Oct. 1980
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Accuphase C7 MC headamp—how good?

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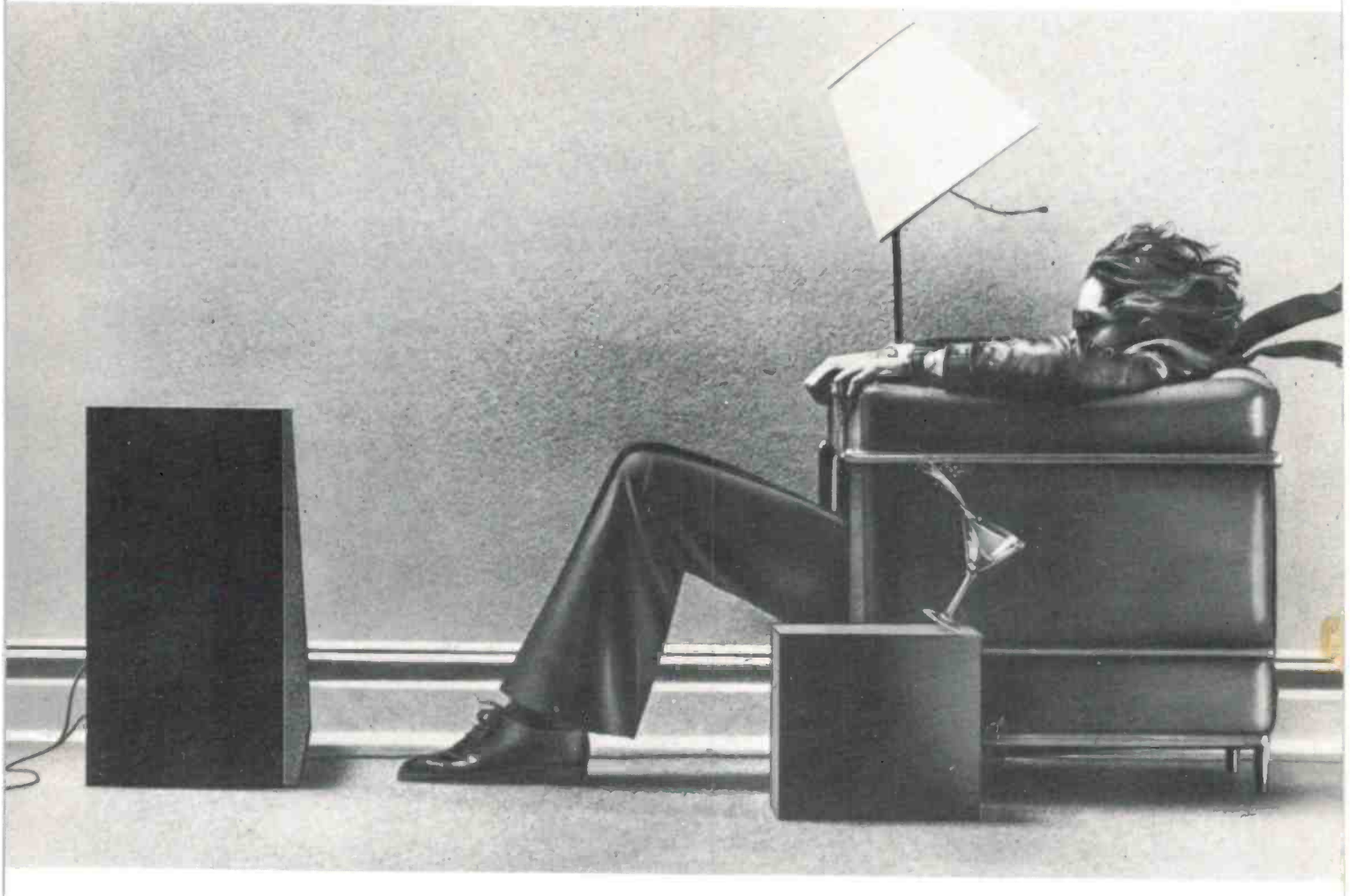

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QUICK INDEX

FEATURES:

13 Project Galileo — Probe To Land On Jupiter
72 Micro Machine Has It All Sewn Up !
148 Radio Astronomy's Original Pioneer — Grote Reber
140 Special Offer on EMI Reel to Reel Tape
91 Floppy Disks — Special Reader Offer

SOUND SECTION:

102 Sound News
122 Consumer Electronics Shows — Tale of Two Cities
110 Nakamichi 482 Cassette Deck Review
135 Accuphase C7 MC Headamp Review
98 Dindy High Energy Cassettes — Special Reader Offer

PROJECT SECTION:

21 568: Sound or Light Operated Flash Trigger
30 147: Electronic Dummy Load
40 327: Turn and Hazard Flasher
37 Short Circuits: Measuring Very Low Currents
47 Short Circuits: Brilliance Boost For Guitar
146 Short Circuits: Audio Noise Limiter
51 Lab Notes: The ETI-566 Metal Locater Revisited
60 Ideas For Experimenters
65 Shoparound
113 PC Board Patterns

IN GENERAL, Australia is slow to adopt technology from overseas until it is "fully proven". As a nation, we're technology followers, not leaders. There are a number of examples contrary to this, but the statement is generally true. However, when we do adopt a technology from overseas we do it with a rapidity and enthusiasm that is staggering.

Australia was almost the last Western country to commence monochrome television broadcasting. But, the growth of TV stations and sales of receivers reached 'saturation' level here faster than had been the case in any other country. The same story was repeated with colour television. It's the same in many fields. Take 'personal' computers for example. Sales growth here has proceeded much faster than in the United States. Indeed, some US companies have used Australia to test market new products in this line using consumers here virtually as a 'litmus' indicator.

Bearing this in mind, ponder a moment on what is likely to happen when 'robot' technology arrives here.

First generation robots were expensive and could only perform a limited number of tasks. Cost had to be recouped over quite a long period. Second generation robots are considerably more sophisticated, much less expensive, are more versatile and can pay their way inside a year. First generation robots have taken over unskilled, repetitive tasks whereas second generation robots will replace semi-skilled workers. Many Western nations, including the industrial giants USA and Japan, are making second generation robots *now*.

The Myers Report on the impact of technological change in Australia was released recently and we were interested in what it had to say about robots.

"Australia is slow to use robots", it says.

I think that should be qualified with: "At the moment". The Myers report doesn't explore many aspects of technology in any depth and I think a golden opportunity has been missed — or is it intended to reduce the effects of "future shock" by shying away from serious analysis of the impact of technology?

Roger Harrison
Editor

advertisers

Agfa Gevaert Ltd 103
A.P. Products 112
All Electronic Components 36
AWA 115
Ampec Electronics 49
Applied Technology 93
Audio Engineers. 120
Aust. Guarantee Corp. 158
Aust. General Electric 56
Audio Reflex Aust. 138
AED 75
Auditec Aust. P/L. 128
Audio Kits 118
Andrews Communications. 47
Advanced Electronic Systems 62
Bose Aust 119
Barratt Lighting. 126
BASF. 134
Bell Instruments. 142
Belle Lumiere P/L. 11
Bib Hi Fi Aust. 130
Bright Star Crystals. 147
Box Hill Tech 74
Computerland. 20
C.I.S.A. 96
Consolidated Marketing 71
Chadwick Audio 116
Convoy. 141
Comp-Soft Micro 92
Christie Rand 92
Computer Country 88
Cleftronics. 147
Dicker Data Projects 68
Defense Force Recruiting 159
Dick Smith. 38,39,64,74,76,80,83,90,144,156
Deisound. 11
David East 44
Dynaudio 131
Daneva Control 88
Electronic Calculator Discounts. 7
Ellistronics. 54
Electro-Voice Aust. P/L 143
Electromedical Engineering 86
Electrocraft 131
Electronic Agencies. 58
Emona Enterprises 58
Energy Control 74
Freedman Electronics 128
GFS Electronics. 147
Hitachi (Sales) Aust. 100
Hagemeyer. 2, 163
Hewlett Packard. 61
Indeva 74
John F. Rose 28, 29
Jaycar 139
Kodak 101
Logic Shop. 11
Looky Video 74
Magrath's P/L 18
Maruni Corp. 6
Micro-80 81
Maurice Chapman Group. 133
Mensa Computers 84
McGill's Newsagency 132
Micro Pro Design 92
National Panasonic A/Asia. 164
National Panasonic 109
Northpoint Hi Fi 136
Omni Computers 12
Parameters P/L 27
Pre Pak 46
Philips 124, 153
Plessey Components 44
Rod Irving 48, 66, 67
Radio Parts 58
Radio Despatch 62
Sansui 105
Sony 106
Stuart Alexander 108
Seeforth 34
S.M. Electronics. 69, 97
S.I. Microcomputers 70
Systems Automation 44, 45
Spectrum Lighting 121
Speedy Communications. 155
Sevlen Lighting 132
Software Source. 74
Tasman Electronics 61
VSI Electronics 50, 59
Vicom International 35
Warburton Franki. 150
Woodland Audio 118
World Imports. 118

eti ELECTRONICS TODAY INTERNATIONAL

COVER

An artist's impression of the Project Galileo probe as it begins its descent into the atmosphere of Jupiter. Story on page 13.

features

PROJECT GALILEO 13
Early in 1982, NASA will launch a mission to investigate the planet Jupiter at close range and over an extended period.

JANOME MEMORY 7 SEWING MACHINE 72
This microprocessor-controlled sewing machine makes embroidery child's play.

GROTE REBER — PIONEER OF RADIO ASTRONOMY 148
Forty years ago, Grote Reber founded the science of radio astronomy. Today he still works with the antenna system he built many years ago in Tasmania.

news

NEWS DIGEST 8
Communications in Amhem Land; Satcom III post-mortem; Zinc chlorine batteries; VCR cleaner.

PRINTOUT 77
Hand held computers; Z8000 support hardware; Speech recognition for TRS 80; HP85 disk drives; New TI speech synthesis chip etc.

COMMUNICATIONS NEWS 145
Heard Island DX-pedition plans well advanced, etc.

SHORTWAVE LOGGINGS 152
Radio Australia's Darwin transmitter to be revived; New Ecuador service; Iceland now possible.

projects

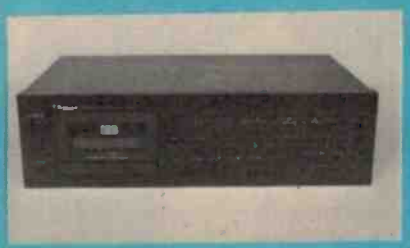
568: SOUND OR LIGHT OPERATED FLASH TRIGGER 21
Some spectacular and intriguing events last only a fraction of a second. Our photo flash tngger helps you catch the action on film by triggering the flash at the right instant.

147: ELECTRONIC DUMMY LOAD 30
This general purpose dc load is convenient for testing power supplies etc. and incorporates multiple protection circuits.

327: VEHICLE TURN AND HAZARD INDICATOR 40
Stable, reliable and powerful, this electronic flasher unit easily outperforms the standard electro-mechanical devices.

THE ETI-566 METAL DETECTOR REVISITED 51
More about the metal detector we featured as a project in the April 1980 issue — alternative construction arrangements, coil details, etc.

SHOPAROUND 65



NAKAMICHI 482 CASSETTE RECORDER 110
The industry pacemakers continue their pursuit of perfection with this superb machine.

ACCUPHASE C7 MOVING COIL CARTRIDGE HEAD AMPLIFIER 135
If you're thinking of upgrading to a moving coil cartridge and you don't want to replace your amplifier a head amp like this is just what you need.

DINDY CASSETTE OFFER 98
High energy tapes at low, low prices.

EMI RECORDING TAPE OFFER 140
Top reel to reel tapes at a discount.

sound

SOUND NEWS 102
TEAC offer dbx; Single chip FM receiver; Distortion often goes unnoticed.

CONSUMER ELECTRONICS SHOWS — A TALE OF TWO CITIES 122
This year's electronics shows in Perth and Sydney were both huge successes. Dennis Lingane reports on both and on the not-so-friendly rivalry between them.

general

SHORT CIRCUITS
Measuring very low currents 37
Brilliance boost for guitar 47
Noise limiter 146

IDEAS FOR EXPERIMENTERS 60
SCR oscillator; Slave flash; Automatic turntable cutoff etc.

IONOSPHERIC PREDICTIONS 154

LETTERS 69

FLOPPY DISK OFFER 91

MAIL ORDER BOOKS FROM ETI 94
Beginners' books, data books, circuit books etc.

PC BOARDS 113

MINI MART 157

KITS FOR PROJECTS 160

ETI SERVICES 161

DREGS 162

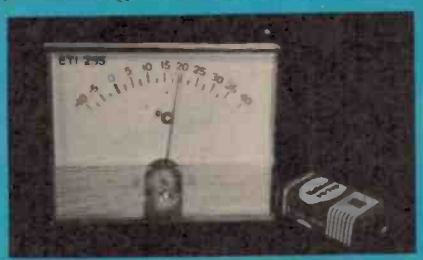
next month

SERIES 3000 'MINI' STEREO AMP

Since the success of the Series 4000 stereo amplifier (May, June, July issues, 1979) we've had an increasing number of requests for a 'compact' unit. This one should fill the bill — but we've not cut corners. It features low noise and distortion, delivers around 20 watts output, is simple to build and should cost around $80!

PINBALL WIZARDRY

Until quite recently, that seductive demon the pinball machine rattled and clattered its way through a five year life span totally unaided by modern technology. But . . . now the micro has taken over! Our correspondent takes you inside a modern monster.



ELECTRONIC THERMOMETER

This simple project is suited to measuring air temperature over the range from −10°C to +40°C or −10°C to +90°C according to your fancy. It's great as an electronic thermometer or it can be used to check air conditioners, heating systems etc.

BUILD A RADIO DIRECTION FINDER

This article describes how to make a direction finding antenna and how to use it with the popular Realistic DX160 receiver.

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

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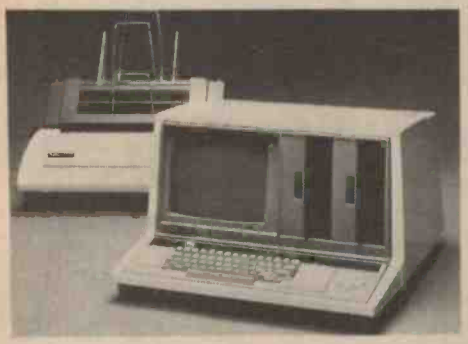

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- HP29C Scientific Programmable 98 steps, continuous $202.50 ($182)
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Keeping in touch in Kakadu

Ingenious frequency planning and the use of solar power are the key features of the communications system developed by Philips for the Kakadu National Park in the Northern Territory.

The newly created park covers some 6000 square kilometres of tropical rainforest in Arnhem Land. It is patrolled by rangers in a fleet of 24 vehicles, who need to be in constant radio contact with their bases, even when they are in the remotest reaches of the park.

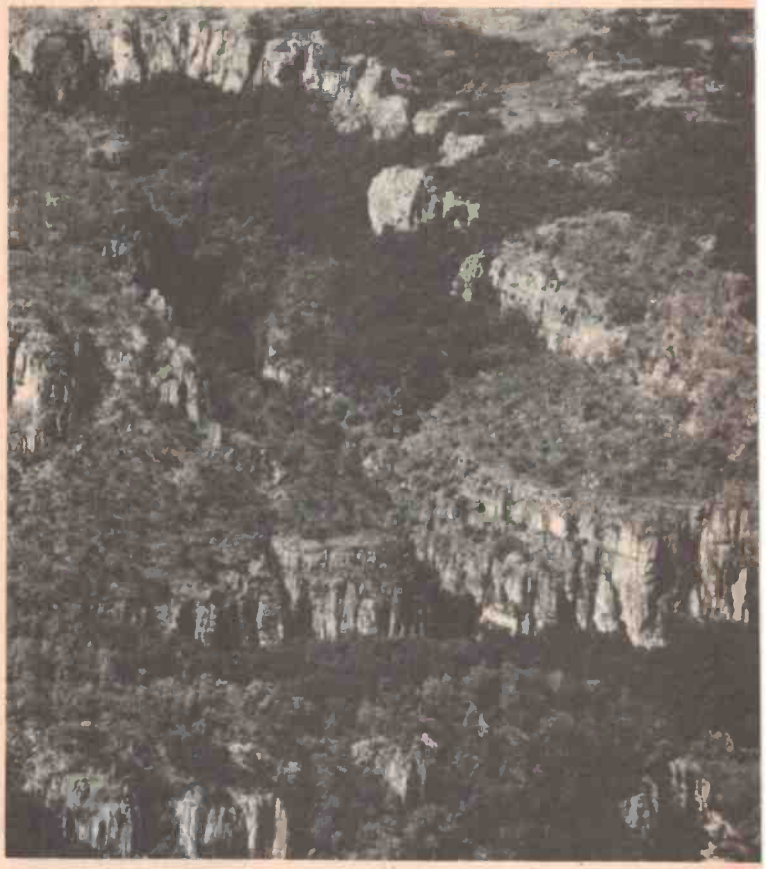
The rugged and inaccessible nature of the country, together with the hot and humid climate, meant that equipment with unusually high reliability and environmental stability had to be specified. Nor could the installations be allowed to detract from the outstanding beauty of the area, which in addition to its natural splendours is also the site of many sacred aboriginal burial grounds and rock paintings.

The complete communications system will cost about $250 000 and will consist entirely of equipment designed and manufactured in Australia. It is expected to be finished in about two years and will be conducted in two phases. The first phase will involve the installation of a central control station at Jabiru, two base stations at the existing campsites of Nourlangi Rock and East Alligator and two solar powered repeater stations (out of an eventual total of five) on mountain top sites.

Helicopter survey of the park has enabled the careful siting of equipment in rock crevices and other natural hiding places so as to leave the environment as undisturbed as possible. In the same spirit, the use of solar energy solves the power supply problems and keeps running costs down in the manner most consistent with the natural concept of the park.

Patrol vehicles will be fitted with specially ruggedised and weathersealed transceiving equipment designed to stand up to the harshest of driving conditions. In addition, each vehicle will carry a portable transceiver for use on foot patrols.

So that radio contact can be maintained at all times, even on foot patrols, each vehicle's transceiver can be switched to a repeater mode when the driver leaves the vehicle. Philips' new approach to frequency planning, for which a patent is pending, means that this kind of relaying can be achieved without the need to equip each vehicle with two separate radios and antennas. The consequent savings in installation costs and improvement in operating efficiency played a large part in winning the contract for Philips.



Another unique feature of the communications system is the automatic prevention of interference between two vehicles operating in close proximity to each other — a provision that could be very important in emergency situations.

. . . and in Brunei

In the equally wild and remote jungle country of Brunei, Philips are to supply solar powered telephone equipment.

The company will provide thirty single channel remote subscriber radio-telephone systems to extend the telephone service to some of the most inaccessible regions of the Sultanate. Solar arrays will supply the power in areas not covered by the national electricity grid.

And the Royal Brunei Police Force have recently taken delivery of more than 100 two-way VHF radios for use in fixed and mobile operational situations. The model FM828 radios are the same that will be used in the Arnhem Land patrol vehicles (see story above) and for the same reasons. Few places in the world are as hot and steamy as the Brunei jungles.

Satcom III — where are you ?

The mysterious disappearance of RCA's US$48 million Satcom III communications satellite late last year caused quite a stir — but they think they know what happened, now.

A recently concluded study suggested two possibilities. The most likely scenario is as follows: as the apogee kick motor starts (to boost the satellite from the transfer orbit to geostationary orbit), the exhaust cone breaks, letting the hot gases melt the rear portion of the satellite resulting in loss of the communications equipment.

The second scenario suggests that the kick motor ignites normally but the solar arrays deploy prematurely. Owing to the satellite's spinning and kick motor thrust, the arrays suffer rapid structural damage, leading to total failure of the onboard power system.

All communications from the satellite ceased 14.5 seconds into the 28-second kick motor burn. At the same time, exhaust temperature sensors indicated overheating. It is this that led the review board to prefer the first scenario.

Apart from the cost of the launch and satellite hardware, RCA stand to lose a further US$20 million in revenue. Insurance cover was for a total of US$77 million so it seems they won't be out of pocket.

To fill the gap, RCA has leased 11 pre-emptable transponders on AT&T's Comstar D-2 satellite. Instead of charging customers the US$70 000 cost for the Comstar D-2 transponders, RCA will only charge the US$40 000 per transponder it was to charge for Satcom III usage. RCA will launch a replacement satellite next June.

Business radio saves fuel

The use of two-way business radio is saving the community at least 225 million litres of motor fuel a year and would be much greater with more encouragement of mobile radio by the authorities.

So says the first issue of "ABIRA Voice", newsletter of the recently formed Australian Business & Industrial Radio Association (ABIRA), representing business, industrial and professional users of mobile two-way radio.

ABIRA Voice said research among radio manufacturers and suppliers had shown that four vehicles fitted with two-way radio do the work of five without. Applied to the existing estimated 180,000 two-way radios in service in Australia, this is saving in total at least 225 million litres of fuel, valued around $70m, a year.

The newsletter noted that the Federal Government had recently reduced licence fees for two-way radio users, but said the reductions did not go far enough.

ABIRA has asked the Minister for Post and Telecommunications, Mr A.A. Staley, to change the licence fee structure to widen the differential between small and large users next financial year.

This would promote efficiency, particularly among small business, and further reduce fuel consumption.

The newsletter added that to save administrative costs, licence fees should be payable five-yearly instead of yearly, and licences should expire on set quarterly dates.

For further information about ABIRA, contact Terry Winters on (03) 561-3555, or Rick Melgaard on (02) 428-5197.

Briefs

Microwave room heating could save fuel by only warming people, not objects, suggests R.V. Pound of Harvard Uni. The idea is to use a wavelength of 30 mm, which would only penetrate about 1 mm into a person's skin, avoiding heat damage to internal organs. But there are a few drawbacks. Wood and paper would absorb the waves, but metal objects would not, so on freezing cold days anything metallic would be untouchable. Pot plants and cut flowers would probably get very hot and bothered (because their leaves and petals are thin) and in any case prolonged exposure to microwave radiation is not now thought to be very healthy for human beings.

Funeral parlours in California are now selling the Memorial Audio Reproduction System, a solar powered tape recorder that fits snugly into your tombstone and will repeat a message to your descendants for many generations to come. The makers are planning to follow this up with a solar powered tombstone-mounted colour TV. Weird, huh?

Toronto will be the venue for the 1981 International Electrical, Electronics Conference and Exposition, which will be held from October 5th to 7th. This will be the 25th anniversary of the biennial conference, which is an international scientific marketplace for all aspects of electronics, with particular emphasis on telecommunications. Over a hundred technical papers will be presented and a call for these will be issued shortly. Enquiries to Southex Exhibitions, 1450 Don Mills, Ontario, Canada M3B 2X7.

Intel have issued a seven page application note detailing how their 5 volt EPROMs can be used with microcomputer systems. The note explains EPROM pinout evolution and philosophy, leading on to a discussion of system architecture. Particular emphasis is laid on eliminating system buss contentions and on the microprocessor/program store memory interface. Copies of application note AP-72 can be had free from A.J.F. Systems and Components, 310 Queen St, Melbourne 3000.

The United States is aiming to protect its lead in the semiconductor industry against increasing foreign competition. The Department of Commerce proposes a co-operative effort to concentrate research and development in university based 'centres of excellence' or in a central national lab. The US semi-conductor industry apparently feels that taxation policies, overstringent application of environmental restrictions and interference by government and other institutions are hampering its progress. It sees the removal of these impediments as a priority for any semiconductor development programme.

Meanwhile, at least one communist country is beginning to rival the Americans in the quality of their integrated circuits (thereby threatening the balance of power, eroding US complacency, precipitating World War Three, etc!). Officials of the US National Bureau of Standards, who visited IC factories in Czechoslovakia, reported that the quality of the devices produced was apparently equal to that of Western devices, although the scale of production and the level of automation are not yet equal to US producers.

A new power MOSFET has been developed by Siemens. Known as SIPMOS, it's made by an ion implantation process that's said to give higher production yields and a better control of channel widths. SIPMOS also has a low threshold voltage — only 2 V.

Zinc/chlorine batteries are current favourites

Institutions in the United States are looking very favourably on the new zinc/chlorine storage batteries being developed by Gulf and Western.

The Department of Energy last year gave US$11.5 million to build 100 of the batteries for tests in power stations, where it is hoped they can be used to store excess energy generated at off-peak times. Now the Electric Power Research Institute has just donated another US$14 million to Gulf and Western's research programme on top of the US$13 million it already has invested.

Electric road vehicles are likely to prove the most lucrative application of the new batteries. A prototype has been used to drive a small car a distance of 240 kilometres at 90 km/hour, which is a considerable improvement on the 160 km that can be achieved in the same car by a nickel/zinc battery and much better than the 80 km range of advanced lead-acid batteries. Zinc/chlorine batteries wear better too — they last six or seven times as long as other types.

Despite complex engineering problems which have yet to be completely mastered. Gulf and Western's President predicts that electric car engines will be selling for US$3000 by 1984.

Audio auto-analyser

Microprocessor control allows a new audio analyser from Hewlett-Packard to be set with a single keystroke to measure frequency response over the entire audio spectrum.

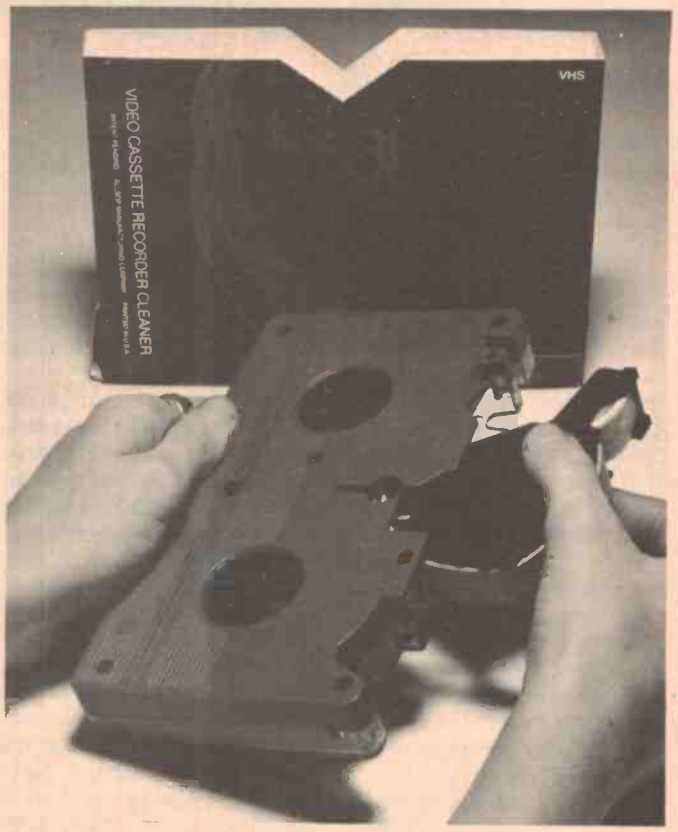
The 8903A combines a low distortion audio source and an analyser in one instrument which measures dc volts, ac volts, distortion, signal-to-noise, signal-to-noise-and-distortion (SINAD), hum and noise, gain and power output.

The audio source section gives 0.6 mV to 6V open circuit from 20 Hz to 100 kHz and can be set for log sweeps as well as incremental changes. Distortion can be measured to around 0.003% (-90dB) in the audio range and ac level accuracy is specified at +-0.5%.

Digital displays resolve frequency to five digits and amplitudes to four. Amplitudes can be displayed in dB or percentage terms relative to a previous measurement or a keyed-in value.

The 8903A source can also be used in transceiver testing to modulate the test transmitter while the analyser section of the same instrument measures the demodulated output of a companion 8901A Modulation Analyser for distortion and frequency response.

More details from Hewlett-Packard (Australia) Pty. Ltd., 31-41 Joseph St, Blackburn, Vic 3130. Phone (03) 89-6351.



Unique VCR cleaner

A unique video recorder cleaning cassette has been produced by Allsop, makers of the famous 'Allsop 3' audio cassette deck cleaning cassette.

The device incorporates a chamois cleaning tape inside a standard VCR cassette assembly and, like the Allsop audio cleaning tape, the whole cleaning action is driven by the machine itself.

The Allsop 3 Video Cassette Recorder Cleaner is placed in the machine and the play button operated. The machine's mechanism then draws the cleaning chamois tape out of the cassette and drives it around the video and audio heads, removing any foreign particles but not abrading the heads, according to Allsop. A judiciously located felt pad presses on the capstan and pinch roller and cleans these two components as well. The cassette shuts off the recorder after the cleaning action is completed. A specially-formulated cleaning fluid is used on the chamois and felt pad.

We had an associate try out one of these units on a VCR that had not been previously cleaned. The number of drop-outs was reduced by a factor of four after the first use and reduced to negligible proportions following two further cleanings. Allsop recommend three 'playings' for a thorough clean.

The assembly in the cassette containing the chamois and felt pad is replaceable.

The Allsop 3 Video Cassette Recorder Cleaner, model 60800, suits VHS machines and is available at reputable video outlets for around $35. The replacement cleaning cartridge, model 61800, costs around $10.

More information from the sole importer, Communications Power Inc., P.O. Box 246, Double Bay NSW 2028. (02)357-2022.

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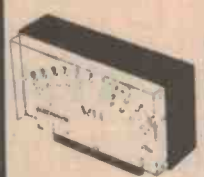

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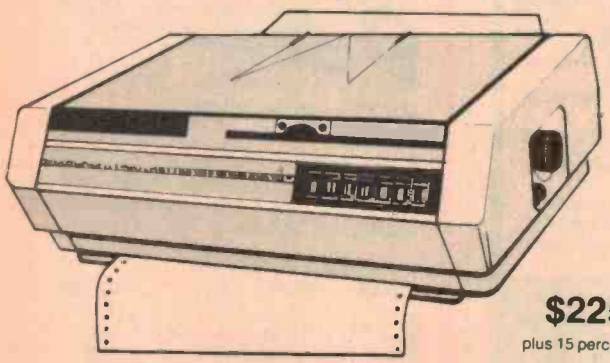

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Project Galileo

Brian Dance

In our January issue, Brian Dance reported on Voyager 2's visit to Jupiter. Now he looks ahead to the next US mission to the giant planet.

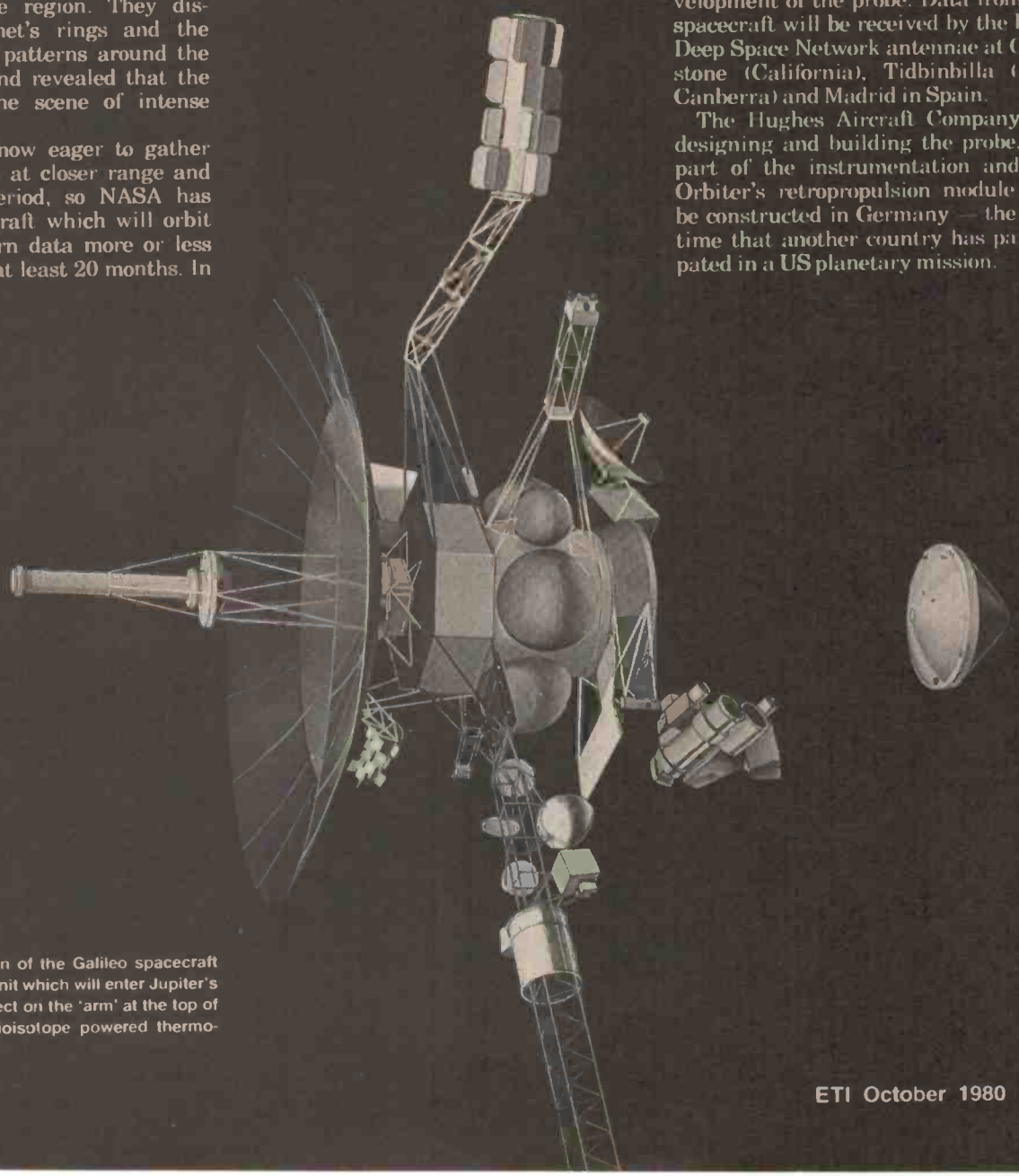
JUPITER has fascinated men ever since Galileo first observed four of its moons in 1610. This huge gaseous planet has 50 times the mass of all the other planets put together and probably has a composition similar to that of the sun.

Two Voyager missions flew past Jupiter within a few months of each other last year and greatly extended our knowledge of the region. They discovered the planet's rings and the peculiar weather patterns around the great red spot, and revealed that the satellite Io is the scene of intense volcanic activity.

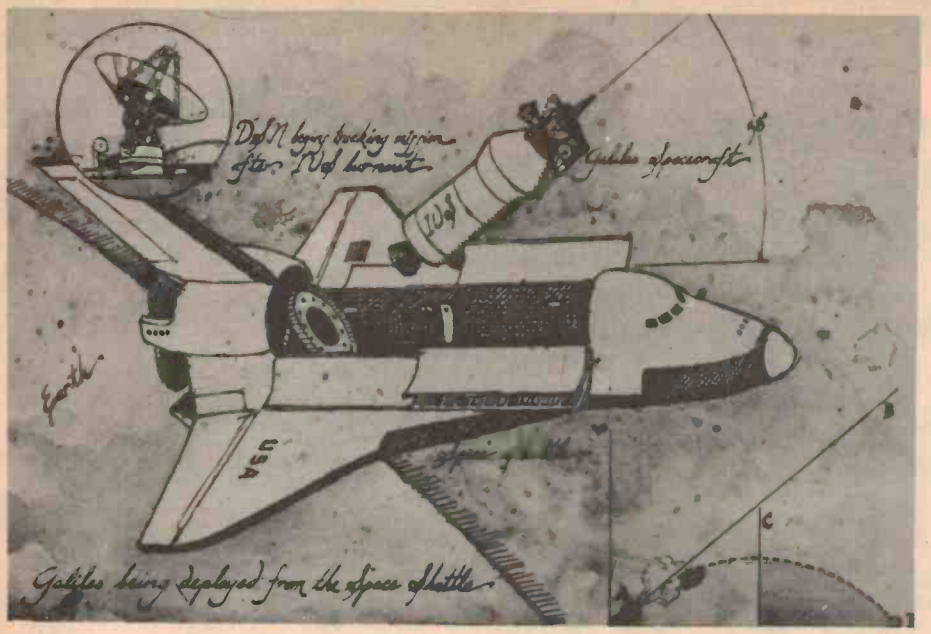
Scientists are now eager to gather more information at closer range and over a longer period, so NASA has planned a spacecraft which will orbit Jupiter and return data more or less continuously for at least 20 months. In addition, a probe carried with this spacecraft will be released before the craft reaches Jupiter and sink deep into the atmosphere to gather and transmit data.

This project was originally know as the Jupiter Orbiter Probe, but it has since been renamed Project Galileo after the famous astronomer. According to current plans, the Galileo spacecraft will be launched in January 1982 and arrive in the vicinity of Jupiter in July 1985. The project will be managed by the Jet Propulsion Laboratory of California and NASA's Ames Research Center will be responsible for the development of the probe. Data from the spacecraft will be received by the huge Deep Space Network antennae at Goldstone (California), Tidbinbilla (near Canberra) and Madrid in Spain.

