 4K assembler and text editor or 8K BASIC. The on-board RAM is available in either 1K or 4K configurations, and the board has a variety of interface devices on it for all manner of applications. The AIM65 is expected to sell for around $450 in Australia.

Centronics Microprinter

Sigma Data Corporation announces the release of the Centronics Microprinter. This non impact desk-top printer is available in two models, the PI with parallel interface and the SI with serial (RS 232C) interface, to satisfy a wide range of printer applications.

The Microprinters employ non-impact discharge technology that requires only four moving parts to produce variable pitch 5 x 8 dot matrix characters at a rate of 150 lines per minute. The paper requires no toner or ribbons. Instead, it carries a conductive aluminized coating which is vaporised by a low voltage discharge from the print head to produce highly readable characters. Print width is four inches.

Features of the Microprinters include 96 characters upper and lower case, 5/10/20 characters per inch – elongated characters & underlining; the SI serial interface model features 7 bit ASCII, serial RS 232C interface with parity selection, switchable baud rate of 40 to 9600 and a 192 character FIFO buffer. The PI Parrallel Interface model features 7 bit ASC11, TTL compatible input/output signals and is compatible with Centronics and other Printer Product lines.

The Microprinter is a low cost printer which Sigma Data believes is ideally suited to local and remote printer applications such as personal computers, micro processor development systems, diagnostic systems, CRT hard copy, demand message printing, dispatch systems etc.

The Microprinter is priced at about $580 for a single unit and is available from the General Products Division of Sigma Data Corporation. Discounts apply to reasonable quantities.

For further information, please contact Sigma Data at 157 Walker Street, North Sydney 2060.

See page 105 for the full story of the HP System 35 (above) as well as Synertek's SYM-1.

COMPUTER CLUB DIRECTORY

Sydney: Microcomputer Enthusiasts Group, P.O. Box 3, St. Leonards, 2065. Meets at WIA Hall, 14 Atchison St., St. Leonards on the 1st and 3rd Mondays of the month.

Melbourne: Microcomputer Club of Melbourne, meets at the Model Railways Hall, opposite Glen Iris Railway Station on the third Saturday of the month at 2 p.m.

Canberra: MICSIG, P.O. Box 118, Mawson, ACT 2607 or contact Peter Harris on 72 2237. Meets at Building 9 of CCAE, 2nd Tuesday of month at 7.30 p.m.

Newcastle: contact Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, NSW 2308. (049) 68–5256 (work), (049) 52–3267 (home).

Brisbane: contact Norman Wilson, VK4NP, P.O. Box 81, Albion, Queensland, 4010. Tel. 356 6176.

New England: New England Computer Club, c/- Union, University of New England, Armidale, NSW 2351. (New club; not restricted to students)

Auckland: Auckland Computer Club, P.O. Box 27206, Auckland, N.Z.

Computer clubs are an excellent way of meeting people with the same interests and discovering the kind of problems they've encountered in getting systems 'on the air'. In addition, some clubs run hardware and software courses, and may own some equipment for the use of members. Try one – you'll like it!

If your club is not listed here, please drop us a line, and we'll list you. The same applies if you are interested in starting a club in your area. Also, if established clubs know their programme of forthcoming events, we can publicise them.

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The New Microcomputer For Only $3950

Vector Graphic wants you to meet the most powerful, most complete microcomputer on the market today . . . VECTOR MZ.

Two built-in floppies — four times the disk capacity of other systems — STANDARD.

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- Extended disk BASIC

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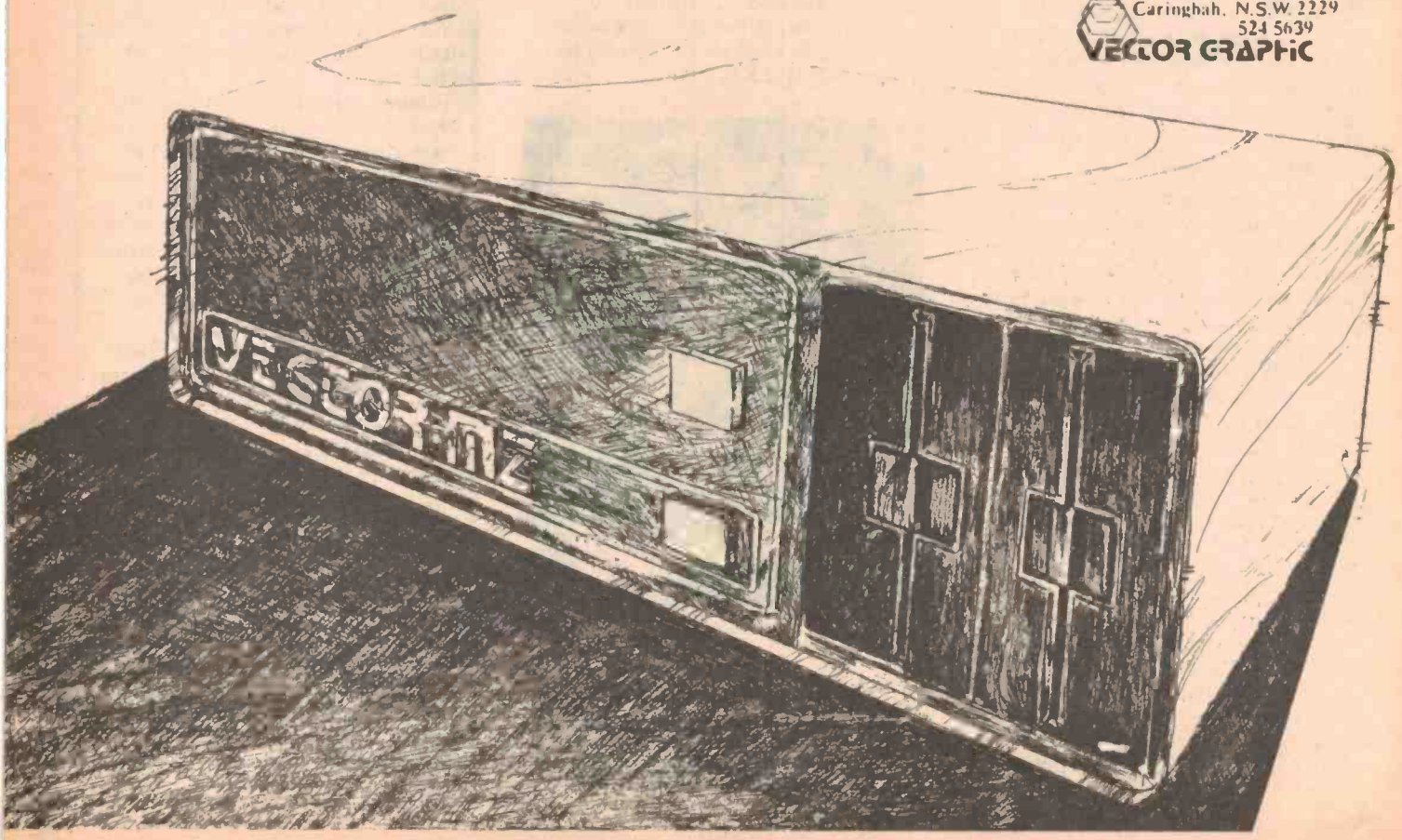
524 5639

VECTOR GRAPHIC



ACS-8

A report on the Eighth Australian Computer Conference, by ETI Correspondent, John Whitlock, who also edits MEGS Micronews, the monthly journal of the Microcomputer Enthusiasts' Group, Sydney.

PEOPLE'S DAY was the public highlight of the Eighth Australian Computer Conference (ACS8) held in Canberra, and an intensive local advertising campaign, including TV, encouraged people to join the conference to discover more about 'The Computer's Role in Society'. Conference papers were especially chosen for presentation on People's Day and the public was also encouraged to visit the equipment exhibition at the Lakeside International Hotel and the Computer Faire across Lake Burley Griffin at the Albert Hall.

With three simultaneous sessions and two exhibitions running 9 to 5.30 for five days at the end of August, the conference covered the varied interests of 1300 delegates. 146 papers were presented and have been published in five volumes of Proceedings consisting of over 2000 pages. Another innovation was the distribution of conference papers on microfiche to all delegates, although printed Proceedings were also available. (More than eight tons of Proceedings were delivered by the printers).

The keynote speakers were Lord Avebury of the UK and Professor T. Kitagawa of Japan.

Junior ACS8

In conjunction with the conference a Junior ACS8 was held for year 11 and 12 students from all parts of Australia. Travel for these students was sponsored by various companies. This conference was future oriented and was conducted by Dr. Chris Evans of the National Physical Laboratories in the UK.

Microprocessors and text processing were frequently mentioned and discussed. Microprocessors are having a big impact on computer hardware and many mainframe manufacturers are developing (or have developed) single board computers based on microprocessors, for reasons of speed, reliability, servicability and cost reduction.

Text processing was considered to be the next main use of computers, exciting much interest from delegates whose traditional interests have been in commercial data processing. In general the commercial applications papers concentrated on improved programming techniques and outlined methods of maintaining software. Improvements in service and productivity, without staff cutbacks, were emphasised. Some papers showed that after computerization to relieve a bottleneck the resulting spare capacity within a firm enabled an expansion of staff in a different area. This leads to more employment of less-skilled labour, and increased service to the public, including expansion of branch offices, as well as a concommitant decrease in overhead costs.

Medical Applications

Medical and biological applications for computers were presented, from commercial applications in doctors' offices to diagnostic aids to research applications. Several aids for the handicapped were discussed. Professor Graeme Clark of the University of Melbourne outlined a hearing system for the totally deaf. A 25 mm square golden box of electronics is implanted in the skull and connected into the cochlea of the ear by 15 wires, each finer than a human hair, to stimulate the ear's nerve ends. This unit requires a separate unconnected silver box outside the skin to process sounds by computer and generate the appropriate stimuli for the 15 nerve ends. The brain reprocesses these signals normally enabling the deaf to hear again, albeit imperfectly. For ethical reasons, it was left unclear as to whether this operation had been performed yet or not, implying that it was either imminent or done.

Computer recognition of speech for control purposes is now tending to become routine, although vocabularies are limited and training of the computer is essential.

Computer speech generation is also becoming routine. Don Keeping of the University of Manitoba, Canada, discussed his own speech synthesizer. His topic was primarily the training of blind programmers. Being blind himself, he found that he needed an alternative form of output from the computer rather than printout.

Starting with a variety of synthesizers including the Computalker, he developed advanced software and has since moved on to an S11 Voice Synthesizer from the Votrax Division of Federal Screw Works in the US. This unit, which uses a PDP-11, has a lookup dictionary table of 1100 words built in. It understands punctuation and endings, but cannot cope with the variation of pronunciation with meaning for some words which leads to occasional ambiguities. Any word not understood by the synthesizer is spelt out. The University of Manitoba is developing a $2000 microprocessor-based unit.

Such a device may be used for 'reading' books to the blind. Negotiations are underway to obtain typesetting tapes from publishers, enabling most books to be simultaneously released in printed, spoken or Braille form.

Braille books are being produced by the Computer Braille Service of the University of Manitoba. These are mainly texts for use in schools and universities in Canada. The books have to be re-edited, and pictures and diagrams described. They are then typed into a computer simultaneously by two people and the

Seen at Computerland's Birthday Party — lots of hackers wanted to try out CP/M.

computer compares the two copies. Any discrepancies are indicated by the computer and can be readily corrected. This has been found to be quicker and more accurate than proofreading. After text editing, the data is translated to Braille format by the DOTSYS program and listed in Braille at 120 lines per minute on a Triformations LED120 terminal.

The same data can also be used to draw large print text on a plotter for partially sighted readers.

Drafting Systems

Architectural and engineering applications were discussed in another group of papers, and an Australian developed drafting aid was described.

Essentially an aid to the experienced draughtsman, the computerised system allows the draughtsman to 'draw' on a TV-like graphics screen and key in specific data, such as the lengths of lines. Special symbols, component shapes, arrowheads, and subassembly drawings can be simply inserted and suitably scaled.

Similarly with essential printing on a drawing; this can be centred on a location and typed in. When all is complete the finished drawing can be run off on a plotter producing A0 sized drawings with an accuracy of 0.05 mm.

French curves are automatically generated. With component assemblies, the components can be separately generated in an 'exploded' view and the computer can 'fit' them. Any incompatibilities will be immediately obvious and the parts can be redesigned where necessary.

For complex drawings which normally cost on the order of $300 each the expected cost is around 60 cents. Instead of two manweeks, the whole drafting job can be done in half an hour. Updating or reusing drawings or parts is handled by the software. The drawings are filed on floppy disks.

Expected cost is around $15 000 for the hardware with a price not yet fixed for the software. Software for many systems seems to be sold at about the same price as hardware.

Environmental applications discussed included aircraft noise monitoring techniques to develop flight operational procedures to reduce noise, and the use of computers in the reduction of vibration induced noise. Another particular use mentioned was in the simulation of the chemistry of photochemical smog.

Social Implications

On the social implications much debate followed sessions on privacy, security, and legal implications and attitudes. Computer crime was discussed and the possible impact of home computers in this area was foreshadowed. Encrypters on dialup systems were advocated, and considered essential within six months.

The possible impact of further computerization was compared with the industrial revolution and the sociological changes then wrought. A thought which might be more appropriate – perhaps the 'computer/automation' revolution may be more likened to the social effects of the settling of nomadic hunting tribes to become farming communities and towns. This change put most hunters out of work but the alteration of living patterns has given rise to a much more knowledgeable and cultural world. Will the computer revolution have the same sort of effects?

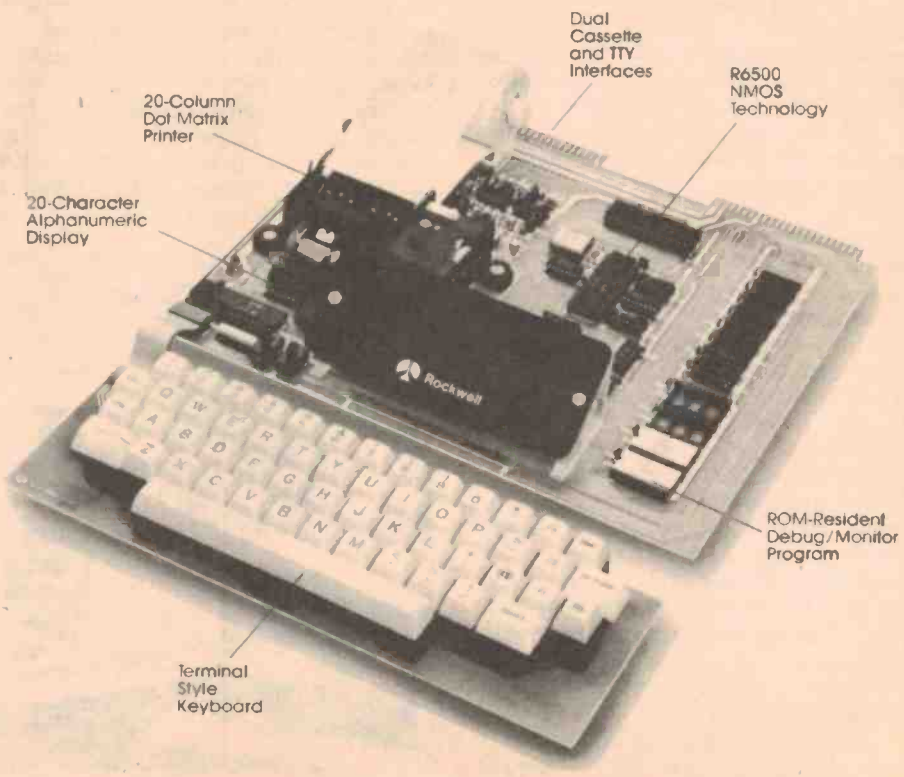
Forecast for the 1980's is a rise in the use of machine intelligence with the likelihood of a computer becoming a chess Grand Master. Access to information libraries or banks and a reduction in many of the mundane complexities of life was the general inference. The western/capitalist world is considered to be ten years ahead of the eastern/socialist world in computing, with the gap growing rapidly. The impact of marketing strategies for the home computer is going to be enormous, enabling cheap machine intelligence to be produced by defraying development costs throughout the community, voluntarily, by selling 'junk' or creating a not-previously-existing demand.

In addition to the formal presentation of papers and the exhibitions, each day offered a short course on a particular topic, or a workshop session for the experienced. Evenings were started with public sessions on a range of topics including computer generated and/or synthesized music, databases, aids for the handicapped and others. Also offered in the evenings were a range of social events giving delegates ideal opportunities for informal discussion of their mutual interests.

In the microprocessor area a short course for relative beginners was given on Wednesday, and an interactive workshop on Tuesday. The short course was booked out two months ahead of the conference. It was organised by Dr. Brian Stone of the Canberra College of Advanced Education.

The workshop session was also heavily booked. Based upon four prepared papers, discussion progressed to other

The Rockwell AIM-65 is a 6502-based microcomputer aimed at the hobbyist market – further details in Printout News.



Seen at Computerland's Birthday Party — a Vector 1 being graphic.

problems and developmemnts experienced by the group.

Comments

Some of the more specific comments arising from the workshop discussions follow.

Timeshare cross-assemblers were criticised as being slow and the costs of these were considered to be very high but more cost-effective for low usage than the purchase of a self contained cross-assembler. The breakeven point was suggested at 500 or so microprocessor implementations (or different programs). Telecom officers considered the Telecom timeshared cross-assembler to be significantly better than other commercially available systems. Batch processing was considered useful for routine updates only.

Cross-simulators were considered desirable to check the implementation of software before committing to production.

Many attendees advocated the use of host compilers.

Although the 6800 microprocessor is the Telecom 'preferred' chip, where a case can be demonstrated for a different processor it will be used by Telecom.

Pascal is seen to be the next high level language for microprocessors. While BASIC is still popular, Pascal is a firm favourite, academically and with software oriented users. Next year should see Pascal compilers for most microprocessor families from the US.

New Hardware

The new 16 bit microprocessor from Intel (8086) was seen in chip form, freshly arrived from the US. It was considered to have been designed with Pascal in mind.

FORTRAN 77 and PL/M have their adherents, but the everpopular BASIC makes a new attack with National Semiconductor about to announce the 8036, an 8748 style of single chip processor containing a 1K Tiny BASIC interpreter.

Bit slice machines received a large share of attention as these devices can provide high speed emulation of any existing processor or chip. With their instruction set being defined in microcode and being alterable, their uses were demonstrated in such areas as disk controllers (50 Mbytes/s), CRT controllers, concentrators for 48 to 64 terminals, digital filters and other areas of discrete logic where high speed and small size is vital.

The Motorola 10800 is said to be the fastest with a 60 – 80 ns microinstruction cycle time. Some eight bit cards are available at around $500.

The Australian Scene Overall

In retrospect, ACS8 was a very useful and informative week. Many useful contacts were made by all. A lot of fascinating and advanced Australian products were seen or heard of.

The exhibitions featured Australian designed terminals, processors and specialised peripherals, side-by-side with overseas competition. The local products stand up very well, being very competitive in price and performance.

Australia already boasts many microprocessor/micrcomputer designers of international stature with five to seven years experience, who have produced quantity, quality products and competed successfully with overseasmanufacturers.

Australian software seems to have a lot of respect and this may be an area for Australian industry to exploit overseas. The economies of scale are vital. Many Australian products are being purchased overseas but the capital backing of the Australian companies does not seem to enable them to meet the demand, which then moves to a more readily available foreign product.

Fears are still being expressed for the Australian electronics industry if reliance is placed entirely on imported components and/or subassemblies. With the emphasis on microelectronics, Australia's defence position is becoming heavily allied with our overseas suppliers.

Contact was established between the computer industry, government and Parliament, and a briefing of ministers about computers was announced for November this year in Canberra.

HP System 35

A new desktop computer featuring the largest memory capacity for its class, plus assembly language programming capability and enhanced BASIC was introduced on Sept. 20th by Hewlett-Packard. The HP System 35 models A and B fill a growing need for a mid-range, large memory, scientific and engineering desktop computer to use in computation and data acquisition applications. The assembly language programming option provides performance improvements of two to 100 times (depending upon the application) over traditional desktop computer languages.

Both models feature expanded read/write memory capacity of up to 256K bytes, 'unified mass storage', a tape cartridge directory in read/write memory, and a 'bad memory' error detect message system.

"Application areas formerly served primarily by minicomputers will now be opened to assembly-language desktop computers," said John Bieske, Australasian sales manager of HP's desktop computer division. "High-speed data acquisition applications, facilitated by standard, plug-in interface cards, direct memory access and 15-level interrupt, will benefit from these significant performance improvements."

The interface cards include the Hewlett-Packard interface bus (HP-IB), 16-bit parallel, RS-232-C, and BCD. A realtime clock interface adds real-time reference and time-related control capabilities to System 35.

Assembly Language

The assembly language programming capability of the System 35 is of particular interest to experienced programmers. Both computation and I/O can be accelerated because assembly language allows the programmer to converse directly with the computer's CPU in its own internal language. The HP System 35 models are the first desktop computers to offer this capability.

Memory

Standard memory for the System 35 is 64K bytes of read/write and 16K bytes of read-only memory. The user (read/write) memory is expandable in increments of 64K to the full 256K bytes. At this maximum configuration a System 35 can manage a 30,000-element array of 12-digit floating-point numbers or solve 170 simultaneous equations with 170 unknowns.

With the new smaller HP ROM configuration, read-only memory can be expanded to a total of 128K bytes. ROMs available at introduction include inout/output – compatible with the System 45, and a plotter, and mass memory ROM. The last enables the HP System 35 to communicate with external tape memory and flexible disc memory.

Language

Standard for both models is HP Enhanced BASIC. In addition to handling programs written in ANSI BASIC, HP Enhanced BASIC makes available to users such Fortran-like capabilities as sub-programs, multi-character identifiers, large-scale array operations, line labels and flexible output formatting. Optional character sets include French, German, Spanish and Katakana.

System integration

As is characteristic of most desktop computers, many peripherals have been integrated into the System 35, including interactive keyboard, alphanumeric display (a 24-line CRT for model A, a single-line display for model B) and an internal tape cartridge drive with a capacity of 217K bytes per tape. An optional 16-character thermal strip printer is also available for users who require low-cost permanent copy for such applications as data logging or program debugging.

Software

The use of HP Enhanced BASIC on both the HP System 35 and HP System 45, greatly simplifies the exchange of data and programs between the two machines. Because of their common language, System 35 and 45 share an extensive library. Programs available for the System 35 at introduction include a utility pack (with plotter graphics), basic statistics and data manipulation, regression analysis, numerical analysis, non-linear regression and statistical plotter graphics. Price of the HP System 35 model is $10,791 plus sales tax if applicable. The model B is priced at $9,483 plus sales tax if applicable.

For further information please contact: Mr John Bieske, telephone: (03) 89-6351.

Synertek SYM-1

Despite an initial lack of enthusiasm from the hobbyist market, the MOS Technology 6502 microprocessor has now very definitely 'caught on', largely due to the success of such computers as the Commodore PET and the Apple II. However the first single-board 'evaluation kit' computer to use the 6502, the MOS Technology KIM-1, has always been popular with hobbyists, offering as it does considerable capability at a low price.

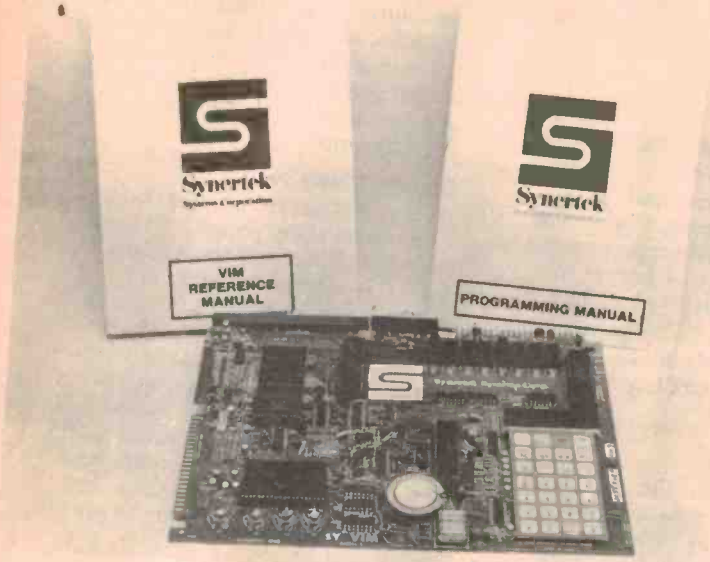
The 6502 has also proved popular with industrial users, and has now been second sourced by both Rockwell and Synertek. Both these companies, wishing to support the product with evaluation kits (and possibly capture a share of the lucrative hobbyist market) have announced a 6502-based boards, the AIM-65 and the SYM-1 respectively The SYM-1 is being supplied by Silicon Valley in Australia, and they kindly loaned us one so we could take a closer look.

The 6502

The 6502 is very similar architecturally to the Motorola 6800; in fact the engineers who designed the 6502 used to work for Motorola. The processor employs the same bus structure as the 6800 family, and a family of peripheral chips is available that is basically similar to the 6820, 6850, etc.

Internally, the CPU is organised in much the same way as the 6800, with a program counter, accumulator (no B accumulator), eight-bit stack pointer, two eight-bit index registers (X and Y), and status register.

The instruction set is similar to that



of the 6800, and 6800 programmers should have little or no difficulty in working with the 6502. The use of two index registers, even though they are only eight bit registers, simplifies a great many applications such as block moves or string I/O.

In benchmark tests, the 6502 turns out to be a very fast and efficient processor indeed – this is borne out by the Microsoft 6502 BASIC, which is the fastest executing micro-computer BASIC currently available.

SYM-1

The SYM-1 board itself measures 272 x 198 mm (excluding edge connectors) and carries the 6502 CPU, a 4 Kbyte ROM, 1 Kbyte of 2114 static RAM, a 6522 Versatile Interface Adapter (VIA), a 6532 RAM/I/O/Timer chip (RIOT), and an assortment of interfaces and buffers. These provide a cassette interface, TTY or CRT interface and general purpose parallel ports as well as the board's primary means of communication with the programmer: a six-digit LED display and 28-key keypad.

The SYM-1 has a very comprehensive monitor program indeed. SUPERMON is a 4 Kbyte program, which is primarily used for entering, debugging and running user programs, but which also provides a collection of useful subroutines. Although designed to operate through the on-board keyboard, SUPERMON can be controlled through the teletype interface.

The SYM-1 keyboard consists of 28 keys which are colour-coded to indicate 'shift' functions. The keyboard is a soft type with very little 'feel', but a small beeper is provided on the board to provide audible feedback.

SUPERMON provides all the usual functions of memory examine and change, data deposition and examination of CPU registers, but also provides some very powerful and useful commands such as block move, search memory for a specific byte, store a double byte and calculate two's complement and address displacements.

Many of SUPERMON's commands can accept up to three parameters, and function in different ways depending on how many parameters have been entered. This makes SUPERMON rather difficult to use at first, but extremely powerful once its intricacies have been mastered. The monitor also offers some facilities normally found on larger machines, such as eight user-definable functions.

As well as providing monitor and debug functions, SUPERMON also handles cassette and paper tape I/O. The SYM-1 is particularly versatile in this area, being able to handle both KIM format and high speed format cassette tapes. The high speed format transfers data at 185 bytes per second, considerably faster than KIM format, which is eight bytes per second.

Oscilloscope Output

The SYM-1 is equipped with a rather unusual feature – an oscilloscope output, which can be used to output alphanumeric characters to a 'scope. This is a neat combination of hardware and software to provide a sawtooth waveform which can be software controlled. A program listing is provided which can be used to output alpha-numerics, and there is considerable scope for modification of this program to generate graphics – this feature is ideal for games programs.

Documentation

The SYM-1 is provided with two manuals – a programming manual which is the same as the MOS Technology 6500 programming manual, and a SYM-1 Reference Manual which is specific to this board. The Programming Manual is very well organised for use by the machine code novice, and makes very few assumptions as to prior knowledge. It is probably even worth reading by users of other processors, as there is a lot of 'meaty' general information in it.

All the really juicy stuff is packed into the SYM-1 Reference Manual, however. This is an extraordinarily well written handbook which gives lots of information about both the hardware the software of the system, from instructions for initial set-up and testing to some useful software. Data sheets for the most important devices on the board are included, as well as a listing of the monitor program.

Amongst other information, the manual lists the monitor calls, entries and tables, and in an appendix lists the matching entry points and subroutines for the KIM monitor, providing some measure of software compatibility. With this information at the user's fingertips, the First Book of KIM, and similar software will be much more usable.

Put It All Together

And you have a very nice little single-board system indeed; the SYM-1 is expandable, in both the software and hardware senses, and is sufficiently powerful to titillate you into putting together a larger system. The same time, it is put together in such a way that you can do a lot with just the single board, and don't need to expand as soon as you would with less versatile boards. Further information on the SYM-1 is available from *Silicon Valley, 21 Chandos Street, Crows Nest, NSW 2065.*

DIODES/ZENERS

1N914	100v	10mA	.05
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.05
1N4733	5.1v	1 W Zener	.25
1N753A	6.2v	500 mW Zener	.25
1N758A	10v	"	.25
1N759A	12v	"	.25
1N5243	13v	"	.25
1N5244B	14v	"	.25
1N5245B	15v	"	.25

SOCKETS/BRIDGES

8-pin	pcb	.20	ww	.35
14-pin	pcb	.20	ww	.40
16-pin	pcb	.20	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.35	ww	.95
24-pin	pcb	.35	ww	.95
28-pin	pcb	.45	ww	1.25
40-pin	pcb	.50	ww	1.25
Molex pins .01		To-3 Sockets		.25
2 Amp Bridge		100-prv		.95
25 Amp Bridge		200-prv		1.95

TRANSISTORS, LEDS, etc.

2N2222	NPN (2N2222 Plastic .10)	.15
2N2907	PNP	.15
2N3906	PNP (Plastic - Unmarked)	.10
2N3904	NPN (Plastic - Unmarked)	.10
2N3054	NPN	.35
2N3055	NPN 15A 60v	.50
T1P125	PNP Darlington	.35
LED Green, Red, Clear, Yellow		.15
D.L.747	7 seg 5/8" High com-anode	1.95
MAN72	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74A	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

C MOS

4000	.15
4001	.15
4002	.20
4004	3.95
4006	.95
4007	.20
4008	.75
4009	.35
4010	.35
4011	.20
4012	.20
4013	.40
4014	.75
4015	.75
4016	.35
4017	.75
4018	.75
4019	.35
4020	.85
4021	.75
4022	.75
4023	.20
4024	.75
4025	.20
4026	1.95
4027	.35
4028	.75
4030	.35
4033	1.50
4034	2.45
4035	.75
4040	.75
4041	.69
4042	.65
4043	.50
4044	.65
4046	1.25
4049	.45
4050	.45
4066	.55
4069/74C04	.25
4071	.25
4081	.30
4082	.30
MC 14409	14.50
MC 14419	4.85
4511	.95
74C151	1.90

— T T L —

7400	.10	7473	.25	74176	.85	74H72	.35	74S133	.40
7401	.15	7474	.30	74180	.55	74H101	.75	74S140	.55
7402	.15	7475	.35	74181	2.25	74H103	.55	74S151	.30
7403	.15	7476	.40	74182	.75	74H106	.95	74S153	.35
7404	.10	7480	.55	74190	1.25			74S157	.75
7405	.25	7481	.75	74191	.95	74L00	.25	74S158	.30
7406	.25	7483	.75	74192	.75	74L02	.20	74S194	1.05
7407	.55	7485	.55	74193	.85	74L03	.25	74S257 (8123)	1.05
7408	.15	7486	.25	74194	.95	74L04	.30		
7409	.15	7489	1.05	74195	.95	74L10	.20	74LS00	.20
7410	.15	7490	.45	74196	.95	74L20	.35	74LS01	.20
7411	.25	7491	.70	74197	.95	74L30	.45	74LS02	.20
7412	.25	7492	.45	74198	1.45	74L47	1.95	74LS04	.20
7413	.25	7493	.35	74221	1.00	74L51	.45	74LS05	.25
7414	.75	7494	.75	74367	.75	74L55	.65	74LS08	.25
7416	.25	7495	.60			74L72	.45	74LS09	.25
7417	.40	7496	.80	75108A	.35	74L73	.40	74LS10	.25
7420	.15	74100	1.15	75491	.50	74L74	.45	74LS11	.25
7426	.25	74107	.25	75492	.50	74L75	.55	74LS20	.20
7427	.25	74121	.35			74L93	.55	74LS21	.25
7430	.15	74122	.55			74L123	.85	74LS22	.25
7432	.20	74123	.35	74H00	.15			74LS32	.25
7437	.20	74125	.45	74H01	.20	74S00	.35	74LS37	.25
7438	.20	74126	.35	74H04	.20	74S02	.35	74LS38	.35
7440	.20	74132	.75	74H05	.20	74S03	.25	74LS40	.30
7441	1.15	74141	.90	74H08	.35	74S04	.25	74LS42	.65
7442	.45	74150	.85	74H10	.35	74S05	.35	74LS51	.35
7443	.45	74151	.65	74H11	.25	74S08	.35	74LS74	.35
7444	.45	74153	.75	74H15	.45	74S10	.35	74LS86	.35
7445	.65	74154	.95	74H20	.25	74S11	.35	74LS90	.55
7446	.70	74156	.70	74H21	.25	74S20	.25	74LS93	.55
7447	.70	74157	.65	74H22	.40	74S40	.20	74LS107	.40
7448	.50	74161	.55	74H30	.20	74S50	.20	74LS123	1.00
7450	.25	74163	.85	74H40	.25	74S51	.25	74LS151	.75
7451	.25	74164	.60	74H50	.25	74S64	.15	74LS153	.75
7453	.20	74165	1.10	74H51	.25	74S74	.35	74LS157	.75
7454	.25	74166	1.25	74H52	.15	74S112	.60	74LS164	1.00
7460	.40	74175	.80	74H53J	.25	74S114	.65	74LS193	.95
7470	.45			74H55	.20			74LS367	.75
7472	.40							74LS368	.65

9000 SERIES

9301	.85	95H03	1.10
9309	.35	9601	.20
9322	.65	9602	.45

LINEARS, REGULATORS, etc.