The Hughes Aircraft Company are designing and building the probe, but part of the instrumentation and the Orbiter's retropropulsion module will be constructed in Germany — the first time that another country has participated in a US planetary mission. ▶



An artist's impression of the Galileo spacecraft releasing the Probe unit which will enter Jupiter's atmosphere. The object on the 'arm' at the top of the picture is a radioisotope powered thermo-electric generator.



An artist's impression of the Galileo spacecraft and inertial upper stage leaving the space shuttle.

Launch and trajectory

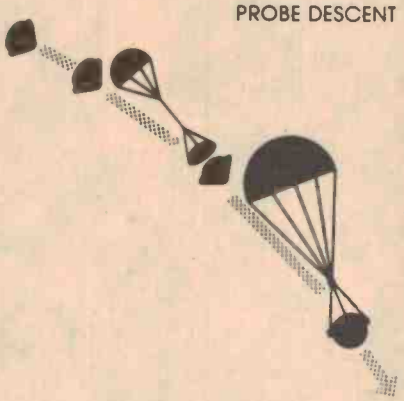
Project Galileo will take advantage of the best Jupiter launch opportunity for the rest of this century to send a large amount of scientific equipment to Jupiter and will be the first mission to use the Space Shuttle as an interplanetary launch vehicle, always assuming that the present problems with the Shuttle are solved in time.

An Inertial Upper Stage will be released from the Shuttle in Earth orbit and aligned for the first stage rocket to be fired. Three rocket motors will fire in sequence and the Galileo craft will be sent speeding towards Mars. About 100 days after launch the craft will fly past Mars, using the red planet's gravity to assist it on its way to Jupiter.

Probe separation

Near the end of its long journey, about 150 days before it reaches Jupiter, the probe will be separated from the Orbiter vehicle. The trajectory of the craft before probe separation is critical. It is essential that the probe strikes the atmosphere of Jupiter at a shallow angle, since the heat generated by a steep descent would burn it up like a meteor. But the angle must not be too shallow or the probe will bounce off the top of the atmosphere into space, like a stone skimming the surface of a lake. Once the probe has left the Orbiter its path cannot be changed.

After probe separation, the rocket motor of the Orbiter will ignite to deflect it away from the atmosphere. The Orbiter will receive radio signals from the probe during atmospheric entry and relay this data immediately to Earth, as well as storing it on magnetic tape for retransmission later if necessary.



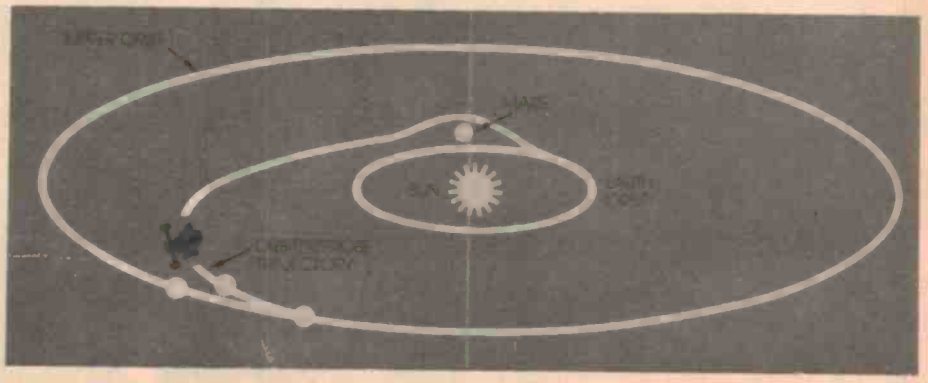
Entry and descent

The probe will be aimed at the light coloured equatorial zone of Jupiter between 1.0 and 5.5 degrees north or south latitude, so as to enter through the highest cloud regions and hopefully make diagnostic measurements of all the important cloud layers. Time of entry will be late afternoon on the Jovian clock.

Let us follow the sequence of events as the probe approaches the giant planet. It will decelerate rapidly from its approach velocity of some 48 km per second (over 100 000 miles per hour), thereby encountering a force of 400 times Earth gravity, and atmospheric friction will cause its heat shield to glow brightly.

Shortly after entry the probe's parachute will open, the heat shield will be jettisoned and the package of instruments will descend more slowly. During its descent it will send data continuously to the Orbiter, which will relay the information to Earth.

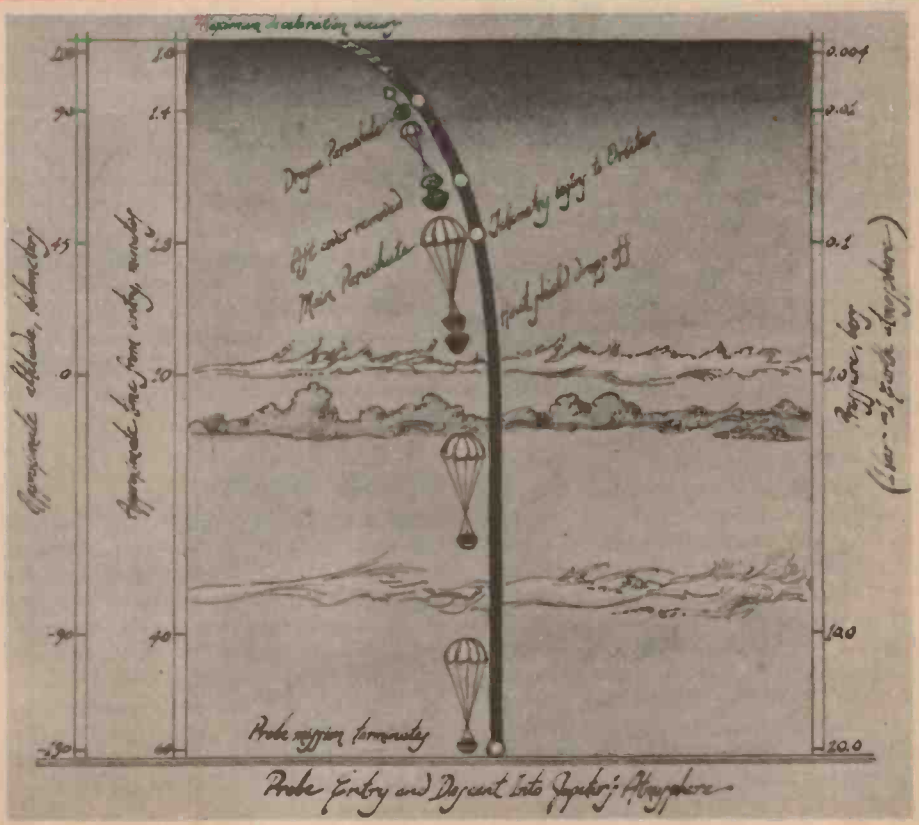
After about 40 minutes the probe will have sunk to a depth in the atmosphere at which the pressure is about ten times that at sea level on Earth. The lowest of Jupiter's cloud regions are expected to be in this region, nearly 90 km below the uppermost cloud layer. Temperatures of about 73°C are anticipated.



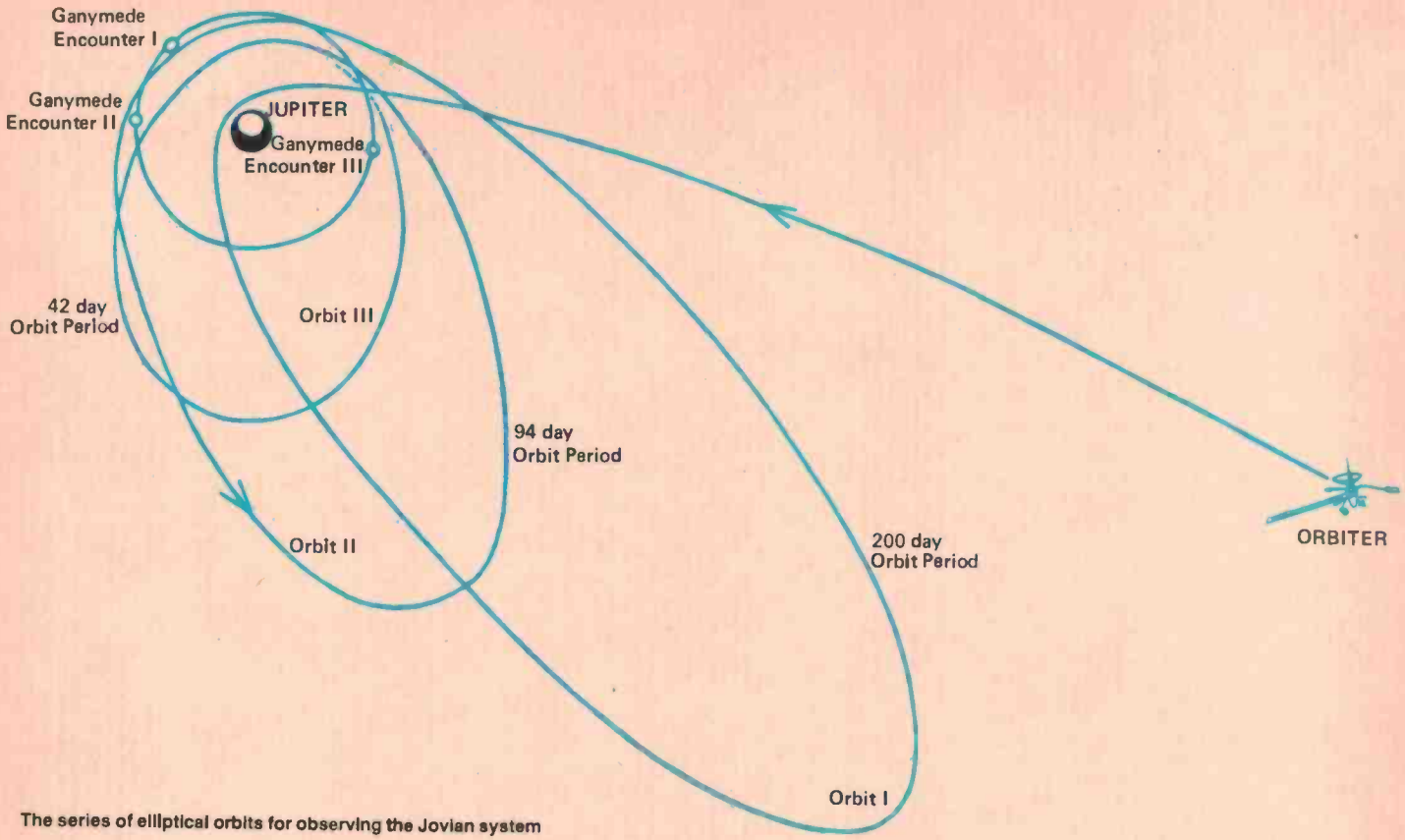
Path of the Galileo craft on its flight to Jupiter.

ABOVE: The red-hot heat shield separates from the descent module which is slowed by parachute. (Picture courtesy of the Jet Propulsion Laboratory).

The probe will continue to sink through the atmosphere, but its mission will be complete after about 60 minutes. By this time it will have reached a depth below the top cloud layers of some 130 km where the pressure is about 20 earth atmospheres and radio signals to the Orbiter will be severely attenuated. Also the higher temperature will have made its circuitry unreliable or inoperative in any case. ▶



An artist's impression of the Probe's descent into the Jovian atmosphere showing the heat shield being jettisoned and the parachute opening.



The series of elliptical orbits for observing the Jovian system

The Orbiter's mission

The main rocket motor of the Orbiter will burn for nearly 50 minutes after the end of the probe's mission, so that the Orbiter enters an elongated elliptical orbit around Jupiter. About this time it will fly past Io, the innermost of the four Galilean satellites and will use Io's gravitational field to reduce the amount of fuel it requires to enter the desired orbit around Jupiter. The firing of the rocket will take the Orbiter outwards from a distance of about 358 000 km (five Jupiter radii) to a distance of some 19.5 million km.

After 100 days, at a point of greatest distance in its elliptical orbit from Jupiter, the craft's large rocket will be fired for the third and last time. This will change its orbit to one that makes closest approach about 900 000 km above the planet's cloud tops.

Each time the Orbiter passes near to the satellite Ganymede it will use the latter's gravitational field to alter orbit slightly. This technique will save fuel and provide at least 11 near-encounters with Jupiter and 11 close passes by Ganymede and Callisto — the two outer Galilean satellites. Some of the encounters will be very close, within one tenth of the radius of the satellites, and details as small as 30 to 50 metres on the surface will be resolved. This is 10 to 100 times better resolution than that obtained by the Voyager craft.

It is planned that Galileo will spend 20 months orbiting Jupiter in ellipses with periods of 200 days (initially), 94 days and 42 days. It is expected to be still functioning at the end of this time, in which case it may be used to look at the dawn regions of the planet and to study the moons in more detail.

The craft will also be used to explore the general environment of the huge planet. During at least one of its orbits Galileo will study the 'magnetotail' of Jupiter — the magnetic fields in a direction opposite to that of the sun. This involves measurements at distances out to 150 times the radius of Jupiter, some 10.74 million km. This type of work cannot be undertaken with fly-by missions, since their trajectories are too near the planet and too strongly deflected to reach the desired region of space behind it.

Orbiter design

Like all planetary craft, the Galileo Orbiter and its probe will carry a variety of scientific instruments, all designed for minimum mass and volume. When it is launched from the Inertial Upper Stage of the Shuttle the mass of the complete system will be over 1500 kg. Much of this will be rocket fuel and the supporting structure. The Orbiter payload will be only a little over 60 kg, and that of the probe 30 kg.

One interesting new feature is that, because of the conflicting requirements of different sets of experiments, one part of the Orbiter vehicle is to be spin stabilised and the other part is three-axis stabilised. During the passage to Jupiter, the two parts of the craft will be allowed to spin together. When a command signal is sent from Earth, the part of the craft containing the imaging camera systems will be de-spun to provide a stable platform. The on-board instruments can then be pointed accurately at Jupiter and its satellites to provide high quality, stable images. The instruments for observing Jupiter's magnetosphere, on the other hand, require a platform which spins several times a minute, so they are situated in the other part of the craft.

A large, 4.8 metre diameter deployable antenna on the Orbiter will transmit signals to the Earth stations of the Deep Space Network in the S band (4 GHz) and the X band (8 GHz). This antenna will be folded during the launch and extended rather like an umbrella with its supporting ribs when the craft is on its trajectory towards Jupiter. A much smaller dish antenna will be used to receive signals from the probe. Radio signals to and from the Earth stations will take about 40 minutes to travel the 700 million km between Jupiter and Earth.

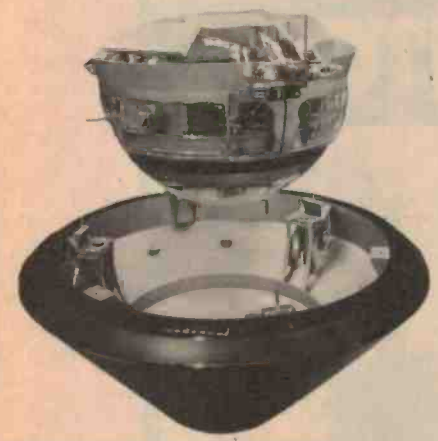
The very low intensity of sunlight at such enormous distances from the sun means that solar cells cannot be used to

power the transmitters and other electrical systems. Radioisotope thermoelectric generators are the only source of continuous long term power light enough to be carried on deep space missions. Two such generators will be mounted on short arms on each side of the Galileo Orbiter, behind the main antenna.

Probe design

The probe to be carried with Galileo is basically similar in principle to the large probe of the Pioneer Orbiter vehicle (see ETI June 1978 and May 1979). It consists of a deceleration module and a descent module. As it is of vital importance that this long and expensive mission shall not fail, a heat shield of very conservative design will be incorporated in the craft — indeed,

Descent module of the Probe.



Descent module (top) and heat shield.

The complete Probe in its heat shield with aft cover.
(All above pics courtesy of Hughes Aircraft Co,)

The probe will transmit data to the Orbiter craft which will then relay the data to Earth.

44% of the weight of the probe assembly is taken up by the heat shield. The problem of designing this shield is made more difficult by the fact that we can only guess at the conditions which are present beneath the uppermost cloud layers of Jupiter.

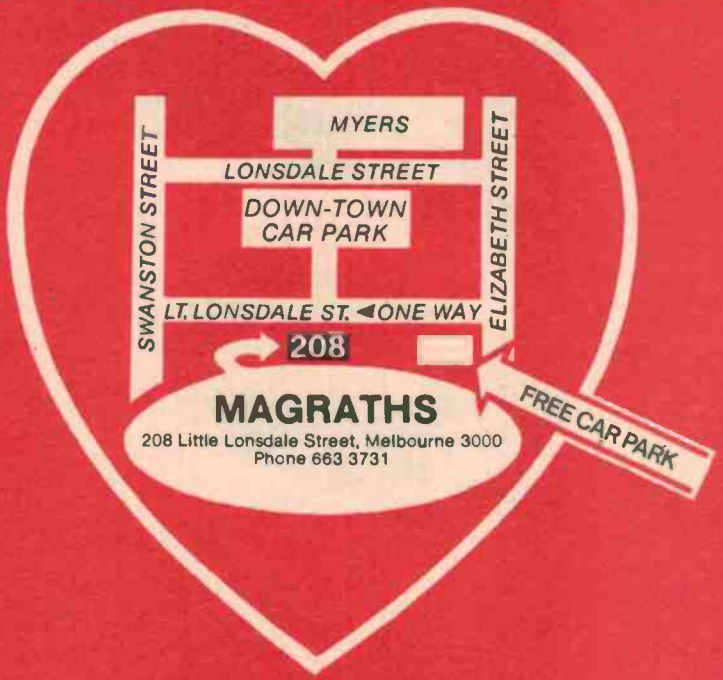
If the descent module had to withstand the very high pressure of the lower Jovian atmosphere, it would need to be extraordinarily massive. For this reason a vented design has been chosen, which allows the pressures inside and outside the module to be equal all the time.

The probe requires electrical power only during its relatively short descent through the Jovian atmosphere. This power will therefore be provided by a lithium battery which lies unused throughout the interplanetary flight to Jupiter. Lithium cells are well known for their long shelf life, but an extra special design has doubtless been selected for the Galileo probe. This battery will power all the probe systems during the descent and also provide the radio transmitter power to communicate with the Orbiter vehicle. But the probe will not be able to transmit directly to Earth.

Special antennae mounted on the rear of the probe have been designed for data transmission to the Orbiter for the longest possible time under the difficult conditions prevailing deep in the Jovian atmosphere. The probe will not receive any command or other signals from the Orbiter, but merely send data.

A timer and a g-switch (gravitational acceleration switch) in the probe will initiate heat shield separation and the parachute deployment sequence. The electronic systems will be turned on by another timer about five hours before entry into the atmosphere and shortly afterwards the probe will start gathering data about the lightning and radio emissions from the planet. This data will be stored in the probe memory until a g-switch turns on the probe radio transmitter after the heat shield has been jettisoned. The stored data and the real time data will then be sent to the Orbiter. ▶

MAGRATHS



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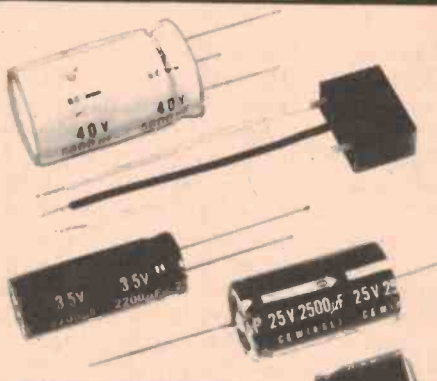

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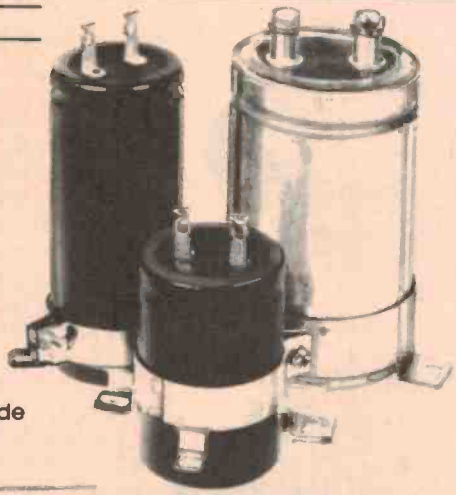

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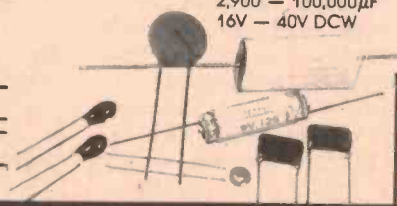

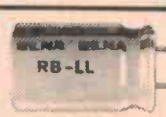

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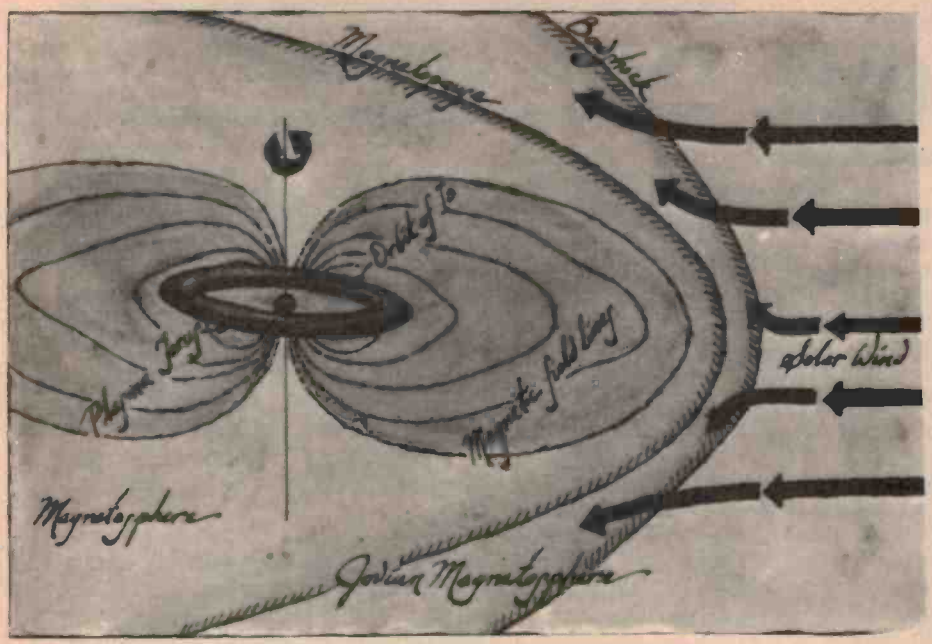

Jupiter's magnetosphere extends for a considerable distance from the planet

Orbiter instrumentation

Previous planetary missions have used conventional vidicon tubes in their TV camera systems, but the Galileo Orbiter will use a new Charge Coupled Device (CCD) camera with a 1.5 m focal length, which will have a broader spectral response and better resolution. This and other remote sensing instruments will be carried on a short arm at the rear of the craft.

Another instrument in the de-spun section of the craft is the near infrared mapping spectrometer which will provide spectral images in many different wavelength ranges, measuring reflected sunlight and thermal emission from Jupiter's atmosphere and from its satellites. This will allow scientists to study the atmospheric composition, cloud structure and temperature, and to identify materials on the surface of satellites. An ultraviolet spectrometer will also be used to study the composition of the planet's upper atmosphere and the rare atmospheres of the satellites.

A photopolarimeter/radiometer in the de-spun section will measure temperatures at various heights in Jupiter's atmosphere and on the surfaces of the satellites. Cloud characteristics will also be investigated with this instrument.

Turning now to the spinning section of the Orbiter, we find a magnetometer which measures the magnitude and spatial variation of the magnetic fields around Jupiter and its satellites. Because electric currents and magnetic materials on board can disturb the field near the Orbiter, the magnetometer will be attached to a long boom to hold it well away from the body of the craft.

Plasma instruments will gather information on low energy particles and clouds of ionised gases in the magnetosphere (more about this later), so that scientists can study their resonances and the effects on them of the magnetic and electric fields near Jupiter.

A particle detector in the spinning section will provide data on the composition, distribution and energy spectra of high energy particles trapped in the Jovian magnetic fields, which cause radiation belts like the Van Allen belts around the earth. A dust measurement instrument will determine the size, speed and charge of micrometeorites and other small objects.

Also in the non-spinning part of the Orbiter will be radio propagation experiments to investigate the structure of the atmospheres and ionospheres of Jupiter and its satellites using radio waves. Celestial mechanics experiments will also be performed to detect any gravity anomalies which may be caused by concentrations of mass in the planet or its satellites.

Probe instrumentation

An atmospheric pressure instrument in the descent module will provide further information on the temperature, density, pressure and molecular weight of the atmospheric gases, while a neutral mass spectrometer will measure their composition at different levels.

A helium abundance interferometer will measure the ratio of hydrogen to helium with extremely high accuracy. This measurement is of great importance to cosmologists, since it should provide evidence for or against the 'big bang' theory of the origin of the universe.

A nephelometer will determine the size of cloud particles and the location of the cloud layers in the Jovian atmosphere. A net flux radiometer will measure the energy radiated and received by the planet at different levels. At present it looks as if Jupiter radiates 2½ times as much energy as it receives from the sun.

Lightning and radio detection equipment will measure the electromagnetic radiation generated by lighning flashes in the atmosphere. An energetic particle detector will determine the energies of electrons and protons in the inner regions of the radiation belts and their distributions near the edges of the belts.

The magnetosphere

As long ago as 1955 when radio astronomers first detected signals from Jupiter, they were certain that the planet must have a large magnetic field which could trap particles and generate radio waves. This region of magnetic field and trapped particles is known as the magnetosphere and it will be one of the main objects studied by the Galileo project.

Jupiter's magnetic field is 20 to 30 times stronger than Earth's, which makes its magnetosphere very large. If the Jovian magnetosphere emitted enough light to make it visible from Earth, it would appear about the same size as the moon in our sky!

There are three distinct regions. The innermost is doughnut-shaped and similar to the magnetosphere of the earth, but larger and more intense. It contains several shells where charged particles of extremely high energy can be concentrated. A middle region consists of a sheath of charged particles driven around by Jupiter's rotating magnetic field. In the outermost region, streams of electrons and protons from the sun interact with the magnetic fields in constantly changing patterns. Some leak into the magnetosphere, while others may be deflected across the solar system as far away as Mercury.

A study of these regions may not only provide us with a much better understanding of astronomical phenomena, but could be very useful in other fields. Nuclear fusion researchers for example will welcome a better knowledge of the ways in which high-temperature plasmas may be contained by magnetic fields.

The writer acknowledges the assistance of the Hughes Aircraft Company, NASA's Ames Research Center, California and the Jet Propulsion Laboratory in preparing this article.

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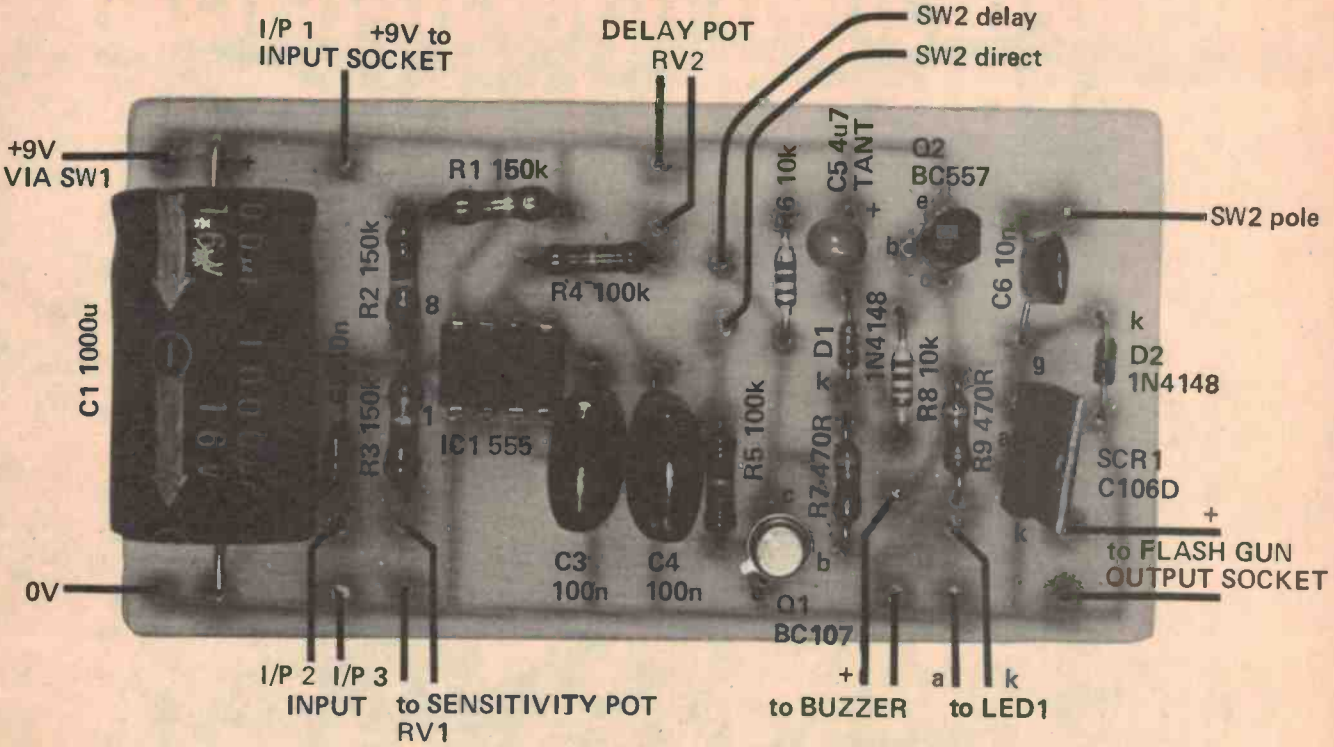
Project 568

Sound or light operated flash trigger has many features

Phil Wait
Simon Campbell

You too can take spectacular action shots just like those shown in these pages. This project is simple to build, suits any flash unit and can be triggered in a number of ways.



NOTE: Printed circuit board artwork is on page 113.

PHOTOGRAPHICALLY 'freezing' an action while it is in progress is an extraordinarily difficult task unless you can accurately time the flash to 'fire' at a particular instant during the event. This project does exactly that. You can trigger your flash from a sound, such as that produced by a bouncing ball, or by light — by having an object break a beam of light for example. You can arrange to trigger the flash by a light source turning on, or turning off. In addition, this unit permits you to *delay* the triggering of the flash by a preset amount, allowing you to 'catch' the action at differing periods after the triggering event.

The attraction of this unit is that you need no fancy equipment to take good pictures like those you see on these pages. You don't have to have a fancy SLR camera — just a simple model on which the shutter can be locked open. We haven't tried it, but with a powerful flash gun even a pinhole camera should work!

The circuit

A 555 timer IC (surprise, surprise!) is employed to provide a trigger pulse from a suitable input sensor. This can be an inexpensive crystal microphone or a phototransistor connected to trigger the 555 from a light source turning on or a light source turning off. Obviously, the unit can be used as a slave flash trigger also.

The 555 is operated in the *monostable* mode. That is, when triggered by the input signal detector it provides a single pulse output, the width of this pulse being predetermined by a preset control. The pulse output of the 555 is arranged to turn on an SCR which is connected in series with the flash gun's power supply via an interconnecting cable.

To provide a variable delay, the SCR is triggered from the *trailing* edge of the pulse output from the 555. The width of the pulse can be varied with a potentiometer control. A minimum delay of about 10 milliseconds and a maximum delay in excess of 200 milliseconds can be obtained. If you require a shorter delay, the value of R4 may be reduced, but do not use a value less than 1k.

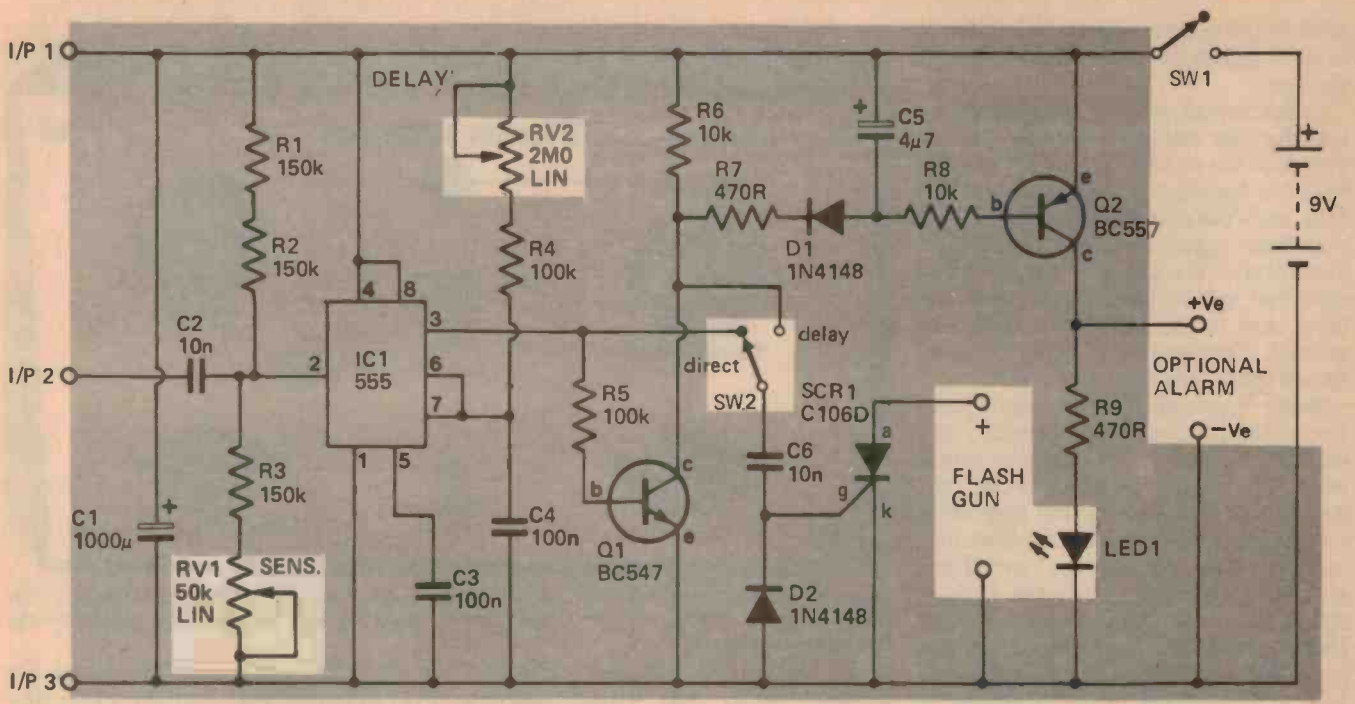
When setting up a shot, one needs some indication that the trigger unit is being correctly fired by the action, without having the flash gun 'popping' numerous times. For this reason we have included a LED on the front panel and a piezo buzzer to provide both a visual and an audible indication. The piezo buzzer is optional, but we found it handy as you can't always be involved in the action and watch the LED at the same time.

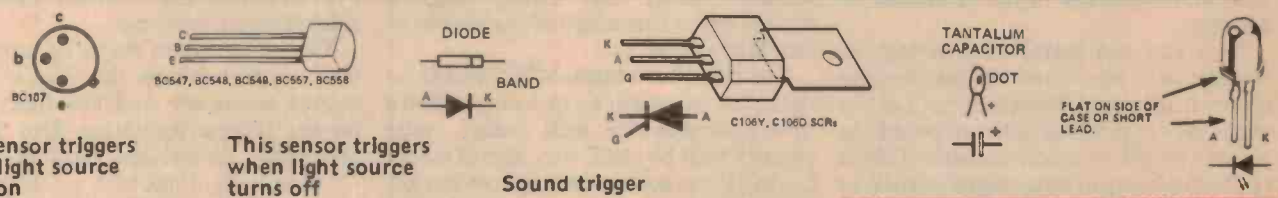
For 'rehearsals', the flash gun cable is disconnected. With everything set to go the sensitivity control on the trigger unit is set at some arbitrarily chosen level and the action initiated. If all is well, the LED will light and/or the buzzer will sound.

The whole unit is powered by a single 9V battery. A No. 216 transistor radio battery does the job nicely and should give long life.