MCT2	.95						
8038	3.95	LM320T5	1.65	LM340K15	1.25	LM723	.40
LM201	.75	LM320T12	1.65	LM340K18	1.25	LM725N	2.50
LM301	.45	LM320T15	1.65	LM340K24	1.25	LM739	1.50
LM308 (Mini)	.95	LM324N	1.25	78L05	.75	LM741 (8-14)	.25
LM309H	.65	LM339	.75	78L12	.75	LM747	1.10
LM309K (340K-5)	85	7805 (340T5)	.95	78L15	.75	LM1307	1.25
LM310	.85	LM340T12	.95	78M05	.75	LM1458	.65
LM311D (Mini)	.75	LM340T15	.95	LM373	2.95	LM3900	.50
LM318 (Mini)	1.75	LM340T18	.95	LM380 (8-14 PIN)	.95	LM75451	.65
LM320K5 (7905)	1.65	LM340T24	.95	LM709 (8, 14 PIN)	.25	NE555	.35
LM320K12	1.65	LM340K12	1.25	LM711	.45	NE556	.85
						NE565	.95
						NE566	1.25
						NE567	.95

MICRO'S, RAMS, CPU'S, E-PROMS

74S188	3.00	8214	8.95
1702A	4.50	8224	3.25
MM5314	3.00	8228	6.00
MM5316	3.50	8251	8.50
2102-1	1.45	8255	10.50
2102L-1	1.75	8T13	1.50
2114	9.50	8T23	1.50
TR1602B	3.95	8T24	2.00
TMS 4044-	9.95	8T97	1.00
		2107B-4	4.95
8080	8.95	2708	9.50
8212	2.95	Z80 PIO	8.50

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AMATEUR COMMUNICATIONS

5A/0 Battle Won! Well, Partly.

In a joint announcement released quietly in the last week of September, the Minister for Post and Telecommunications, Mr Tony Staley, and the Minister for Immigration and Ethnic Affairs, Mr Michael MacKellar, said that the Government had made arrangements to provide for multi-cultural television services to begin operating in Australia on a national basis early next year using channels within the UHF band. This was in line with the Government's commitment to ethnic communities, they said.

The permanent service would be administered by the Special Broadcasting Advisory Committees. Installation costs of the UHF transmitters would be borne by the Government, the Ministers said.

The joint statement advised that the Government had agreed to the establishment of a temporary service from early next year because it would take some time to set up the permanent service. It said that the temporary service would use facilities of the Australian Broadcasting Commission.

The temporary service would be administered by the SBS also; they had negotiated an agreement with the ABC whereby facilities could be used to transmit programs as an interim measure. This would provide practical experience of multi-cultural programs, assisting in the later development of the permanent service.

The SBS, in conjunction with NEBAC, would co-ordinate the preparation of a public discussion paper on needs, programs and structural and administrative options for the permanent 'special purpose' television.

The Ministers said that the SBS would be responsible for financing the new service.

It is expected that the permanent service would be transmitting in 1980.

Sideband Electronics Move

Peter Schultz, proprietor of Sideband Electronics Sales, has announced a move to a new address in Crows Nest, Sydney, from his old QTH at Loftus.

The new shop is located at *Shop 9, Rose and McLeod Plaza, 477-479 Pacific Highway, Crows Nest 2065.*

The new shop is right opposite the Crows Nest picture theatre, not far from the location of the NSW Division Wireless Institute Centre.

Peter advises that he is a Trio-Kenwood specialist, and apart from their amateur gear, he also carries Trio-Kenwood instrumentation, test equipment, hi-fi and sound equipment. Spares too!

The new phone number is (02) 439-4191.

Casey VKØ Oscar 8 Contacts

Antarctica is a hard one to get on Oscar 8 but the following stations have managed it, including a first VK-VKØ on mode B. Col, VKØGM (ex-VKØCC etc) handled the Casey base end to:

VK30T, Mode A on 9-5-78
VK7LZ, Mode A on 20-6-78
VD7DK, Mode A on 12-7-78
VK3ACR, Mode A on 1-8-78
VK3ZBB, Mode B on 2-8-78 (a first)

and VK7LZ, Mode B on 3-8-78.

Col, VKØGM also worked KC4AAA (South Pole Station) on 20-6-78 on the same pass he worked VK7LZ.

Ham Gear 'Printout'

Flogging off your shack, eh? Stocking up your shack then?

No matter what shape your shack is in . . . you could well consider a new service introduced by Daicom Electronics of Canberra. Called "Amateur Equipment Printout" it will contain listings of equipment for sale or wanted to buy and will cost 75 cents per copy posted to your QTH. To list gear costs $4.75 and you get a copy of the first issue in which the listing appears. Then, you're never in doubt about when subscribers saw your gear listed.

To have your gear listed, send all the details (including extras, installed modifications, channels installed in VHF gear etc), the price wanted, or willing to pay, and the address to appear in the listing (include postcode and STD prefix).

As a special offer, until February 1979, the service will be *free* to persons wishing to list gear for sale.

For more details, or to submit a listing, write to: *Daicom Electronics, Amateur Equipment Printout, P.O. Box 37, Fisher, A.C.T. 2611.*

Project ASERT

Australia's scientific institutions (e.g. Universities, Government bodies) are experiencing severe funding limitations and greater pressures towards conducting research directed towards short term, practical goals. It is these factors that have contributed to a decline in the studies of radio propagation in Australia, according to Ken McCracken, VK2CCX, in a paper titled *"Conduct Of A Systematic Investigation Of VHF/UHF Propagation Modes By The Amateur Service In Australia".*

"The amateur service is ideally suited to fill the specific role outlined in 'goals' (in preamble to the paper) and thereby fill the gap left by institutional science. It has a technical 'work force' distributed over the greater part of Australia and it has a considerable history of scientific success in this very field (e.g.: – the first observation of TEP). It already has a network of beacons . . . that permit many diverse paths to be monitored."

Mr McCracken lists the goals of the projects as follows:

"(1) To provide a set of unbiased statistics, and a definition of the morphology, of VHF/UHF transmissions over the Australian continent and to conjugate and other points in the northern hemisphere.

"(2) To distinguish between the several propagation modes, and to relate them to other observable parameters."

The project is to be supported by the Wireless Institute of Australia since "it accords most perfectly with the aims and objects of the amateur service", according to the Federal Executive.

Ken McCracken points out in his paper that, if the project is to have scientific validity, co-ordination on a national basis together with a high standard of technical and scientific data are mandatory requirements.

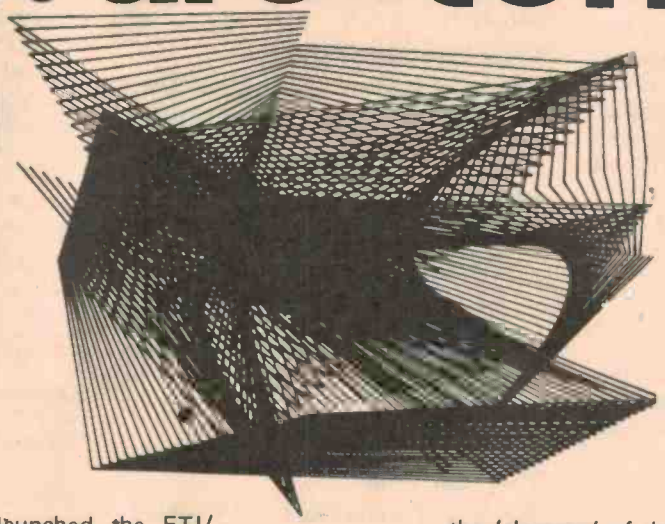
Two levels of experiment are proposed. Firstly, a statistical study of VHF/UHF transmission paths conducted by a co-ordinated group of experimenters throughout Australia. Secondly, experiments by individual amateurs to distinguish between the various propagation modes and to determine if a path is open.

There is some urgency in getting the project underway as the solar cycle is rapidly on the increase.

A copy of the paper is available to interested persons from: *Chairman, VHFAC, Project ASERT, C/- Box 150, Toorak, Victoria 3142.*

You could also phone Roger Harrison, VK2ZTB on (02) 33-4282 extension 28 during business hours if you'd like a copy.

eti/computerland software contest



Last minute exhortation! We launched the ETI/Computerland Software Contest back in April, and since then it seems to have stimulated considerable interest but, frankly, not as many entries as we'd hoped. For this reason, we have decided to set back the closing date of the contest to the 19th of January 1979, and encourage readers to send in their recent software efforts. They don't have to be very complex; quite short programs could well 'scoop the pool'.

We really aren't looking for professional-style brilliance, just software that works and can be used by people to *do* something with their computers.

The type of applications software we're seeking can be anything from a spelling or arithmetic demonstration program or a mortgage repayment program to the kind of sophisticated software we list here:

* *Mailing list processor.*
* *Address/telephone file.*
* *Point of sale terminal.*
* *Recipe file.*
* *Inventory control.*
* *Circuit analysis.*
* *Music synthesis.*
* *Calendar/clock/reminder list.*
* *Chequebook balancing program.*
* *Applications to help the handicapped.*
* *Small business accounting package.*
* *Computer communications set.*
* *Amateur radio station control.*
* *Burglar alarm with police notification.*

The idea is to get your computer doing something that is in some way useful. The only stipulation we'd like to make is that software must be written either in BASIC or in the form of a well-annotated assembly language listing for one of the popular microprocessors such as Z-80, 8080, 6800, 6502 and 2650. This means that we stand some chance of running your software to check it out. For the same reason, specialised hardware should be kept to an absolute minimum.

The criteria the judges will use to decide upon the winning entries will be: the value of the software to the user; its complexity, i.e. the size of the program; the 'elegance' of the software; the degree of 'human engineering' in the design of software features; and the quality, amount and presentation of the documentation supplied. It is likely that other factors will also influence the judges to some extent, as different criteria will apply in varying degree to different programs. The judges will be Dr R Graham, of NSW Institute of Technology, Rudi Hoess, of Computerland, and Collyn Rivers and Les Bell of ETI.

The prizes? Overall first prize is a Cromemco ZPU Z-80 CPU card while the second prize winner will receive a Vector Graphics 8K RAM kit. Third prize is a Vector Graphics 260 x 260 graphic display generator and fourth prize is a PROM/RAM card from Vector Graphics. In addition, each of the prizewinners will receive a two year airmail subscription to the US computer magazine of their choice and a two year subscription to ETI.

There will also be three special prize categories – the awards for 'Best Documentation' and 'Most Original Application' will each be a two year subscription package, while the 'Most Marketable Software' winner will, subject to agreement, be marketed on a royalty basis. In addition, the winning entries will be published in ETI, and payment for this will be made at our usual (excellent!) rates.

With the promise of all these super prizes, fame, and fortune, it's well worth while tidying up some of the software you've written recently, writing it up and sending it in. You've got nothing to lose and a whole lot to gain!

The closing date for the contest is now Friday, 19th January 1979, which should give plenty time to 'polish up' existing programs. The winners will be announced in the March or April 1979 issue of ETI, but if (as we hope) there is a lot of entries to be checked this may be delayed.

SWL COMMUNICATIONS

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC).

All times are in Greenwich Mean Time (GMT), add 10 hours to convert to Australian Eastern Standard Time. All frequencies are in kiloHertz.

Mongolia

Radio Ulan Bator is not one of the first overseas stations which a beginning DXer hears. Reception is seldom flawless, and the station tends to use many frequencies which are outside the usual allocated bands for shortwave broadcasting. The present schedule for English programmes from Ulan Bator includes the evening service daily except Sunday on 12070 and 6383, between 1200 and 1250. The English service for Africa between 1945 and 2015 each day except Sunday, is currently using 17865.

Afghanistan

A schedule to hand from Kabul indicates Radio Afghanistan's External Services operate on 11820 daily, with programs in Arabic at 1630, Russian at 1700, German at 1830, English at 1900. All foreign language segments are of half an hour duration, and the period 1730-1830 is taken up by programs in the languages of Afghanistan, Pushto and Dari.

Iran

With the recent events in this increasingly significant country, readers may wish to hear the latest reports direct from Tehran. The External Service of the Voice of Iran broadcasts foreign language programs daily on 9022, with Russian programs at 1700, Turkish at 1730, Arabic at 1800, German at 1830, French at 1900, and English programs at 1930-2000. Programs for Persian speaking listeners are broadcast on 15084 and 9022 from 2000-0200.

The Home Service of Radio Iran also may be heard well in Australia at present, with excellent reception on 15084 between 0200 and 2000, and on 15315 from 0200-1230.

Seychelles

During period S-78, (September to November), the Far East Broadcasting Association with transmitters on the island of Mahe, has been using the new outlet of 15405 for the Arabic service between 0345 and 0445 daily. FEBA recently altered its policy regarding the verification of reception reports, so that listeners in non-target areas, including Australia, can expect to receive only non-detailed QSL cards in response to their listening reports.

Ukraine

Radio Kiev began its winter schedule on September 3, with three daily half-hour English programs listed. English for European listeners is scheduled for broadcast 2030-2100 on 9775, 9665, and 6020. There are two English services each day for North American listeners, at 0030-0100 on 17845, 15210, 15180, 9720 and 7150. The second service is aired between 0300 and 0330 on 15425, 12050, 12030, 9720, 9655, and 7390. The transmitters for these services are located throughout the USSR.

Laos

The Lao National Radio, in Vientiane, operates an Overseas Service on 7145. The current language schedule includes Thai programs at 1130, Vietnamese at 1200, Cambodian at 1230, French at 1300, and the English service at 1330 every day. The station has recently begun verifying listeners' correct reception reports by letter.

Meanwhile the Lao regional station at Houa Phan, is currently giving excellent reception in eastern Australia each evening on 6198, with programs in Lao and a local dialect. The early evening service may be heard between 1030 and sign-off at 1200, while there is a further service between 1300 and 1430. All transmissions include selections of traditional music, making for interesting listening.

Kuwait

Radio Kuwait has introduced the new frequency of 17740 for its daily English service between 0500 and 0800. Reception on this new outlet is excellent in Australia at present, and has replaced the long-established frequency of 15345. Transmissions began with a program preview, and much popular music and features on Kuwait are included in each service.

Malaysia

English programs from The Voice of Malaysia, transmitting from Kuala Lumpur, may be heard daily between 0625 and 0855 on 15295, 9750 and 6175, according to a schedule from the station. Best reception is currently noted on 15295, in eastern Australia. News bulletins are broadcast in this service at 0630, and a further ten minute bulletin is timed for broadcast at 0830 daily.

KENWOOD

1.8-28MHz SSB TRANSCEIVER TS-520S SERIES

TS-520S/VFO-520S/SP-520

Antenna Coupler

Frequency range	6 amateur bands from 1.8 to 29.7 MHz
Input Impedance	50 ohms
Output Impedance	50 to 500 ohms, unbalanced
Through power	200 Watts maximum
Wattmeter	
Type	Through-line wattmeter
Frequency range	1.8 to 29.7 MHz
Measurable RF power	Up to 20/200 Watts, switched
Kinds of RF power	Forward & reflected power, switched
Impedance	50 ohms
Accuracy	Better than /-10 percent of full sacle

The SP-820 has built-in selectable tone filters to attenuate high and/or low frequencies. You can switch between 2 different receiver sources. Headphones may also be used in conjunction with the filter network.

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31 Whiting Street, Artarmon, Sydney. NSW. Australia. 2064. Tel: (02) 438-1277.