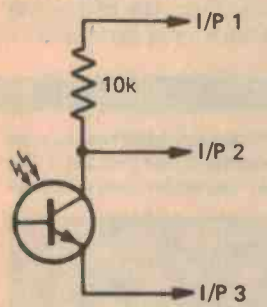
Construction

We constructed our unit using a pc board to mount all the minor components. We recommend you use the pc board as it simplifies construction and avoids the more common wiring errors. The whole unit was assembled into a convenient 'jiffy' box measuring 160 mm long by 95 mm wide by 50 mm deep. All the major components were mounted on the aluminium front panel and wired to the pc board with hookup wire. We used a five-pin standard DIN socket for the input connector and a two-pin socket, usually used as a speaker connector, as a connector for the flash gun cable. The sensors generally need to be placed in a convenient position re- ▶

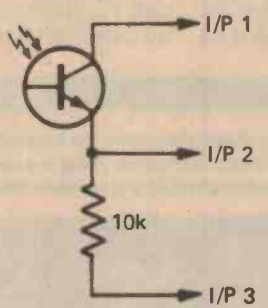




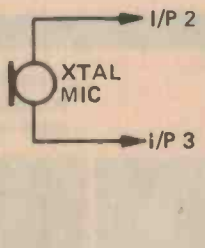
This sensor triggers when light source turns on



This sensor triggers when light source turns off



Sound trigger



Use phototransistors, type FPT100 or TIL78 or similar

HOW IT WORKS — ETI 568

IC1 is a 555 timer connected in the monostable mode. The timing period is determined by RV2, R4, C4 and is adjustable between 11ms and 230ms with the values shown. The trigger input of the chip is held just above its firing potential of one third supply voltage by adjustment of RV1 which acts as a sensitivity control. A negative-going signal is coupled to the input by capacitor C2. Note that the values of R1, 2, 3, RV1 provide a medium input impedance and screened cable may be required when the sensor must be separated from the unit.

When IC1 is 'fired', its output (pin 3) goes high for the monostable period. With SW1 switched to 'direct', this positive going pulse will fire the SCR and discharge the flash enabling the unit to be used as a slave flash. There will be a finite delay owing to rise time of phototransistor response, propagation delay within IC1 and rise time of its output. However, this will be measurable in microseconds and should be negligible.

When used in the 'delay' mode, the output pulse is inverted by Q1 causing the flash to fire on the trailing edge of the monostable pulse. To avoid repeated use of the flash when setting up the unit, indicator LED1 is provided. Each negative excursion of Q1 collector causes C5 to charge via R7, D1 effectively stretching the monostable pulse and providing a clearly visible flash.

An optional alarm, for example a solid-state buzzer, can be connected into the circuit providing audible indication of triggering.

Capacitor C1 provides overall decoupling. Supply current is about 10 mA.

PARTS LIST — ETI 568

Resistors all ¼W, 5%
- R1,2,3 ..... 150k
- R4,5 ..... 100k
- R6,8 ..... 10k
- R7,9 ..... 470R

Potentiometers
- RV1 ..... 50k lin
- RV2 ..... 2M lin

Capacitors
- C1 ..... 1000u electrolytic
- C2,6 ..... 10n polyester
- C3,4 ..... 100n polyester
- C5 ..... 4u7 tantalum

Semiconductors
- IC1 555
- Q1 ..... BC547, BC107 etc
- Q2 ..... BC557, BC177 etc
- SCR1 ..... C106D or similar
- D1,2 ..... 1N4148 or 1N914
- LED1 ..... any LED

Miscellaneous
- SW ..... SP DT toggle switch
- SW2 ..... SP DT toggle switch

ETI-568 pc board; flash gun connector, crystal microphone with plug and socket (if used); 9V battery and battery clip; box to suit; buzzer (if required).

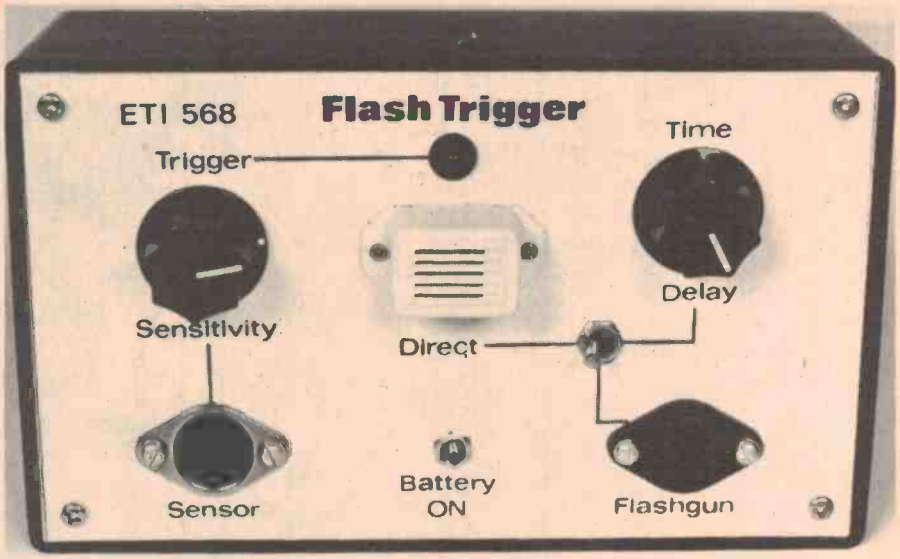
Additional Components for Light Operation:
Phototransistor FPT 100, TIL78 etc.
10k resistor.

mote to the trigger unit and we made up several cables for each of the different sensors.

Construction is best commenced by loading the components into the pc board. It is usually convenient to start with the resistors and capacitors. Take care with the orientation of the 4.7 μF tantalum capacitor and the 1000 μF electrolytic. The semiconductors can be mounted on the board next. Here too, take care to get them the right way around. Particularly watch the orientation of the IC and the two diodes.

Some mechanical work comes next. Mark out the front panel carefully and drill all the holes. Temporarily mount each individual component on the panel, just to make sure that they all fit without problems. We used a Scotchcal front panel to dress up the unit. If you are doing likewise, now's the time to attach it to the panel of the jiffy box. Having done that, finally mount the two pots, the two sockets, the switches, the LED and the buzzer (if you've elected to use one).

Now you can install the wiring between the pc board and the components on the front panel. Note that pin 1 of the input socket is wired to the pc board via a short length of shielded cable. This is to avoid pickup of stray signals, such as hum, which may cause triggering difficulties. Be careful with the connections



The prototype was housed in a 'Jiffy' box measuring 160 mm long by 95 mm wide by 50 mm deep. The front panel was dressed up with a Scotchcal transfer. These should be available through suppliers — see Shoparound on page 65.

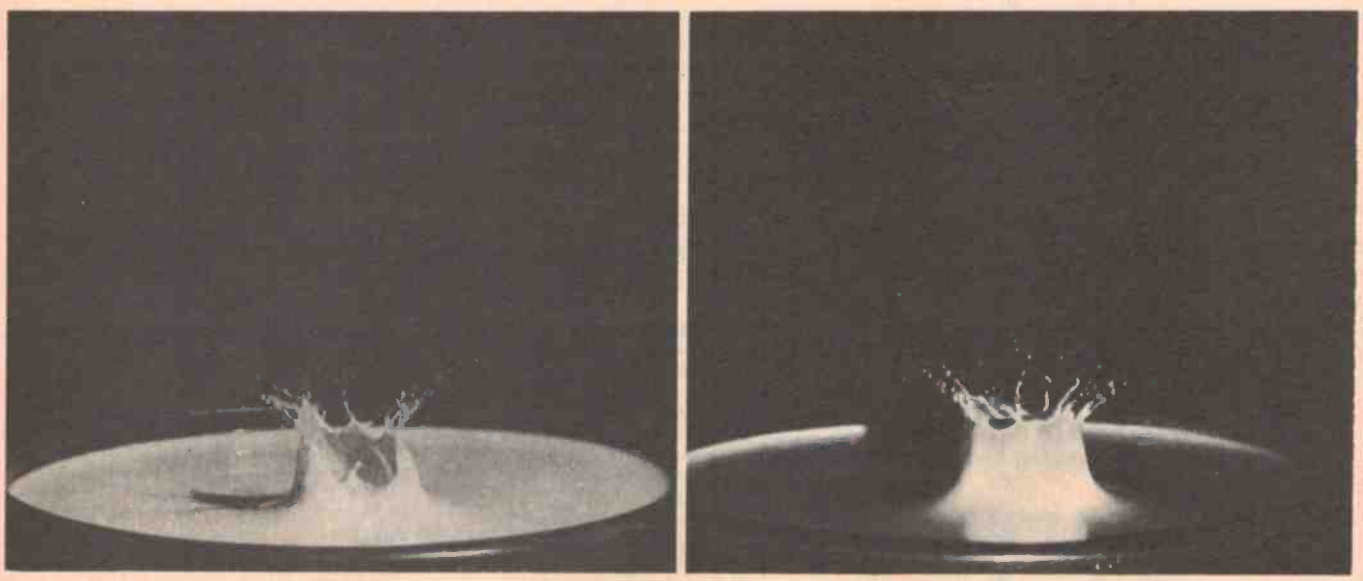
to the LED and the two pots. The component overlay and wiring diagram should make this stage of the construction fairly clear.

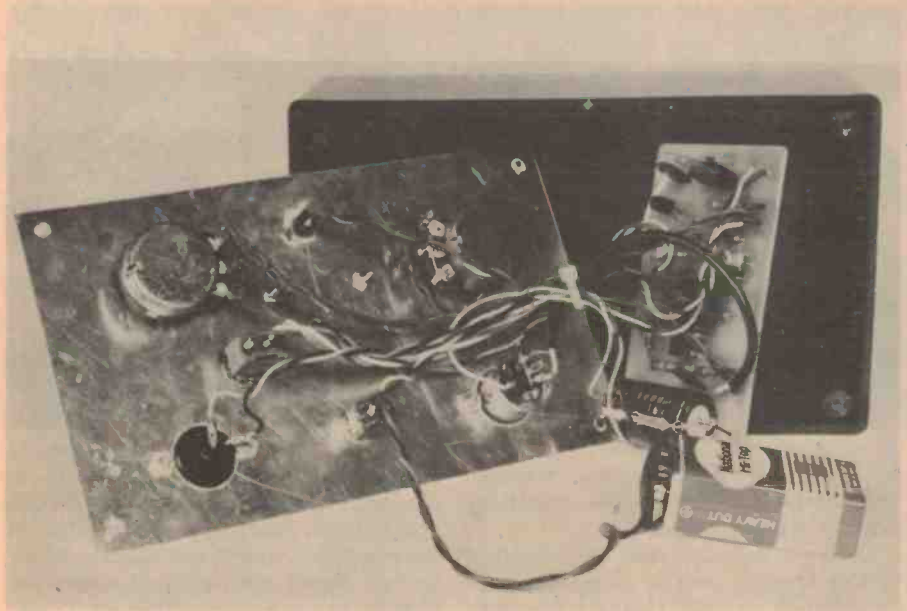
You don't have to use a DIN socket for the input connector as we have, indeed a tip-ring-and-sleeve jack socket could equally well be used. Any sort of socket having three connections will do the job. Similarly, we used a two-pin socket for the flash gun connector as we had it on hand. Both these connectors are readily available and this was the main consideration in our choice.

You will have to make up a suitable lead to go between the trigger unit's output connector and the flash gun's remote trigger connector. Use the appropriate connectors at each end.

Polarity is important as the trigger unit employs an SCR for the triggering 'switch' device. One way of determining

This series of pictures shows how the variable time delay facility can be used to capture the effect of a ball bouncing in a container of fluid (milk here). The shots were sound-activated and the time delay was set for delays between





Internal view of the completed prototype. Note that wiring between I/P2 and the panel-mounted input socket is via shielded cable. Sensors should be wired with shielded leads also.

the polarity of the flash gun is to measure the voltage present at its trigger socket with a multimeter.

Sensors

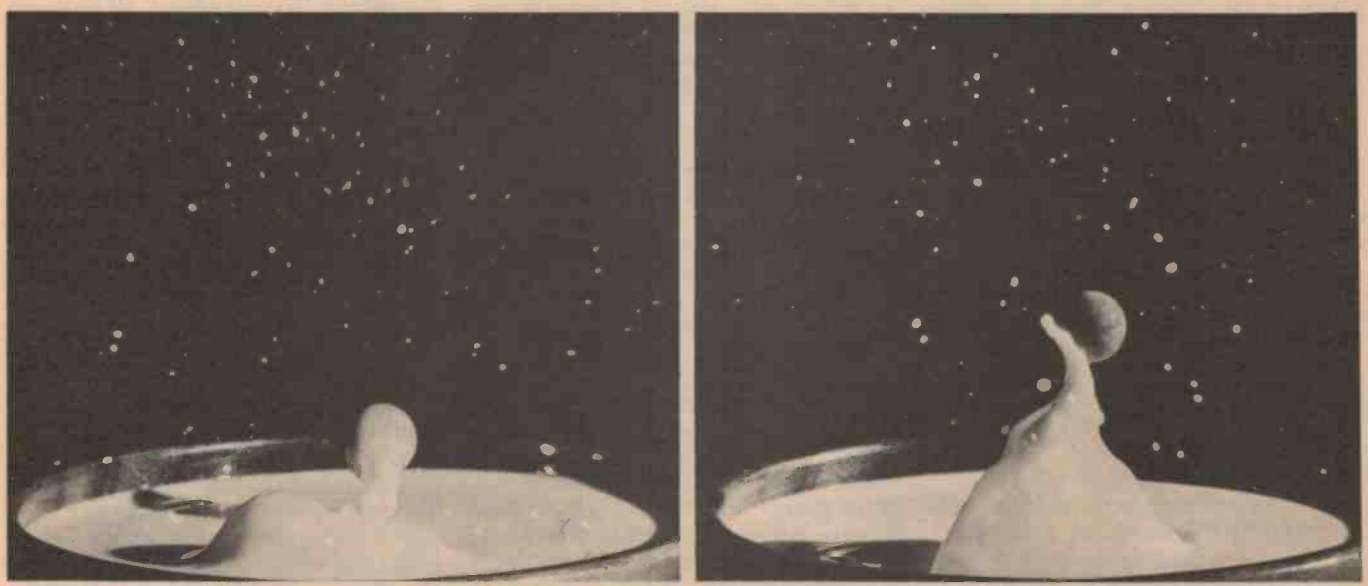
Before you can try out the unit, you will need to assemble some suitable sensors. The simplest is just a crystal microphone. We used an inexpensive 'lapel' mic and obtained excellent results. A crystal mic is recommended as it has quite a high output level. You can give the unit a 'dry run' at this stage. Set the Direct/Delay switch to Direct and the Sensitivity control to mid range and turn on. Clap your hands once and, if all is well, the LED will light and the buzzer will sound for a brief period. Set the unit to Delay and the Time control fully clockwise. Clap once more and again the LED will light following a brief delay. Experiment a little with the sensitivity control so that you get some idea of how it affects the operation.

There are two ways the unit can be triggered from a light source, as we said before — by a light source turning on, or a light source turning off. The different sensor circuit configurations are given in the accompanying circuits. An inexpensive, readily available phototransistor is employed — either a Fairchild FPT100 or a TIL78 from Texas Instruments. There are many similar devices available and no difficulty should be experienced here.

The phototransistor can simply be 'hung' from the leads at the end of a cable, the other end being terminated in the input plug (which suits the input socket used). The 10k resistor may be mounted in the input plug housing. There is plenty of room in a DIN plug. If you want something a little more salubrious, the phototransistor could be inserted in a small diameter plastic tube (say, 12 mm dia.) with the 'business' end of the device flush with the end of the tube. The tube can then be filled with epoxy resin. It's advisable to have the phototransistor attached to the cable before you do this!

Microphones usually come in their own housing, so there's no need to go to any trouble with them. The lapel mics come with a handy clip, so they can be attached to any convenient support. ▶

50 milliseconds and 200 milliseconds. Similar shots could be light activated by arranging the ball to break a beam of light.



Another sensor to try out is a silicon solar cell. To use one as a sensor with this unit, you will need to obtain one of those small 'transistor radio audio transformers' — the type having a "1000 ohm" primary and an "8 ohm" secondary, or similar. It is used 'back to front' in this application. Connect the solar cell directly across the transformer's low impedance winding and connect the high impedance winding between I/P2 and I/P3. It's simple, but it's sensitive. Suitable solar cells, or solar cell pieces, are obtainable from David Reid Electronics stores, Dick Smith Electronics stores, Ellistronics, Electronic Agencies, Radio Despatch Service (all advertisers in ETI) or Amtex Electronics of P.O. Box 285, Chatswood NSW 2067.

Above, a ball on the bounce. Top right, breaking a light bulb.

Using the trigger

You'll probably need a fair bit of practice before you get properly used to working with our flash trigger, but persevere — the results will be well worth it.

First of all, position the microphone or light sensor near the object to be photographed, taking care to keep it out of the camera's field of view. The sensitivity of the trigger is quite high, so it should be possible to place the sensor quite remote from the action. For scenes involving explosions or splashing liquids this is certainly advisable!

Set up your camera for the shot you want and then do a dry run of the action with the camera shutter closed and the flash gun disconnected. The purpose of this is to make sure that the trigger is being reliably fired by the action. If all is working well, the front panel LED will light and the buzzer (if one is fitted) will sound. If not, adjust the sensitivity control or move the sensor.

Once you're happy with the operation of the trigger, you're ready to start shooting in earnest. Connect the flash gun to the trigger unit and set your camera aperture according to the exposure guide table supplied with the flash gun. Remember that the aperture setting given in the guide relates to the distance from the object being photographed to the *flash gun*, not to the camera. Take another look through the viewfinder, just to check that all the action will be in frame and neither the flash gun nor the sensor is visible.

The camera shutter cannot be triggered by the flash, so it must be set to the 'time exposure' or 'B' position. Before you open the camera shutter, make sure the room is in TOTAL darkness. Try not to trip over any of the equipment in the dark!

Open the camera shutter and set off the action, releasing the shutter button when the flash has fired. You may find a cable shutter release very useful if you don't have a friend helping you to set up the shots.

You should now have a picture, but at this stage you won't know whether or not you've captured the exact instant of the action you wanted. So set the trigger unit to give a different delay and shoot again. If your trigger is sound operated, you can get very fine control over the delay by taking advantage of the relatively slow speed of sound. Sound waves move at about 330 metres per second, so for every metre change in the object-to-microphone distance there's a 3 millisecond change in the triggering delay.

By this time you'll have spent quite a lot of time and trouble (and some money) in constructing and setting up your flash trigger, so don't be mean with film. Shoot a whole roll if necessary, to make sure of getting the one or two shots that you really want.

The ability of the flash trigger to freeze very fast action such as explosions or collisions will depend on the speed of your flash. Most camera flashes have a flash period around one millisecond which may produce a blurred picture in some circumstances. If you find your picture is blurred you will have to use a faster flash or strobe unit.

Calibrating the delay

If you wish you can use an oscilloscope to calibrate your delay control.

If you have a dual-trace oscilloscope, connect one vertical input to the sensor output and the other to the gate of the SCR. Set the oscilloscope to trigger from a positive going edge on the sensor output and the time base to 10mS per division. Switch the flash trigger to the delay mode and activate the sensor. Looking at the CRO you should see a delay between the first negative edge of the sensor output and the gate pulse. You should be able to vary the gate pulse, by rotating the delay control, from about 10 ms to 200 ms. As the trace will only sweep once for each trigger pulse, it may be difficult to see. Retriggering the sensor quickly with a flashing light will improve the visibility of the trace. Alternatively the sensor can be replaced with a low frequency pulse generator, but be careful not to have a pulse period shorter than the delay you are trying to measure. Measure the delay for each 20 degrees or so of the delay potentiometer and calibrate your scale. Our unit measured close to 11 ms minimum delay to a little over 200 ms at maximum.

The procedure for using a single trace oscilloscope is similar, except that the sensor output is fed to the external trigger input on the oscilloscope, and the trigger control set to trigger from a negative going edge. The vertical input is connected to the gate of the SCR and the sensor activated. The delay is then measured from the left hand edge of the trace to the gate pulse. ●

John Shillabeer's department is involved in the maintenance, calibration and servicing of all test equipment used within S.T.C. We asked him why S.T.C. used Trio CS1560A scopes.

"My department gets involved with all test gear purchases. As a general purpose scope we've found that the Trio provides excellent performance for its price. Being easy to trigger we find staff can readily get it up and going. On the production line, the bright clear trace makes it an easy scope for operators to use.

"Over the past three or four years, S.T.C. has bought 8 Trio 1560s and we've had virtually no trouble from them. Any minor services have been easy to carry out. As you can see we even use one in our department in the development of our own digital test equipment."

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OPAL 1000

The OPAL 1000 is an 8 slot S-100 system conforming to the new IEEE standards. A Delta Products Z80a 4Mhz CPU card with 2 RS232c serial and 3x8 bit parallel ports is used in conjunction with the Delta Products Disk Controller. One serial and one parallel (Centronics interface) port have been initialised as printer ports.

Memory is provided by a 4Mhz 64k dynamic RAM Board by Measurement Systems and Control. The memory board is fully bank selectable and is designed for upgrading to a multi-user system.

Disk drives are 2x8" Shugart SA801R running at double density (480k/drive) and fitted with our exclusive Disk Saver which prolongs the life of the drives and floppy disks by turning off the AC power to the drives 14 seconds after the last drive select and thus reduces routine maintenance. The Disk Saver also reduces the risk of data loss due to power failures.

The system is mounted in an attractive pressed Aluminium housing with a cast front panel fitted with reset button and key operated on/off switch.

The operating system software is CP/M version 2.2 with Delta Product's utilities which include DTEST (for testing drives and floppy disks) and M2 (a comprehensive memory test program). The Delta PROM monitor enables fault finding to be carried out independently of the Disk Drives.

PRICE $4,174.00 + 15% sales tax.

OPAL 1004

The OPAL 1004 is an upwards compatible version of the OPAL 1000. The OPAL 1004 is based on an upgraded CPU card with a real time clock. The system is supplied with 1 x Shugart SA801R disk drive (operating at single density) and 1 x Shugart SA1004 10 Megabyte hard disk drive. The operating system is CP/M 2.2.

PRICE $7,700.00

OPAL 10004 Multi-User

The multi-user version of the OPAL 1004 features 128k RAM and Digital Research's MP/M operating system. The system is fully implemented for connection to 2 serial terminals and a NDK S-2000 or S-4000 printer.

PRICE $9,345.00

OPAL 5 + 5

Any OPAL system can use an AMPEX 5 + 5 (5 fixed Megabytes and 5 removable megabytes - top loading cartridge) hard disk drive. The AMPEX 5 + 5 is housed in an attractive timber case together with the controller unit. The unit is supplied with the S-100 interface card and all necessary cabling. The CP/M 2.2 and MP/M operating systems are supplied fully implemented for use with the OPAL system. Up to 4 AMPEX 5 + 5 drives can be daisy chained together.

PRICE (excluding OPAL) $8,500 plus 15% sales tax.

John F. Rose Computer Services Pty Ltd can also supply the new AMPEX 16 + 16 hard disk.

OPAL SMD

An industry standard SMD interface is available for the OPAL range. This allows the OPAL to control up to 600 Megabytes of on-line hard disk storage.

PRICE $3,000.00 plus 15% sales tax.

TELEVIDEO 920c

The TVI 920 by Televideo includes editing capabilities, protected fields, addressable cursor, micro-processor control, line and character insert/delete, upper and lower case and tabbing. Options include a second 1920 second page character display memory. General features are:

- Standard 96 ASCII Character set displayable
- 1920 character display
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- Dynamic control of conversation/block mode
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- Non-glare etched screen
- 115/230 VAC 50/60 Hz Refresh
- Serial port for hard copy (OPTIONAL)
- Functionally equivalent to the ADM-31 terminal.

PRICE $1,305.00

MPI 88T Serial/Parallel Printer

Specification:

PRINTING TYPE	Impact bidirectional, 7 x 7 dot matrix.
PRINT RATE	100 characters per second (maximum).
THRUPUT	80 characters per second (maximum).
CHARACTER SET	Full upper and lower case 96 character ASCII set, software selectable single or double wide character fonts.
CHARACTER HT.	0.1 in. (0.25 cm)
PRINT FORMAT	8.0 in. (20.3 cm) line length, 80 characters per line at 10 CPI, 96 characters per line at 12 CPI, 132 characters per line at 16.5 CPI.
PAPER FEED	10 lines per second, stepper motor controlled. User selectable pressure roller or tractor feed.
LINE SPACING	6 or 8 lines per inch, user selectable.
MEDIA	Roll paper: 8.5 in. (21.6 cm) wide by 5 In. (12.7 cm) diameter single ply or pressure sensitive multiple copy paper, 0.012 in. (3 mm) maximum thickness. Fan fold paper: 1 in. to 9.5 in. sprocket (including sprocket margins), 0.012 in. maximum thickness. Cut Sheet paper: Maximum width 9.5 in.
RIBBON	Continuous loop cartridge, 20 yds x 0.5 in. width blck ribbon, 5 million character life.
INPUT POWER	115/230 V + or − 10%, 50/60 Hz.
TEMPERATURE	10 − 40 deg. C operating; 0 − 70 deg. C Storage.
HUMIDITY	20% − 90% operating (non-condensing); 5% - 95% storage (non-condensing).
DATA INPUT	Parallel: Centronics compatible 7-bit ASCII, TTL levels with strobe, acknowledge returned to indicate data was received. Serial: RS232C or 20 ma Current loop with BUSY handshake, 10 or 11 bits; 110, 150, 300, 600 or 1200 baud rate.
DATA BUFFER	Two lines standard; optional 1k and 2k buffers available.
FORMS CONTROL	Top of form (8 selectable forms lengths), skip over perforations.
OP. CONTROLS	Power On/Off; Top of form set; select/deselect; forms feed.
DIMENSIONS	41.3 cm wide x 27.3 cm deep x 15.9 cm high. Dimensions exclude paper and paper holder. Weight is less than 6.75 kg.
WARRANTY	30 days.

PRINTER $935.00

NDK S-4000

MATHEMATICS SAMPLE USING STANDARD CHARACTERS

$$F(\omega) = aT\frac{\text{Sin } \omega T/2}{\omega T/2}\, e^{-j\omega T/2}$$

$$e_{RMS} = \sqrt{4KTR(f_2 - f_1)}$$

$$L_1 = 10 \log \frac{1}{80} \times S_a \text{ (dB)}$$

$$A^2+B^2=C^2$$

$$H_2SO_4 \quad H_2O$$

$$W_{xy}(f)=\int_{-\infty}^{\infty}\psi_{xy}(\tau)e^{-j2\pi f\tau}\,d\tau$$

$$L=\int_0^R\sqrt{\left(\frac{dx_1}{d\theta}\right)^2+\left(\frac{dy_1}{d\theta}\right)^2}\,d\theta$$

$$\psi_{xy}(f)=\tan^{-1}\left[\frac{P_{xy}(f)}{C_{xy}(f)}\right]$$

$$\left.\begin{aligned}a_1x+b_1y=c_1\\ a_2x+b_2y=c_2\end{aligned}\right\}$$

$$x=\begin{vmatrix}c_1 & b_1\\ c_2 & b_2\end{vmatrix}\div\begin{vmatrix}a_1 & b_1\\ a_2 & b_2\end{vmatrix}=\frac{c_1b_2-c_2b_1}{a_1b_2-a_2b_1}$$

$$S=\sum_{j=1}^{n}X_j$$

$$\Delta f_{max}\tau_{max}\leq 0.3$$

$$\left|W_{xy}(f)\right|=\sqrt{C^2_{xy}(f)+Q^2_{xy}(f)}$$

$$\Psi_{xy}(\tau)=\lim_{T\to\infty}\frac{1}{T}\int_0^T f_x(t)f_y(t+\tau)dt$$

$3,105.00 Plus sales tax.

Project 147

Electronic dummy load

Jonathan Scott

With this unit you can test power supplies at currents up to 15 amps and voltages up to 60 volts. It can 'sink' up to 200 watts on a static test and you can modulate the load to perform dynamic tests.

THIS PROJECT is fundamentally a test instrument — but an unusual one. It is intended primarily for testing and 'setting up' power supplies of all varieties — from ordinary transformer-rectifier supplies to sophisticated regulated supplies. It can even be used to plot the discharge characteristics of storage batteries.

The unit employs four high power transistors connected as constant current 'sinks'. These dissipate power from the source to which the unit is connected. The characteristics of the load are controlled by controlling the base drive to these transistors. Self-destruction is avoided by the addition of protection circuitry which 'shuts down' the load if the rated current or power is exceeded. In addition, a relay will disconnect the unit if more than a safe voltage is applied.

The load can be *modulated* to vary the load current by means of an externally-applied signal. It can be modulated at frequencies up to 70 kHz. The resultant load current waveform can be monitored on an oscilloscope connected to the *current output* socket. The specifications of the unit are given in the accompanying box. We have also drawn up a graph showing the *operating area* of the unit.

Applications

Regulated power supplies have a finite 'reaction time' following the application of a load or variation in load current. This project can be used to test the transient response, the reaction time, of a power supply as the load can be modulated. A low frequency square wave applied to the unit's *modulation input* will effectively vary the load resistance. The rise and fall times of the power supply under test can then be ascertained from an oscilloscope connected to the *current output*. Varying the level of the signal applied to the modulation input will vary the 'depth' of modulation. The load can be 'swung' from full current to zero current, or over a lesser range, and a good idea of how the supply reacts to this test can be gained.

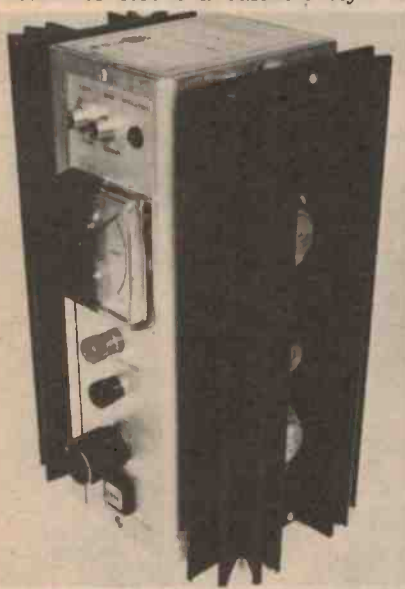
The same technique can be used to check a power supply's regulation and to set the internal impedance.

Construction

We chose to use one of the larger Horwood rectangular boxes to house the

project. The layout is not particularly critical and the unit could be assembled in a number of different ways. We chose the Horwood box as it proved convenient and inexpensive. It's convenient as the assembly is dominated by the 220 mm long heatsinks which have to be mounted vertically, and that's how we used the box — a little unconventional, but entirely practical. The box is designated type 34/9/DS and measures 240 mm x 100 mm x 70 mm. It comes in four pieces — the rectangular 'tube' is in two pieces and there are two end pieces. The heatsinks are mounted off the sides of the case on standoff pillars. This allows a free air flow around the vertically mounted heatsinks, ensuring good cooling efficiency.

There are several sources for suitable heatsink sections. Dick Smith Electronics stocks a 225 mm length, catalogue number H-3426. Rod Irving Electronics stocks a suitable style of heatsink, manufactured locally, but you may have to ask for a length to suit.



Side view showing Q9, Q10 and D2 mounted on the heatsink.

First thing to do is tackle the metalwork. Carefully mark out and drill the heatsinks. One heatsink has two of the transistors mounted on it plus the BYX200R/21L diode, D2. This is a stud-mounting diode that is meant to 'press-fit' into a suitable hole in the heatsink. However, it is easier for home construction if you buy a bolt-on mount for it. These should be available from the supplier from whom you bought the diode. The transistors should be mounted well away from each other, but not too close to the ends of the heatsinks.

Having drilled all the holes in each heatsink, remove any burrs as these interfere with good thermal contact. Bolt all the semiconductors to the heatsinks using thermal compound (such as Bevaloid GS13). No insulating washers are necessary, but solder lugs should be inserted under each of the transistor mounting bolts. Although all the transistor collectors are connected directly to the case, separate wires are run from each to the pc board so as not to *rely* on the mechanical connection and so that the unit may be tested or serviced with the case disassembled. The anodising on the heatsinks is actually a good insulator, and whilst toothed washers may be used where necessary to provide an electrical connection, we felt it better to provide a direct wire to the pc board. It's certainly more reliable.

Two standoff pillars, about 10 - 15 mm long, are used to support each end of each heatsink, as can be seen from the photographs.

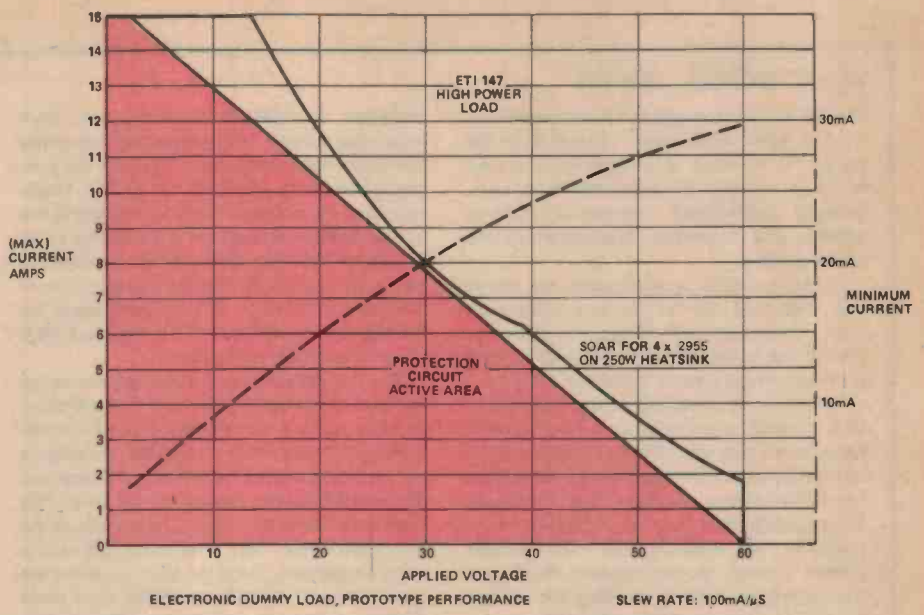
Next, drill the case. Front panel layout is not critical and you can arrange it to suit yourself.

Mount relay behind the front panel using a small clamp fashioned from a scrap of aluminium. You can glue it on if you wish! It should be mounted quite close to the positive terminal so that a very short, heavy lead can run from the terminal to the relay contact pins.

The pc board is mounted on standoff pillars on the panel of the case opposite the front panel. It can be mounted in any convenient position. The panels on which the heatsinks mount have a large diameter hole (9 - 13 mm) drilled in them through which the wiring to the heatsink-mounted components passes. These holes should be grommeted to prevent possible shorts to the case. Transistor Q8, a TIP31 flatpack, is mounted on the case panel adjacent to the pc board. It is insulated from the case using an insulating washer and insulated mounting bush.

All the components that mount on the front panel can be assembled next. If

— *text continues page 34.* ▶



ELECTRONIC DUMMY LOAD, PROTOTYPE PERFORMANCE SLEW RATE: 100mA/μS

SPECIFICATIONS ETI-147 ELECTRONIC LOAD

Maximum dissipation	200 watts (see graph)
Maximum voltage	60 volts
Maximum current	15 amps
Minimum voltage	2 volts
Minimum current	3 mA
Modulation range	0 to full current
Modulation sensitivity	1 V p-p or better
Mod. frequency response	1kHz - 70 kHz
Protection	see graph

HOW IT WORKS — ETI 147

The ETI 147 dummy load is a passive constant current 'sink' which draws power from the supply to which it is connected. The load includes circuitry for protection from overvoltage, overcurrent, overpower, reverse voltage and secondary breakdown of the power devices.

For convenience of explanation, the circuit can be divided into five sections — the main power dissipator and drivers, the reference circuit, the reference comparison circuit, the protector circuit and the indication circuit.

The power is dissipated in transistors Q9 - Q12. MJ2955 transistors have been chosen because, as they are PNP, their collectors can be connected to the heatsink without the need for an insulating washer. This decreases thermal resistance from the transistors to the heatsink. The resistors R24 - R27 ensure correct current sharing between the power transistors as well as forming the current sensing resistance for the protection circuit.

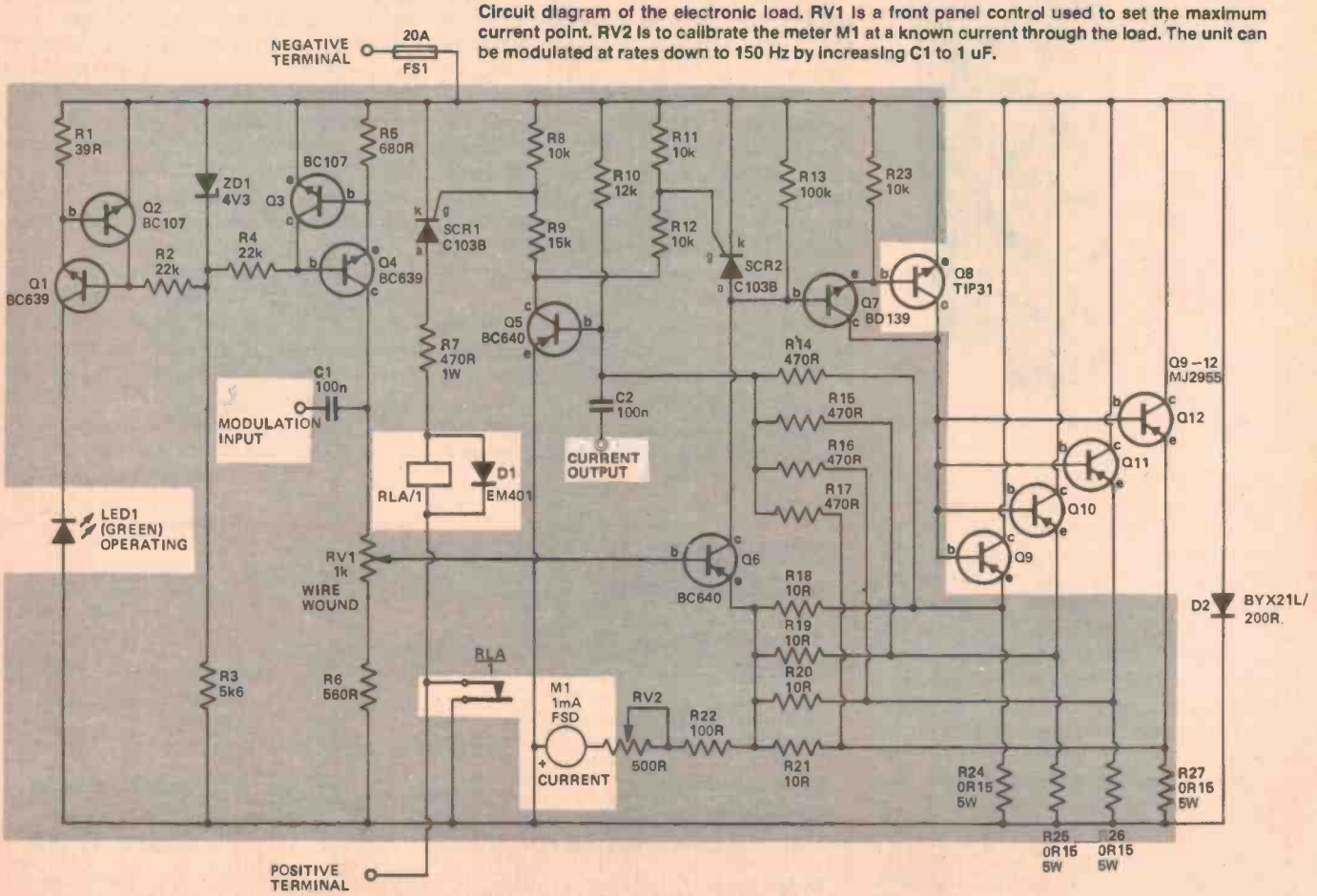
An internal reference is provided by passing a constant current — generated by ZD1, Q3 and Q4 — through R6 and RV1. Using a constant current generator allows the unit to operate over a very wide range of supply voltages, yet deliver a stable, low value reference voltage. The transistor Q6 compares the reference voltage from RV1 with the voltages across the resistors R24 to R27. These voltages are proportional to the current in the output devices and appear at the emitter of Q6 through R18 to R21. Q6 supplies current to the driver transistors, Q7 and Q8. The output transistors are turned on sufficiently to cause the voltage on the emitter of Q6 to be about 0.6 V above the voltage on its base.

The current sensing voltages appear on the base of Q5 through R14 to R17. R10 proportionally adds a component of the terminal voltage. Should either the current, the voltage or their sum exceed safe limits, Q5 turns on, tripping SCR2 and turning off the load. This 'sum-of-volts-and-current' circuit protects the unit from overcurrent, overpower and secondary breakdown. Because shutting down the load will not provide protection from overvoltage a relay is provided which operates when SCR1 conducts. SCR1 has been arranged to cut in if the current shutdown looks like being inadequate, i.e: if there is considerable voltage present. If the device protects only by current shutdown, turning RV1 to minimum will reset the circuit. If, however, the relay is operated it will be necessary to remove power to the unit before it will reset. Reverse polarity protection is provided by D2 and FS1.

The current through the load is monitored by M1 which senses the voltage at the emitter of Q6. The meter is calibrated by RV2. A LED indicating that the unit is operating is driven from a constant current source comprised of ZD1, Q1 and Q2. When the voltage is sufficient to operate the load the LED will light, giving an 'adequate voltage' indication. The LED will also extinguish if the relay drops out, indicating the need to remove power.

Finally, in order to make dynamic measurements, C1 provides the option of modulating the reference, and thus the current drawn, from anywhere between zero and full load. The actual current may be viewed with an oscilloscope connected to the output at C2. Capacitors are used here to avoid grounding these points, which would interfere with the operation of the unit. There is no reason why the dc voltage appearing on the meter could not be made available if so desired.

Circuit diagram of the electronic load. RV1 is a front panel control used to set the maximum current point. RV2 is to calibrate the meter M1 at a known current through the load. The unit can be modulated at rates down to 150 Hz by increasing C1 to 1 uF.



PARTS LIST — ETI 147

Resistors all ¼W, 5% unless marked

R1	39R
R2, R4	22k
R3	5k6
R5, R6	680R
R7	470R, 1W
R8, R11, R12, R23	10k
R9	15k
R10	12k
R13	100k
R14 - R17	470R
R18 - R21	10R
R22	100R
R24 - R27	0.15 ohm, 5W

Potentiometers

RV1	1k wire wound
RV2	500R trimpot

Capacitors

C1, C2	100n greencap

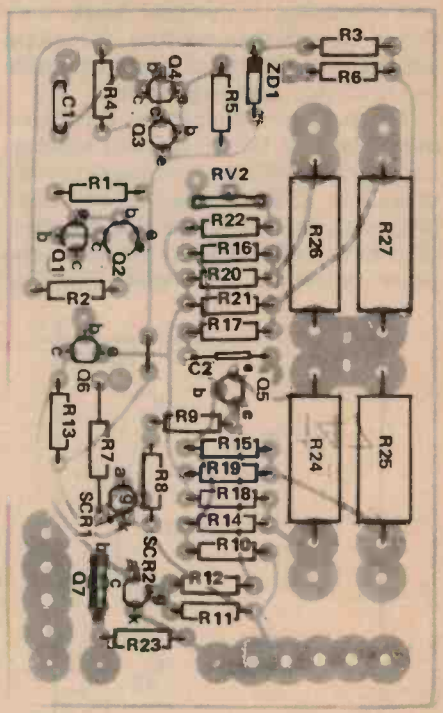
Semiconductors *see text

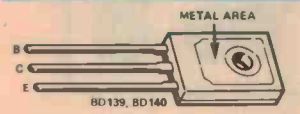
D1	EM401 or similar
D2	BYX21L/200R or similar 25A diode
ZD1	4V3, 400mV zener diode
LED1	Green LED, TIL220G or similar
SCR1, SCR2	C103B or similar SCR
Q1, Q4	BFY50, TT801, BC639*
Q2, Q3	BC107, BC547 or similar
Q5, Q6	TT800, BC640*
Q7	BD139
Q8	TIP31
Q9 - Q12	MJ2955

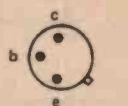
Miscellaneous

M1	1 mA FSD meter, University TD48 or Minipa MU45 or similar
RL1	24 V relay with 15 A contacts, see Shoparound on p.65

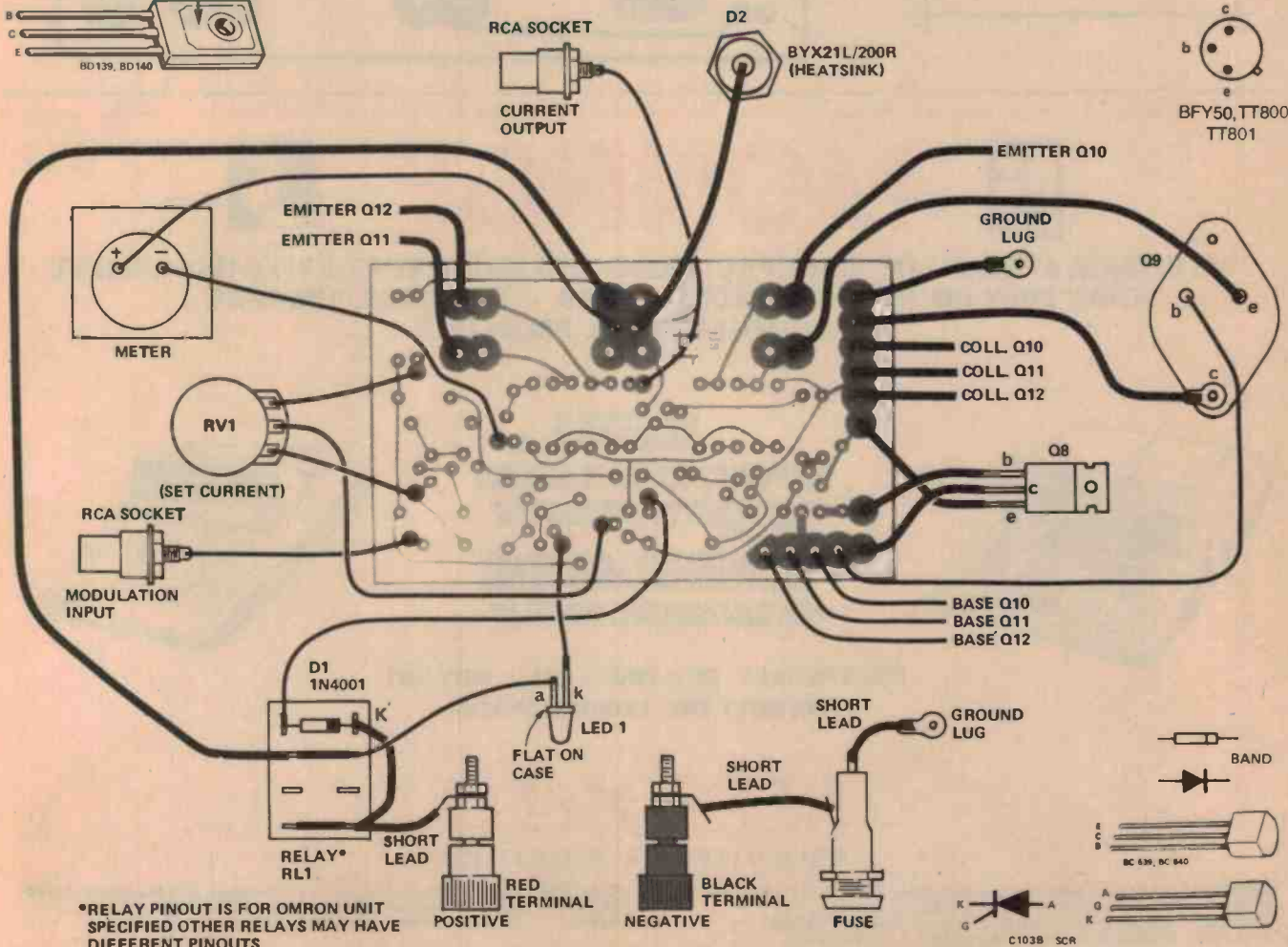
ETI-147 pc board; fuse holder with 20 A fuse; two RCA sockets; two screw terminals; 10 x 12 mm standoffs; two lengths 225 mm-long flat-sided heatsink (see Shoparound, p.65); Horwood box, type 34/9/DS; 15 A hookup wire.







BFY50, TT800
TT801

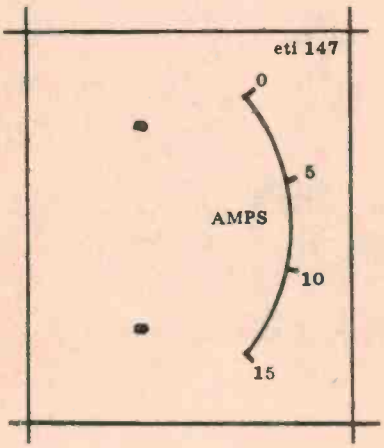


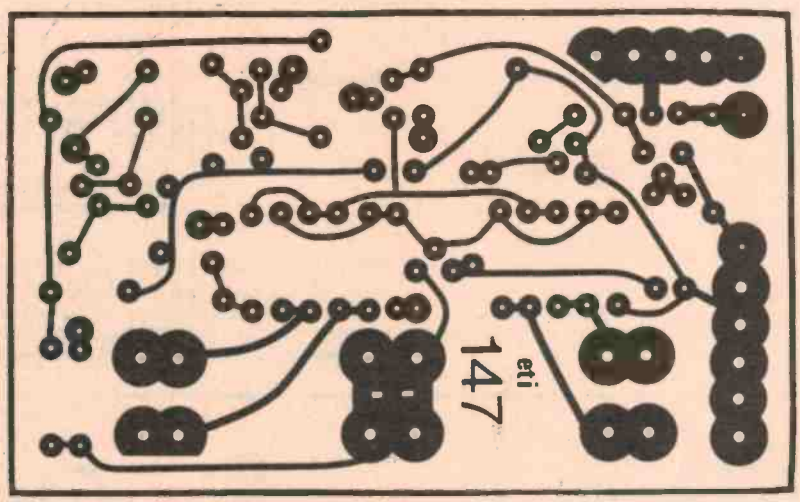
*RELAY PINOUT IS FOR OMRON UNIT SPECIFIED OTHER RELAYS MAY HAVE DIFFERENT PINOUTS

you are using a Scotchcal label, don't forget that it goes on first. Suppliers should have Scotchcal labels available — see Shoparound on page 65.

The pc board should be assembled next. Refer to the component overlay, taking care with the orientation of the transistor. If BC639 and BC640 transistors are used for Q1 and Q4, note that they have quite different pinouts to the other types, *so be careful*. The four 0.15 ohm, 5W resistors should be mounted 5 - 6 mm off the pc board to allow free circulation of air.

Check the pc board before wiring it to the case mounted components. Heavy duty, multi-strand hookup wire should be used to wire all high current carrying connections. This includes the collector and emitter leads to Q9, Q10, Q11 and Q12, the lead to the cathode of D2, the lead from the pc board 'ground' connection to the 'ground' lug on the case, wiring to the fuse and input terminals and to the relay contacts. Heavy lines on the wiring diagram indicate where to use heavy wiring leads. We suggest 32 x 0.2 mm cable as a minimum, preferably something heavier. Remember that it may have to carry as much as 15 amps. ●





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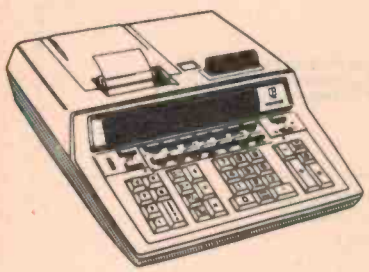

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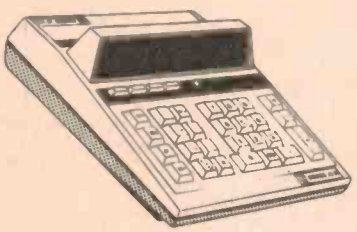

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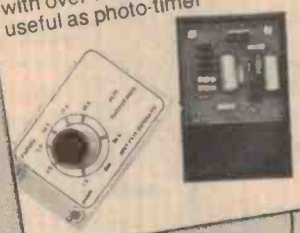

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R17 E.A. 130 Communications Receiver
R18 E.A. All Wave 1/C2
R20 E.A. Fremodyne 4 Complete Kit
R21 E.A. Fremodyne 4 RF Section
R23 E.A. Mos Fet 52 MhZ Converter
R29 E.A. Short Wave Converter for 27 Mhz
R30 E.A. Simple S.W.R Meter
R31 E.A. 27 MhZ Pre-Amp
R32 E.A. 10-30 MhZ Pre-Amp
R33 ETI 718 Shortwave Radio
R34 ETI 490 Audio Compressor
R35 ETI 721 Aircraft Band Converter (less XTALS)
R36 ETI 726 6 or 10 meter Power Amp

MODEL TRAIN UNITS

MT1 ETI 541 Model Train Control
MT2 E.A. 1974 Model Train Control
MT3 E.A. 1971 S.C.R. P.U.T. Control Unit
MT4 E.A. Electronic Steam Whistle
MT5 E.A. Electronic Chuffer
MT6 E.A. 1978 Train Control

TEST EQUIPMENT

TE1 ETI 134 True RMS Voltmeter
TE2 ETI 133 Phase Meter
TE3 ETI 533C Digital Display
TE4 ETI 129 R.F. Signal Generator
TE5 ETI 130 Temperature Meter
TE6 ETI 706 Marker Generator
TE7 ETI 709 R.R. Alternator
TE8 ETI 122 Logic Tester
TE9 ETI 124 Tone Burst Generator
TE10 ETI 123 C Mos Tester
TE11 ETI 116 Impedence Meter
TE12 ETI 533 Digital Display
TE13 ETI 117 Digital Voltmeter 1975 Display
TE14 ETI 117 Digital Voltmeter 1976 Display
TE15 ETI 704 Cross Hatch Dot Generator
TE16 ETI 120 Logic Probe
TE17 ETI 121 Logic Pulser
TE18 ETI 118 Digital Frequency Meter 1975 Display
TE19 ETI 118 Digital Frequency Meter 1976 Display
TE20 ETI 222 Transistor Tester
TE21 ETI 113 7 Input Thermocouple Meter
TE22 ETI 107 Wide Range Voltmeter
TE23 ETI 108 Decade Resistance Box
TE25 E.A. SWR Reflectometer
TE26 E.A. R.F. Impedence Meter
TE27 E.A. Antenna Noise Bridge
TE28 E.A. 1968 Transistor Test Set
TE29 E.A. 1971 Transistor (F.E.T.) Tester
TE30 E.A. 1977 Digital Logic Trainer
TE31 E.A. 2½ Digit Volt Ohm Meter
TE32 E.A. Simple Function Generator
TE33 E.A. Direct Reading Capacitance Meter
TE34 ETI 487 Real Time Audio Analyser
TE35 ETI 483 Sound Level Meter
TE36 ETI 489 Real Time Audio Analyser
TE37 ETI 717 Cross Hatch Generator
TE38 E.A. 3 MhZ Frequency Counter
TE40 E.A. Direct Reading Ohm Meter
TE41 E.A. Function Generator
TE42 E.A. Transistor Tester incl. Bipolar & F.E.T.S.
TE43 ETI 591 Up Down Presetable Counter
TE44 ETI 550 Digital Dial (less case) includes ETI 591
TE45 ETI 144 Expanded Scale R.M.S. Voltmeter
TE46 ETI 148 Versatile Logic Probe
TE47 ETI 724 Microwave Oven Leak Detector
TE48 ETI 150 Simple Analog Frequency Meter
TE49 ETI 151 Linear Scale Ohm Meter
TE50 ETI 152 Linear Scale Capacitance Meter
TE51 E.A. Digital Capacitance
TE52 ETI 589 Digital Temp. Meter
TE53 E.A. TV C.R.O. Adapter
TE54 E.A. Zero Voltage sx. Heat Controller
TE55 E.A. XTAL Locked TV Pattern Generator
TE56 E.A. Decade Resistance Box
TE57 E.A. Decade Capacitance Box
TE58 E.A. Capacitor Substitution Box
TE59 E.A. Tantalum Cap Sub Box

POWER SUPPLIES

PS1 ETI 132 Experimenters Power Supply
PS2 ETI 581 Dual Power Supply (High Powered Version)
PS3 ETI 712 CB Power Supply
PS4 ETI 131 Power Supply
PS5 ETI 119 5 volt switching regulator supply
PS6 ETI 105 Laboratory Power Supply
PS7 ETI 111 I/C Power Supply
PS8 E.A. D.C. Voltage Reference
PS9 E.A. 1976 Regulated Power Supply
PS10 E.A. Dual 30-2 0-30V • 2A or 0-60V • 2A or Dual Pos and Neg 30V • 2A
PS11 E.A. C.B. Power Supply
PS12 ETI 142 Power Supply 0-30 V 0-15 A (fully protected)
PS13 ETI 472 Power Supply
PS14 E.A. Power Supply for Dream 6800
PS15 ETI 577 Dual 12V supply

AUDIO TEST UNITS

AT1 ETI 441 Audio Noise Generator
AT2 ETI 128 Audio Millivolt Meter
AT3 ETI 112 Audio Attenuator
AT4 ETI 102 Audio Signal Generator
AT5 E.A. A.F. Tone Burst Generator
AT6 E.A. Laboratory Solid State A.F. Generator
AT7 ETI 137 Audio Oscillator
AT8 ETI 138 Audio Power Meter

MISCELLANEOUS KITS

M1 ETI 604 Accentuated Beat Metronome
M2 ETI 546 G.S.R. Monitor (less probes)
M3 ETI 549 Induction Balance Metal Detector includes wire for search Head
M4 ETI 547 Telephone Bell Extender
M5 ETI 602 Mini Organ (less case)
M6 ETI 544 Heart Rate Monitor
M7 ETI 044 Two Tone Doorbell
M8 ETI 043 Heads and Tails
M9 ETI 068 L.E.D. Dice Circuit
M10 ETI 539 Touch Switch
M11 ETI 529 Electronic Poker Machine
M12 ETI 236 Code Practice Oscillator
M13 ETI 218 Monophonic Organ
M14 ETI 701 Masthead Amplifier
M15 E.A. I/C Volume Compressor
M18 E.A. 240 volt Lamp Flasher
M19 E.A. A/C Line Filter
M20 E.A. Bongo Drums
M21 E.A. Keyless Organ
M22 E.A. Auto Drums
M23 E.A. Electronic Roulette Wheel
M25 E.A. Digital Metronome
M26 E.A. Voice Operator Relay
M27 E.A. Gas Detector Car Boat
M28 E.A. Led Chaser
M29 E.A. Sound Effects Generator * see below
M30 ETI 551 Light Chaser 3 channel 1000 watt/ch.
M31 E.A. Electronic Poker Machine
M32 E.A. Remote TV Headphone
M34 ETI 650 STAC Timer
M35 ETI Wheel of Fortune
M36 ETI 557 Reaction Timer
M37 ETI 249 Combination Lock (less lock)
M38 ETI 814 Dinky Die
M39 E.A. Electronic Combination lock (including lock)
M40 E.A. Mast Head Amplifier
M41 ETI 576 Electromogram
M42 E.A. Prospector Metal Locator Including Headphone
M43 ETI 561 Metal Locator Less dowel & tubing potplant stand
*set as for Steam Train and Prop Plane noise

VOLTAGE/CURRENT CONTROLS

V1 ETI 481 12 volt to ± 40V D.C. 100 watt Inverter
V2 ETI 525 Drill Speed Controller
V3 E.A. S.C.R. Speed Controller
V4 E.A. Stage fete.) Auto Dimmer 2 K.W.
V5 E.A. Stage fete.) Auto Dimmer 4 K.W. & 6 K.W. add on for above
V6 E.A. 1976 Speed Control
V7 ETI 592 Light Show Controller (3 ch.) (1000 w/ch)
V8 E.A. Inverter 12V D/C Input 230V 50hz 300VA output
V9 ETI 593 Colour Sequencer (for use with ETI 592)

PHOTOGRAPHIC

PH1 ETI 586 Shutter Speed Timer
PH2 ETI 548 Photographic Strobe (less reflector)
PH3 ETI 514B Sound Light Flash Trigger
PH4 ETI 532 Photo Timer
PH6 ETI 505 High Powered Strobe (less reflector)
PH7 ETI 513 Tape Slide Synchronizer
PH8 ETI 512 Photographic Process Timer
PH9 ETI 515 Slave Flash
PH10 ETI 540 Universal Timer
PH11 E.A. 1970 Stroboscope Unit (less reflector)
PH12 E.A. Synca-Slide
PH13 E.A. Auto Trigger for Time Lapse Movies
PH14 ETI 558 Mast Head Strobe
PH15 ETI 553 Tape Slide Synchronizer
PH16 E.A. Digital Photo Timer
PH17 ETI 594 Development Timer

TUNERS

T1 ETI 062 A.M. Tuner
T2 ETI 740 F.M. Tuner *
T4 E.A. Playmaster 146 AM-FM Tuner *
* Wooden Cabinet not included

AUTOMOTIVE UNITS

A1 ETI 317 Rev. Monitor
A2 ETI 081 Tachometer
A3 ETI 316 Transistor Assisted Ignition
A4 ETI 240 High Power Emergency Flasher
A5 ETI 239 Break Down Beacon
A6 ETI 312 Electronic Ignition System
A7 ETI 301 Vari-Wiper
A8 ETI 502 Emergency Flasher
A10 ETI 303 Brake Light Indicator
A11 ETI 309 Battery Charger
A12 E.A. 1970 C.D.I. Capacitor Discharge Ignition
A13 E.A. High Efficiency Flasher
A14 E.A. Dwell Meter
A15 E.A. Variwiper
A16 E.A. Tacho for Tune-ups
A17 E.A. Ignition Analyser and Tachometer
A18 E.A. Strobe Adaptor for Ignition Analyser
A19 E.A. 1975 C.D.I. Capacitor Discharge Ignition
A20 E.A. Mains Supply for Car Cassettes
A21 E.A. Automatic Heavy Duty Battery Charger
A22 ETI 318 Digital Car Tachometer (less Metalwork)
A23 ETI 319A Variwiper Mk. 2 (no dynamic braking)
A24 ETI 319B Variwiper Mk. 2 (for dynamic braking)
A25 ETI 555 Light Activated Tacho
A26 ETI 320 Battery Condition Indicator
A27 E.A. Transistor Assisted Ignition

GUITAR UNITS

G1 ETI 447 Audio Phaser
G2 ETI 413 2 x 100 watt Bridge Amplifier
G4 ETI 408 Reverberation Unit
G5 ETI 413 100 watt Guitar Amplifier
G6 ETI 410 A.D.U. for your Guitar
G7 E.A. PM 125 50 watt Guitar Amplifier
G8 E.A. PM 134 21 watt Guitar Amplifier
G9 E.A. PM 138 20 watt Guitar Amplifier
G10 E.A. Waa Waa Unit
G11 E.A. Fuzz Box
G12 E.A. Sustain Unit
G13 E.A. PM 135 12 watt Guitar Amplifier
G14 ETI 452 Guitar Practice Amplifier
G15 ETI 466 300 watt Amp module - less H/S & Transformer

COMPUTER AND DIGITAL UNITS

C1 ETI 633 Video Synch Board *
C2 ETI 632M Part 1 Memory Board V.D.U. *
C3 ETI 632P Part 1 Power Supply V.D.U. *
C4 ETI 632A Part 2 Control Logic V.D.U. *
C5 ETI 632B Part 2 Control Logic V.D.U. *
C6 ETI 632C Part 2 Character Generator V.D.U. *
C7 ETI 632 Mother Board Including P/S *
C8 ETI 632 U.A.R.T. Board *
C9 ETI 631-2 Keyboard Encoder *
C10 ETI 631 A/Sch. Keyboard Encoder (less keyboard) *
C11 ETI 630 Hex Display
C12 E.A. Educ-8 Computer
C13 E.A. Cassette Tape Interface
C14 ETI 638 Eprom Programmer
C15 ETI 637 Cuts Cassette Interface
C16 ETI 651 Binary to Hex Number Converter
C17 ETI 730 Getting Going On Radio Tele Type
C18 E.A. Dream 6800 Computer for Beginners less keyboard and cover

WARNING SYSTEMS

WS1 ETI 583 Gas Alarm
WS2 ETI 066 Temperature Alarm
WS3 ETI 528 Home Burglar Alarm
WS4 ETI 702 Radar Intruder Alarm
WS5 ETI 220 Wailing Siren
WS6 ETI 219 Hee Haw Siren
WS7 ETI 313 Car Alarm
WS9 ETI 503 Electronic Thief Trap
WS10 ETI 506 Infre Red Intruder Alarm
WS11 ETI 305 Automatic Car Alarm System
WS12 ETI 582 House Alarm
WS13 E.A. Electric Siren
WS14 E.A. 1976 Car Alarm
WS15 E.A. 10 Ghz Radar Alarm

E. D. & E. (SALES) PTY. LTD., NOW

ALL ELECTRONIC COMPONENTS

118 LONSDALE STREET, MELBOURNE, VIC. 3000. TEL: 662-3506.

Measuring very low currents

IT IS NOT POSSIBLE to accurately measure currents of a few microamps or less using an ordinary panel meter or multimeter. In order to make such measurements it is necessary to use an active circuit such as the one shown here. It can be built as a self-contained unit or used as part of an instrument requiring a highly sensitive current range.

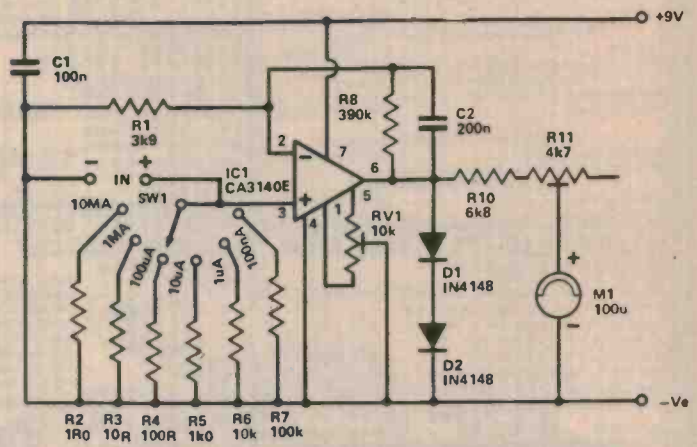
This instrument will measure from 100 nanoamps (10^{-7} amps) to 10 mA full scale, in six ranges. The higher ranges are included so that the instrument may be accurately calibrated and they generally overlap with the lower current ranges on many multimeters.

The meter, M1, is a 100 μA movement connected as a voltmeter having 1 V full scale deflection. Resistors R10 and R11 (a trimpot) are the 'multiplier' resistors. The trimpot is a calibration control, adjusted to give full scale meter deflection on the 10 mA or 1 mA ranges.

IC1 is an op-amp connected in the non-inverting mode and having a dc voltage gain of about 100 times (set by the feedback network R8 and R1). C2 reduces the ac gain to about unity to improve stability and immunity to stray pick-up. The non-inverting input of IC1 is biased to the 0 V rail by whichever of the range resistors (R2-R7) is selected by SW1. In theory, this gives zero output voltage and no meter deflection, but in practice it is necessary to compensate for small offset voltages using the offset null control, RV1.

Current in the circuit being measured flows into the instrument's input terminals. A voltage will be developed across the selected input resistor, one of R2 to R7. This voltage will be amplified by IC1 and will produce a positive meter deflection. Say the 10 mA range has been selected. The input current will flow through R2. If the input current is 5 mA, say, from Ohm's law, 5 mV will be developed across R2.

R1 TO R7 ARE CLOSE TOLERANCE TYPES



$$E = I.R$$
$$= 5 \times 10^{-3} \times 1$$
$$= 5 \text{ mV}$$

Now, IC1 has a gain of 100, as

$$\text{Gain} = \frac{R8}{R1}$$
$$= \frac{390 \times 10^3}{3900}$$
$$= 100$$

The voltage at pin 6 of IC1, with 5 mA flowing in the input, will be 500 mV, or half a volt. The meter will thus indicate half scale, giving a reading of 5 mA.

Successive ranges increase the sensitivity of the instrument by a factor of 10.

This arrangement relies on the fact that IC1 (a 3140) has a very high input impedance so that it does not 'load' the input resistor selected and affect the accuracy of the reading by drawing a significant amount of input current itself. The 3140 is a FET-input op-amp having a typical input impedance of 1.5 million megohms. Note that, to achieve reasonable accuracy, the input resistors R2 to R7 and the op-amp feedback resistors should all have a tolerance of 2 % or better.

Meter protection is provided by D1 and D2. Should the input current exceed the maximum for the range, the output of IC1 will rise higher than 1 V. If it exceeds about 1.2 V, the two diodes conduct, preventing any further rise in the output of IC1 and protecting the meter from any overload exceeding 20% of the rated input.

When adjusting the offset null control (RV1), start with its slider positioned at the end connected to pin 5 of IC1. The meter should show a strong deflection. Back off RV1 just far enough to zero the meter and no further.

The unit may be calibrated by a number of methods. A simple way is to obtain a variable power supply that will provide 10 V and a 10k 1% or 2% resistor. You will also need either a good mirror-scale multimeter or a digital multimeter.

Connect the resistor and the low current meter in series and connect across the output of the power supply. Also connect the multimeter across the output of the power supply (observe polarities). Select the 1 mA range on the low current meter and a suitable range on the multimeter. Turn the output of the power supply down and switch it on. Set the power supply to give a reading of 10 V on the multimeter. Do this carefully for best accuracy. Now, adjust R11 for full scale deflection. Your low current meter should now be calibrated. If you substitute a 1k, 1% or 2% resistor for the 10k resistor, you can check the calibration on the 10 mA range.

PARTS FOR NEW KITS

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

ACOUSTIC COUPLER (See EA September)
Complete kit, including metalwork, etc. .... Cat K-3605 $78.00
Printed Circuit Board only ..... Cat H-8380 $4.00

EXPANDED SCALE AUTOMOTIVE VOLTMETER (See ETI Sept.)
Printed Circuit Board ..... Cat H-8630 $1.50
LM3914 IC ..... Cat Z-6295 $4.25
Choose round or rectangular, large or small LEDs to suit your particular application.

CHASER (See EA August)
Complete kit, including front panel ..... Cat K-3145 $69.50
PCB only ..... Cat H-8379 $5.95

NASA POWER CHOPPER (See EA August)
Short form kit (All components & PCB) ..... Cat K-3325 $16.50
PCB only ..... Cat H-8378 $3.00

LEDS AND LADDERS GAME (See EA August)
Complete kit inc. printed panel ..... Cat K-3390 $15.75
PCB only ..... Cat H-8378 $3.00

LED TACHO (see ETI August)
Short Form Kit (includes PCB components etc, but no case – build it into your dash board). ..... Cat. K-3240 $24.50

FAST NICAD CHARGER (See ETI August)
PCB only ..... Cat H-8627 $3.00
(All other components in this kit are normal stock lines)

GUITAR/PA PREAMP (See ETI August)
Short form kit PCB & components, no transformer or case). ..... Cat K-3035 $29.50

300 WATT AMPLIFIER (See EA June)
Printed Circuit Board only ..... Cat H-8376 $9.95
(Most other components are normal stock lines).

TV CRO ADAPTOR (See EA May)
Complete Kit ..... Cat K-3060 $29.95
Printed Circuit board ..... Cat H-8375 $3.75

IT'S A DIALLER! IT'S A CALCULATOR! AND IT'S A CLOCK!

Great for busy executives, secretaries, or even in the home! It remembers 32 numbers for you, and dials them at the push of a button. But it's more than that. It is also a comprehensive memory calculator, and a clock: great for timing those STD & ISD calls!
Note: although this fits perfectly onto our phone system, present regulations do not permit them to be used in this way.

Cat. X-1176 **$179.00**

ANOTHER TWO NEW STORES NOW OPEN!

We're still expanding! A new store in up-town Sydney (near the Tech & Institute of Technology). And one in the heart of the Northern Beaches. Call in and compare our prices with others in the area!

818 GEORGE ST BROADWAY Ph 211 3777

531 PITTWATER RD BROOKVALE Ph 93 0441

DON'T FORGET: ONLY 11 WEEKS TO CHRISTMAS!!!

Need a few ideas for someone into electronics? Go no further than your nearest Dick Smith store!

LOWEST PRICE EVER!

16K MEMORY UPGRADE KIT SUITS ALL COMPUTERS!!!

Fast (250nS) 4116 memory IC's for updating any microcomputer to 16K (or to 32K or 48K). Complete with instructions for fitting – a huge saving over our previous price!

WAS $149 ONLY 12 MONTHS AGO!!

$59.95!!!

Cat X-1166

BE QUICK FOR THIS FM TOO!

Update your car sound and save! This superb FM/AM/Car cassette is now $20 off: you reap the benefit of Dick's bulk buying! Easy to fit (goes in standard dash opening). Here's your chance to own a superb car sound system at a bargain price! (Speakers extra).

~~$149~~ **$129** Cat. A-6480

GREAT GIFT IDEA . . .

It's the greatest teaching aid since the book! Children not only learn to say the words, they learn to spell them as well! Amazing microcomputer technology actually creates the sounds: no tapes! And with the plug-in modules (optional) the range of the speak-and-spell is greatly increased!

$79.50

Cat X-1300

PLUG-IN MODULES FOR SPEAK'N'SPELL
SUPER STUMPER 1 Cat X-1301
SUPER STUMPER II Cat X-1302
VOWEL POWER Cat X-1305
ALL $17.95 EACH

NEON TEST S DRIVER

You've often wondered if a circuit is live . . . Find out with this neon test screwdriver. If it has mains voltage applied to the tip, the neon lights. The rest of the time it's a handy screwdriver!