Interstate Distributors:

VIC: Vicom Imports Pty Ltd (03) 699-6700
QLD: Mitchell Radio Co (07) 57-6830
SA: International Communications Systems P/L (08) 47-3688
WA: Willis Trading Co. (09) 321-7600
TAS: Advance Electronics (003) 31-5688
NT: R.J. Klose (089) 81-8704

PS Did you know Kenwood are to release a new solid state 30W PEP HF Mobile Transceiver TS-120 with full 10M coverage, digital display and noise blanker in OCTOBER — watch for further details.

CB COMMUNICATIONS

"Jackson" – new brand name

I.F.T.A. Australia has established itself as a leading importer and wholesale-distributor of quality accessories for CB enthusiasts over the past year or so and have recently advised they will be marketing a range of items under their newly created 'Jackson' brand name label.

A limited number of products distributed by I.F.T.A. have, to date, carried the Jackson brand. These are: the 6-102 Electro-lock security slide mount, 11-101 alternator filter, 11-103 generator filter, 11-105 hot-line filter, 11-107 TVI hi-pass filter, 5-201 coax jumper lead and the 7-103 transceiver dynamic microphone.

Many other products will soon be joining these under the Jackson name, distributed by I.F.T.A. Products bearing the Jackson name will continue to distinguish themselves by their quality and very reasonable price, I.F.T.A. claim.

jackson

Jackson Slide-lock Mount

The Jackson model 6-102 is a slide-lock mount with a difference. When locked in the mounting position with transceiver (cassette player, whatever . . .) attached the assembly cannot be removed unless the ignition is switched on.

The rig is readily removed before locking the ignition and placed in the boot, or other safe place, before locking and leaving your vehicle. Simple. Avoid the hassle of being ripped off.

There are times however when you don't want to go to the whole rigmarole of undoing the rig, locking all your vehicle up etc – like when you slip into the newsagent's to get the latest ETI and CB Australia, or just a packet of fags. But, your rig can still get knocked off. Some of these light-fingered gentry are mighty swift.

That's where the 6-102 slide-lock mount has it all over the others. If you turn off the ignition and take your keys with you they'd need a crowbar and a stick of jelly to get the rig out!

When removing the rig, the ignition switch is on and you simply press the button on the front panel of the mount – hey presto! Slip out the rig.

Now you've read the rave, check one out at your local CB dealer. If he hasn't got one (!!!) tell him to contact *I.F.T.A.* at *P.O. Box 21, Bondi Beach NSW 2026.* He might learn something to his advantage.

Locally-made SWR Meter

Proudly presented by Allied Communications, the model S-700 transceiver/antenna test instrument is locally made and features an unusual dual meter.

Designed for both mobile and base station operation, the S-7000 will measure SWR, RF power and field strength. It has two power measurement ranges: 10 watts and 100 watts. It is fitted with standard S0239 sockets on the rear panel, marked TRX and ANT on the front panel to indicate correct connection.

The instrument is housed in an attractive black, satin-finish anodised aluminium case and the meter scales are conveniently colour coded.

Allied Communications claim the S-700 is accurate to 250 MHz and rated to withstand up to 1000 watts for forward RF power when measuring SWR. Two other models are also available, similarly constructed. The S-7000E will measure RF power up to 1000 watts and the S-7000H is rated to work up to 500 MHz, the makers claim. All instruments are suitable for CB or amateur applications.

The S-7000 basic instrument measures 140 mm across by 50 mm high and 76 mm deep.

For further information, contact *Allied Communications* at *2 Lockinvar Place, Hornsby, NSW 2077;* phone (02) 476-3975. Trade enquiries welcome.

Dick Pack

According to Dick Smith, self-professed 'CB Wizard', one of the major bugbears of CBs is their lack of portability. Enter Dick with 'Porta Pack'. This doo-dad is a tough case designed to house any of the Dick Smith or Midland AM rigs.

The case itself is made from leather-look fibre material which is said to resist marks and scratches and keep your rig in as-new condition. The wide shoulder strap is fully adjustable allowing the Porta Pak to be worn in any position . . . even around the waist.

The optional 1.5 m centre-loaded whip antenna mounts either vertically – as shown in the illustration – or across the case for use on a flat surface, i.e. as a base station.

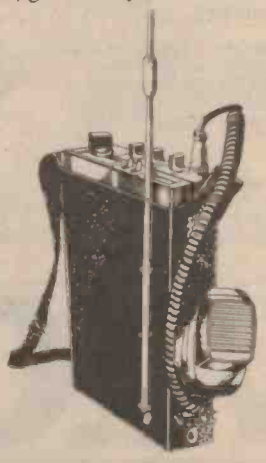
At the bottom end of the case there is an optional battery compartment which is easily removed for replacing or recharging batteries. It takes 10 Nicads or eight dry cells (two dummy batteries supplied). The pack is pre-wired to a plug which connects to the rig's power socket.

The best part of the whole deal, according to Dick, is that the Porta Pack case is FREE with the purchase of a Dick Smith Wasp ($99.50), Midland 857 ($119.50) or Midland 882C ($129.50).

If you bought the case separately it would cost you $25.00. The optional extra battery container goes for $6.50 and optional antenna for $14.50. That's $46 for the case with all options.

Put it all together and you have a CB that can take you anywhere (or the other way around), on foot, on horseback, on a bike, the Bondi Beach public conveniences – use your rig anywhere, in the bush, on the water, in the car, in the 'loo, as an emergency base or full base – in fact, Dick claims it's the most versatile CB thingo available today!

Well, good for you Dick!



all rigs predelivery checked!

ICOM

ICOM IC-22S FM transceiver

SPECIAL OFFER!

$299.00 The popular machine!

SPECIAL SHIPMENT AT THE OLD PRICE!
2M FM MOBILE
MOST POPULAR 2M RIG IN AUSTRALIA!

Yes, ICOM have made available a special shipment of the famous IC22S radio at the old price. Over 200,000 of these reliable rigs have been sold world-wide. Synthesised, this 22 channel rig utillses a diode matrix for channel selection. Comes complete with spare diodes for adding additional channels. Hurry before they run out. Limited offer.

The rig that has taken Australia by storm!

IC-701 SMALL ENOUGH FOR MOBILE!

Utilising the latest technology, the IC701 is small enough to mobile yet sophisticated and easily interfaced with microprocessors. Standard in every IC701 are two independently selectable digitally synthesised VFOs at no extra cost! Your new IC701 comes complete with high quality electret condenser desk mic and 90 day warranty backed by VICOM. Price $1380 (AC power supply extra).

IC-211 2m all-mode $785.00

The famous IC211 2m all-mode transceiver from ICOM. Covers the full 4MHz and standard features include pulse type noise blanker, front panel discr. meter, VOX, and computer interface facility. And your new IC211 carries the VICOM 90 day warranty backed by spare parts and technical expertise!

PORTABLES:

IC202E 2m ssb portable (new model)	$219.00
IC502 6m ssb portable	$219.00
IC402 70cm ssb portable, coming soon!	

NEW 70cm SSB portable

usb.lsb.cw. first shipment arriving next month!

High quality state of art rigs from Icom.

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TL922 Linear amplifier	$1,389.00
TR3200 70cm fm portable	$229.00
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TR7500 2m fm mobile	$280.00
TS600 6m all-mode	$565.00
TS700SP 2m all-mode	$810.00
VFO820S VFO for TS520S	$155.00
VFO820S VFO for TS820S	$183.00
TS520S HF Transceiver	$770.00
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AT200 antenna tuner	$175.00
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SP520 Matching for TS520S	$30.00
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rotators

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Model DR7500S medium duty	$189.00
Model DR7600S heavy duty	$259.00

NEW

Stacks of top quality accessories

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88/70cM, 18.5 dBd gain, 88el, length 3.98M	$102.00
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PBM18/70, 18el, 14.9 dBd gain, length 2.8M	$71.00
D8/70cM, twin 8el, 70cM, 12.3 dBd, 1.1M	$62.00

2M ANTENNAS

Scalar M22T ¼ wave whip	$7.00
Scalar M25T 5/8 wave whip	$17.50
Bases for above	$4.00
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ARX-2 Ringo base antenna	$49.00

TRAP VERTICALS

V4JR 40-10M, 5.2M high, no guys	$99.00
V5JR 80-10M, 6.7M high, no guys	$165.00
14AVQ/WB Hy-Gain, 40-10M	$109.00
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SWR/PWR METERS

VC2 twin meters, 3-150 MHz cal. chart	$34.00
SWR200 Oskerblock 2-200 MHz	$75.00
SW410A 140-500 MHz, direct reading	$129.00
SW210A 1.8-150 MHz, direct reading	$96.00
SWX777 up to 30 MHz, professional	$131.00

VALVES

6146B for Uniden, Kenwood, Yaesu	$13.00
6KD6 for early Yaesu linears	$13.00
6JS6C for FT101 series	$13.50
572B for Yaesu linears	$59.00

ANTENNA CHANGE-OVER RELAYS (DAIWA)

CX-2L 1.8 thru 170 MHz, 100w pep max	$48.00
CX-2H 1.8 thru 450 MHz, 200w pep max	$69.00

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CS201 2 position, high pwr, up to 500 MHz	$25.00
CS401 4 position, high pwr, up to 500 MHz	$59.00

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RF440 phasing type, 6dB gain	$135.00
RF550 filter type, 6dB gain	$179.00

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HK702 deluxe key with marble base	$39.00
HK708 economy key	$21.00
HK706 operator's key	$25.00
MK701 manipulator (side swiper)	$43.00
EK103Z electronic Keyer	$169.00
Palomar IC Keyer	$149.00

LOW PASS FILTERS

FD30M 32 MHz Fc, 1 Kw max, 3 stages	$35.00
FD30LS 32 MHz Fc, 200w max, 3 stages	$20.00

BALUNS

AS-BL for beams	$31.50
BL50A 50 ohm 4 Kw model for dipoles	$26.00
BL70A 70 ohm 4 Kw model for dipoles	$27.00

antennas

HY-GAIN ANTENNAS

Hy-Quad 10/15/20 2 elements	$369.00
204Ba 4el monobander for 20m	$279.00
203Ba 3el monobander for 20m	$220.00
TH3MK3 10/15/20m 3 el beam	$299.00
TH3Jr 10/15/20m 3el beam	$229.00
TH6DXX Thunderbird 6el tribander	$399.00
Long John 5el widespaced for 10/11m	$180.00

HUSTLER MOBILE ANTENNAS

BM-1 deluxe universale bumper mount	$25.00
RM20/15/10 resonators	$22.00
RM40 40m resonator	$24.00
RM80 80m resonator	$27.00
M02 fold-over mast	$33.00

2M BEAMS

5Y/2M Jaybeam, 7.8 dBd, length 1.6M, 5el	$39.00
8Y/2M Jaybeam, 9.5 dBd, length 2.8M, 8el	$47.00
10Y/2M Jaybeam, 11.4 dBd, length 4.4M, 10el	$79.00

VICOM

68 Eastern Road
SOUTH MELBOURNE VIC 3205
PH (03) 699.6700 Telex AA30566

DEALER ENQUIRIES INVITED

Perth	446.3232	Sydney	681.3544
Adelaide	43.7981	Brisbane	38.4480
Gold Coast	32.2644	Hobart	43.6337
Canberra	82.3581	Melbourne	836.8635

A major independent research company proved that the ADC XLM MKII incurred no perceivable record wear over the life of your records!
Since then ADC's massive research programme has created a new state-of-the art, top of the line model–the ZLM Aliptic–designed for ultimate stereo performance combined with the concept of zero record wear.

Greatly reduced tip mass

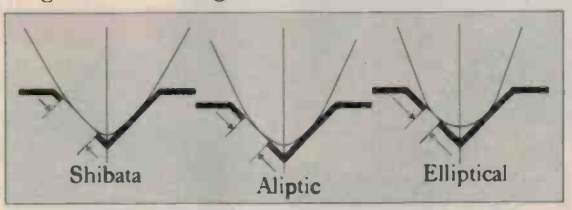
The ZLM has a tiny nude diamond with a ·004" x ·008" rectangular shank.
This achieves more lateral strength than the fashionable ·006" square shank, plus a 10% reduction in mass.
The diamond is mounted on a new tapered stylus, which again reduces mass.
In fact, the ZLM has only half the tip mass of the famous ADC XLM MkII.

Less mass by patent

The patented ADC Induced Magnet system, where the magnet is suspended over the moving stylus arm instead of being attached to it, inherently means less mass for the record groove to move. This, coupled with major innovations in the pivot block stylus suspension (which have solved deficiencies in the old system), has resulted in greatly improved frequency response characteristics.

New low-wear ALIPTIC shape

The ZLM has a new tip shape that combines the advantages of the elliptical and Shibata shapes, while eliminating their disadvantages.



It is basically elliptical (·0003" x ·0007"), but its bottom radius has been modified to extend the vertical bearing surface on the groove wall by 100%.
Large enough to greatly reduce record wear, while still small enough to prevent dirt particles being reproduced.
This new shape is called ALIPTIC™.

The best polish available

We decided it was worth the extra cost to get the ultimate polish for the ZLM.
The method involves a cam action to shape and polish evenly while forming the elliptical surfaces simultaneously with the other radii. This Pathe-Marconi method is expensive, but the result makes another important contribution towards reducing record wear.

Spatial sound

You'll notice a distinct difference in sound quality.
Words such as 'open,' 'spatial,' 'uncoloured' and 'true' spring to mind. Individual instruments are easily identified, and there's no hint of listening fatigue.
That's strictly for the competition with its peakier response.

The new ZLM Aliptic

The culmination of all ADC's research has resulted in the new ZLM Aliptic.
Its specifications below are some of the most impressive around, and with each cartridge you receive an individual, signed, frequency response testimonial.
Certain ZLM's fall within a range of ±¼db 10Hz to 20kHz and ±1dB out to 26kHz.
These rare cartridges are called ZLM Select and are only available on special order.

The best cartridge we've ever made

The ZLM is without doubt the best cartridge we've ever made, but it's well worth taking a closer look at the new ADC XLM III which incorporates all of the reduced mass accomplishments of the ZLM, but with a tiny elliptical diamond. This also includes an individual specification.
Complementing the range, we have the new four-cartridge QLM Mk III series, incorporating our new design criteria and exciting innovations like the Diasa (diamond + sapphire) elliptical tip.

ZLM Aliptic specifications

Diamond tip	Nude Aliptic
Tracking force	½ to 1¼ gram
Frequency response	10Hz to 20kHz ±1dB 20kHz to 26kHz ±1½dB
Output	1.0mV per cm/sec
Output balance	1dB max. diff.
Channel separation	30dB at 1kHz/20dB at 10kHz
Inductance	580mH
Resistance	820 Ohms
Load resistance	47,000 Ohms
Load capacitance	275pF
Cartridge weight	5.75 grams
Accessories	Stylus brush, screwdriver, all mounting hardware and signed frequency response curve.

Please write for our illustrated brochure.

The new ZLM Aliptic™ cartridge. The difference between playing your records and wearing your records.

ADC

A BSR Company
Distributed by: EXPO International Trading Pty Ltd
27 Buckley St., Marrickville NSW 2204

BSR (A'asia) Pty Ltd. Anne St., St. Marys NSW 2760

BSR151

At last:
A budget-priced mosaic printer.

The new EUYIOE series is ideal for microprocessor-based systems or data logging.

How often have you needed a small printer which can produce many characters, alpha-numerals, symbols and graphs at 2 lines per second on 60 mm paper?

Matsushita's new quiet non-impact Electrosensitive Printers use a 7 x 5 dot matrix and a choice of characters per line (15, 21, 32 or 40).

Added versatility is built into the EUY10E models because there is also a choice of scanning direction.

But with all these features only a low 24 volts is needed to operate the units.