ONLY **$1.00!!**

Cat T-4005

NEED A SAFE AC SUPPLY FOR YOUR PROJECTS?

How about 12 volts at 500mA!!!

Most plug-packs give you around 200mA. This one gives 500mA! The reason: it is ALL transformer. You put the rectifiers, capacitors, etc. in the project: and plug in the AC supply. It's a great space saver!

$9.50 Cat M-9555

OUR PIECE DE RESISTANCE

YES! We now have good stocks in all values of our famous 1% metal film high quality resistors. These used to sell for around 35c each: look at our price!
They're great for all close-tolerance uses, and we have sufficient quantities to suit the OEM as well as the design lab, the technician and the hobbyist!

FROM ONLY **5¢** (per 100 up of same value)

WAVE A FLAG

What's an electronic store selling flags for, you ask? Dick couldn't buy one himself, so he thought 'I'll fix that!' Show your Aussie spirit and fly your own flag, 1 metre long.

$9.95 Cat X-1001

INCREDIBLE BARGAIN!

Superseded Amateur Radio Handbooks

WOW! We've made an incredible scoop purchase of Amateur Radio Handbooks direct from the publisher. These are the 1978 issues: the last of the ones that contain useful valve data! Great for novices, beginners, etc: here's your chance to own the amateur's 'bible' at a tiny fraction of the current price!

$2.50

$15 VALUE! Cat B-2217

HURRY! LIMITED STOCK!

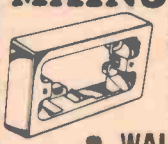
NEW WIA CALLBOOK 1980 EDITION IN STOCK NOW! ONLY $2.95!!

Cat B-2319

HUGE RANGE OF AMATEUR RADIO BOOKS ALWAYS IN STOCK!

MAINS WIRING?

These useful mains wiring aids from Dick Smith make the job that much easier . . .



WALL MOUNTING BOX
Accepts standard switch plates, power outlets, TV outlets, etc. Proud of wall: enough room for wiring & outlet, etc, within box.
$1.25 Cat P-5531

WALLBOARD CLIP
Great for fibrous plaster, fibro, masonite, ply, etc: lugs clip over wall board, power outlet screws on so it is flush with wall. Ideal for new installations in old buildings.
45¢ Cat P-5630

Junction Box
For mains cable connections, complete with connectors. As used by electricians, etc.
$1.40 Cat P-5625

DOUBLE POWER OUTLET: For new jobs or for converting singles. Takes same space as single
$4.70 Cat P-5580

POWER OUTLET SAFETY CHECKER
Check outlets easily and safely. 3 lights give instant good/bad reading.
$4.95 Cat P-5300

Playmaster Graphic Equaliser

A Playmaster Graphic equaliser in your hi-fi system will make so much difference you won't believe it! The graphic equaliser can boost or cut various bands of frequencies over the entire audio spectrum, allowing you to adjust the sound to make up for system deficiencies; or to make the sound the way YOU like it. If you want deep bass, you've got it. If you want high highs, you've got it!
A graphic equaliser in your system can make it sound like one costing twice as much!
The kit is very easy to build, and perfectly suits practically all hi fi amplifiers.

$99.50 Cat K-3500

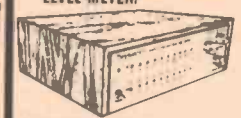
THE PERFECT ADD-ON TO ANY HI-FI SYSTEM!

TIMBER SLEEVE SHOWN IS OPTIONAL (Cat H-3113 @ $8.50)

DON'T WANT TO MAKE THE KIT? SEE THE BUILT-UP MODEL AT RIGHT!

Playmaster Graphic Analyser

● ALSO DOUBLES AS A PEAK LEVEL METER!



$99.50 Cat K-3510

GET THE MOST FROM YOUR SOUND SYSTEM!

TIMBER SLEEVE SHOWN IS OPTIONAL (Cat H-3113 @ $8.50)

Like the horse needing the cart, the graphic equaliser needs a graphic analyser. This remarkable piece of equipment allows you to obtain the maximum performance from your graphic equaliser by setting the system up to suit the room and furniture exactly. You've probably noticed if you move your speakers around the room they sound different: the graphic equaliser can take care of this, but the graphic analyser tells the equaliser what to do!
And when you've set up your system, the graphic analyser isn't wasted: flick a switch, and it becomes a superb peak level reading meter – a mini light display playing along with your music!

MAJOR DICK SMITH RE-SELLERS:

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

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

BAIRNSDALE, VIC: Odyssey Electronics
101 Main Street. Phone 525 282

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

BLACKHEATH, NSW: Goodwin Electronics
123 Station Street. Phone 878 378

BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street. Phone 5867

COFFS HARBOUR, NSW: Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave. Phone 525 884

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

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

GEELONG, VIC: Electrofix
133 Malop Street. Phone 07 827

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

GOSFORD, NSW: Tomorrow's Electronics & HI FI
88 William Street. Phone 247 248

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

KINGSTON, TAS: Kingston Electronics & Records
Channel Court. Phone 298 802

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

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

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

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

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

MT GAMBIER, SA: Hutchesson's Communications
5 Elizabeth Street. Phone 258 404

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

NAMBOUR, QLD: Nambour Electronic Shop
Shop 4, Lowan House, Ann St. Phone 411 804

NEWCASTLE, NSW: Elektron 2000
181 Wharf Road. Phone 282 844

NOWRA, NSW: Lyrebird Electronics
50 Berry Street. Phone 25 525

ORANGE, NSW: M&W Electronics
48 McNamara Street. Phone 826 491

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

SOUTHPORT, QLD: Amateur's Paradise
121 Nerang Street. Phone 322 644

SURFERS PARADISE, QLD: Viking Electronics
3108 Gold Coast Hwy. Phone 322 644

TAMWORTH, NSW: Sound Components
78 Brisbane Street. Phone 661 383

TOOWOOMBA, QLD: Hunts Electronics
18 Neil Street. Phone 328 944

TRARALGON, VIC: Power'N'Sound
15 Franklin Street. Phone 743 838

VINCENT, QLD: Tropical TV
249 Fulham Road. Phone 791 421

WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street.

WALGETT, NSW: P.J. O'Brien Electronics
82 Wee Wee Street. Phone 243

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

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A 3 channel, digital proportional radio control system, complete with servos, and it's less than $100

That's right: compare this little beauty with similar models elsewhere. You get the transmitter, receiver, battery pack and three servos, as shown, for less than $100!!! We've never seen these for less than $150.00 before!

It's the ideal system for model planes, boats, cars, etc etc: each channel is individually proportional controlled and has a preset position on the transmitter to allow for trimming, mechanical wear, etc. Our initial shipment is limited: so hurry in for this if you're at all interested in radio control (or would like to be!)

AND THE PRICE? JUST $99.00!!!!

A 15MHz DUAL BEAM CRO FOR ONLY $638?

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Yes! This superb Hitachi 15MHz CRO offers dual beam capability, high (1mV/div) sensitivity, X-Y operation, trace rotation, Z-axis input, 10x sweep magnifier, and five modes of vertical deflection operation! It's a superb piece of craftsmanship, way ahead of its opposition!

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HUGE RANGE OF OTHER COMPUTER BOOKS IN STOCK: JUST ASK!

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WANTED: Free-lance programmers familiar with TRS-80 level II BASIC to write customised software packages for us.

If you are a Uni. student, tutor, lecturer, computer programmer, professional person or a microcomputer buff and you own a System 80 or TRS-80 and enjoy programming in BASIC, why not take this opportunity to make some extra money in your spare time by writing various software for us?

Give us a call: you have nothing to lose, but plenty to gain.

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A very common request in for a transformer to operate 115V equipment from 240 volts. Here it is: rated up to 60VA (suits most audio & entertainment appliances). Fully approved, ready to plug in.

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NEW RANGE OF SOUND CARE EQUIPMENT JUST ARRIVED!

You asked for it: so here it is! Economy sound care equipment that will do a really professional job on your records and cassettes. Something for everyone, at a bargain price!

Cassette windere, labels and reel locks. Cat. C-7086	$2.95
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WOTTA BARGAIN!

We've just bought a HUGE shipment of these incredibly popular push button telephone dials in – so our cost has dropped. You reap the benefit of Dick's huge bulk buying power!

Simply substitute for any rotary dial. Although these units fit perfectly into standard Aust. phones (no soldering required) current regulations do not allow you to use them for this purpose. Cat X-1175

NOW: $39.50

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Don't lose that important program through mains spikes. This filter effectively smoothes the mains supply, resulting in less 'crashes'. A must for all serious computer users, businesses, etc.

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More of Dick's BONZA BULK BUY BARGAINS: BEWDY!

We admit it: we blew it! A mistake on our order has left us with red faces and a couple of thousand wrong switches! We can't send them back, so we've slaughtered the price just to get rid of them! They're five position, single pole switches, which can also be used as two, three or four position: just ignore the extra positions. They would normally sell for around $1.50: look at the price now! Thousands of hobbyist uses – buy now while stocks last! Cat S-2315

55¢!

And another bulk buy switch bargain: this one is the most popular we stock: DPDT mini toggle switch, with contacts rated at 125V 10A (but great for 240V at lower current). As used in just about every EA & ETI project! Normally $2.25 each, because of our HUGE bulk purchase, the price has been slashed to just $1.75! (Or $1.50 for ten or more!) Cat S-1168

$1.75!

How's this for a bargain: a superbly made 4PDT relay with 12 volt (185 ohm) coil at near half price! Yes, hundreds of uses for the professional, the hobbyist and the experimenter. And for 10 or more, the price drops to just $2.50 – incredible! Cat S-7000

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Unbelievable price: Famous quality Memorex reel-to-reel tape at pre-1974 prices! Yes, 2400 ft Memorex tape on 7" reel, in box, for around 1/3 off current price while stocks last. $9.95! Cat C-3406

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High quality 5¼ inch (sorry, Metric conversion board!) diskettes for all disk drives at a new low bargain price. Both hard and soft sectored; with huge savings for quantity buyers, too! And they're now in stock: so hurry before you miss out!

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WERE $5.95 EACH – NOW:
1 TO 10: $4.95!
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INCREDIBLE QUALITY SOUND from such a tiny speaker!

You'll find it hard to believe that such good sound can come from such a small speaker! They're ideal for cars, vans boats etc, and, of course, for extension speakers around the pool, in the rumpus room, etc etc. They're made of heavy aluminium, with a tweeter and a woofer in each enclosure. Yet the size is only 120 x 120 x 190mm! They come complete with mounting brackets and spring-loaded connecting terminals. Check them out soon!

Cat A-2375 $99.50 pair

THE BARGAIN OF THE CENTURY! dbx BOOM BOX:

LESS THAN HALF PRICE!

First question: What is a 'Boom Box'?

The Boom Box is aptly named: it is a sub-harmonic synthesiser which connects to your stereo system. It electronically synthesises another octave below the lowest notes in the music, resulting in a bass note you've got to feel to believed! It adds a whole new dimension to your hi fi sound!

The bad news was that these remarkable devices sold for well over $300.00 each!

Now for the good news:

Dick Smith has made a scoop purchase of manufacturer's distress stock! You can save $200 on the normal retail price . . .

NOW ONLY $125.00!!!!

(STRICTLY LIMITED STOCK)

Cat. A-1750

Please note: If you don't know whether or not you want a Boom Box at this crazy price, please don't buy one! There are so many people who definitely will want them, we won't have enough to go around!

NEW! AF & RF WIDEBAND SIGNAL GENERATOR

Here's a great new test instrument for the hobbyist and the professional. It's a wideband AF & RF signal generator offering sine and square wave capability from 10Hz to 200MHz in 6 ranges (AF 10Hz to 220kHz; RF 100kHz to 50MHz in fundamentals, 50 to 200MHz in harmonics). It is solid state for reliability and light weight (240V operated) – making it ideal for bench work or the toolbox.

Another Dick Smith quality import.

Cat Q-1305

ALL THIS FOR ONLY $149.50

Dear Customers,

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

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

Dick Smith and Staff

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Dick Smith Zippy Boxes are unique: they're the ones with slotted sides allowing for easy mounting of pcb's, etc, inset on them!

SIZE:	Cat No:	1-9	10 up
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$49.50

This two sector alarm control module gives you an edge over the crooks and these days, you need one! Easy to install, extremely reliable in operation. Accepts all standard detecting and sensing devices (reed switches, trap switches, fire detectors, motion detectors, etc etc). Why wait until you have been burgled? Fit an alarm now and beat the burglar! Cat L-5055

LARGE RANGE OF ALARM SENSORS ALWAYS IN STOCK: DESIGN YOUR OWN SYSTEM!

GRAPHIC EQUALIZER WITH LED LEVEL DISPLAYS

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$169.00 Cat A-1650

LIKE TO BUILD YOUR OWN? SEE OPPOSITE PAGE!

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$199.00

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Cat A-3078

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Opening new stores requires new staff. Good staff. Electronics enthusiasts who can be trained to become professional sales people and managers.

If you're talented and enthusiastic, we offer good wages and conditions. If you're above average, promotion can be very rapid. (One of our salesmen became general manager three years later!)

No matter what area you live in, if you'd like to work with us, drop us a line. When we open a store in your area, we'll be in touch . . .

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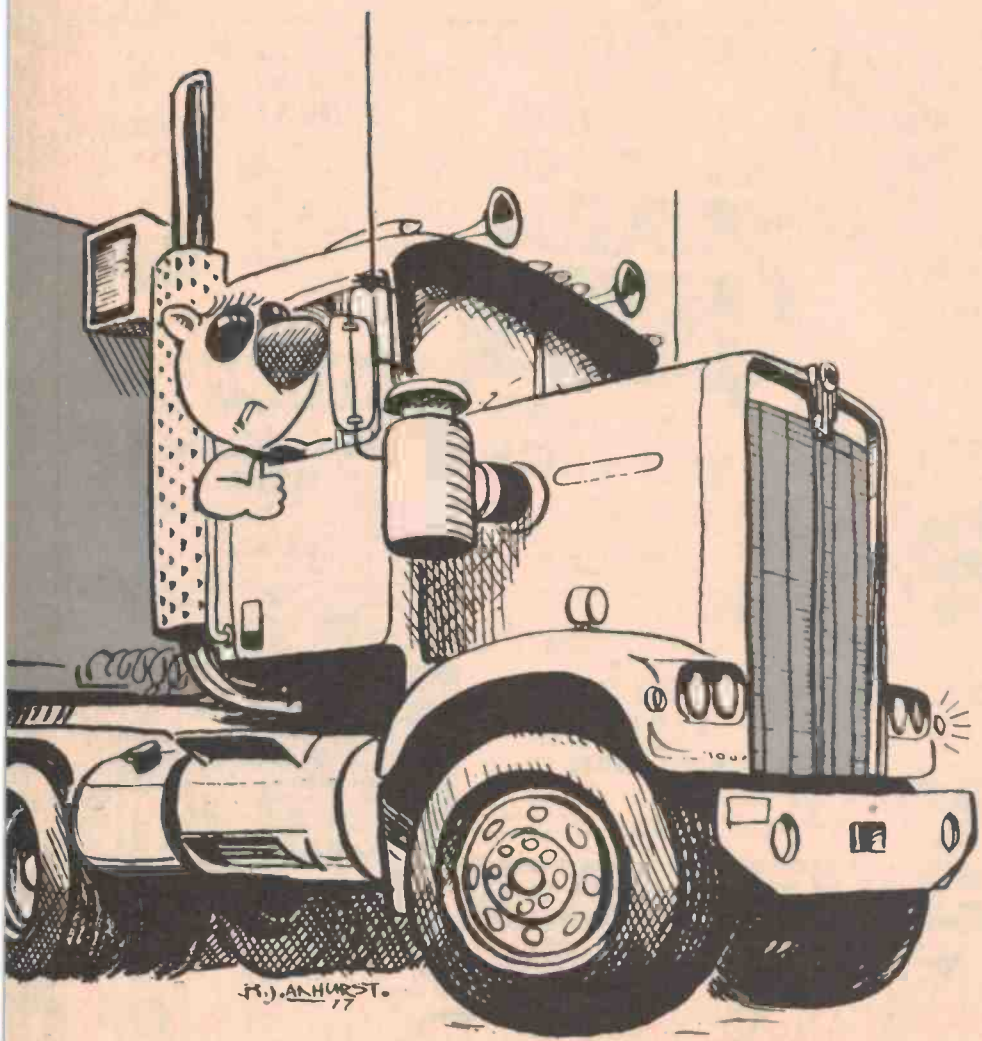
Turn and hazard indicator for your vehicle

Staff

This 'electronic flasher' is a great improvement on the electromechanical flashers fitted as standard equipment on most cars. It features a stable flash rate, high reliability and the ability to drive up to 144 watts worth of indicator lamps!

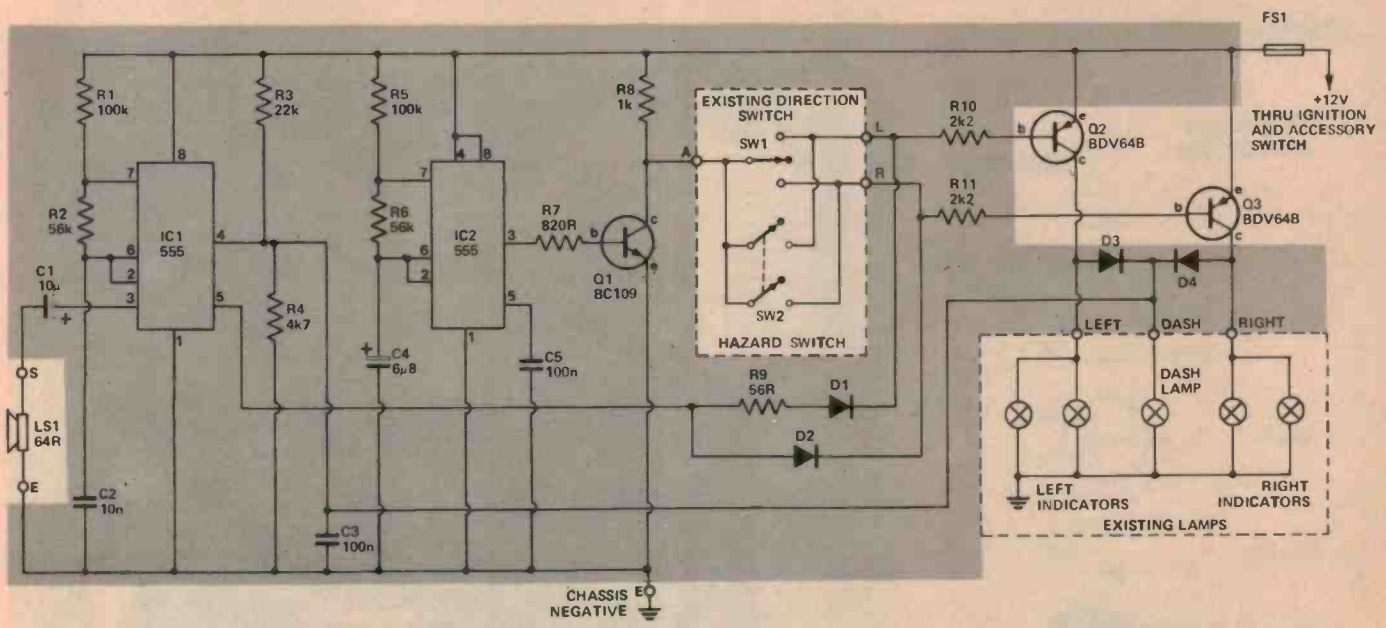


IF YOUR CAR was made before 1960 it probably doesn't have any kind of indicators, but all cars built after that date are fitted with turn indicators of some sort and post-1970 models have hazard flashers too. However, the conventional bimetallic strip flashers fitted to nearly all cars have a few shortcomings which we have attempted to overcome with our new solid state unit.

The bimetal flashers give only a weak sound indication, which can easily be drowned out by general vehicle noise. They are especially difficult to hear if the ravages of time (or uproarious living, or overindulgence in very loud music etc.) have left you with less than perfect hearing. Another disadvantage of conventional units is that they cannot cope with the extra power drained by the turn/hazard indicators on a trailer or caravan. Also the flash rate of bimetallic units is preset by the manufacturer and cannot be adjusted to compensate for drift caused by battery voltage variations and ageing of the metal strip.

Our solid state flasher connects easily to the car's wiring and is designed to completely replace the existing bimetal unit. It can handle up to 12 amps, which allows it to drive a substantial load (up to 144 W at 12 V). The flash rate will remain substantially the same through-

turn/hazard flasher



HOW IT WORKS — ETI 327

The flasher consists of a low frequency oscillator, IC2, producing a pulse at about one Hertz, driving either or both of two Darlington output transistors, Q2 and Q3. These switch the vehicle's battery to the turn indicators and dash light. An audio oscillator, IC1, gives an audio tone through the speaker at a different frequency for *left*, *right* and *hazard*.

The output of IC2 (a 555) gives the flash frequency. The frequency and duty cycle (on to off time) are set by the values of R5 and R6 and can be made variable by substituting trim pots for these two resistors.

The pulses from IC2 are fed to an inverter, Q1, and then to the vehicle's turn and hazard switches. If the vehicle doesn't have a hazard switch, one can be added. Transistors Q2 and Q3 are Darlington output transistors used here for their very high current gain. Darlington transistors have two transistors in the one package in a gain multiplication configuration.

The pulses are fed to either of the Darlington transistors for turn indication, or to both for the hazard indication. The transistors switch the battery to the appropriate indicator lights on the vehicle.

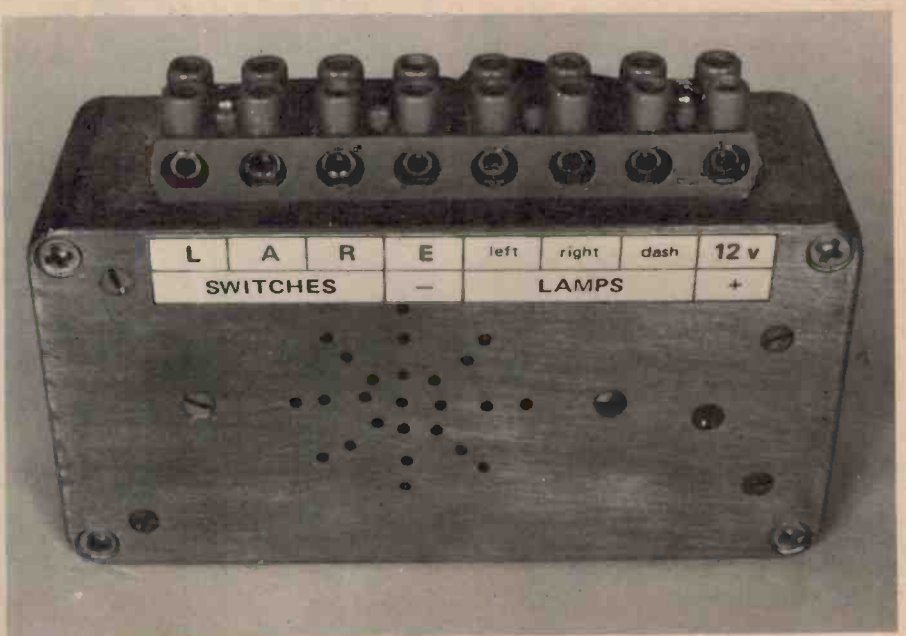
The dash light is illuminated through D3 and D4 whenever either of the Darlington transistors are turned on.

IC1 is an audio oscillator with a variable frequency controlled by the voltage on its control input, pin 5. This pin is tied to the bases of Q2 and Q3 through D1, D2 and R9 in such a way that the oscillator gives a different tone for left, right, and hazard. The oscillator is enabled by the voltage on pin 4 which is normally held low through the dash light. When the dash light turns on pin 4 goes high and the oscillator starts, beeping in time with the flash of the indicators.

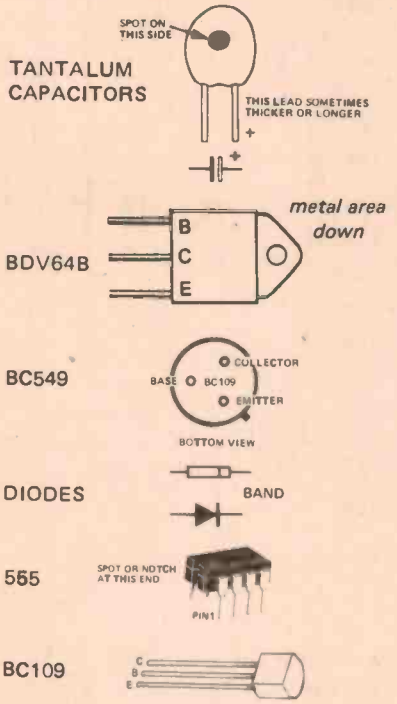
out the life of the unit. A special feature is that it provides an audio tone whose pitch is different for each of the three modes — 'left turn', 'right turn' and 'hazard'. If you want to alter the flash rate, two of the fixed resistors can be replaced by trimpots to allow variation of the frequency and duty cycle.

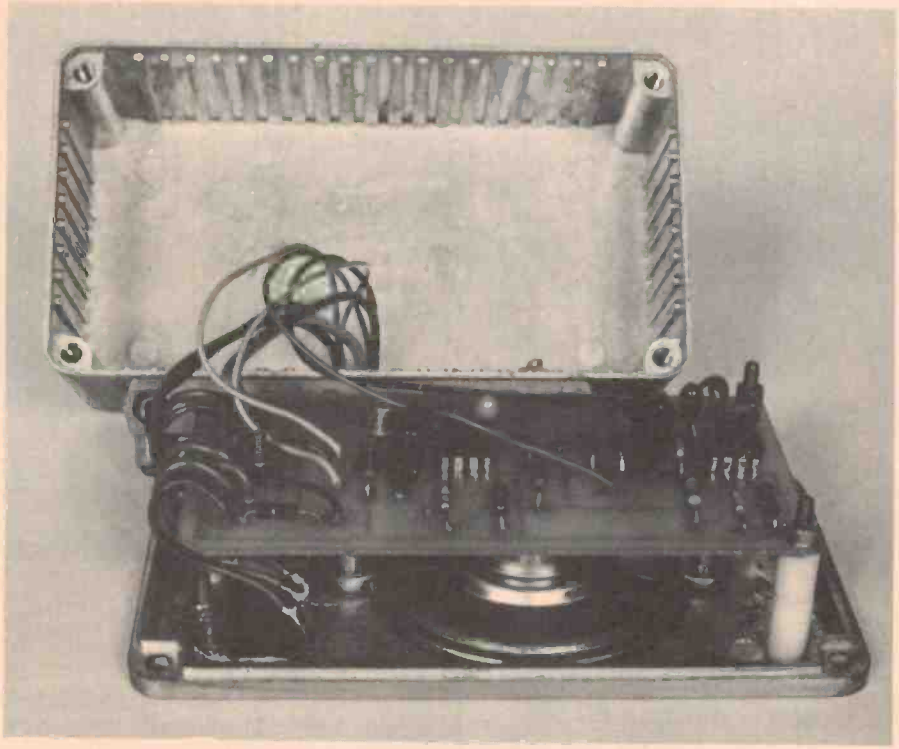
The flash rate is determined by a 555 timer IC, whose output is routed through the car's turn indicator switch on the steering column and turns one of two Darlington power transistors on and off. These transistors are actually two transistors connected in the same package in such a way as to provide a very high current gain. This allows them to be operated with a low base drive current to switch quite high currents, making them ideal for this application.

A second 555 IC is used as an audio oscillator to drive a small loudspeaker. This oscillator is held off until one of the Darlington transistors is turned on and then turns on and off in time with the Darlington, producing a beeping sound which is synchronised to the flashes. ▶



COMPONENT PINOUTS





Our unit was assembled into a diecast box using standoff pillars to support the pc board. If you use an 8 ohm or 16 ohm speaker with a series resistor, the value of the resistor may be varied to alter the speaker volume. With a high impedance speaker, a suitable value resistor may be inserted in series to lower the volume. Try 100 ohms as a start.

Construction

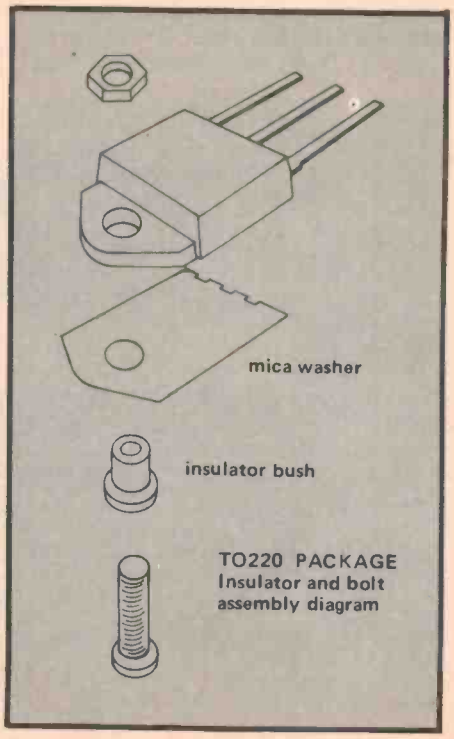
Since the unit is designed to operate inside a car it should be made as rugged as possible. Our prototype was constructed in a diecast aluminium box which doubled as a heatsink for the switching transistors.

Connection to the vehicle's wiring is made via a terminal strip mounted along the outside of the box. The speaker and the pc board are mounted inside the lid of the box to facilitate wiring.

Start by mounting the resistors and non-polarised capacitors on the pc board. Next mount the two tantalum capacitors, the diodes, the ICs and the transistor, paying particular attention to their orientation.

If you wish to vary the flash rate and the duty cycle, the two timing resistors R5 and R6 can be replaced by trimpots as the pc board has been designed to accomodate either trimpots or fixed resistors. Drill holes in the lid of the box for the pc board, the Darlington transistors and the speaker. We drilled a series of small holes in front of the speaker but this may not be necessary in some circumstances because the sound from the speaker is quite loud.

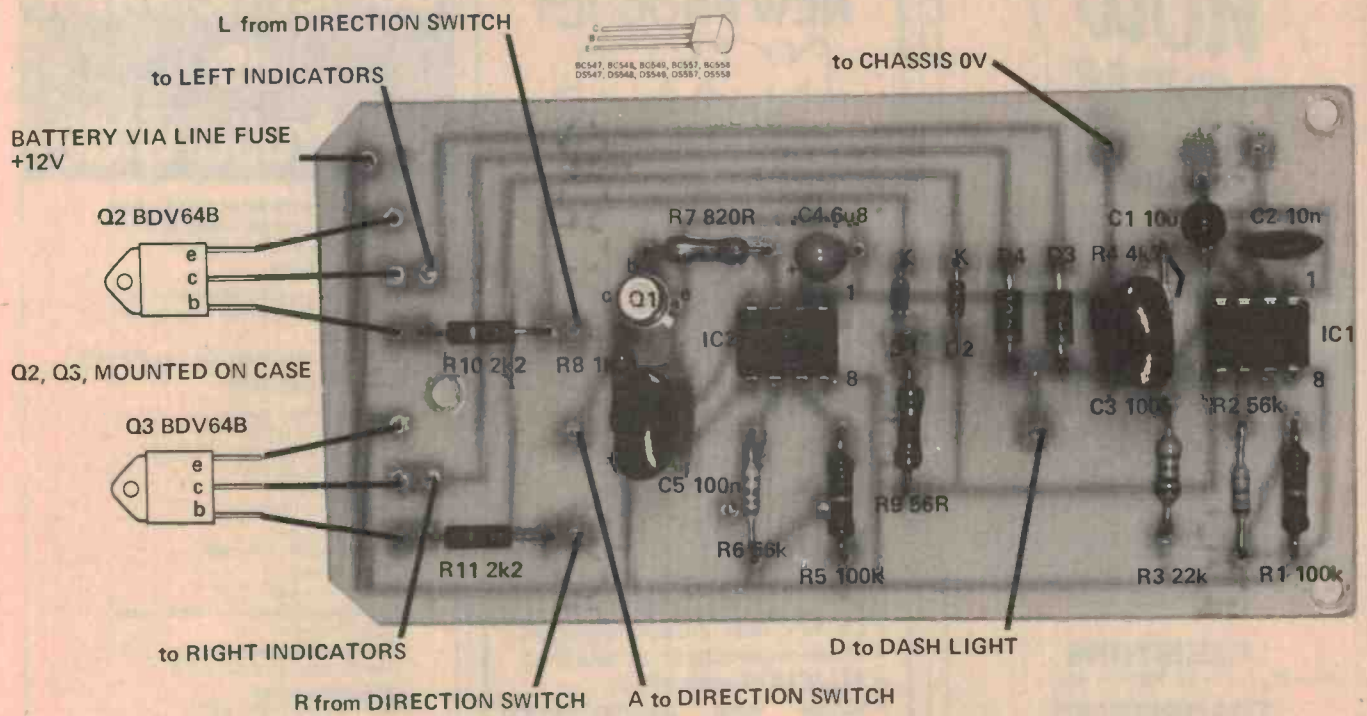
The two Darlington switching transistors are mounted on the lid of the box as shown in the photo of the prototype. The cases of these transistors are connected to the collectors and must therefore be insulated from the diecast lid. Mount the transistors using a mica or plastic insulator and plastic sleeves as shown in the diagram. Use an ohmmeter to check that there is an open circuit between the collectors and the diecast lid after the transistors are mounted.



TO220 PACKAGE
Insulator and bolt assembly diagram

Mount the loudspeaker on the lid, using nuts and bolts with two large washers clamping the edge of the speaker against the lid. If you have an eight ohm speaker you can use that instead, if a 47 ohm, ½ watt resistor is connected in series with one of the speaker leads.

Solder all the connecting wiring from the pc boards and Darlington transistors, using heavy gauge wire to the emitters and collectors of the transistors. Then mount the pc board on 20 mm standoffs above the speaker and transistors. Connections to the car's electrical system are made via a length of screw terminal strip with the wires to the pc board run through a grommet in the side of the box.



Component overlay and external component connections.

NOTE: The printed circuit board artwork is reproduced on page 113.

Installation

The flasher unit can be installed in any convenient position under the dash within earshot of the driver. However, it is not a good idea to mount it near the output pipe of the heater as it could get quite hot there. The connection to the battery can be taken from the battery terminal through a 10 A line fuse, or from the accessories position on the ignition switch. This way the hazard flasher can still be used with the engine turned off.

If your car is too old to have turn indicators you can mount a double pole switch on the steering column and run wires under the dash to the unit. You can buy switches with long lever extensions which are ideal for the purpose. The hazard switch should be a push-off/pull-on type (to avoid accidentally knocking it on) and can be mounted in any convenient position on the dash with the dash turn indicator.

External lights are easily mounted and are available from motor accessory stores. Make sure the connection from the light to the chassis is good. If in doubt, run a wire from the light case chassis connection to a good chassis contact point on the vehicle or direct to the battery negative terminal. ●

Flashers and the Law

Flashing turn and hazard indicators fitted to motor vehicles must comply with Australian Design Rule No. 6 (ADR 6), whose provisions are summarised below.

Colour:	Rear and side flashers must be amber or orange. Front flashers on Australian-made vehicles must be orange; on imported vehicles they may be orange or white.
Flash Rate:	Not less than 60 and not more than 120 flashes per minute.
Duty Cycle:	Not specified.

PARTS LIST — ETI 327

Resistors all ½W, 5%

R1	100k
R2	56k
R3	22k
R4	4k7
R5	100k or 250k min. trimpot.
R6	56k or 100k min. trimpot.
R7	820R
R8	1k
R9	56R
R10,R11	2k2

Capacitors

C1	10u/25V tantalum
C2	10n greencap
C3,C5	100n greencap
C4	6u8/25V tantalum

Semiconductors

D1,D2	1N914, 1N4148 etc.
D3,D4	1N4001, A14A etc.
Q1	BC549, BC109 etc.
Q2,Q3	BDV64B Darlington transistor

Miscellaneous

SW2	DPDT toggle switch
LS1	small, high impedance speaker (48-80 ohms) or eight ohm speaker with 47R series resistor.

ETI-327 pc board; line fuse with 10 amp fuse; diecast box to suit (65mm x120mm x 40mm); eight-connector barrier strip.

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¼W — 5c. 1 W — 8c. PW5's — 45c.

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TRIACS
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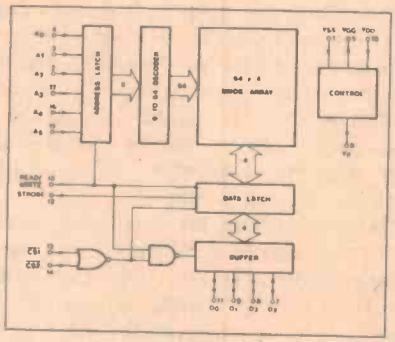

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OHIO SCIENTIFIC

The Challenger 4

Whichever way you look at it, no other computer offers so much for so little, and in colour!

Minifloppy - two can be added.

Full 53 key, keyboard which in polled mode can recognise up to 8 simultaneously depressed keys.

RF shielded aluminium case with 2 step baked on enamel finish.

Inside: real time clock and countdown timer 24K memory 6502A processor

Solid oiled walnut sides.

Control line interfaces, parallel lines for home security, accessory BUS, parallel I/O lines or other TTL signals.

Joystick sockets - add realism to games.

Colour adjustment.

Video Display 64 x 32

Sound outputs, programmable tone generators - 8 bit companding digital to analog convertors.

RF output for control of AC appliances.

Printer RS232 interface

Numeric key pad slots.

Cassette sockets.

You'd have to go a long way to get better value in a computer. It has execution speed that really separates the computers from the toys. We think the Challenger 4 is way ahead of anything you've seen so far, for a wide variety of uses including business, personal, educational and games, as well as a real-time operating system, word processor and a data base management system.

The Challenger 4 has a 2MHz 6502 processor, and if that's not fast enough we can supply the GT option with the 6502C processor, and 120 nanosecond memory which averages over one million instructions per second.

A real time clock and count down timer, a 64 x 32 display in 16 colours, including 8K memory in the cassette version, 24K for the minifloppy. A BUS structure allows easy plug in of extra memory or many more OHIO boards. The BUS means modularity. If you bought your vintage C2-4 in 1977 we can change the boards at a much lower cost than a new computer.

For the best surprise of all ask our opposition if they can provide all these facilities. When they can't, ask us!

For the complete list of dealers, please refer to listing on opposite page.

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25W RMS 8inch 3way 8Ω SPEAKER KIT SALE!

WALNUT finish, ready-made boxes, black speaker cloth.
8" WOOFER + 5" MID-RANGE + TWEETER + X'OVERS + wire and Inner bond + screws!
- Can be finished in 2 hours!
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*NEW BIG POWER Speaker Systems

ETI 4000/2 KITS 150W JUNE ETI p51 3 WAY

SPEAKERS and X'OVERS	INCLUDING CABINETS
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2½" 33Ω	4" 15Ω	5" 3·5Ω	5¼" 4Ω 15W	6"x4" 15Ω
$1	$1·50	$2	$1·50	$1·95

5" round 4 or 8Ω	6" round 4 or 8Ω	6x4" oil 4 or 8Ω	7x5" oil 4 or 8Ω	9x6" oil 4 or 8Ω
$5	$6	$5.50	$6	$7.25

A — RIPPER — OFFER

SAVE ZIPPY BOXES

	Plastic/Aluminium lids	Price
UB-1	150 x 90 x 50mm	$ 1.95
UB-2	196 x 113 x 80mm	$ 2.95
UB-3	130 x 68 x 61mm	$ 1.75
UB-5	83 x 84 x 28mm	$ 1.10

BUY 10 - SAVE 20X
The economical way to house all your small projects.

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A small manufacturer found these U-beaut SINCLAIR Stereo 60 Pre-amps, chassis and hardware after stock-take. The pre-amp has ON-OFF switch, phono/tuner/aux inputs, VOL/BASS/TREBLE/BAL and runs on 9-40v DC at about 20mA. The chassis (all holes are punched) has labelled back panel with a separate satin aluminium front panel with black lettering.

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OR build your own power amps! But hurry, only 50 kits available.

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Range: 5K, 10K, 25K, 50K, 250K, 500K, 1M, 2M, 3M.

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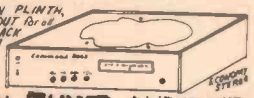

from bankrupt company production line, PCB is wired but needing final assembly. All parts eg transformer, panel lead etc supplied and circuit diagram - includes plinth but not turntable. Features: AM tuner, Volume, Bass, Treble, Balance controls, Din (tape) socket, H Phone socket etc. TO CLEAR AT LESS THAN PARTS COST! SORRY, NO WARRANTY AT THIS PRICE. ADD ONLY TURNTABLE AND SPEAKERS, only $18 ea

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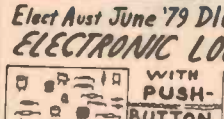
Elect Aust June '79 DIGITAL ELECTRONIC LOCK KIT!



$15
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MEASURE VOLTS 0-16, AMPS 0-40, RPM 0-12000/1400, POINTS TEST DWELL ANGLE etc TEST 4, 6 OR 8 CYLINDER MOTORS WITH FULL INSTRUCTIONS
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12 Warranty claim units, some slightly marked, all g'teed!
DON'T DELAY - LAST FEW AVAIL!

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All new and g'teed! TRANSMIT/REC. Scoop buy! Were $4.50 Save $2.00
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2	27.025	13	27.165
3	27.035	14	27.175
4	27.055	15	27.185
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11	27.135	Marine	27.910

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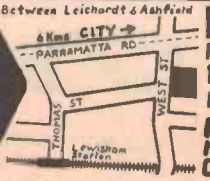

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"Brilliance boost" for guitar

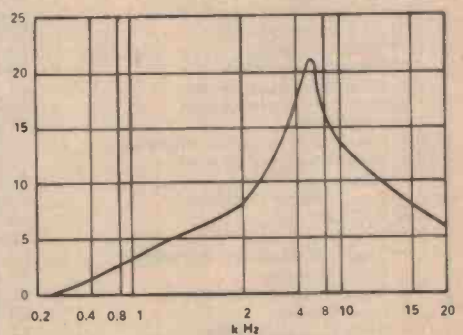
A TREBLE BOOSTER circuit can be used with a guitar, and other electronic musical instruments, to boost a range of the higher order harmonics and give a more "brilliant" sound. A circuit to achieve this has a fairly flat response at the bass and across most of the middle frequencies while the upper middle and most of the treble frequencies are given a substantial gain boost.

The circuit is basically just an op-amp (IC1) used in the non-inverting amplifier mode. The non-inverting input is biased by R4 and R5 via a decoupling network which is comprised of R3 and C3. C4 and C5 give dc blocking at the input and output respectively. With SW1 open there is virtually 100% negative feedback through R1, R2 and C1, giving the circuit unity gain and a flat response. Closing SW1 brings C2 into circuit, and this decouples some of the feedback through R1 and R2 at frequencies of more than a few hundred Hz, giving the required rising response.

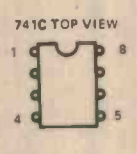
Feedback through C1 at high treble frequencies causes the response to fall away above about 5.5 kHz, and prevents the very high frequency harmonics from being excessively emphasised.

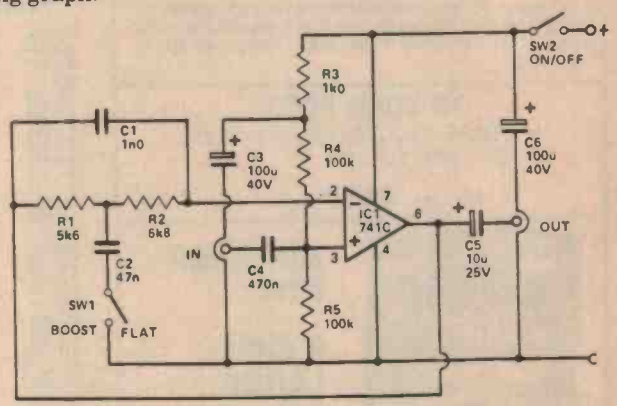
As the unit has unity gain at frequencies where boost is not applied it can simply be connected between the instrument and the amplifier.

It is normal to give only a modest amount of emphasis to the upper-treble in order to get good stability and a low noise level. This also prevents the output from sounding too harsh. The frequency response of this treble booster is shown in the accompanying graph.



THE FREQUENCY RESPONSE OF THE TREBLE BOOSTER





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★BC210 .....$350 ★Thinscans from $179

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First release in Australia **$395** 10ch.

Searches and scans Australian Low Band, High Band and UHF to 512MHz. Touch tone frequency programming.
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our price **$450** (RRP $510)

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10 TURN POTS

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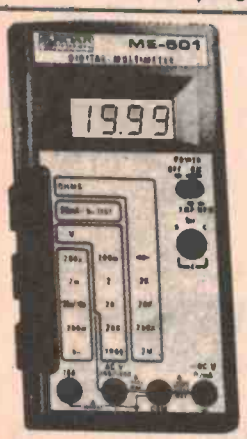
Inc. tax **$8.50** ea.



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Kit form	$249.00
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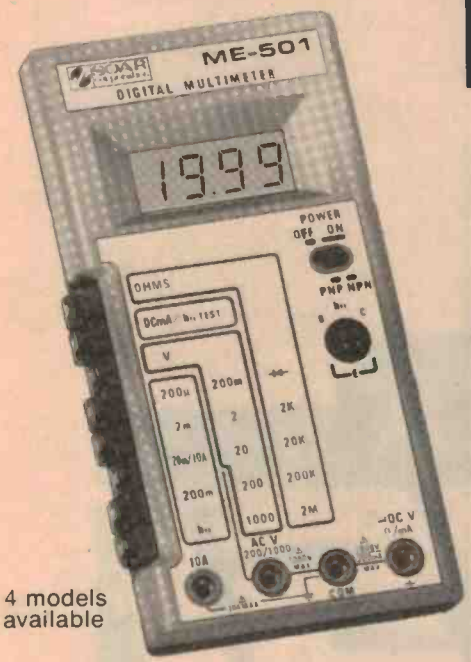

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DC Voltage

Ranges: 200 mV, 2V, 20V, 200V, 1000V
Input R: 10 M Ohm
Accuracy: ± (0.8 percent of rdg plus 1 dgt)
Overload protection: 100V dc/peak

AC Voltage

Range: 1000V
Input R: 10 M Ohm
Accuracy: ± (1 percent of rdg plus 5 dgt)
Overload protection: 1200 Vrms

DCmA:

Ranges: 200 uA, 2mA, 200 mA, 10A
Voltage Burden: 250mV maximum at F.S. except 10A range, 5.00 mV
Accuracy: ± (1.2 percent of rdg plus 2 dgt)
Overload protection: 0.5A/25DV Fuse

Resistance:

Ranges: 2k, 20k, 200k, 2M, Diode test
Accuracy: ± (1 percent of rdg plus 2 dgt)
Overload protection: 250 Vdc/rms

Transistor Hfe Checker:

Range: 0 — 100 (IB 10 ma)
Accuracy: ± (10 percent of rdg plus 2 dgt)

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PROFESSIONAL RANGE

ME-522
3½ DIGIT LCD DISPLAY

ME-522

General Specifications
Display: Liquid Crystal Display.
Maximum indication: 1999 or -1999.
Measuring mode: DC V, AC V, DC mA, AC mA, OHMS.
Measuring range: 5-range change-over in each mode.
Polarity: Automatic, negative polarity indication.
Zero adjustment: Automatic.
Overrange Indication: The top of digit position of (1) or (-1) is displayed.
Sampling time: 300 mSec.
battery voltage indication: the "BATT" mark lights on the display panel.
Power source: Single 9V transistor battery. (NEDA 1604 or S-006P)
Power consumption: Approximately 15mW.

ME-523

General Specifications
Display: Liquid crystal display.
Maximum indication: 1999 or -1999.
Measuring mode: DC V, AC V, DC mA, AC mA, and OHMS.
Measuring range: 5-range change-over in each mode.
Polarity: Automatic, negative polarity indication.
Zero adjustment: Automatic.
Overrange Indication: the top of digit position of (1) or (-1) is displayed.
Sampling time: 300mSec.
Battery voltage indication: When the voltage drops below the operating voltage, the (▶) lights on and the decimal point (not yet used) lights on.
Power source: Single 9V transistor battery. (NEDA 1604 or S-006P)
Power consumption: Approximately 15 mW.

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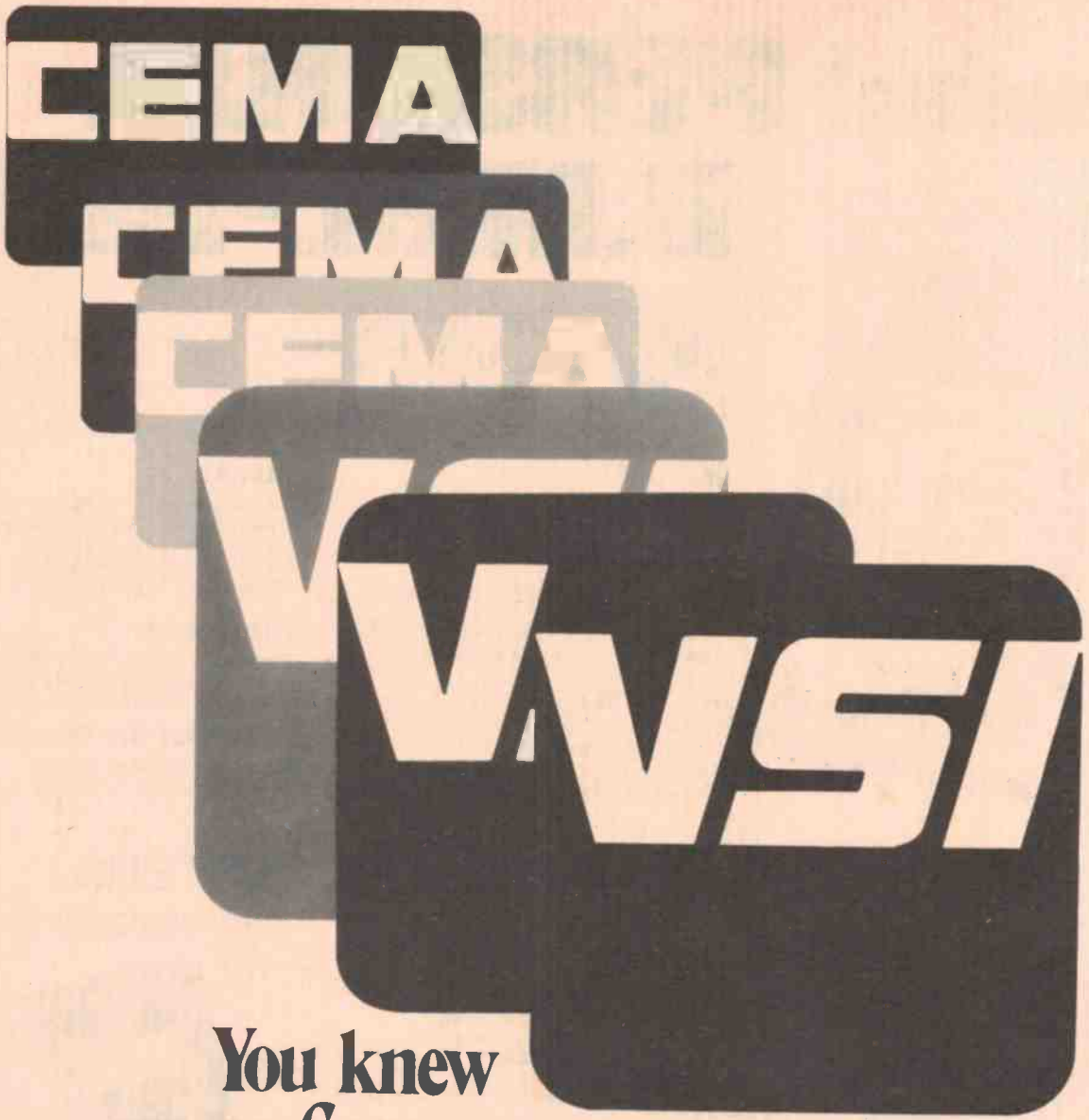

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Lab Notes

The ETI-566 Metal Detector Revisited

This project, published in the April 1980 issue, has proven to be pretty popular amongst experimenters who have clamoured for more complete construction details. Your patience is herewith rewarded !

IT SEEMS from correspondence that this project has been popular amongst experimenters. We have been asked to give more details on the unit and/or alternative construction etc. There have also been problems with component supply, particularly the coils. This Lab Notes gives details, for the experimenter, of alternative construction arrangements, coil details and suggestions on different configurations to make the unit more sensitive to small objects.

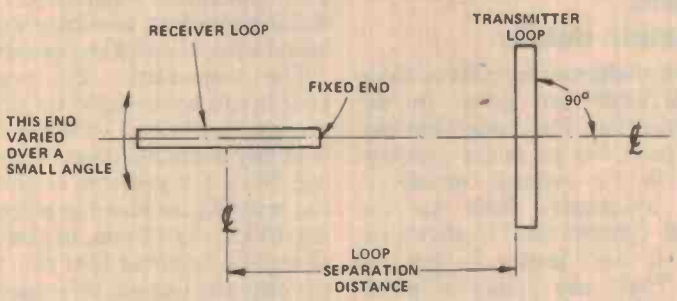


Figure 1. The 'Induction Balance' principle employed in the ETI-566

Notes on the principle of operation

First of all, to be able to experiment with the construction of the instrument, it is useful to know something of the principle of operation. As explained in the original article, the unit employs an *induction balance* technique. As illustrated in Figure 1, the transmitter antenna loop and the receiver antenna loop are located with their planes at right angles and a small distance apart. This provides the minimum induction of the signal from the transmitter loop into the receiver loop as there is minimum magnetic coupling between the two. To permit accurate alignment, the receiver antenna loop can be varied over a small angle.

The transmitter puts out a pulsed signal at 20 kHz. The pulsing is principally to provide a modulated signal for the receiver that may be demodulated and put through a speaker or headphones for the convenience of the operator. The pulse repetition frequency may be set to some convenient pitch in the audio range between about 200 Hz and 1.5 kHz.

The alignment of the antennas is adjusted such that, with no metal object within the field of the instrument, there is minimum (or no) received signal.

The receiver is tuned to the *third* harmonic of the transmitter, i.e.: 60 kHz. This provides better sensitivity than if it were tuned to the transmitter at 20 kHz. It seems to work like this: the transmitter is deliberately designed to have a considerable harmonic content in its output. The inductive coupling between the antenna loops is greater at the third harmonic than it is at the fundamental frequency, but ground penetration is better at 20 kHz than 60 kHz as the ground resistivity increases with frequency. The transmitter antenna loop is oriented vertically to give maximum ground penetration of the transmitted signal and maximum induction into buried metal objects.

With the instrument near the ground, the effect of the ground on the field patterns of the two antennas will result in some distortion of their fields but this can be compensated for by realigning the receiver antenna for a null (minimum signal).

When a buried metal object is encountered, eddy currents induced in the object will cause a distortion in the field pattern of the transmitter antenna. As the antenna is tightly coupled to the oscillator, this will also bring about a distortion in the field pattern of the antenna at the harmonic frequencies. This will increase the coupling between the transmitter and receiver antenna loops and a signal will be heard in the receiver.

Metal objects buried close to the surface will affect the field pattern of both antennas, but deeply buried objects will primarily influence the transmitter antenna field.

The 'depth sensitivity' of the instrument is dependent on a number of ▶

Lab Notes

LEFT: General use of the instrument. With the receiver correctly adjusted for a null, proceed along a line, or parallel lines, until an indication is received. For accurate location, cross the indication point from each side and mark with your heel where the indication is strongest. The location of the buried object is between the two marks.

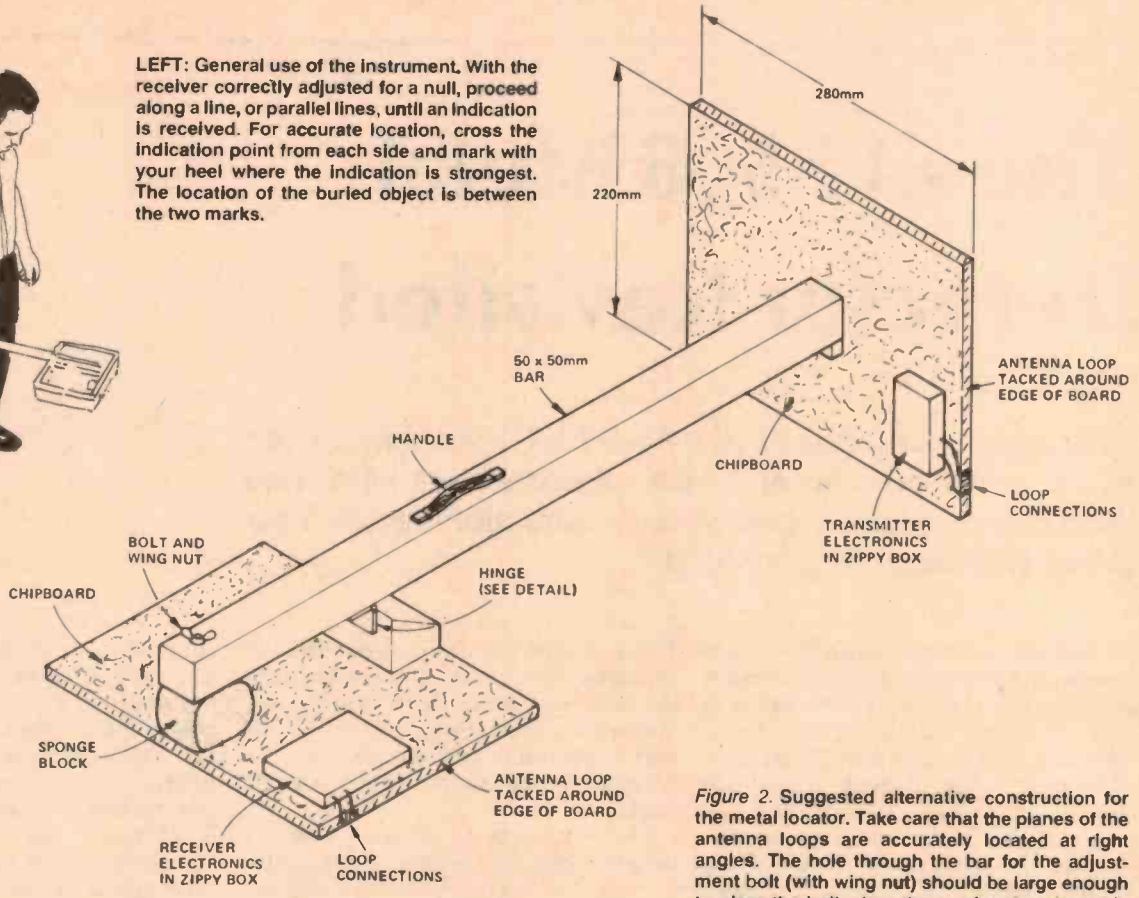


Figure 2. Suggested alternative construction for the metal locator. Take care that the planes of the antenna loops are accurately located at right angles. The hole through the bar for the adjustment bolt (with wing nut) should be large enough to clear the bolt when the receiver baseboard is fully angled towards the bar.

factors — primarily the 'loop separation distance' (see Figure 1), the size of the antenna loops, the power of the transmitter and the sensitivity of the receiver. Ground mineralisation also affects sensitivity and penetration.

The ability of the instrument to detect small objects depends largely on the loop separation distance and the size of the loops. Smaller loops and closer spacing improve the unit's sensitivity to small objects, but at the expense of penetration.

Constructed to the dimensions illustrated, a football-sized object can be detected at depths as great as two to five metres, depending on ground mineralisation and how long it has been buried. Small diameter pipes can be readily detected at depths of one metre below ground level.

As a matter of interest, the principle of operation is some 50 years old! Following the April article a reader sent us a clipping from a popular electronics magazine, describing a similar instrument, published in the 1930s!

Alternative construction details

Full details of alternative coils suitable for the ETI-566 are given in the accompanying box. Pin connections can be taken from the pc board overlays published in the original article. A suggested alternative form for the mechanical construction is shown in Figure 2. It ain't pretty — but it's practical! There are plenty of possibilities — which we'll leave to your ingenuity — but keep the basic principles in mind.

Two pieces of chipboard, 15 - 19 mm thick, serve as bases to mount the antenna loops. The latter are made from aluminium (or copper — if you can afford it!), as shown in Figure 3, and tacked around the edge of each board. The connections to the loops should be as good as you can make them to ensure low resistance contact. Solder lugs popriveted to the edge of the loops at the 'break' make good connection, or you could use pk screws and solder lugs — with shakeproof washers on both sides of the solder lugs to ensure a good 'bite' into the metal and a secure connection.

The transmitter and receiver pc boards can be mounted in 'zippy' boxes of convenient sizes — the receiver board is amply accommodated in one measuring 196 x 113 x 60 mm or thereabouts, the transmitter board in a box measuring 130 x 68 x 41 mm, or similar. They should be mounted near the 'breaks' in the antenna loops to keep lead length to the loops as short as possible. Twist the leads.

The wooden bar which holds the two chipboard antenna bases could be a length of 50 x 50 mm dressed western red cedar (to minimise warping). Alternatively, you could us a length of square-section aluminium tubing. Overall length of the bar should be about one metre for best depth penetration with this arrangement (the original project used a handle measuring 1120 mm). However, there is plenty of room to experiment. All wooden parts should be sealed and painted or given

several coats of 'Estapol' or similar clear lacquer finish to preserve them from the effects of the weather. Do this prior to final assembly.

The hingeing arrangements for the receiver antenna baseboard are shown in Figures 2 and 3. An 80 mm length of 50 x 50 mm dressed timber is chamfered as indicated and fixed to an edge of the receiver baseboard, in the centre. A hole is drilled in the middle of the opposite side, just smaller than the outside diameter of a ¼" Whitworth nut. The nut is forced into this hole. A corresponding hole is drilled in the bar. A ¼" Whitworth bolt, 6" (150 mm) long, with a wing nut screwed up to the head, is passed through the bar and into the nut in the receiver baseboard. A block of sponge rubber serves as a 'spring'. The diagram in Figure 2 makes it all clear.

A brass hinge is fixed to the chamfered block and the underside of the bar, as illustrated in Figure 3.

The transmitter baseboard is mounted flush on the end of the bar. Note that this end must be cut as square as possible. The underside of the bar is 60 mm above the *horizontal* centre line of the baseboard. Fix the baseboard to the bar with a single long wood screw. This allows you to rotate the transmitter antenna to achieve correct alignment. The small block shown under the bar, against the transmitter baseboard, is glued in place after the antenna is aligned. ▶

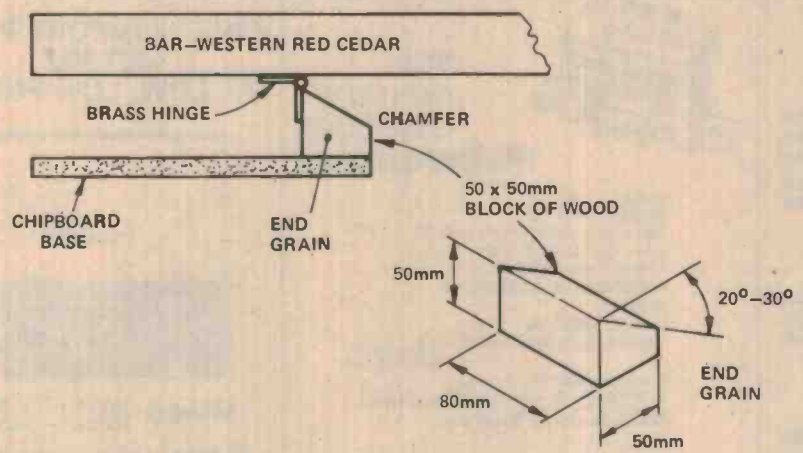


Figure 3. Hingeing arrangement for the receiver antenna baseboard.

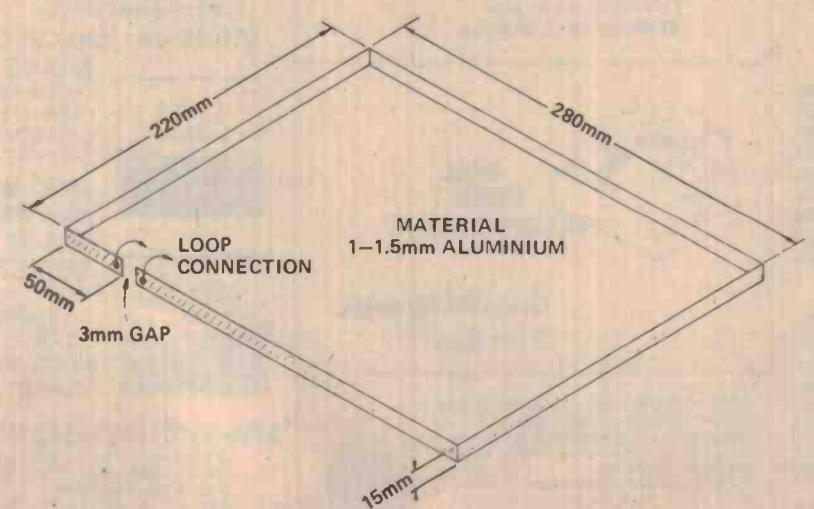
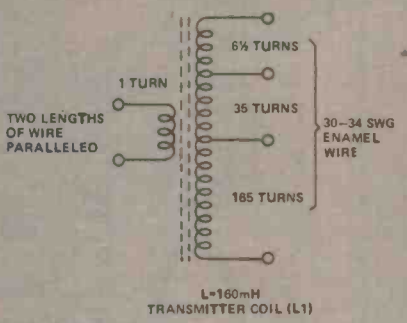


Figure 4. Dimensions of the antenna loops. The 'break' for the loop connections need not necessarily be as indicated here, but could be located at a corner or midway along one side.

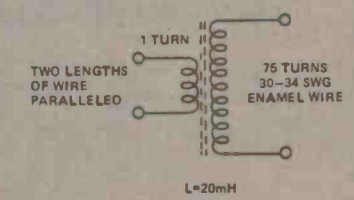


ETI-566A (Tx) — L1

Inductance — 160 mH. Wound on pot core assembly, primary and secondary turns and tappings as illustrated above. Pot core is Philips type P18/11, 3H1 material, ungapped with two-section bobbin, can and tag plate.

Part Numbers

Pot core —	4322 020 2150
Bobbin —	4322 021 30280
Can —	4322 021 30530
Tag plate —	4322 021 30450

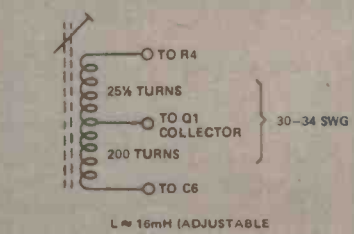


ETI-566B (Rx) — L1

Inductance — 20 mH. Wound on pot core assembly, turns of primary and secondary as illustrated above. Pot core, Philips type, P18/11, 3H1 material, ungapped with two-section bobbin. This assembly is bolted to the pc board through the central hole.

Part numbers

Pot core —	4322 020 2150
Bobbin —	4322 021 30280



ETI-566B (Rx) — L2

Inductance — approx. 16 mH, adjustable. Wound on pot core assembly, turns and tappings as illustrated above. Pot core, Philips type, P18/11, 3H1 material (μe = 150), with single-section bobbin, adjuster (colour-coded white), can and tag plate.

Part numbers

Pot core —	4322 022 24270
Adjuster —	4322 021 32130
Bobbin —	4322 021 30270
Can —	4322 021 30530
Tag plate —	4322 021 30450

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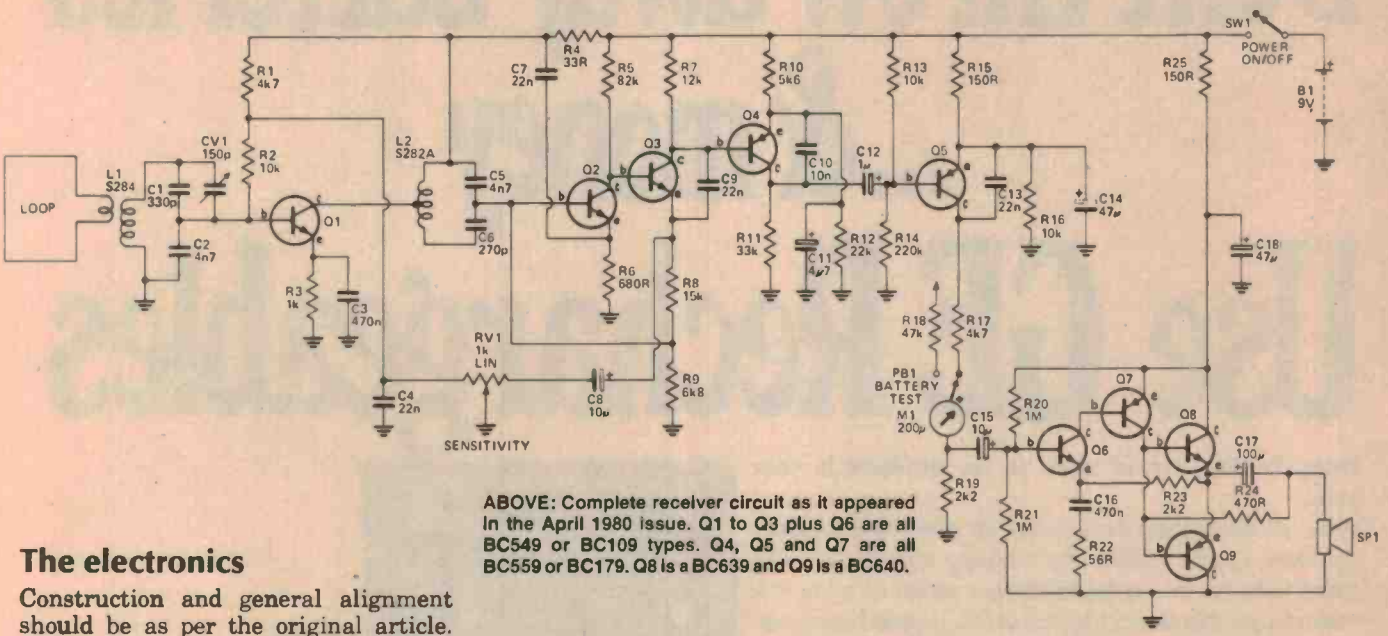
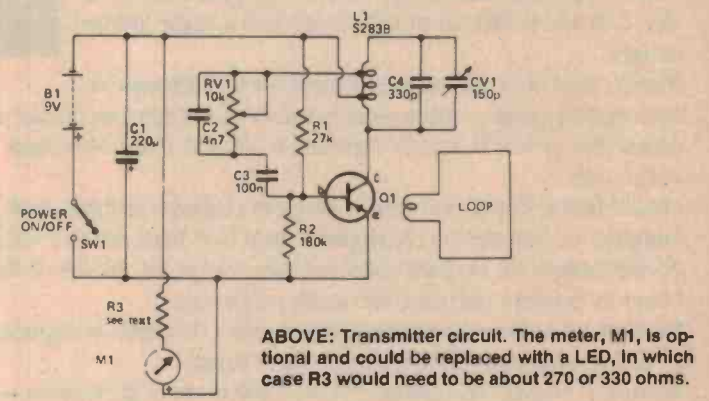


ABOVE: Complete receiver circuit as it appeared in the April 1980 issue. Q1 to Q3 plus Q6 are all BC549 or BC109 types. Q4, Q5 and Q7 are all BC559 or BC179. Q8 is a BC639 and Q9 is a BC640.



ABOVE: Transmitter circuit. The meter, M1, is optional and could be replaced with a LED, in which case R3 would need to be about 270 or 330 ohms.

The electronics

Construction and general alignment should be as per the original article. NOTE: Q6 in the receiver was left out of the original parts list — it is a BC549 or BC109. Coil details are given in the box on page 53. Note that, as these coils are jumble wound on the formers they will have greater self-capacitance than those specified for the original instrument. This will result in some variation in the tuning but there should be sufficient adjustment in the trimmer capacitors in the transmitter and receiver and the core adjuster in L2 in the receiver. If any difficulty is experienced, C4 in the transmitter and C1 in the receiver could be reduced to 270 pF each. In addition, C6 in the receiver could be reduced to 220 pF.

The trimpot (RV1) in the transmitter should be set at mid-point resistance prior to alignment and adjusted to produce a suitable pitch in the receiver after the initial alignment.

As for batteries, a No. 2362 or 2364 9V battery may be used in the receiver with the size box suggested, while a No. 2362 battery will fit in the box suggested for the transmitter. Alternatively, No. 216 size 9V batteries may be used, but they won't last too long with prolonged use. (Alkaline types in this size might be ok, though).

Antenna alignment

Following initial alignment of the electronics, the antenna baseboards can be attached to the bar and the transmitter antenna aligned. Standing well clear of metal objects (at least 5 - 6 metres) align the receiver baseboard such that it is parallel with the bar. Turn on both units and adjust the receiver sensitivity to obtain a convenient indication on the meter. Rotate the transmitter baseboard to get minimum received signal, adjusting the sensitivity if necessary. Tighten the screw securing the transmitter baseboard. Check that you can get a good null with the receiver baseboard adjusting screw; the receiver sensitivity should be advanced at least 3/4 at the point of minimum signal. If so, glue a small block of wood in place, as per Figure 2, on the underside of the bar where it meets the transmitter baseboard.