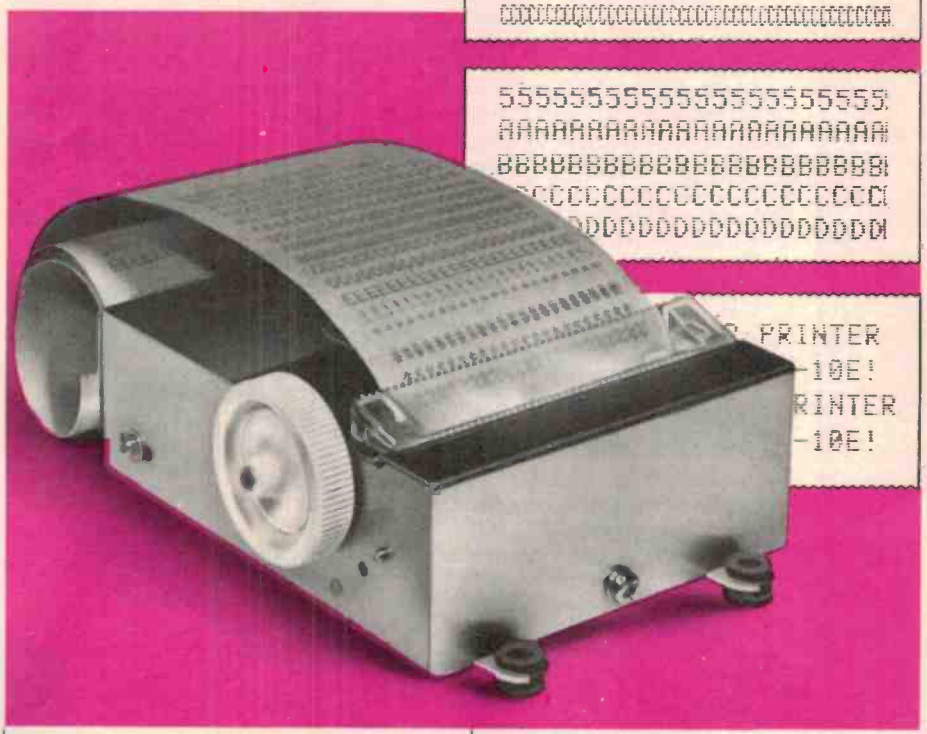
Due to low power consumption, it can operate on batteries with converters.

One motor drives both the printing head and recording paper through a dependable mangle gear. Special overall design reduces the number of parts needed and the natural result is less weight, smaller size and most important, greater reliability.

Choice of drive units.

To drive the EUY10E printer you have the choice of two interface units. EUYPUD022A is a basic drive unit which provides signals to power the motor and printing head. It offers the user maximum versatility and flexibility. EUYPUD022A is designed to interface between the printer and microprocessor kits such as 2650KT9500, SC/MP or DE.

The EUYPUD022A contains a full 64 ASC11 character generator.



Specifications

Printing method	Electrosensitive
No. of characters per line	15, 21, 32, 40
Types of characters	Alpha-numeral, symbol, graph
Character composition	7 x 5 dot matrix
Printing speed	Approx. 2 lines/sec.
Character height	2.4 ± 0.2 mm (0.094" ± 0.008")
Input voltage	−24V ± 5%
Current	300mA
Life	MCBF 1 x 10^6 lines
Dimensions	90.5(W) x 110(D) x 42.5(H) mm 3.56(W) x 4.33(D) x 1.67(H) inch
Weight (approx:)	370 g (0.814 lb)

Pricing

EUY10E PRINTERS $60.00
EUY10E INTERFACES $82.50
EUY10E INTERFACES $133.40
(PLUS 15% SALES TAX IF APPLICABLE)

EUY10E Electrosensitive printers have all the features you need, at a price that makes them even more attractive. You can purchase your EUY10E and interface from your local distributor of Philips components.

If you'd like more data and application information write to the:—

Professional Component Marketing Group
Philips Electronic and Materials
P.O. Box 50, LANE COVE, N.S.W. 2066

PHILIPS
Electronic Components and Materials

PHILIPS

We want you to have the best

HRME 153-0250

Mini-Mart

We'll print your 24 words (maximum) totally free of charge. Copy must be with us by the 7th of the month preceding the month of issue. Please, please write or preferably type your adverts clearly, using BLOCK LETTERS.

CONDITIONS

Name and address plus phone number (if required) must be included within the 24 words allowed.

Reasonable abbreviations, such as 25 Wrms, count as one word.

Private adverts only will be accepted. Please let us know if you find a commercial enterprise using this service.

Every effort will be made to publish all adverts received – however, no responsibility for so doing is accepted or implied.

Adverts must relate to electronics or audio – general adverts cannot be accepted.

PLEASE USE BLOCK LETTERS			

THE RECORDING SOCIETY OF AUSTRALIA MEETS MONTHLY FOR DEMONSTRATIONS, LIFE RECORDINGS ETC., FOR FURTHER INFORMATION OR SYLLABUS RING OR WRITE TO DON PATRICK, 36 ARGYLE ST., MACLEOD, 3085. PHONE (03) 459.1717.

WANTED: HYGAIN 5, LAFAYETTE SSB 75, MIDLAND 13892, KRACO OR UNIVERSE 2340. SSB CB. ONE ONLY WANTED. WILL PAY $60.00. 86 NOOSA ROAD, GYMPIE, 4570. PHONE (071) 821239. MUST BE SYNTHESISED.

CB RADIO FOR SALE, BOBCAT 23-D AM, A1 WORKING ORDER, AISO LISENCED. POWER SUPPLY, SCALAR MOBILE WHIP, PA HORN $90 ONO. PHONE 681-1483 NSW.

SELL: PIONEER AMPLIFIER SA500A 44 WATTS MUSIC POWER. SONY CASSETTE DECK TC121. SELL BOTH TOGETHER $150 M.RILEY PHONE (03) 89.9988, 14 BEATTY STREET, MONT ALBERT, VIC.

WANT TO EXCHANGE SOFTWARE AND HARDWARE IDEAS WITH OTHER TMS 9900 MICROCOMPUTER USERS. SEND TO MICHAEL CVET. 10 CAROONA CLOSE. ADAMSTOWN HEIGHTS. NSW. 2289.

WANTED MULTIMTEER WITH TRANSISTOR TESTER & A.C. CURRENT TO 15 AMPS PREFER DICK SMITH'S Q-1136 RING (02) 631-4201 AFTER 4 PM ASK FOR PHILLIP.

MINISCAMP WITH PROGRAMMING GUIDE AND NATIONAL MANUALS $90 ONO. 60 KEY KEYBOARD WIRED FOR MM5740-AAF ENCODER. EASILY CHANGED $45 ONO J. MUIR, 32 CLARKE STREET, BENDIGO 3550. (054) 432979.

SELL: OVER 25 COPIES OF E.T.I. AND EA MAGS, ALL MINT CONDITION FROM 76-78 $20 THE LOT RING JAMES COTTERILL AFTER 5.00 PM (03) 565011 CHAOSTONE.

WANTED BY VALVE-ENTHUSIAST "AWA RADIATRON DESIGNER'S HANDBOOK". MID 1950'S ONWARD, VALVE CIRCUITS AND DESIGNS (CONDITION UNIMPORTANT) L. NELSON 307 BAMBRA ROAD, STH. CAULFIELD 3162. TEL 578-1582.

WANTED RADIO AND HOBBIES MAGAZINES PRE 1944. WRITE TO JIM GORDON C/- 6 GRAEME AVENUE RINGWOOD. VIC 3134.

WORKING MINISCAMP COMPUTER WITH SCMP MANUAL $60 O.N.O. R. STIRLING 4/92A JANET STREET MEREWETHER 2291 PHONE (049) 682311 (WORK).

FOR SALE 6 COVERS THAT HOLD 12 ISSUES OF EA OR ET MAGAZINES RING JOE A.H. (03) 4657553.

FOR SALE BACK ISSUES. E.A. JUN 74 TO AUG 78. E.T. JUN 75 TO AUG 78. WILL SELL TO BEST OFFER. RING JOE. A.H. (03) 4657553.

OSCILLOSCOPE CONSTRUCTIONAL PLANS, COMPLETE DETAILS TO BUILD TRANSISTORIZED 15MHz SCOPE. TWO COPIES AVAILABLE, $11 EACH (POSTED) P. LEVCHENKO, 28 ANSELM GVE, GLENROY, VIC. 3046. PHONE (03) 306-3241.

S-100, 4KRAM WITH FULL DOCUMENTATION. BOUGHT AS A KIT FOR $100. FULLY ASSEMBLED AND TESTED. HARDLY USED. SELL $98 (ONO) M. NICOTRA 74.9762 (BURWOOD).

WANTED FOR PURCHASE OR COPYING WORKSHOP MANUAL OR CIRCUIT OF MN26C RADIO COMPASS RECEIVER ANDERSON 17 KORANGI ROAD ST. IVES 2075 PHONE (02) 44-1062.

AUSTRALIAN RADIO DX CLUB, FOR SHORTWAVE AND MEDIUMWAVE DXERS. MONTHLY MAGAZINE PUBLISHED. WRITE FOR DETAILS, WITH 30C STAMP, TO PO BOX 67 HIGHETT, VICTORIA, 3190 OR PO BOX 79 NARRABEEN NSW 2101.

TRS-80 PROGRAMS INCLUDING BIORYTHM, DRAUGHTS, ETC, FOR SALE OR EXCHANGE FOR OTHER PROGRAMS. RING FOR PRICES. PROGRAMMABLE DOORBELL $25.00. AKAI GXC38D CASSETTE DECK $210.00. (02) 30 8261.

HEWLETT-PACKARD HP-67 FULLY PROGRAMMABLE CALCULATOR (EXCELLENT CONDITION), WITH GAMES PAC, $450 – PAUL FOGDEN, 1A DULDIG AVE., GAWLER, SA. 5118. PHONE (085) 22-2938.

WANTED: COPIES OF ARTICLES ON "CHROMACHASE IV", LIGHT CHASER PROJECT, FROM PRACTICAL WIRELESS. G. CLIFFORD, 63 FINLAY ST., BRIDGEWATER, TAS. 7401.

POWER SUPPLIES: 90V to +30V AT 1A $25. –14V +10V & +20V AT 5A $35. +5V & –5V AT 50A $45. 24 MALOUF ST., LAWLEY HEIGHTS. PH. 604-4137.

FT-101E, CW FILTER, $825 ONO. FR-101DD DIGITAL 160M TO 2M, BC BANDS, $1100 ONO. 18AVT/WB INCL. RADIALS, $110 ONO. OR $1950 THE LOT. GOING OVERSEAS. BEAGLEY (07) 370-8343.

FOR SALE: SCOTCH REEL TO REEL VIDEO TAPES ½IN. x 2400FT. $12 EACH. R. GOOGE, 15 WOODGATE ST., IPSWICH QLD. 4305.

ELECTRONICS FIRMS AND INDIVIDUALS. STOP THROWING MONEY AWAY! SELL POSTAGE STAMPS FROM YOUR MAIL. SEND 20c STAMP FOR DETAILS. BLEYERVEEN 43 O'SULLIVAN ST., HIGGINS, A.C.T. 2615.

send your ad to –
ETI MiniMart,
Modern Magazines,
15 Boundary Street,
Rushcutters Bay,
NSW 2011.

PCB's

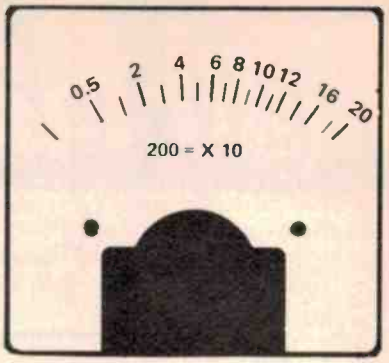
Using ETI PCB Artwork

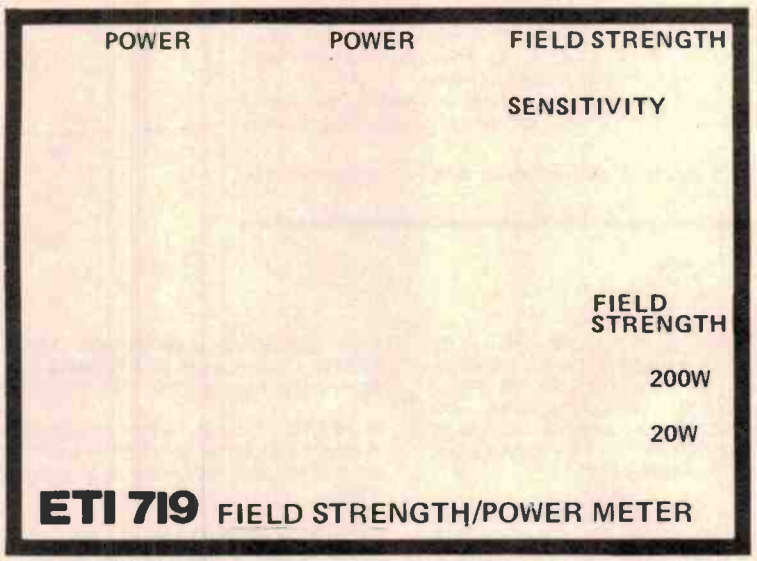
This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007 which is UV sensitive and can be used under normal subdued light.

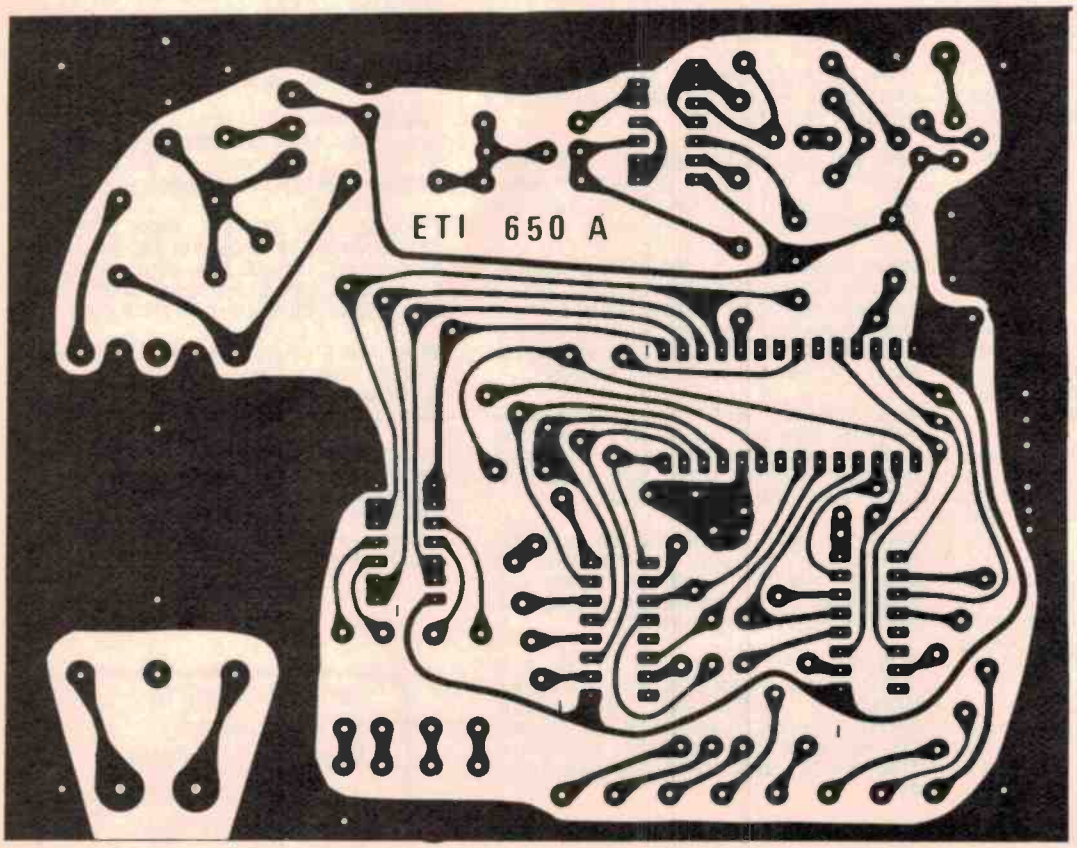
Cut a piece of film a little larger than the PC board and expose it to UV light through the magazine page. The non emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner - it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

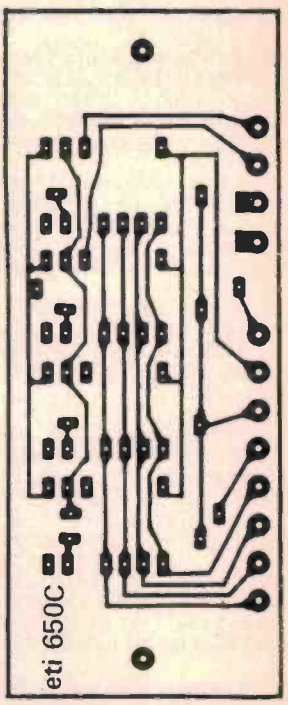
The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

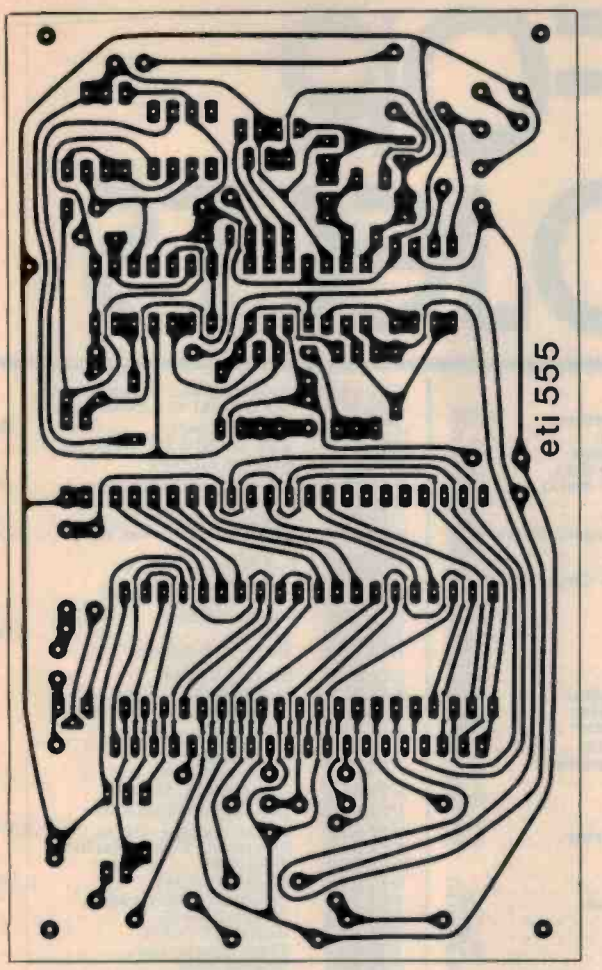
Further information on Scotchcal and PCB manufacture can be found in the September and December 1977 issues of ETI. Please note also, that occasionally pressure on space may unfortunately prohibit the printing of blue type behind all PCB's, in which case the reader must resort to more conventional photographic techniques for PCB manufacture.

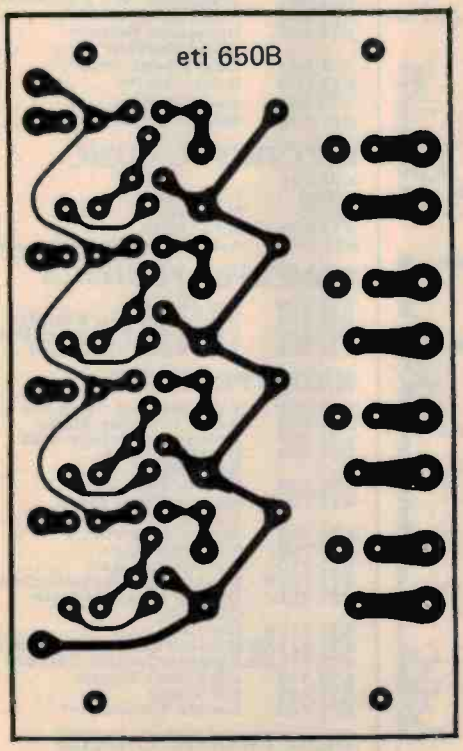


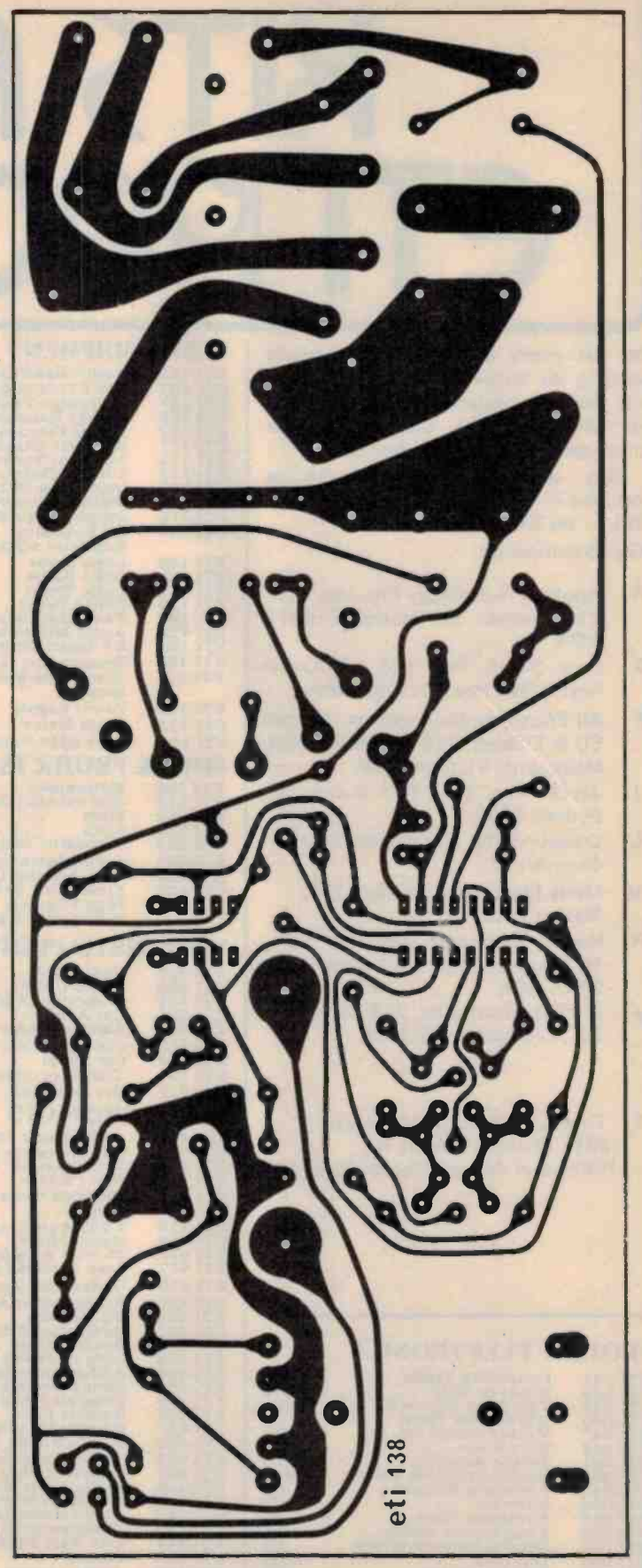







eti 555


eti 650B


eti 138

KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

Any companies who want to be included in this list should phone LES BELL on 33-4282.

Key to companies:

A Applied Technology Pty. Ltd. 109 - 111 Hunter St, Hornsby. 2077. NSW.

D Dick Smith Pty. Ltd. of Crows Nest, NSW. (see Ads. for address).

E All Electronic Components (formerly ED & E Sales), 118 Lonsdale Street, Melbourne, Victoria 3000.

J Jaycar Pty. Ltd. 405 Sussex St., Sydney 2000.

L Delsound Pty. 1 Wickham Terrace. Queensland.

M Mode Electronics. PO Box 365, Mascot 2020.

N Nebula Electronics Pty. Ltd. 15 – 19 Boundary St., Rushcutters Bay 2011. NSW.

P Pre-Pac Electronics. 718 Parramatta Rd., Croydon NSW 2132.

T Townsville Electronics Centre. 281E Charters Towers Rd, Rising Sun Arcade, Hermit Park. 4812

PROJECT ELECTRONICS

ETI 041	Continuity Tester	DS
ETI 043	Heads or Tails	DATSE
ETI 044	Two-Tone Doorbell	DATSE
ETI 045	500 Second Timer	DS
ETI 047	Morse Practice Set	DS
ETI 048	Buzz Board	DS
ETI 061	Simple Amplifier	DATS
ETI 062	Simple Amplifier Tuner	DSE
ETI 063	Electronic Bongo's	DS
ETI 064	Intercom	ATS
ETI 065	Electronic Siren	DS
ETI 066	Temperature Alarm	ADTSE
ETI 067	Singing Moisture Meter	DS
ETI 068	Led Dice	ADSE
ETI 072	2-Octave Organ	DS
ETI 081	Tachometer	E

TEST EQUIPMENT

ETI 102	Audio Signal Generator	E,DS
ETI 105	Lab Power Supply	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	ES
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	ES
ETI 112	Audio Attenuator	ES
ETI 113	7-Input Thermocouple Meter	P,E
ETI 116	Impedance Meter	ES
ETI 117	Digital Voltmeter	E,AS
ETI 118	Simple Frequency Counter	E,AS
ETI 119	5V Switching Regulator supply	ETS
ETI 120	Logic Probe	L,ES
ETI 121	Logic Pulser	L,ES
ETI 122	Logic Tester	ES
ETI 123	CMOS Tester	ES
ETI 124	Tone Burst Generator	ES
ETI 128	Audio Millivoltmeter	L,ES
ETI 129	RF Signal Generator	L,ES
ETI 130	Temperature Meter	E
ETI 131	General Purpose power supply	E,N
ETI 132	Power Supply	NSE
ETI 133	Phase Meter	E
ETI 134	True RMS Voltmeter	E

SIMPLE PROJECTS

ETI 206	Metronome	T
ETI 218	Monophonic Organ	ET
ETI 219	Siren	ET
ETI 220	Siren	ET
ETI 222	Transistor Tester	ETS
ETI 234	Simple Intercom	T
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E
ETI 240	High Powered Emergency Flasher	E

MOTORISTS' PROJECTS

ETI 301	Vari-Wiper	ET
ETI 302	Tacho Dwell	ET
ETI 303	Brake-light Warning	E
ETI 305	Car Alarm	E
ETI 309	Battery Charger	P,E
ETI 312	CDI Electronic Ignition	P,ET
ETI 313	Car Alarm	E,DT
ETI 316	Transistor Assisted Ignition	E
ETI 317	Rev. Monitor	E

AUDIO PROJECTS

ETI 401	Audio Mixer FET Four Input	E
ETI 406	One Transistor Receiver	T
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 413	100 Watt Guitar Amp	P,L,J,DT
ETI 413	x 200 Watt Bridge Amp	SE
ETI 414	Master Mixer	E,J
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P,E,DT
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	S L,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	S L,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	S L,E,J
ETI 429	Simple Stereo Amplifier	E
ETI 433	Active Crossover	J
ETI 435	Crossover Amp	J
ETI 438	Audio Level Meter	L,ES
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,ES
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	ES
ETI 445	Preamp	J,E,D
ETI 446	Audio Limiter	J
ETI 447	Phaser	E,J
ETI 449	Balanced Mic Preamp	JE
ETI 480	50 W. 100 W Power Amp	A
ETI 480P	Power Supply	DAT
ETI 481	12V to 40V DC Inverter	E
ETI 482A	Preamp Module	AE
ETI 482B	Tone Controller	AE
ETI 484	Compressor Expander	E
ETI 485	Graphic Equalizer	JSE
ETI 480	50W, 100W Power Amp	ADBE

MISCELLANEOUS

ETI 502	Emergency Flasher	E
ETI 503	Burglar Alarm	ET
ETI 505	Strobe	L,E,D
ETI 506	Infra-Red Alarm	E
ETI 509	50-Day Timer	E
ETI 512	Photographic Timer	E
ETI 513	Tape Slide/Synchroniser	E
ETI 514	Flash Unit — Sound Operated	E
ETI 515	Flash Unit — Light operated	E
ETI 518	Light Beam Alarm	ET
ETI 525	Drill Speed Controller	E
ETI 528	Home Burglar Alarm	P,ET MS
ETI 529	Electronic Poker Machine	E
ETI 532	Photimer	E
ETI 533	Digital Display	L,E,AS
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	ES
ETI 541	Train Controller	ET
ETI 543	Double Dice	A
ETI 544	Heartrate Monitor	AE
ETI 546	GSR Meter	E
ETI 547	Telephone Bell Extender	E
ETI 548	Photographic Strobe	E
ETI 549	Induction Balance Metal Locator	E
ETI 581	Dual Power Supply	E
ETI 582	House Alarm	E
ETI 583	Gas Alarm	ME
ETI 586	Shutter Speed Timer	E

ELECTRONIC MUSIC

ETI 601 4600	Synthesiser	J
3600	Synthesiser	J
ETI 602	Mini Organ	E,A,D
ETI 604	Accentuated Beat Metronome	E

COMPUTER PROJECTS

ETI 630	Hex Display	AE
ETI 631	VDU Keyboard Encoder	AE
ETI 632	VDU 1 k x 8 Memory Card	AE
ETI 633	VDU Sync Generator	AE

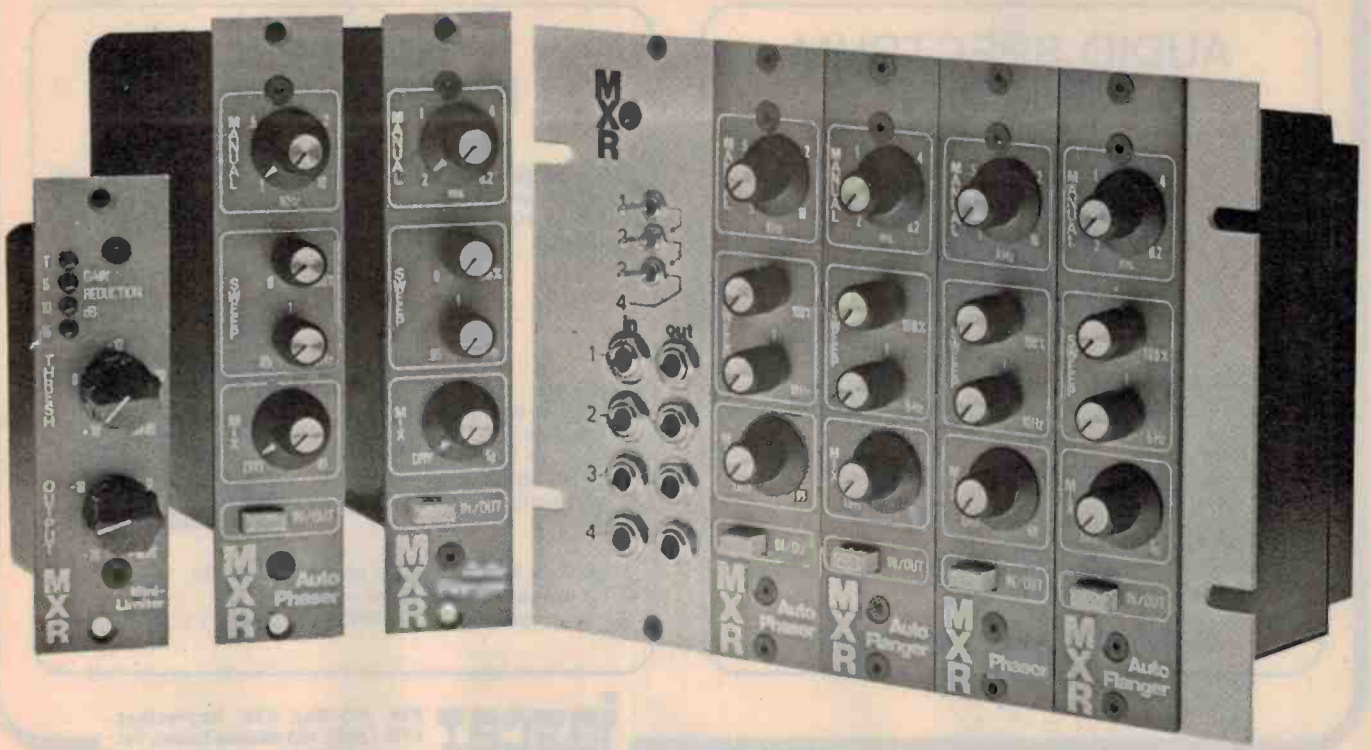
RADIO PROJECTS

ETI 701	TV Masthead Amplifier	E,D
ETI 702	Radar Intruder Alarm	DE
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L,A,D,ES
ETI 706	Marker Generator	ES
ETI 707	Modern Solid State Converters	E
ETI 708	Active Antenna	E
ETI 709	RF Attenuator	E
ETI 710	2 metre Booster	E
ETI 711B	Single Relay Remote Control	AE
ETI 711C	Double Relay Remote Control	AE
ETI 711R	Receiver	AE
ETI 711AR	Remote Control Transmitter	AE
ETI 711DR	Remote Control Decoder	AE
ETI 712	CB Power Supply	E
ETI 740	FM Tuner	AE
ETI 780	Novice Transmitter	E

ELECTRONIC GAMES

ETI 804	Selecta-Game	O,A,DS

MXR Professional Products



The MXR Auto Phaser is designed to be the finest phasing unit available for professional applications. The Auto Phaser's low distortion, low noise, and wide range of effects enables it to fill every studio phasing need.

Ease of operation, low power consumption, and wide supply range makes it ideal in any portable mixing or P.A. application.

Packaged in a compact and durable case, its controls are set up in a user-oriented fashion.

The subjective audible effect of phasing is a product of a phase-shift created response characteristic resulting in a series of "notches" in the audio spectrum similar to reel flanging, but differing from flanging in the sense that these notches are not harmonically related.