That's it. Happy hunting!

Experimentation

The following details are suggestions for the dyed-in-the-wool experimenter. The instrument can be constructed to improve sensitivity to small objects by decreasing the 'loop separation distance' (see Figure 1). We tried a bar only 600 mm long and found the unit would detect a small bunch of keys at about 300 - 400 mm. However, the alignment of the receiver antenna is much more critical.

Smaller antenna loops will improve sensitivity to small objects, at the expense of penetration, as discussed earlier. This, combined with closer spacing, should provide a good starting point for further experimentation. Indeed, a number of units could quite easily be constructed, sharing a common bar perhaps, with different antenna loop dimensions. Incidentally, the loops need not be square or rectangular, but could be circular.

With close-spaced loops, the receiver ▶

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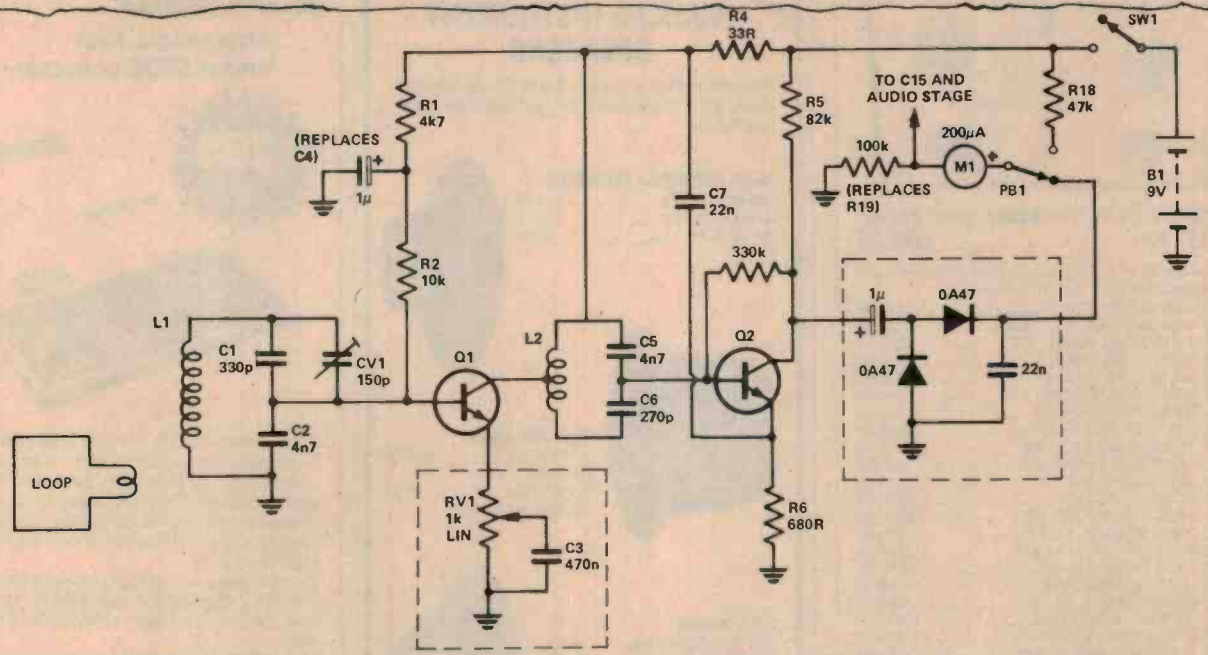

Figure 5. Suggested alternative for a simpler, lower gain receiver. This may prove a better proposition where small, close-spaced antenna loops are used. The original pc board may be used, the unnecessary components being removed. Major changes are shown inside the dashed squares. A voltage doubler diode detector is coupled directly from the collector of Q2, its output being taken to the pushbutton PB1. R19 is replaced with a 100k resistor; the original audio stage is retained. If you only want to use headphones, the audio stage could be removed also and the phones (Hi-Z) capacitively coupled to the 100k resistor. The construction should be arranged so that there is only a short lead between the gain pot (RV1) and the emitter of Q1. Mount C3 on the pot. Note that C4 is replaced with a 1uF tantalum capacitor.

may be over sensitive. A modified circuit is suggested in Figure 5. The original pc board may be used but only the first two stages involving Q1 and Q2 are necessary, along with some of the original components. Major changes are shown in the dotted lines. The gain control is shifted to the emitter of Q1 and provides various amounts of degeneration as the bypass capacitor, C3, is connected across a greater or lesser part of the emitter resistance of Q1, formed by RV1. Greatest gain is provided when C3 is connected across the whole of RV1.

A simple half-wave voltage doubler diode detector is coupled from the collector of Q2. A 330k bias resistor is connected between base and collector in this circuit as Q2 in the original circuit had the base bootstrapped to the emitter circuit of Q3 (now removed).

This circuit should provide a stable receiver of adequate sensitivity for close-spaced antenna loops.

As suggested in the original article, lowering the unit closer to the ground from the natural carrying position at arm's length improves penetration. However, it upsets the alignment of the receiver antenna a little and you have to stoop down and re-adjust it. Carrying the instrument in this position is a pain in the ... whatever ... so if you can devise some method of carrying it such that the antennas are placed closer to the ground, results can be improved. A strap for this purpose was shown with the original unit and is certainly effective, though it's "fiddly" to adjust the receiver antenna alignment. An extra attachment could be fashioned to perform the same task. We'll leave that to your ingenuity, once again — *but it must not be metal.*

When using the unit close to the ground, it is generally most effective if the bar is not horizontal, but tilted forward slightly so that the receiver antenna is angled towards the ground.

From here on in, it's up to you. Good luck! ●

CONDENSED INSTRUCTIONS

1) Set receiver angle adjustment fully clockwise so that the front of the receiver is close to the bar. Keep away from cars, fences and metal objects when setting up the instrument.

2) Turn on receiver and set the gain to about 3/4 range.

3) Turn on transmitter. A loud tone should be heard in the receiver.

4) To adjust the instrument, hold it level at normal arm length beside your body. Adjust the receiver angle until no tone is heard and/or no meter reading is obtained. Continue adjusting the receiver angle in the right direction until a slight indication is obtained. The instrument is now ready for use.

5) If a correct 'null' cannot be obtained, check you aren't near a metal object and then reduce the sensitivity control.

6) To locate metal objects, proceed along a series of parallel lines until an indication is received. To accurately locate the object, cross this indication point from each direction along your line and mark, each time, with your heel where the indication is strongest. The object will be midway beneath the two marks.

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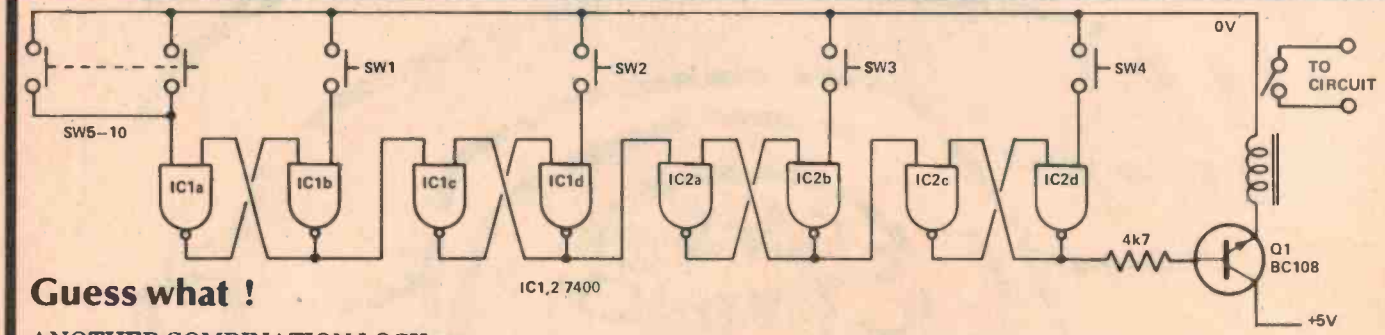
Ideas for Experimenters

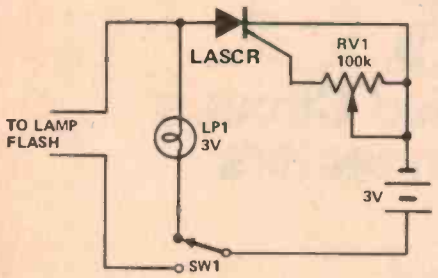
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we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



Guess what !

ANOTHER COMBINATION LOCK we hear you say! This one, **from Denis Dowling of Mulwala, NSW,** only operates the relay when the switches are pressed in the correct order. The unit provides a large number of combinations to foil the would-be thief. By the way, the correct order for this circuit is SW1, SW2, SW3, SW4, but of course, when you build the unit these switches can be mounted in any order. If any of the switches SW5 - SW10 are pressed the circuit will reset. The ten switches should be mounted in a matrix and wired in the combination order you wish.

Slave Flash



This is a simple but effective slave flash unit for use with the fusible type of flash bulb (magnesium filament). The firing is done using an LASCR which is an SCR which is triggered by light. When the master flash gun fires the LASCR is switched on, allowing current to flow to the flash bulb. The bulb blows and the LASCR turns off (as the supply is then not connected).

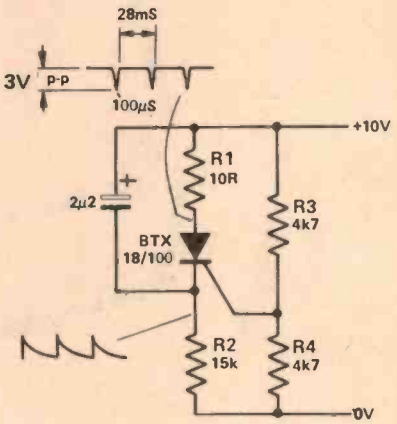
To set the sensitivity, switch the output over to the light bulb LP1, and adjust RV1 for reliable triggering from the master flash. A simple, but effective idea from **Michael Saleeba of Croydon, Vic.**

SCR oscillator

An SCR can be made to oscillate when connected in the circuit as shown. The component values specified give 100 us pulses at intervals of 28 mS. The output voltage with a 10 V supply is about three volts.

The current through the bias resistors, R3 and R4, must be high enough to allow adequate gate current for reliable switching. The charging resistor, R2 and the supply voltage are chosen so the current through the SCR is below its minimum holding current.

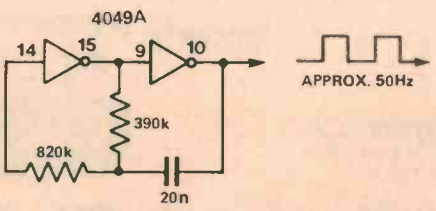
The frequency is determined by the gate voltage and the value of the capacitor and the charging resistor, R2. The output voltage is largely dependent on the voltage on the capacitor when the SCR fires. Pulse width is determined by the value of R1 and the capacitor.



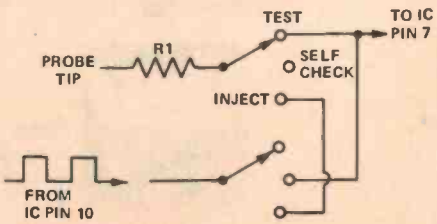
The circuit can be voltage controlled by altering the gate voltage, but this will also alter the output voltage. Another cunning circuit from **Phillip Denniss of Chippendale, NSW.**

Signal injector for logic probe

Ian Shearer of Darwin, NT, added a signal injector to his ETI-148 logic probe using two inverters and a two-pole, three-position switch. The centre position is a test function, which, when the oscillator and probe are working correctly, should light all LEDs on the probe.



The oscillator circuit uses two inverters in a 4049 IC and oscillates at about 50 Hz. The frequency can be varied by changing the values of the capacitor and the two resistors.



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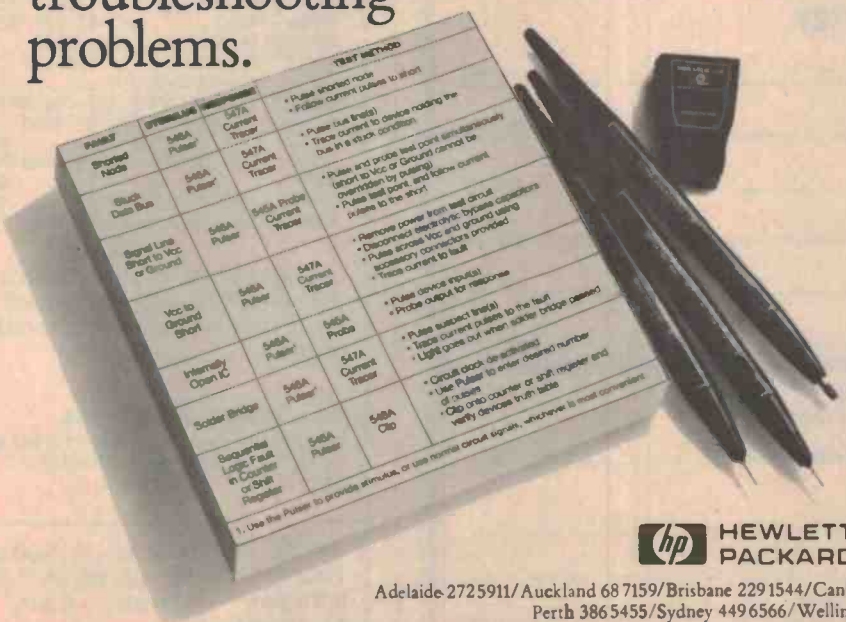

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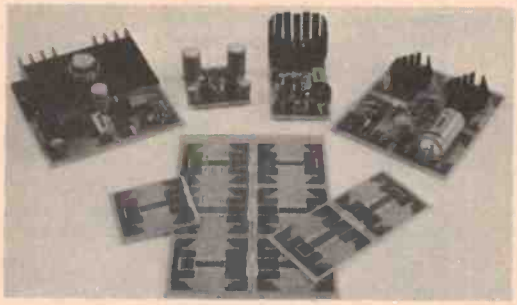

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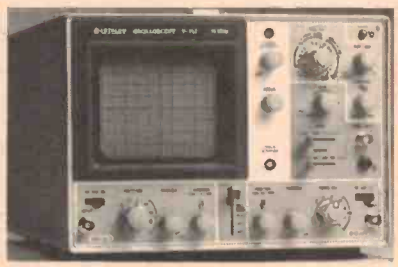

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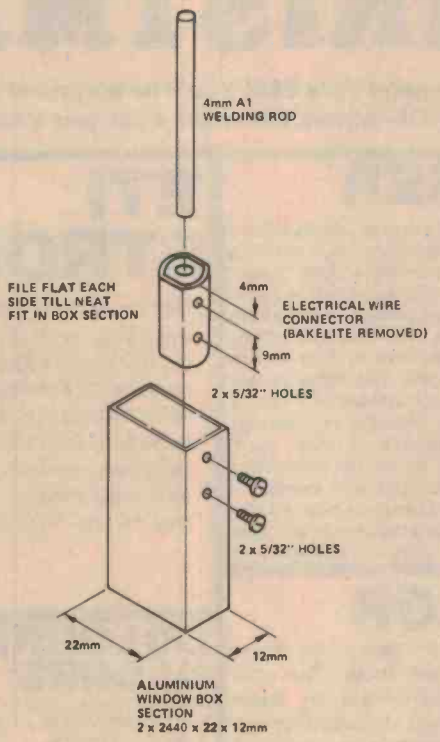
Ideas for Experimenters

SWR trimmer for homebrew halfwave

Max Soul of Weipa, WA, uses a half wave dipole from his location just 400 metres from Albatross Bay. His antenna is made from aluminium window box section with tuning rods attached to each end for fine adjustment of SWR.

The brass insert from an electrical connector is filed down to a tight fit inside the box section at the top of the antenna. Two holes are drilled through the box section to align with the holes in the connector. The screws hold the brass insert in place and also clamp a length of 4 mm welding rod. The SWR is adjusted by moving the welding rod in and out while using an SWR meter. When the correct position is found, the rod is clamped tightly in place with the two screws.

Max has achieved SWR readings as low as 1.1/1 using this system, though his location near the sea requires him to clean the contact surfaces twice yearly.

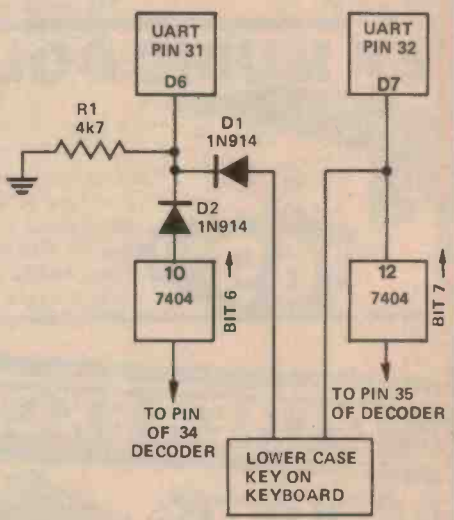


Keyboard modification

Len Henson of Dural, NSW, submitted this modification for the KBO4 keyboard used with the 5740 decoder to give a lower case keyboard function.

The copper track is cut between pin 31 of the UART (D6) and pin 10 of the 7407 and the circuit modified as shown.

With the key depressed, HEX 00 — 3F are unaffected, HEX 40 — 5F are raised to HEX 60 — 7F, giving lower case. As the KBO4 is easy to expand (keywise) the modification is a junkbox project which, since no special lower case routine is necessary, saves memory space. A flip flop could be added between the key switch and the diode D1 if required.

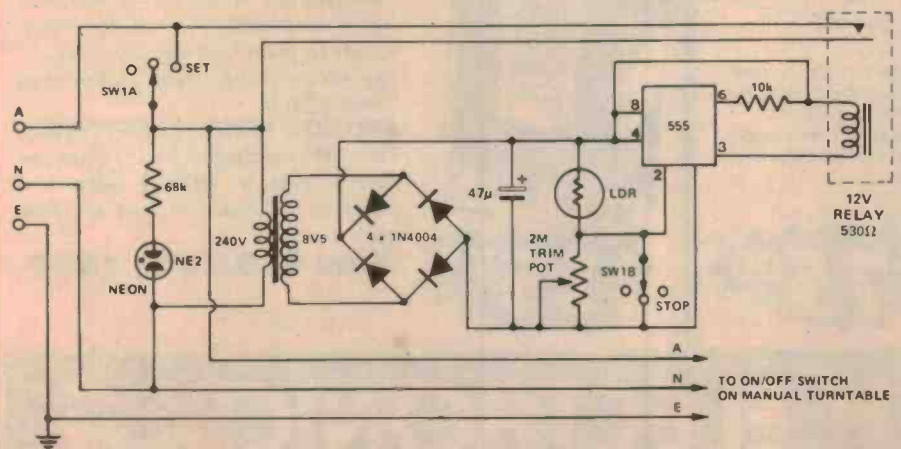


Automatic cutoff for a manual turntable

Mr. T. Threlfall of West Perth, WA, built this unit into a manual turntable to prevent the record being carved up, or more likely, to prevent stylus wear if he forgot to take the tone arm off after the record had finished.

A neon tube is mounted in the end of a black plastic tube and an LDR in the other end. A slot is cut across the tube so the light beam can be interrupted by a small plastic flag connected to the tone arm shaft. The flag must be light, to allow proper operation of the tone arm, and positioned so the light is interrupted when the tone arm is at the end of the record.

The 555 latches when the voltage on pin 2 rises, operating the relay and starting the turntable. When the beam is broken the voltage on pin 2 falls, the relay drops out and the turntable stops. The potentiometer is adjusted for correct operation.



Any ideas ?

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

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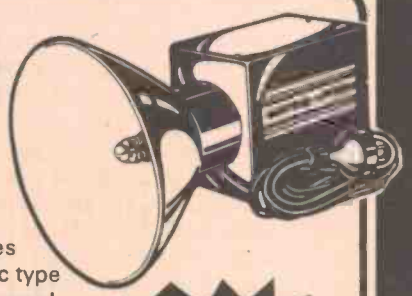

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Cat. P-5620

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Line socket for bayonet mount lamps makes it ideal for running wander light leads for loft & outside. Ideal for holding standard colour globes for parties, Xmas decorations outside etc.

P-5510

95¢

OTHER EXCITING DICK SMITH KITS...

ACOUSTIC COUPLER

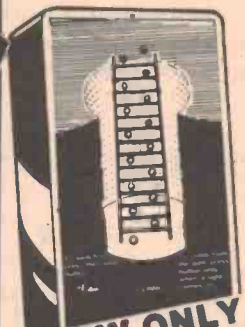
We've lost count of the number of customers who have asked for this project: well here it is! This acoustic coupler acts like a modem without any physical connection to the phone lines. It uses your standard telephone handset, placed over a small microphone & speaker in the coupler case, & transfers the information from your computer by sound. Hence the name, acoustic coupler.
Now you can have your computer talk to another across the street, across the town – even across the country (or further!) It is a must for all serious computer users, and we hope to release the kit soon.

A must for everyone with a computer

$75.00

Cat. K-3605

LEDS & LADDERS GAME



One of our most popular kits of the past was the intriguing 'LEDS & LADDERS' game described in EA in 1975. Now EA have come up with a new version of the game which is not only easier to build, it is also easier to play! Can you climb out of the well without being plummeted down again?
AND NOW FOR THE BEST NEWS: This kit is actually $1.00 cheaper than it was in 1976 – despite 4 years of inflation! Makes an ideal gift.

Was $16.75 in 1976

NOW ONLY

$15.75

Cat. K-3390

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here. Also, for a list of suppliers who stock the ETI projects published over the last few years, our "Kits for Projects" page may generally be found on the page immediately before the DREGS page (inside the back cover).

Readers should have little difficulty obtaining parts for this month's projects.

For the **Electronic Dummy Load, ETI-147**, the relay we used is an Omron type LY2. We paralleled the contacts for greater current carrying capacity. Other types may be used and almost any 24 V relay with contacts rated at 15 A, or pairs of contacts rated at 10 A each, will do the job. It won't be called on to switch full load very often and it will only be switching dc on a resistive load, so little trouble should be experienced.

The heatsinks for this project we obtained from Dick Smith and they are listed as catalogue number H-3426. They measure 225 mm long by 105 mm wide. Rod Irving Electronics stock a similar heatsink, with a slightly better thermal capacity, but the nearest standard length is 300 mm. They can have it cut to size we are informed, so you might ask.

Front panels, meter faces etc

Scotchcal front panels, meter scales and labels for our projects are available from a number of suppliers. In Sydney, Radio Despatch Service, 869 George St, Broadway, stock a small supply for our projects from 1979 onwards. If they don't have what you want in stock, then they'll make it up on order. Electronic Agencies also stock a supply of front panels and meter scales for our recent projects. They're at 115 Parramatta Rd, Concord.

In Melbourne, Rod Irving Electronics of 425 High St, Northcote stock front panels, labels and meter faces for our projects from 1979 onwards and generally have stocks available for current issue projects shortly after the issue goes on sale. All Electronic Components stock panels and meter faces from way back and generally have stocks for current issue projects shortly after we go on sale also. They're at 118 Lonsdale St, right in the heart of Melbourne.

The 3080 again !

Last month we omitted to mention an important supplier of this useful device. The CA3080, by RCA, is distributed here by AWA. You can buy the IC direct from the AWA Micro-electronics division at 554 Parramatta Rd, Ashfield 2131. Many thanks to the reader (an avid 3080 fan!) who drew our attention to this omission.

'Universal' circuit board

Every month — nay, every day! — the post brings a swag of 'press releases' about the products of various companies. Every (and we mean *every*) press release extolls the virtues of the product about which it is written. Many weird and wonderful products are drawn to our attention, plus the usual 'run-of-the-mill' range of new products which are updates on familiar items. However, every now and then, a product comes to our attention that sets itself apart from the rest. We refer to "Uniboard".

We ran a small item on the product under *Briefs* in August *News Digest* (page 9). We rang the supplier, Advanced Electronic Systems, for more information and some weeks later their Director arrived on our doorstep with samples, photographs ... and more information.

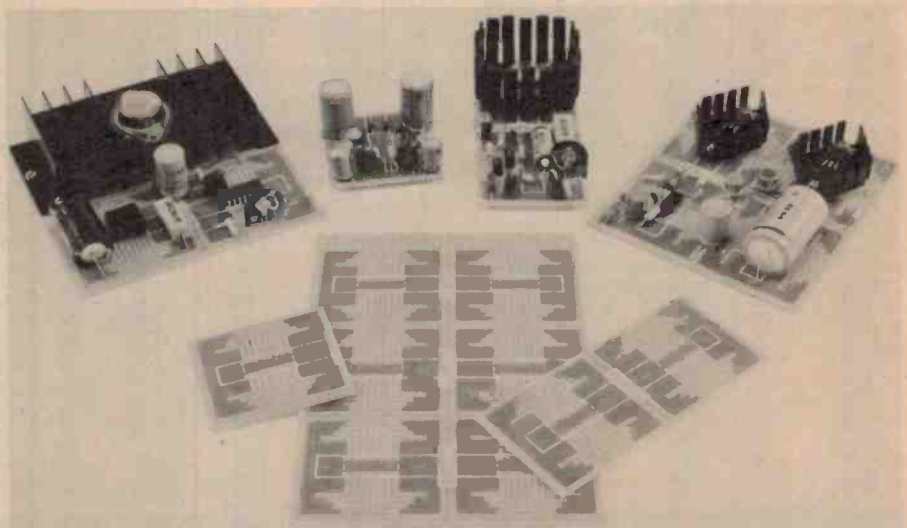
The product struck us as a good idea well done. Uni-board is a printed circuit board with rows of holes at 2.5 mm intervals. The pc tracks are arranged in a carefully thought-out pattern to accommodate ICs from eight to forty pins, along with discrete components in a convenient grouping. Uni-board is useful for either prototyping, experimenting or for complete projects and can accommodate power transistors, including heatsinks, trimpots, power resistors etc and even bridge rectifiers. Apart from that, the product has several unique — and very useful — features. To assist in arranging the component layout, all the circuit trackwork is reproduced on the 'top' side of the board in a colour-coded pattern. A brilliant innovation. All the pc tracks are solder coated to assist assembly. We understand Uni-board is available in single and double board packs as well as six board packs. A multi-board pack is economical to use and can be trimmed to suit the size of your project or prototype.

Uni-board is Australian designed and manufactured. You can obtain an 'introductory kit' from Advanced Electronic Systems Pty Ltd at 3 Staniland Grove, Elsternwick Vic 3185, for $9.95 including post and packaging. In this kit you get a Uni-board twin pack and a six pack, plus an applications manual.

Project price estimates

This information is published as a guide and a variety of factors may affect the actual price of a project, whether obtained as separate components or as a kit.

ETI-568 Flash Trigger	$27 - $33
ETI-147 Electronic Load	$68 - $75
ETI-327 Turn/Hazard Unit	$18 - $22



Uni-board is a "universal" prototyping and construction pc board for electronic projects. It can be obtained with fibreglass or phenolic base material and in packs containing single, twin and six modules.

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. PH (03) 489-8131

CMOS	
4000	.40
4001A	.40
4001B	.40
4002	.50
4006	1.10
4007	.50
4008	1.00
4009	.80
4010	.50
4011	.40
4012	.50
4013	.80
4014	1.70
4015	.90
4016	.70
4017	1.50
4018	1.50
4019	.60
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4027	.60
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4030	.60
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4034	3.00
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4039	.70
4040	1.70
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4042	.70
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4044	.70
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4048	.60
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4050	.60
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4052	.80
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4060	2.00
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MM80C95	.90
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LINEAR	
LH0002	9.50
LH0022CD	16.50
LH0042CH	8.60
LH0070	12.70
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REF02CJ	8.40
TL071	1.00
TL072	1.50
TL082	1.50
LM0091CD	26.40
LH0094CD	37.60
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TCA220	2.20
LM301	.50
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LF351-N	.70
LF356-AN	1.10
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LM391	1.80
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LM565	1.30
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NE571	6.50
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TBA641B11	2.50
LM709-14PIN	.70
UA710CA	.60
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74LS368	.90
74LS373	1.50
74LS374	1.70
74LS386	.50
74LS670	2.70
81LS95	2.10
95H90	11.50
11C90	17.50
81LS96	2.10
81LS97	2.10
TRANSISTORS	
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2N657	.60
2N930	.60
2N1613	1.10
2N1711	.50
2N1893	1.00
2N2219A	.60
PN2222	.20
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2N2484	.65
2N2646	.70
2N2647	1.10
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BC547	.15
BC547B	.18
BC548	.15
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BC549C	.18
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BC559	.16
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BC638	.38
BC639	.40
BC640	.40
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BCY71	.85
BD115	1.50
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BD237	.50
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BD301	.75
BD302	.75
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BD435	.70
BD646	1.70
BD647	1.80
BD675	.80
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BVD65B	3.10
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BF199	.30
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BF337	.80
BF458	.90
BF494	.40
BFX85	.75
BFY50	.90
BFY90	1.30
BSV17	1.00
BU126	3.00
BU208	3.00
BUX80	7.90
FT2955	1.40
FT3055	.75
MEL12	.90
BU326A	3.40
MJ2955	1.00
MJ4032	7.40
MJ802	3.40
MJ4035	6.90
MJ4502	3.70
MJE340	1.20
MJE350	1.50
MJE7000	1.30
MJE8000	1.00
MJE1101	2.20
MJE2955	1.20
MJR3055	1.20
MJE3521	.60
MJ15003	4.00
MJ15004	4.00
MPF102	.60
MPF131	1.40
MPSA05	.60
MPSA06	.60
MPSA12	.60
MPSA14	.60
MPSA42	.60
MPSA56	.80
MPSA92	.60
MRF475	4.40
TI31B	.90
TI3PIC	1.00
TIP32B	.90
TIP32C	1.00
TIP33A	1.10
TIP34A	1.20
TIP24B	1.50
TIP42B	1.10
TIP110	1.30
TIP120	1.30
TIP2955	1.20
TIP3055	1.20
VMP4	28.00
VN88AF	2.50
MICRO CHIPS	
ADC0 800	12.00
DAC0 808	2.00
2102 200 NS	2.00
2102 350 NS	2.00
2102 450 NS	1.40
2102 650 NS	1.40
2111	8.60
2114 150 NS	11.15
2114 300 NS	5.00
2114 450 NS	4.30
8 — 31	4.20
32 up	4.10
2513	14.50
2516	55.00
2532	69.00
2650	23.00
2708	8.50
2716	18.00
4116	8.00
5101	9.00
55101	9.00
MM52030	14.50
MM5204	12.50
MM5220	7.20
MM5307	18.00
MM5309	6.50
MM5312	9.00
MM5369	2.60
5387	8.50
MM5395	8.50
MM5740	17.00
6502	10.50
6508	5.50
6520	5.50
6522	10.00
6523	17.00
6551	17.00
IM6561	4.50
MCM6574	19.60
MCM6575	10.50
MC6900P	9.00
MC6802	13.60
MC6808	12.50
6810A	4.90
6820	5.50
6821	6.00
6850	5.15
6852	6.40

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. PH (03) 489-8131.
RITRONICS WHOLESALE PH (03) 489-7099, MAIL ORDERS PH (03) 481-1436.

ELECTRONIC COMPONENT SUPPLIERS DESIGNERS AND MANUFACTURERS.

7106	12.90
7107	15.00
7210	13.20
LS7220	6.00
Z80 CPU	14.00
Z80A CPU	16.00
Z80 P10	13.80
Z80A P10	16.50
Z80 CTC	13.80
Z80A CTC	16.50
Z80 DMA	40.70
Z80 S10/0	56.90
Z80 S10/1	56.90
Z80 S10/2	56.90
Z80A S10/0	63.00
Z80A S10/1	63.00
Z80A S10/2	63.00
8035	27.00
INS8050	15.00
INS8080	8.00
P8085	25.00
8155	22.00
8165	22.00
8205	5.00
P8212	4.00
8214	8.00
8216	5.90
8224N	5.50
8224	7.50
8226	5.90
8228	9.50
8238	8.00
8243	8.00
8251	14.00
INS8251	6.50
8253	19.50
8255A	8.60
8257	99.00
8259	99.00
8275	99.00
8278	99.00
8295	25.00
DM8578	3.50
Ay-5-2376	19.56
MM5104N	10.00
MM55106N	10.00
MM57160	7.50
8748A	99.00
8755A	99.50
MCT2	.80
MCT6	3.30
MCT275	1.50
MCC671	3.00
4N28	.85
4N33	1.20
4N26	.85
MM80C95	.90
80C96	.90
MM80C97	.90
80C98	.90

CAPACITORS

16V	
33uf	.15
330uf	.40
25V	
100uf	.25
330uf	.45
2500uf	1.00
50V	
2500uf	2.15
63V	
10uf	.16
47uf	.30
100uf	.40
220uf	.55
470uf	.75
1000uf	1.65
RB. (PCB)	
6.3V	
470uf	.20
1000uf	.30
10V	
4.7uf	.10
100uf	.10
16V	
10uf	.08
22uf	.10
33/47uf	.10
100uf	.15
220uf	.20
470uf	.25
640uf	.45
1000uf	.40
2500uf	.65
25V	
2u2/3u3	.10
4u7/10u	.10
25u/33u	.12
47uf	.13
100uf	.15
220uf	.20
330uf	.25
470uf	.35
1000uf	.50
2200uf	.90
35V	
2u2/3u3	.10
10uf	.15
100uf	.20
220uf	.30
1000uf	.70
2000uf	.90
2200uf	1.10
50V	
0.47uf	.08
1u/2u2	.08
3.3uf	.15
4.7uf	.15
10uf	.15
22u/33u	.20
47u/100u	.20
220uf	.50
470uf	.60
63V	
0.47uf	.10
1u/2u2	.10
3u3/4u7	.10
10u/25u	.15
47uf	.20
100uf	.25
63V	
220uf	.40
330uf	.45
470uf	.80
160V	
2.2uf	.20
10uf	.30
22uf	.50
250V	
2.2uf	.25
350V	
1uf	.20

CAN TYPE

35V	
2500uf	1.95
40V	
5600uf	1.90
50V	
6800uf	4.50
63V	
2500uf	3.25
75V	
3300uf	5.90

BIPOLAR 50V

1u/2u2	.25
3u3/4u7	.30
6.8uf	.30
10/22uf	.40
33uf	.50
47uf	.69
100uf	.80

POLYSTYRENE

125V	
10pf to 680pf	.45
1000pf to 10,000pf	.55

RESISTORS

.33W	.03
1W	.07

WINDING WIRE (B&S)

16,23	2.00
21,29	3.60
36,37	3.60
38,39	3.60
40	3.60
22	3.80
26	3.90
20,24	4.50
28	4.90
18,30	6.50
31,32	6.60
33,34	6.60

FUSES

3AG	
1-9	.09
10+	.08

GREENCAPS

100V	
.001-027	.09
.003-056	.11
.058-1	.15
.12-22	.25
0.27uf	.30
0.33uf	.30
0.39uf	.45
0.47uf	.40
.56,.68,.82	.50
1,1.2,1.5	1.00
1.8uf	1.00
2.2uf	1.20
3.3uf	2.00
4.7uf	3.40

ZENER DIODES

E24 Range	
400MW	.12
1 Watt	.23

OPTOCOUPLERS

MCT2	.80
MCT6	3.30
MCT275	1.50
MCC671	3.00
4N28	.85
4N33	1.20
4N26	.85

NEW PROJECT BOARDS

ETI 263	$1.80
ETI 151	$2.20
ETI 152	$2.00
ETI 261	$1.50
ETI 264	$1.50
ETI 321	$3.90
ETI 322	$2.75
ETI 452	$5.90
ETI 466	$6.50
ETI 474	$2.20
ETI 470	$2.70
ETI 471	$9.90
ETI 472	$2.70
ETI 541	$2.60
ETI 549A	$2.50
ETI 561	$2.75
ETI 573	$2.90
ETI 576	$4.50
ETI 577	$2.70
ETI 606	$2.30
ETI 726	$3.30
80sa3	$3.90
79FE11	$2.50
79UPS6	$2.90
79TI11	$2.20
79SF9	$2.60
79PS11	$2.90
79se3	$3.90
79md9	$2.20
80au3	$2.90
80cm3A	$2.40
80cm3B	$3.50

DREAM 6800 $10.90

DREAM 6802 $11.90

(Redesigned board with notes to eliminate 6875 clock chip.) Please note boards are figreglass 1 oz copper precision drilled.