The MXR Mini Limiter is designed as a cost-effective answer to meeting the wide variety of audio limiter applications.

Its wide supply range, low power consumption, and input-output characteristics enable it to interface with a diversity of equipment, from portable high impedance mixers to custom low impedance consoles.

Low noise, low distortion and quick response enable it to effectively control signal peaks. Attack time is fast (approx. 1ms.), and release time is both variable via rear trim pot and dependent upon the amount of gain reduction. Four instantly responsive L.E.D.'s continuously indicate gain reduction. The Mini Limiter has quick recovery from heavy gain reduction, but approaches maximum gain slowly, a most useful recovery characteristic in application.

The Mini Limiter is supplied in a sturdy and compact case which can easily be incorporated into any console or rack.

The MXR Auto Flanger is the first professional audio delay line capable of producing true flanging—repeatably and economically, designed for both portable use and custom installations, the Auto Flanger reliably meets the most demanding of professional audio needs.

The front panel layout and control functions are designed to be as versatile as possible while maintaining ease of operation.

Due to the precise mathematical relationship between the time delay and the resulting comb filter response, the Auto Flanger causes random program material (i.e. drums, cymbals, and other percussion) to take on musical tonality, a characteristic not found with phasing.

The MXR Professional Products Rack is a compact, self-contained enclosure for mounting, powering, and interfacing up to four Auto Flangers or Auto Phasers in any combination. Its unique power supply design allows operation over a wide range of line voltages.

Packaged in a rugged and attractive case, the Professional Products Rack is designed for standard half-rack mounting. It may also be used in a freestanding configuration for studio effects on location. A versatile control arrangement permits independent operation of each unit or synchronous operation in a wide variety of master-slave combinations. Conveniently grouped phone jacks make it possible for units to be patched individually or in series. This complete flexibility allows a wide spectrum of creative effects.

For more information see your MXR dealer.
The Music Distillery, 503 Pittwater Road,
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MXR Professional Products Group

Jaycar New Audio Kits and Components

AUDIO SPECTRUM ANALYSER

The 489 Analyser can be used in conjunction with a Graphic Equaliser to accurately equalise systems for room acoustics.

Features:

- Ten octave spaced displays
- LED readout in 3 dB steps.
- Input sensitivity control.
- Inbuilt pink noise generator.

Complete kit includes matched LEDs, polarised plastic display, complete metalwork, etc.

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This rugged, compact amplifier is ideal for PA, disco, foldback or guitar amp use. 2-input Preamp with tone controls or 10-way Equaliser can be built into the same cabinet.

Features:

- Robust construction.
- Handles for portability.
- Cannon mains input, quick connect speaker terminals.
- Attractive finish in light grey.

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2-input Preamp with front panel $25.
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C103A	TO 18	100	800mA	1.38
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C103Y	TO 18	30	800mA	1.28
C106A1	Plastic	100	4A	$1.11
C106B1	Plastic	200	4A	1.28
C106D1	Plastic	400	4A	1.28
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C122M	Plastic	600	8A	2.90
C230D	Stud	400	25A	10.00
C230E	Stud	500	25A	11.20
TIC106B	TO220	100	5A	.92
TIC106D	TO220	400	5A	1.40
TIC106Y	TO220	30	5A	.76
TIC116A	TO220	100	8A	1.48
TIC116B	TO220	200	8A	1.51
TIC116D	TO220	400	8A	1.94
TIC116F	TO220	50	8A	1.20
TIC116M	TO220	600	8A	2.73
TIC126B	TO220	200	12A	1.66
TIC126D	TO220	400	12A	2.11
TIC126M	TO220	600	12A	2.88
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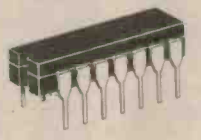
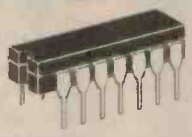
CMOS



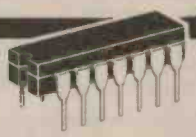
4000	.25	4046	1.95
4001	.25	4049	.60
4002	.25	4050	.60
4006	1.40	4051	1.20
4007	.25	4052	1.20
4008	1.25	4053	1.20
4011	.25	4060	2.65
4012	.25	4066	1.00
4013	.55	4068	.40
4014	1.35	4069	.35
4015	1.20	4070	.40
4016	.50	4071	.40
4017	1.40	4072	.40
4018	1.40	4073	.40
4019	.75	4074	.40
4020	1.60	4076	1.85
4021	1.40	4077	.40
4022	1.60	4078	.40
4023	.25	4081	.40
4024	.90	4082	.40
4025	.40	4510	1.50
4027	.80	4511	1.50
4028	1.25	4518	1.50
4029	1.90	4520	1.45
4030	.40	4528	1.20
4040	1.30		
4041	1.25		
4042	1.25		
4043	1.50		
4044	1.50		

TTL



7400	.28	7474	.65
7401	.28	7475	.65
7402	.28	7476	.45
7403	.28	7480	1.25
7404	.37	7483	1.25
7405	.37	7485	1.45
7406	.50	7486	.65
7407	.50	7489	1.20
7408	.34	7490	.75
7409	.34	7491	1.00
7410	.30	7492	.75
7411	.37	7493	.75
7413	.54	7494	1.10
7414	1.03	7495	.95
7416	.60	74100	2.45
7417	.60	74107	.65
7420	.30	74121	.60
7422	.30	74123	1.10
7426	.45	74132	1.25
7427	.45	74150	1.80
7430	.30	74151	1.10
7432	.43	74153	1.10
7437	.50	74154	1.70
7438	.50	74157	1.10
7440	.30	74160	1.55
7441	1.50	74164	1.55
7442	.70	74165	1.55
7447	1.25	74173	2.75
7448	1.25	74175	1.65
7450	.35	74180	1.35
7451	.35	74192	1.40
7453	.35	74193	1.40
7454	.30	74221	1.50
7460	.35		
7470	.65		
7472	.45		
7473	.60		

74LS



74LS00	.30	74LS92	1.20
74LS01	.30	74LS93	1.20
74LS02	.30	74LS95	1.50
74LS03	.30	74LS109	.50
74LS04	.35	74LS113	.55
74LS05	.35	74LS114	.55
74LS08	.30	74LS138	1.20
74LS09	.30	74LS151	1.20
74LS10	.30	74LS154	1.60
74LS11	.30	74LS157	.90
74LS12	.30	74LS163	1.20
74LS14	1.20	74LS164	1.30
74LS20	.30	74LS174	1.00
74LS21	.30	74LS175	1.00
74LS27	.30	74LS191	1.20
74LS28	.40	74LS192	1.20
74LS30	.30	74LS193	1.20
74LS32	.33	74LS194	1.20
74LS37	.45	74LS195	1.20
74LS38	.45	74LS196	1.20
74LS40	.30	74LS221	1.20
74LS42	1.20	74LS253	1.85
74LS73	1.20	74LS279	.65
74LS74	.50	74LS365	.80
74LS75	.70	74LS367	.80
74LS78	.50	74LS368	.80
74LS85	1.50		
74LS86	.50		
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307	.65
308	1.35
311	.85
324	1.35
339	.90
349	2.25
356	1.65
380	2.00
381	2.00
382	2.00
386	1.95
555	.35
556	.85
565	1.95
566	2.50
567	2.65
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predictions

The Ionospheric Prediction Service have kindly developed propagation predictions for us, in the form of a computer printout, which we can reproduce directly. These predictions are known as GRAFEX and contain a lot more information than those we published previously.

The left hand vertical column of each printout lists the frequency, in MHz, for each horizontal row of characters. Each vertical column of characters represents one hour, commencing at 00 UT on the left-most column going to 23 UT on the extreme right column.

Each printout is for a particular path, named at the bottom. The month to which the predictions apply, the mean path distance and the great circle bearing are also listed beneath each printout.

A variety of up to ten characters may appear on the printout and their meanings are listed in the table reproduced here.

The form of the GRAFEX predictions allows the indication of several 'modes' of propagation. The *first* mode is that requiring the least number of 'hops'. This will mean *two* hops on paths of length 4000 to 6000 km or so, *three* hops on paths around 7000 to 10,000 km in length, and so on. The *second* mode for a path will be the next integral number of hops that may be required to propagate a signal over the path.

Thus, the second mode for paths around 4000 to 6000 km in length will involve *three* hops and for paths 7000 to 10,000 km long will involve *four* hops, and so forth.

Mixed modes may also be indicated (symbols M, S and X). That is, a combination of hops involving both first and second modes perhaps (this indicates that considerable fading may be experienced on signals); a mixture of hops involving both the E and F layers of the ionosphere, etc. (See "Propagation, a Closer Look", the July 1978 issue of ETI, pages 112 to 114.).

For ultra-reliable predictions follow the times and frequencies indicated by the F characters on the printouts. For a bit of adrenalin in your operating, use the % symbols area of the printouts. But, for a real 'buzz' look to the dot symbols area and hang around during the month of the predictions for those magic days when the higher frequency DX starts pouring through!

Six metre band amateur enthusiasts should scan the printouts for those that have characters extending into the 40 MHz region and operate accordingly.

Co-ordinated Universal Time (UT) is used on all predictions. For most people's purposes that's equivalent to the well-known GMT. Thus, times for Eastern Australia will be 10 hours ahead (Eastern Australian Standard Time or E.A.S.T.); for central Australia, 9½ hours ahead and for Western Australia, 8 hours ahead. Don't forget to take into account Daylight Saving Time where and when it applies. Oh, heck, save yourself all the hassle and run a clock in the shack set to Universal Time!

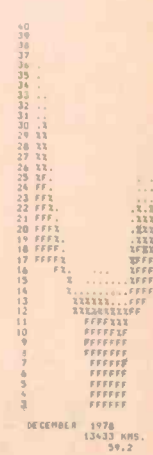
For information on the areas served by the prediction charts, see ETI July 1978, page 113.

' '	A blank means no propagation is possible by a normal first or second mode.
' . '	A dot indicates that propagation is possible but probably on less than 50% of the days of the month. This normally applies for the first F mode but under some circumstances the first mode may not be propagated because the layer is too low (usually for hops greater than 3000 kilometres) in which case the symbol applies to the second mode.
' % '	Propagation is possible between 50% and 90% of the days of the month. It should be noted that the median F MUF for each hour lies between the lowest ' . ' and the highest ' % ' for that hour.
'F'	Propagation is possible by the first F mode on at least 90% of the days of the month unless there is a severe ionospheric disturbance. For frequencies on the highest 'F' for the hour the probability is 90% but this will increase slightly on lower frequencies.
'E'	Propagation is possible by the first E mode and on less than 50% of days by the first F mode. This symbol overrides ' . ' if present.
'P'	Propagation is possible by the first E mode and between 50% and 90% of days by the first F modes. This symbol overrides ' % '.
'B'	Propagation is possible by the first E mode and by the first F mode on more than 90% of the days. This symbol overrides 'F'.
'M'	Propagation is possible by both the first and second F modes. The strongest mode is normally the first mode but the vertical aerial pattern may influence the mode received. It should be noted that the second F mode MUF is just about the highest frequency showing 'M'.
'S'	Propagation is not possible by the first mode but it is possible by the second mode. It should be remembered that propagation may be possible by other modes, e.g.: the third F or mixed E and F modes at these frequencies. This symbol does not occur very often.
'A'	High absorption i.e.: above the ALF but probably too close to it for good communication.
'X'	Complex mixture of modes including the second E mode (the vertical angles of the first F and the second E modes are often very close).

East Coast — South Africa (also serves South Central)

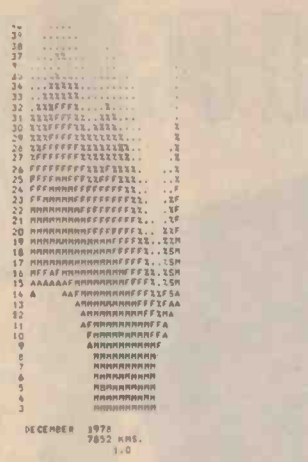
East Coast — North Africa (also serves South Central)

East Coast — South America (also serves South Central)

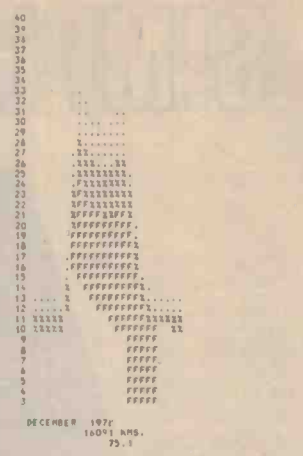


East Coast — North America (also NE and South Central)

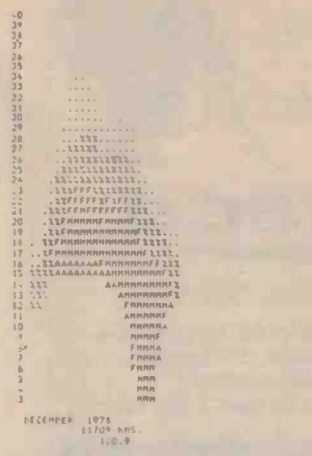
East Coast — Japan (also serves NE and South Central)



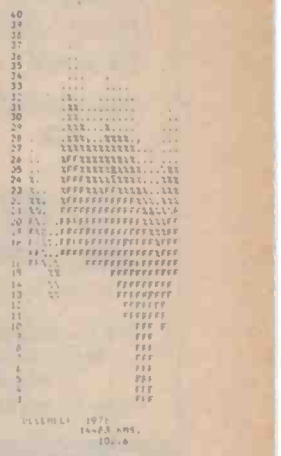
East Coast — South Pacific



East Coast — Europe (Short Path)

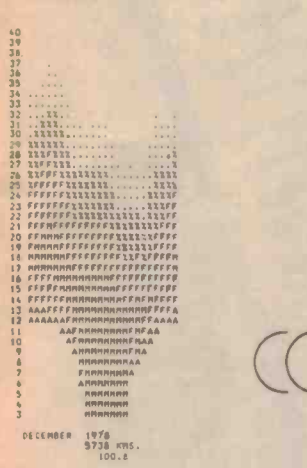


North East — South Africa

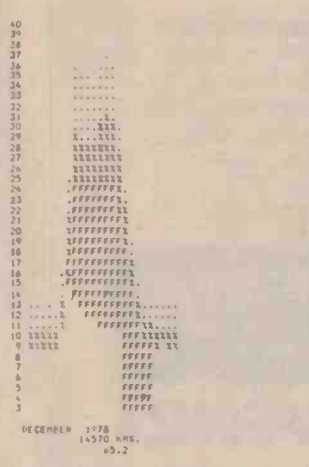


North East — North Africa

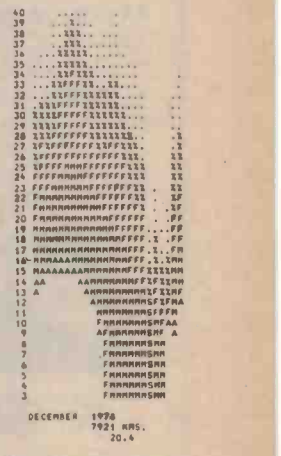
SWL and AMATEUR COMMUNICATIONS



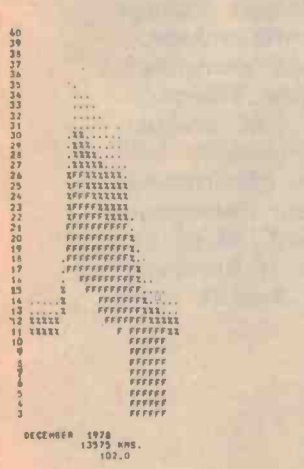
North East — South Pacific (also serves South Central)



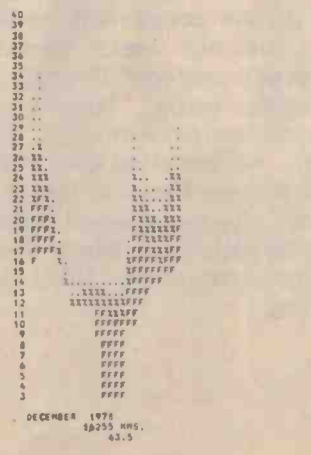
North East — Europe (Short Path)



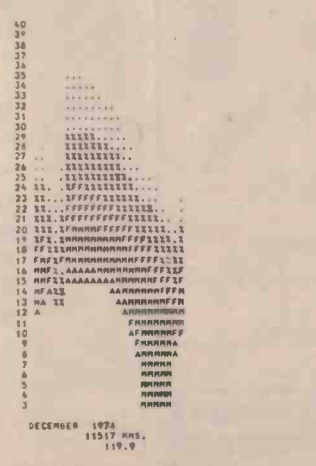
West Coast — Japan



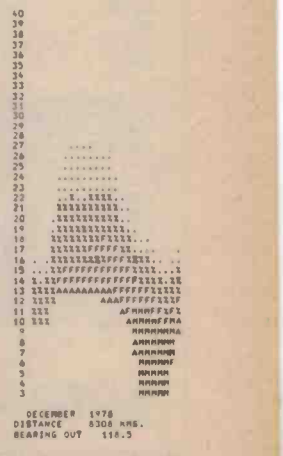
South Central — Europe (Short Path) (also West Coast)



West Coast — North America



West Coast — North Africa



West Coast — South Africa

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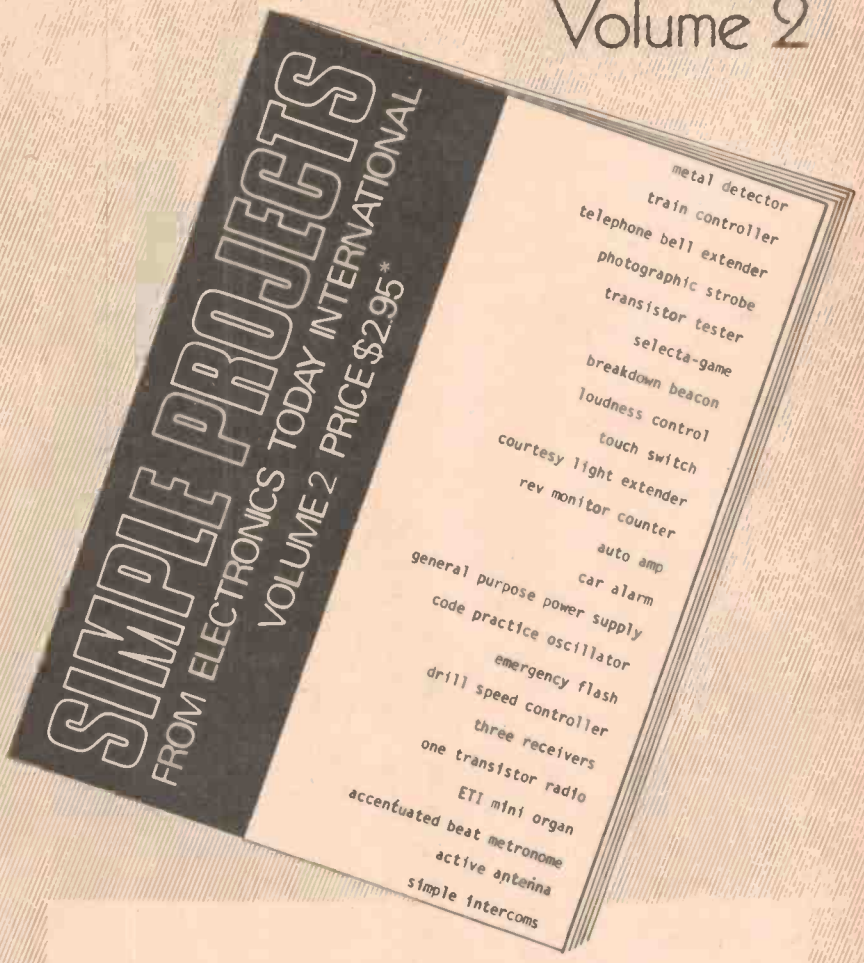
Volume 2



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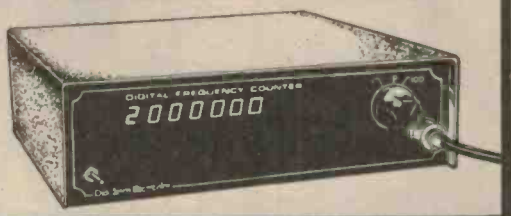

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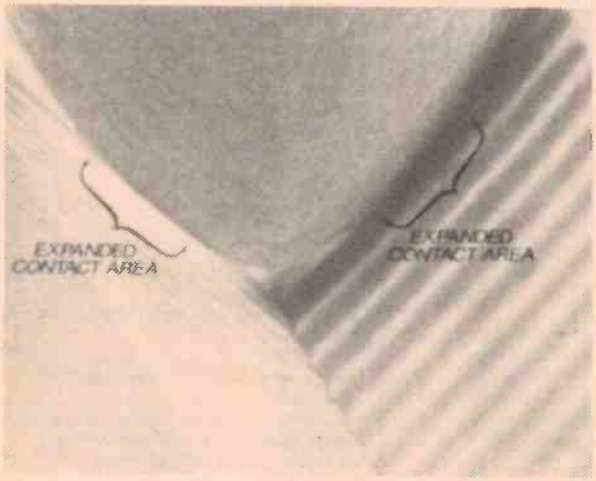

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Ideas for experimenters

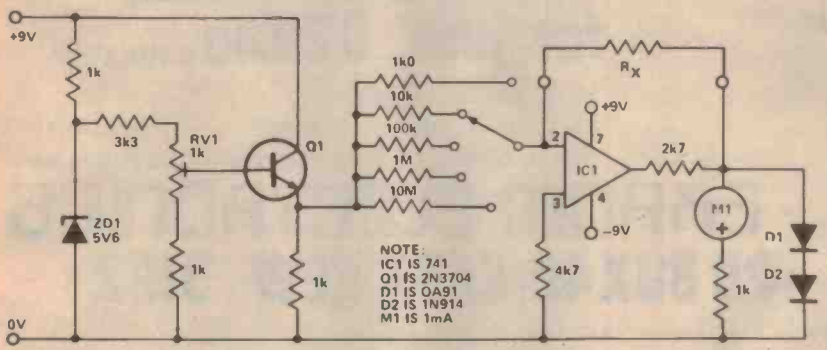
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.

Linear Scale Ohmmeter

This circuit has several advantages over other linear scale ohmmeters.

Only one preset resistor is used for all the ranges, simplifying the setting up and reducing the cost. Diode clamping is included to prevent damage to the meter if the unknown resistor is higher than the range selected. The use of a FET 741 op-amp reduces any zero error and makes offsetting unnecessary.

When the meter has been assembled, a 10k precision resistor is placed in the test position, Rx, the meter is set to the 10k range and RV1 adjusted for full scale deflection.



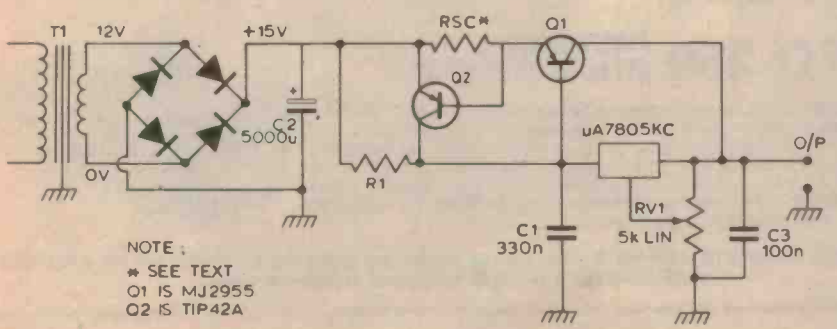
High Current Regulator

This circuit can supply 10A at 5V which falls to about 8A at 15V, (make sure your transformer can take it!). The circuit is fairly straightforward. Most of the output current flows through Rsc and Q1 (less than 1A flows through the e-b junction of Q1. Voltage is regulated by the μA7805 and controlled by RV1, giving a variation from 5V to 15V.

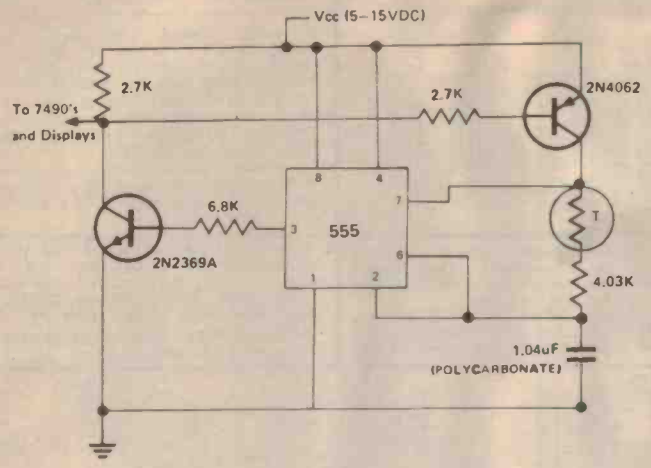
Output current is limited by Rsc and can be calculated from

$$Rsc = \frac{0.9}{I\ max}$$

For currents greater than 5A, Q1 should be mounted on a heatsink. Q2 and the regulator should run cold (if not there's something wrong!).

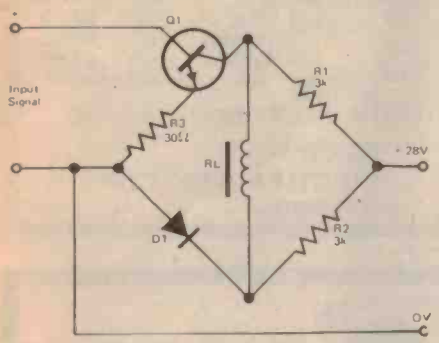


Ideas for experimenters



Digital Thermometer

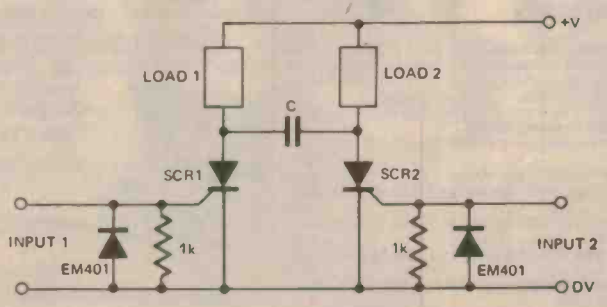
This circuit we haven't tried yet but it looks very good, anybody who tries it, let us know how you get on. The circuit's output frequency varies in a nearly linear manner from 38 to 114Hz as the temperature changes from 37°F to 115°F. The 555 is set up in the normal astable configuration with one resistor replaced by a thermistor/resistor network and other replaced by a transistor. The transistor's near zero on-resistance and very high off-resistance results in equal charge and discharge intervals that depend only on the thermistor/resistor network. The thermistor is one with a value of 5000 ohms at 25°C and a resistance ratio of 9.06:1 over the temperature range 0°C to 50°C. The capacitors need to be temperature stable and may need to be hand selected and added to give the best results. It would seem that a similar circuit for Centigrade might also be possible – any ideas?



Temperature Stabilized Relay

Accurate relay trip-point operation can be obtained over an ambient temperature range from –50°C to +90°C using this simple circuit.

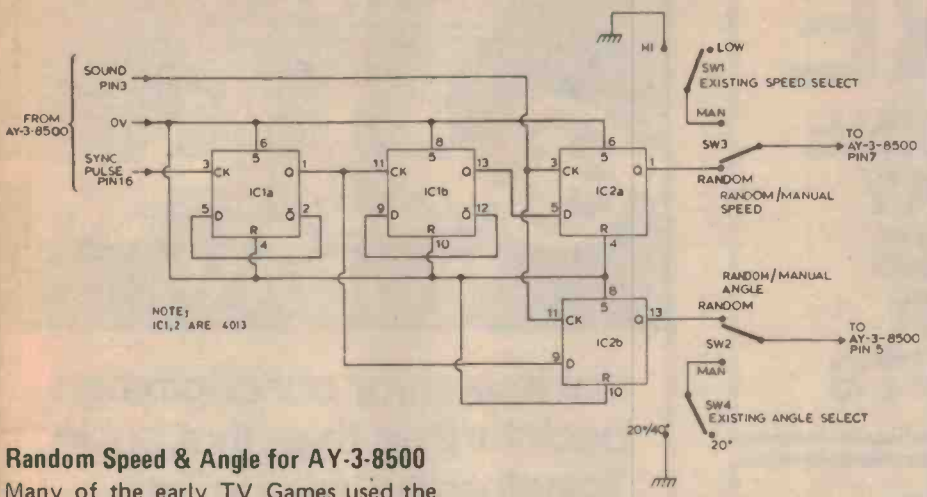
The temperature sensitivity of the silicon transistor Q1 is balanced out by the silicon diode D1. Gain/temperature stabilization may be obtained if required by using a positive temperature coefficient resistor for R3.



SCR Multivibrator

A triggered multivibrator – an input to 1 energizes load 1. A subsequent input to 2 energizes load 2, thus turning off SCR1 and de-energizing load 1.

Ideas for experimenters



Random Speed & Angle for AY-3-8500

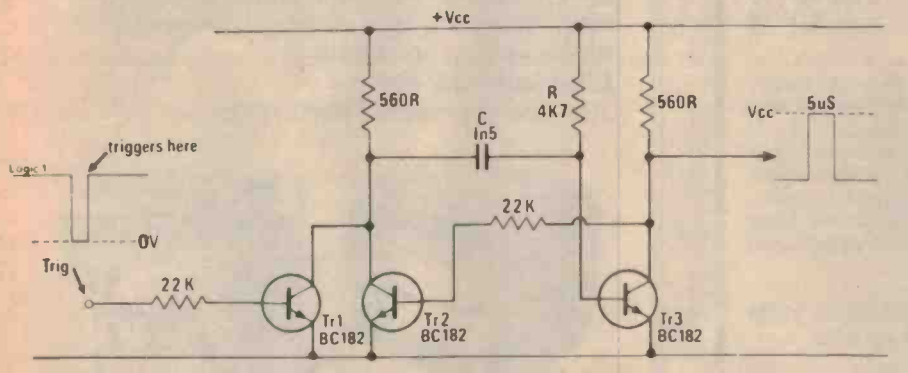
Many of the early TV Games used the GI AY-3-8500 chip. This has the facility to switch ball speed pin 7, and the angle of rebound on pin 5. These two pins are usually brought out to a switch for selection by the users.

The games can be made more exciting and realistic if the speed and rebound angle vary randomly at each bounce or when a player hits the ball. This can be simply achieved with the addition of two 4013s (Dual D type).

SW1 and SW2 are the existing manual select switches. IC1 forms a two bit counter, clocked on by the sync pulses from pin 16 on the AY-3-8500 chip. This counter will assume a random state from bounce to bounce.

The two D type flip flops in IC2 are connected to pins 5 and 7 on the AY-3-8500 chip via the random select switches. To ensure that these two D types are clocked by the sound output (which consists of a 32ms pulse train at each bounce). This pulse train will, of course, overlap several sync pulses, but the effect of the angle and speed changing rapidly for 32ms is not noticeable and the ball speed and angle stays constant after leaving the bat or boundary until the next interception.

Because the two ICs are of CMOS construction they will have little effect on battery consumption, and the circuit can be easily incorporated into TV games units.



Rising Edge Trigger

The diagram shows a method of triggering a conventional monostable on the rising edge of a short negative-going pulse. The additional transistor, TR1, provides good isolation between the output pulse and the triggering circuitry. The circuit shown gives a pulse of 5μsec duration, but of course the usual design formula $\tau = 0.65$ RC can be used to determine circuit values for other pulse widths.

One slight disadvantage of this circuit is that the collector of TR2 is held down by the triggering wave-form, so the switch-on of TR3 is not regenerative. For this reason the falling edge of the output pulse is not as fast as it might be, but is sufficient for most purposes.

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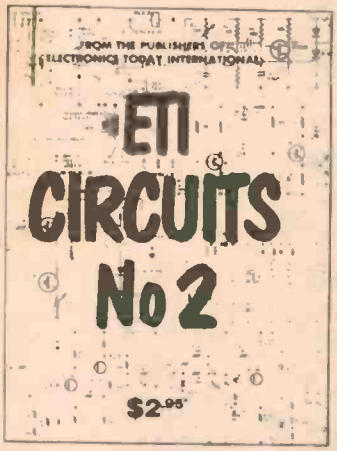

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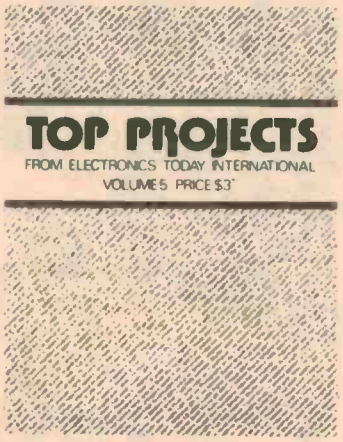
Ideas and data for experimenters. There are about 200 circuit ideas in this book. It's not for the beginner. But someone with a fair bit of experience in electronics will get a lot of use from this book. Invaluable for ideas and inspiration.. . . . . $2.95.



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