VOLTAGE REGULATORS

78L05	.5V 100mA	.40
LM341P-5	.5V 500mA	.80
7805	.5V 1A	1.00
7905	.5V 1A	1.70
LM309K	.5V 1A	1.20
7805K	.5V 1A	2.10
LM323-K	.5V 3A	6.90
78H05KC	.5V 5A	8.50
LM341p-8	.8V 500mA	.80
78L12CP	.12V 100mA	.40
79L12	.12V 100mA	.65
LM341P12	.12V 500mA	.75
7812	.12V 1A	1.00
7912	.12V 1A	1.90
7812KC	.12V 1A	2.15
7912KC	.12V 1A	2.60
79H12KC	.12V 5A	8.00
78CBUC	.13.8V 2A	3.50
78CBUC	.13.8V 2A	6.00
78L15	.15V 100mA	.35
79L15	.15V 100mA	.65
LM341P15	.15V 500mA	.80
7815	.15V 1A	1.00
7915CT	.15V 1A	1.80
7915KC	.15V 1A	2.60
78H15KC	.15V 5A	6.50
78L18	.18V 100mA	.35
7818	.18V 1A	1.40
78L24	.24V 100mA	.35
79L24	.24V 100mA	.65
7824	.24V 1A	1.10
LM317T	.ADJ 1A	2.40
LM337T	.ADJ 1A	3.80
LM317K	.AD J2A	4.50
LM337K	.ADJ 2A	5.90
LM350K	.ADJ 3A	8.40
78HCKC	.ADJ 5A	10.50
78P05	.5V 10A	16.50

BRIDGES

VM48	400V 1A DIL	1.50
WO2	200V 1.5A	.60
WO4	400V 1.5A	.60
KHPC02	200V 3A	2.00
KBP602	200V 6A	2.50
KBP604	400V 6A	2.60
KBP606	600V 6A	2.80
KHPC1002	200V 10A	2.60
KBPC1004	400V 10A	3.20
KBPC1006	600V 10A	3.20
MDA3501	100V 35A	3.20
MDA3502	200V 35A	3.20
MDA3504	400V 35A	3.40

DISPLAYS

MAN2A	3" Red Alpha Num	6.30
MAN72A	3"CA Red	2.20
MAN74A	3"CC Red	2.20
MAN52A	3"CA Green	3.40
MAN82A	3"CC Green	3.40
MAN82A	3"CA Yellow	3.40
MAN84A	3"CC Yellow	3.40
MAN6740	56"2 Digit CC Red	3.60
MAN8610	Red	3.30
MAN8640	Red	3.30
TIL306		12.00
DL704	3"CC Red	2.20
DL707	3"CA Red	2.30
DL747	63"CC Red	3.40
DL750	63"CC Red	4.00
FND357	362"CC Red	1.80
FND500	5"CC Red	1.80
FND507	5"CA Red	1.80
FND800	8"CC Red	3.00

DIP SOCKETS

16 Pin Zip* Dip 11	$11.50
24 Pin Zip* Dip 11	$12.50
40 Pin Zip* Dip 11	$17.50

*Zero Insertion Pressure

DIP SWITCHES SPST

P/N	No. of Switches	Price
SD3	3	$1.60
SD4	4	$1.70
SD5	5	$1.90
SD6	6	$2.30
SD7	7	$2.40
SD8	8	$2.50
SD9	9	$2.70
SD10	10	$3.00

WIRE WRAP 3-LEVEL

	1-9	10-25	100+
8 Pin	.75	.65	.50
14 Pin	.90	.85	.80
16 Pin	1.00	.90	.85
18 Pin	1.20	1.10	1.00
20 Pin	1.40	1.30	1.20
22 Pin	1.60	1.40	1.30
24 Pin	1.90	1.80	1.70
28 Pin	2.20	2.10	2.00
36 Pin	2.60	2.40	2.30
40 Pin	2.90	2.70	2.50

CANNON CONNECTORS

XLP-3-11C	4.50
XLP-3-12C	4.50
XLP-3-13	4.20
XLP-3-14	3.60
XLP-LNE-31	4.50
XLP-LNE-32	4.60
XLP-LNE-12	5.50

COMPUTER GRADE ELECTRO.

2900uf	40V	6.50
6800uf	16V	6.40
10,000uf	16V	9.00
10,000uf	25V	9.50
10,000uf	40V	11.90
15,000uf	40V	12.00
22,000uf	25V	12.90
22,000uf	40V	23.00
27,000uf	35V	23.50
33,000uf	16V	23.50
68,000uf	16V	21.50
100,000uf	10V	20.50

MULTISTRAND RIBBON CABLE

Price Per Meter:

	1-9	10+
10 Way	.70	.60
12 Way	.75	.65
16 Way	1.00	.90
20 Way	1.35	1.25
40 Way	2.70	2.50

CRYSTALS

freq. MHz.	HOLDER	PRICE
1.000	HC33	$12.50
1.8432	HC33	$10.50
2.000	HC33	$12.50
2.097152	HC33	$12.50
2.4576	HC33	$6.90
2.500	HC33	$6.90
3.000	HC33	$7.90
3.000	HC18	$7.90
3.2768	HC18	$7.90
3.2768	HC33	$7.90
3.330	HC33	$7.90
3.330	HC18	$7.90
3.579545	HC33	$7.90
3.579545	HC18	$5.50
3.6000	HC18	$4.90
4.000	HC33	$4.90
4.000	HC18	$4.90
4.194304	HC18	$6.90
4.33619	HC18	$6.90
4.440	HC18	$6.90
4.550	HC18	$6.90
4.750	HC18	$6.90
4.91520	HC18	$6.90
4.9562	HC18	$6.90
5.0688	HC18	$6.90
5.185	HC18	$6.90
5.585	HC18	$6.90
5.585	HC18	$6.90
5.587	HC18	$6.90
5.7143	HC18	$6.90
5.9904	HC18	$6.90
5.000	HC18	$5.50
6.000	HC18	$5.50
6.1444	HC18	$5.90
6.400	HC18	$6.90
6.5536	HC18	$6.90
6.6670	HC18	$6.90
7.15900	HC18	$6.90
8.000	HC18	$4.90
8.330	HC18	$6.90
9.304	HC18	$6.90
10.000	HC18	$5.50
10.73865	HC18	$6.90
11.000	HC18	$5.50
12.000	HC18	$5.50
13.5168	HC18	$6.90
14.31818	HC18	$6.90
15.000	HC18	$6.90
16.000	HC18	$6.90
18.000	HC18	$6.90
18,432	HC18	$6.90
19.6608	HC18	$7.50
20.000	HC18	$6.90
23.400	HC18	$7.50
23.684	HC18	$7.50
24.000	HC18	$6.90
27.000	HC18	$6.90
32.000	HC18	$6.90
36.000	HC18	$6.90
48.000	HC18	$6.90
100.00	HC18	$15.00

PLEASE NOTE:
Not all crystals are in stock at present but are on order.

SPECIALS:

2114 (450 ns)	8 for $34.40
2114 (450 ns)	16 for $68.00
2114 (450 ns)	32 for $130.00
2114 (450 ns)	64 for $250.00
2708 (450 ns)	1-8 for $8.50 ea
2708 (450 ns)	16-32 for $8.35 ea
4116 (200-250 ns)	1-7 $8.00 ea
4116 (200-250 ns)	8-15 $7.00 ea
4116 (200-250 ns)	16-31 $6.50 ea
4116 (200-250 ns)	32 plus $6.25 ea
10 BU208	$25.00
100 BU208	$200.00
10 BU126	$20.00
10 BOX80	$75.00
10 BD139	$5.50
10 BD140	$5.50
10 BD549	$1.00
10 BC559	$1.50
10 BC547	$1.00
10 BC557	$1.50
10 BC327	$1.50
10 RL4136	$13.00
10 2114 (450 ns)	$42.00
10 2708	$84.00
10 Red Leds	$1.20
100 Red Leds	$10.00
10 Green Leds	$2.00
10 7447	$6.00
10 7490	$5.00

All prices current only until 15th November, 1980.

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LETTERS

Dear Sir,

Have you ever published a design for a receiver antenna suitable for use on HF, VHF and UHF bands, 30 MHz to 514 MHz? If you haven't published such a design, could you recommend a commercially available antenna construction book?

L. Jones
Subiaco, W.A.

Unfortunately, we have not published the design of such an antenna, I doubt if anyone has published a single antenna design to do the job you ask.

Theoretically speaking, the "discone" antenna is capable of doing the job, but in practice, there are difficulties. The nearest thing to your requirements that we have described as a project is the ETI-714 Log-Periodic Antenna. This was published in the February and March issues, 1978. It covers 40 MHz to 250 MHz.

For books on the subject, you might look at "The Radio Amateur Antenna Handbook" by Orr and Cowan; the "ARRL Antenna Handbook" by The American Radio Relay League or perhaps "The Radio Handbook" by Orr. Most libraries will have copies or can obtain them on inter-library loan. Many technical book specialists also carry them, as do Dick Smith Electronics.

Dear Sir,

I am very interested in electronics and would like to learn about radio and hi-fi systems. I know very little about these fields and would like to learn. Could you please tell me where to get information on the basics of radio and hi-fi.

The article in your July issue about "Good Car Sound" was much appreciated. Sealing the cavity in the doors and boot made a big difference to my modest system!

Stephen Sutcliffe
Parramatta, NSW

It is very difficult for us to suggest a book that covers the basics of hi-fi. Quite a number are available pitched at "the layman" but it seems you want something more technical. Unfortunately, we've seen nothing recently that covers the technical basics of the subject.

The same is not true for radio, though. "A Course in Radio Fundamentals" by George Grammer, published by The American Radio Relay League, covers the subject very thoroughly. Most technical book specialists stock it. A series of books, published by Hayden, called "Electronics One", "Electronics Two" etc also covers the subject, but in a more descriptive manner. These are distributed here by Butterworths Pty Ltd, 586 Pacific Highway, Chatswood NSW 2067.

Dear Sir,

People these days are becoming increasingly interested in CB radios. Would it be possible for you to design a "compact" walkie-talkie which would include such features as good sensitivity, low current drain, reasonable working range (5 - 10 miles), squelch, beeper, a range of channels (say three or four of the most used ones, including ch. 14) and incorporating "chips".

It may sound a lot, but if you are able to do this in the near future (say two issues) I think it would be worthwhile. Price should be less than $30, if possible.

Chris Muller
Bellingen, NSW

It not only "sounds a lot" — it's quite a tall order! For certain, we could design such a project, but unfortunately it is not practical. Firstly, a licence would have to be obtained by any person wishing to use the completed equipment. For you to obtain the licence, the equipment would need to be 'type approved' by the P & T Department. As performance would be subject to variations in construction — including possible modification — we doubt type approval would be forthcoming. It's not that we couldn't design a unit to meet the appropriate specifications, it's that actual performance is completely in the hands of the constructor.

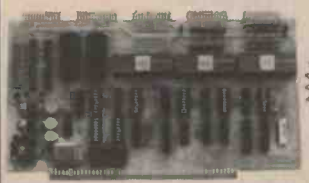
Getting onto the technical problems, a reasonable working range of "5 - 10 miles" with a walkie-talkie requires power. This precludes low current drain — except perhaps in the receiver. In any case, the range will depend greatly on terrain and antenna efficiency — and antennas suitable for handheld transceivers are generally inefficient. Lastly, I doubt if such a project would cost "less than $30".

It seems like a good idea . . . at first.

Sm ELECTRONICS
MELBOURNE
Ph (03) 842-3666

Trading Hours: 10am-6pm Mon to Fri

S-100 I/O PORT BOARD

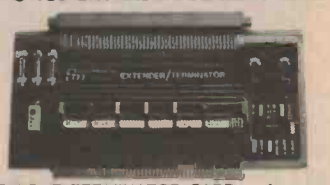


DUAL SERIAL I/O CARD Features:- dual independantly controlled serial ports with TTY and RS232 outputs and inputs. Nine programmable parallel ports, crystal controlled baud rates fully buffered and address decoded. Plated through holes & solder resist mask.
Price: Kit $189. Ass. $225.

UV EPROM ERASER

New product range. Model LEE/T 15W tube, 120 min timer, up to 40 EPROMS will erase in 10/15 mins. Model MEE/T 8W tube 120 min timer, up to 10 EPROMS will erase in 20/30 mins. Model MEE is same as MEE/T but with no timer. All erasers are fully assembled and have a safety switch. LEE/T $125. MEE/T $105. MEE $85.

S-100 EXTENDER/TERMINATOR



EXTENDER TERMINATOR CARD — features:- true active termination of the bus with inbuilt extender connector on top of board, fused rails to extended board. Test points numbered, solder resist, plated through. Price: Kit $80. Ass. $110.

LA34 DECWRITER PRINTER/ TERMINAL

Desk Top printer, full 128 ASCII character set, switchable 110 and 300 baud rates, 30 cps speed, adjustable character widths, adjustable line spacing, 9 x 7 dot matrix printing. Price $1,595 ex stock.

TELEVIDEO TV1-912B TERMINAL

80 x 24 display, upper and lower case, 110 to 9600 baud rate, dual intensity, numeric pad, cursor controls, XY addressable cursor, block mode, self test, microprocessor controlled. Price $1,295.

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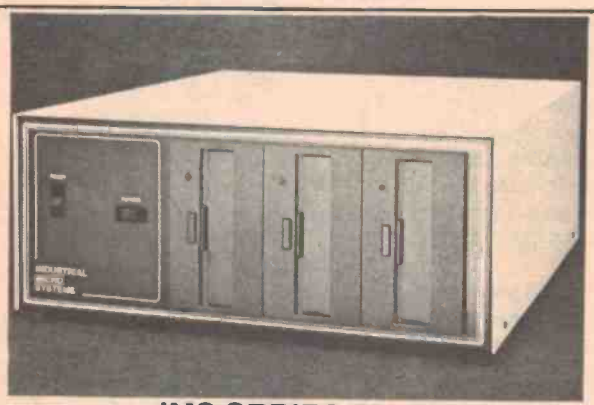
IMS SERIES 8000



IMS SERIES 5000

THE NEW MODEL 16
HARD DISK SUBSYSTEM

WINCHESTER TECHNOLOGY
WITH BUILT-IN BACKUP

A chain is only as strong as its weakest link, and any system is only as good as its individual components. Because of the way they have been developed, you won't find any weak links in the systems made by Industrial Micro Systems. They have evolved. Evolution means survival of only the fittest components. From the popular and reliable static RAM boards to the floppy disk sub-systems, Industrial Micro Systems quality components have been used for years in thousands of systems by many well known companies around the world. With the development of the Z80 CPU, I/O cards and DMA double density floppy disk controllers, Industrial Micro Systems components have evolved into Microcomputer Systems. Thus the systems have inherited the Industrial Micro Systems quality and field proven reliability of their components.

If you are looking for only the best in Microcomputer Systems you cannot ignore the Industrial Micro Systems family of Computers and component sub-systems. Aside from their mechanical strength and reliability, the systems feature incredible versatility in regard to expansion of both hardware and software. The size of the system that you will purchase initially does not place any restriction on the ultimate size of system to which you can expand.

BASIC SPECIFICATIONS:-
CPU: Z80A operating at 4 MHz.
BUS: S-100 with 12 slot Motherboard.
18A at 5 Volts available.
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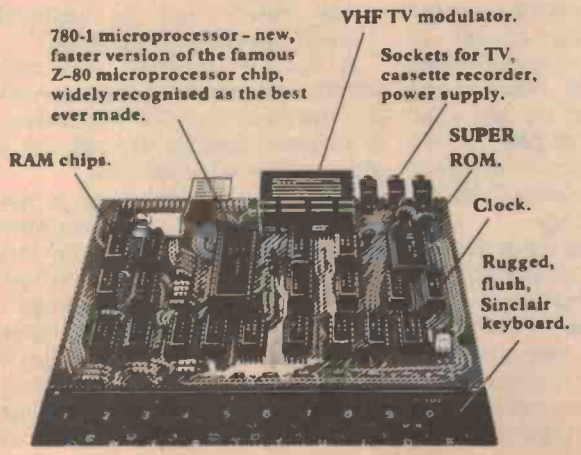

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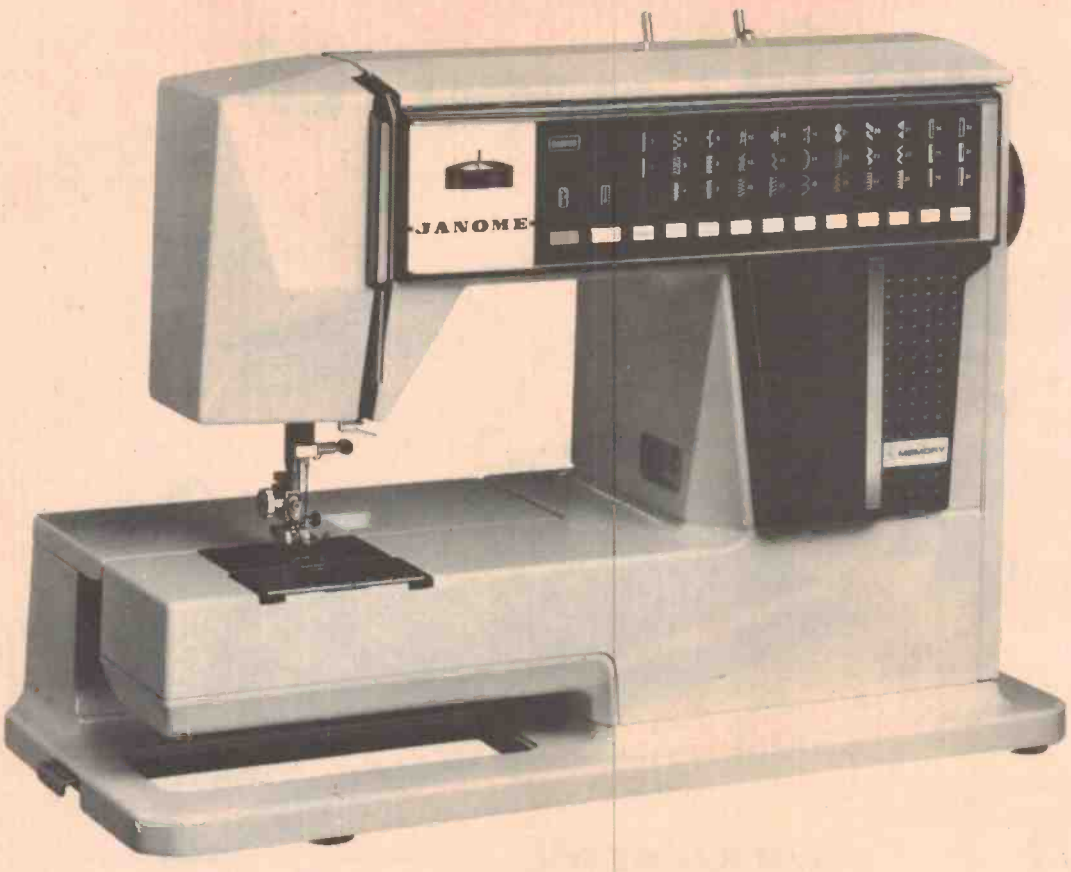


Micro machine has it all sewn up !

William Fisher

Employing modern microprocessor technology and precision stepping motor drives, this machine is several 'quantum leaps' from Thimonnier's wooden wonders of 1830.

THE microprocessor-controlled sewing machine just released by Janome applies modern technology to a craft that has persisted virtually unchanged since the dawn of civilisation — embroidery.

The pace and impatience of modern lifestyles and the changing patterns of education have led to a steady decline in the popularity of decorative needlework. Few people nowadays have enough skill, patience or time to embroider by hand and although sewing machines have been able to execute fancy stitches for years, the results are generally recognisable as inferior to work done by hand.

Janome's Memory 7 sewing machine is flexible and versatile enough to match the quality and variety of hand stitching and does not require any special expertise from its operator. Thirty-one different stitch patterns are preprogrammed in its memory and each of these patterns can be varied in length and width over a wide range.

Stitches are selected by touch buttons and the machine can be programmed to run through any combination of up to seven different stitches in sequence, sewing the sequences repeatedly in rows or freehand. So for example, complex hem decoration lines can be sewn in a single pass or freestanding multi-stitch motifs can be embroidered without resetting the machine.

A 'mirror' program will laterally invert a programmed sequence, so that a row of stitches can be matched to a row of reversed stitches, for example down either side of a blouse front.

Automatic buttonholing is nothing new, inasmuch as many machines already on the market can be set to sew a run of buttonhole stitches, but getting the buttonholes the right length has previously involved either guesswork or inserting pins at the 'stop' points (which involves some risk of breaking the needle if it strikes the pin). Janome have made the whole thing a lot easier

by building a program into the Memory 7 that allows the user simply to preset the width and length of a buttonhole. Similar buttonholes can then be repeatedly sewn without any resetting, so that all the buttonholes on a garment can be exactly matched with no trouble.

Apart from its decorating capabilities, the Memory 7 has a number of features that assist plain sewing. At the end of straight seams, it automatically sews four, on-the-spot locking off stitches to give a neat and secure finish. When the machine is stopped it automatically returns the needle to its 'up' position, clear of the workpiece, to avoid cotton jamming.

A comprehensive range of attachments allows the Memory 7 to perform overlocking, insertion of zips, scallopping, pleating, pintucking and other dressmaking operations.

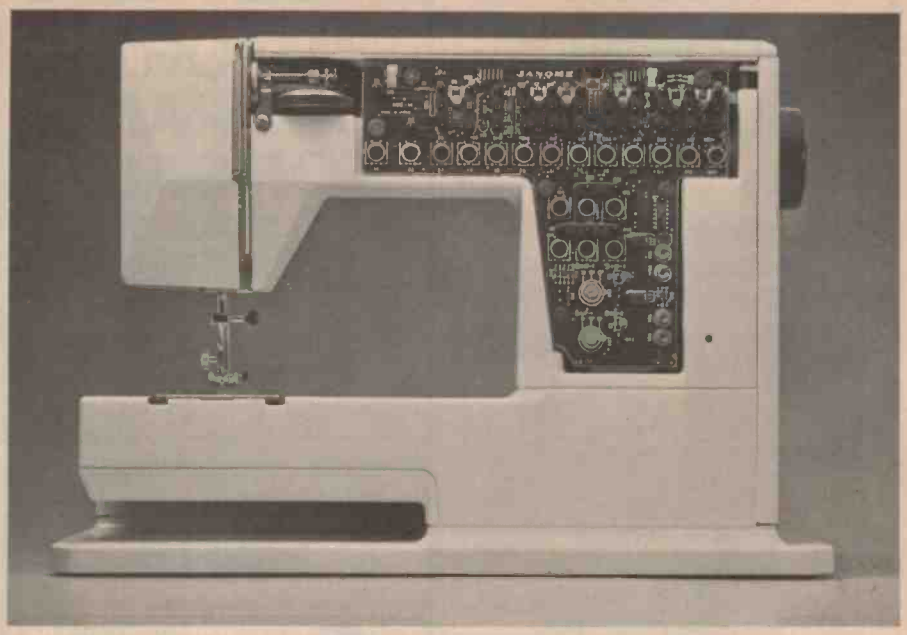
We obtained a Memory 7 from Janome and gave it to staff member Elaine Ray to try out for us. Among her many other talents, Elaine is an expert seamstress, so she was able to appreciate some of the machine's features which were not obvious to the rest of us.

On the whole, she was very impressed with its performance. It's apparently very easy to operate and even the most hamfisted operator ought to have no trouble with it. In contrast to some semi-automatic sewing machines, threading and bobbin loading are child's play, which is a distinct advantage in a machine designed primarily for decorative work where colours need to be changed frequently.

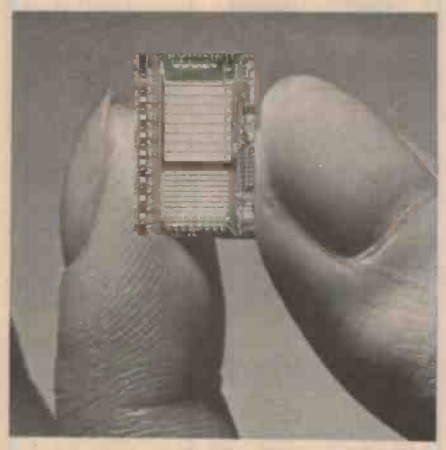
The automatic tension on the machine Elaine tested worked absolutely perfectly on a variety of different fabrics, with no trace of 'pulling' or 'spitting' caused by over or under-tensioning. She was also pleased with the number of 'stretch stitch' options in the range of stitch patterns. These are stitches that can be used for straightforward sewing of stretch fabrics to give a seam that will stretch along with the fabric.

In fact the only practical criticism of the Memory 7 is that it has no 'gathering foot' to automatically gather up a cuff (for example) while sewing a trimming onto it. However, given the general range and versatility of the machine, this is hardly a serious drawback.

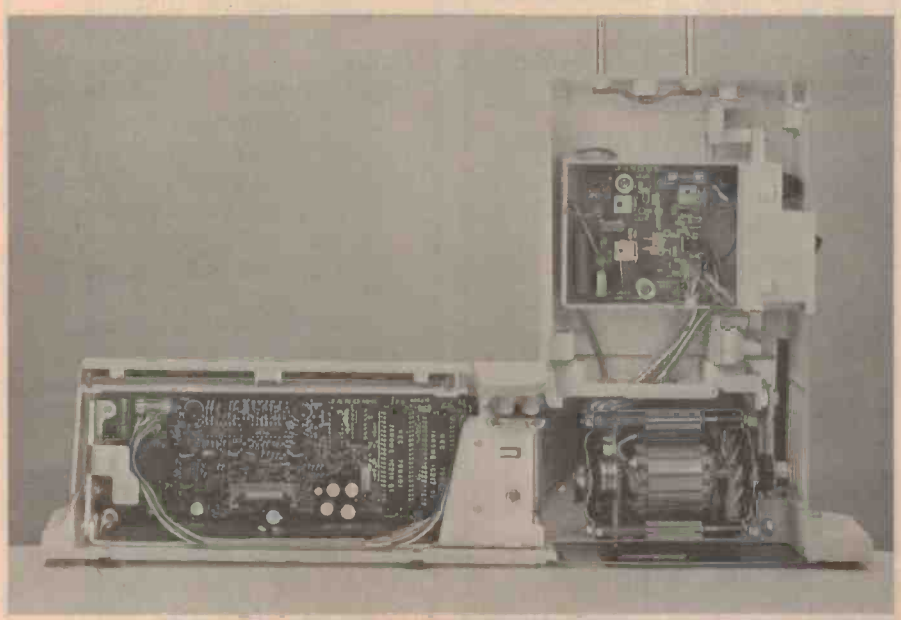
The Memory 7 will cost around $900 and is available from major retail stores and sewing centres. ●



Behind the side panel is an array of LEDs to show which stitches have been selected.



One of the memory chips where the stitch patterns are stored.



Cutaway view showing the stepping motor and some of the control circuitry.

Sewing machines — a brief history

Around 1830 Barthelemy Thimonnier built about 80 wooden sewing machines with hooked needles (steel, we hope!) to make uniforms for the French army, but they were all wrecked by rioting tailors who feared they would destroy their livelihoods.

An American, Walter Hunt, invented the eye-pointed needle in 1832 but failed to patent it. Another American, Elias Howe, incorporated it in the first lockstitch sewing machine, which he patented in 1846. This used a curved needle which carried the thread through to the underside of the fabric where it interlocked with a second thread carried by a reciprocating shuttle. Howe's machine did not have an automatic fabric feed — this was perfected in the 1850s by A.R. Wilson.

Isaac M. Singer, who invented the foot treadle and the presser foot, brought together the ideas of several of his predecessors in a machine which became the industry standard when it went into full scale production in the 1860s. In doing so, he infringed some of Howe's patents, but after a long legal wrangle Howe and Singer agreed to share their patents and both made fortunes.

The zigzag machine was developed in Japan in the 1950s and that nation is now the world's largest sewing machine manufacturer.

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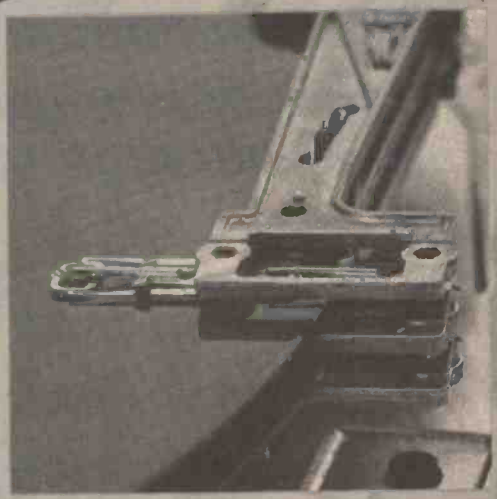

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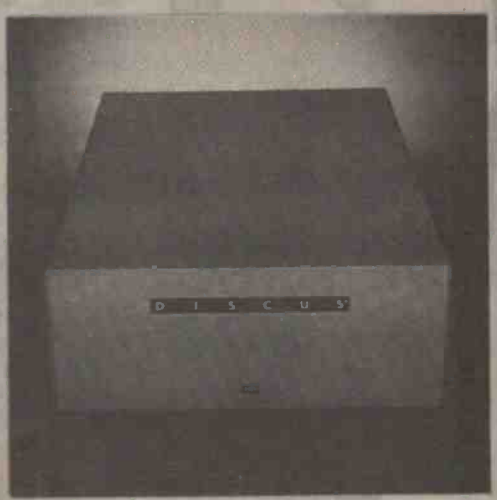
The DISCUS M26™ system is delivered complete — a 26 megabyte hard disk drive, controller, cables and operating system — for just $5,250. Up to three additional drives can be added.

The DISCUS M26 ™ system features the Shugart SA4008 Winchester-type sealed media hard disk drive, in a handsome metal cabinet with fan and power supply.

The single-board S-100 controller incorporates intelligence to supervise all data transfers, communicating with the CPU via three I/O ports (command, status, and data). The controller has the ability to generate interrupts at the completion of each command to increase system throughput. There is a 512 byte sector buffer onboard. And each sector can be individually write-protected for data base security.

The operating system furnished with DISCUS M26 ™ systems is the widely accepted CP/M* 2.2.

*CP/M is a trademark of Digital Research.



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Hand held computers

Portable computer terminals and completely portable microcomputer systems are just coming onto the American market.

Tandy's TRS-80 Pocket Computer has only just been released here. It features resident BASIC and 1.9K of RAM. Priced at $249, a cassette interface and recorder are also available.

Although their makers would dearly love to succeed with their new products in the mass consumer market, business users are the most promising prospect so far.

As one company president put it, "We're going to see hand held computers used more and more by big companies with a large sales force. A salesman with access to his company's computer could sit at a customer's facility and get things like the exact status of an order, inventory situation, or price quotes."

So far there are no standard approaches to portable computers, with each company going its own way and aiming at a different market sector. Commodore have been displaying prototypes of their 'Minipet', which uses the same 6502 microprocessor as their well-known PET. Its hand held keyboard/processor unit has the letters arranged in typewriter fashion, with separate number keys, and interfaces with a normal TV screen to display monochrome images.

Production models of the Minipet are expected to retail for about US$200 when they are introduced, or 50% more for a version which will display in colour. These prices are so far only estimates and the final price will depend on the amount of memory included and whether a liquid crystal display is added to the TV facility. Commodore are also planning to produce a US$500 system with cassette mass storage and a printer included.

National Panasonic and Quasar have systems with hand held Keyboard/CPUs and peripherals housed in an attache case. These systems are also able to communicate with remote computers via optional modems and acoustic couplers.

They are aimed more up-market, with higher prices justified by their larger memory capacity and greater speed. Panasonic's system has 73 kilobytes of RAM and 40K of ROM.

Sinclair's ZX80 has been selling for less than Aus$200 in the UK for the last six months and was introduced to the USA at the Chicago Consumer Electronics Show in June. It's basically designed for the hobbyist (you can get it at 20% discount in kit form) and is a Z80 based CPU/keyboard module that interfaces with any cassette recorder and TV monitor. No doubt there'll be lots of interest in this when it's released here (due this month!).

Are PETs good for business ?

Properly trained Commodore PETs could be the small businessman's best friend.

That's what Sydney entrepreneur John Guidice believes and he's acted on his convictions in establishing the Microcomputer House to market PETs with business software packages.

He first became interested in the possibilities of these microcomputers when he bought one for his own personal use. Being a DP professional, he soon became dissatisfied with the limitations of its standard operating system and the simple BASIC programming capability, so he set out to develop his own software. While he was doing this, he also started a users' association and began editing a magazine and newsletter for it.

Guidice aims to lease PETs for around $140 per month, with software developed by Data soft, Hanimex and himself, including a word processing package.

More information from The Microcomputer House Pty. Ltd., 19 William St, Alexandria, NSW 2015. Phone (02) 699-4334. ▶

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Integrated business software

IMS Computer Systems, the Melbourne based software house, has released two integrated packages which form the base of a totally integrated business system.

The systems released are General Ledger 2.1 and Creditors Ledger 2.1. The packages can operate in either a stand alone application, or the General Ledger can access all purchase analysis information on the Creditors Ledger to provide the integrated function.

In addition to the integration programs, the packages include additional features over General Ledger V1.0 and Creditors V1.3, the previous release.

The General Ledger contains budgets for twelve months, providing profit and loss MTD and YTD actual, budget and variation, printouts of budgeted amounts, balance sheet, trial balance, transaction print etc. It is suitable for companies, partnerships and sole traders. The 500 accounts in the chart can be manipulated to suit the user's need.

The features of the Creditors Ledger, apart from general ledger account integration, include: purchase analysis by supplier MTD and YTD, and discount received MTD, YTD, purchase analysis by product group, cheque printing, listings of invoices, credit notes, and cash payments, remittance advices, aged trial balance etc.

The packages also include enhancements to speed up processing. The debtors and integrated order entry invoicing system is currently being upgraded to provide a totally integrated business system. This is due for release in the fourth quarter 1980.

The packages are designed to run on CP/M systems such as the Micro Star, Superbrain, Croemco etc and support twelve brands of VDUs. The packages utilize the latest release of CBASIC2 (2.06) which has been designed for CP/M version 2.

The prices, which include manual and system diskette, are $500 for the General Ledger and $400 for the Creditors. For users of previous IMS systems, there is a 50 percent upgrade charge.

Further information can be obtained from IMS head office 825 St Kilda Rd, Melbourne 3004. (03) 51-9156.

Disk drives for the HP-85

Hewlett-Packard are bringing out a set of disk drives for their HP-85 personal / professional computer.

The new HP 82900 Series drives read double-sided double-density minifloppies. The dual master drive allows 540K of on-line storage, which can be doubled if necessary with a dual add-on drive.

Users who want the speed and convenience of disk but don't need so much capacity can opt for a single master drive to get 270K of storage, which can be doubled if necessary with a single add-on drive.

The interface between the disk drives and the computer is the HP-85 Mass Storage ROM. With this plugged into the HP-85 the disk operating system is ready to go as soon as power is turned on and no bootstrapping is necessary.

Included on the ROM are a set of thirty additional BASIC commands that allow the user to take advantage of the mass storage capabilities without learning a new language.

Other features of the ROM include a TRANSLATE command which automatically upgrades previously-written tape based programs for use on the disk drives and the ability to store and retrieve the CRT graphics display quickly.

First deliveries of the drives and the ROM are expected on September 1st. Further details are available from Hewlett-Packard Australia Pty. Ltd., 31-41 Joseph St, Blackburn, Vic 3130. (03) 89-6351.

Contrec cuts development costs

A new development system for the Intel MCS-48 range of microcomputers is said to be priced well below comparable systems.

The makers, Contrec Systems, don't actually tell us the price though. They do tell us the system is based on the Cromenco Z-2D computer and that it will run all the standard software packages including BASIC, Fortran, Pascal, wordprocessing and accounting systems.

All the usual features like assembly, emulation and file storage are standard and an auxiliary MCS-48 Computer Unit allows testing and debugging of programs in a stand alone mode or with prototype hardware.

The system also provides assemblers and simulators for 8085 and Z80 software development and full emulation facilities for the 8085 are expected to be announced later this year.

Further information from Contrec Systems Pty Ltd at 55, Dundas Place, Albert Park, Vic 3206. (03) 690-6905.

Dick Smith Sounds Off

Australia's best-known electronics retailer/wholesaler is distributing several types of sound synthesis units.

To begin with, there's the low cost sound effects and music package for his own System 80 microcomputer. This is known as 'Sound Off' and is also compatible with the TRS 80 Level 11 machine. It consists of a battery powered amplifier which connects to the computer via the normal external cassette recorder cable, and a cassette tape with the software recorded on it. It is said to achieve a wide range of pitch, duration and dynamic characteristics.

Much more elaborate is an S-100 card called the SBI Music Synthesiser, which comes either in kit form or ready assembled. It's programmable over a nine octave range from 15Hz to 25kHz, with fifteen possible output levels and waveforms definable in 32 bytes of memory. Attack and duration are also programmable.

For the Exidy Sorcerer, there's a speech analyser/synthesiser unit known as Cognivox, which plugs directly into the computer and uses the latter's power supply.

Software support enables the device to 'learn' to recognise up to 32 spoken words with an accuracy of 98%, to make spoken responses, to play two different voice operated video games or to function as a talking calculator.

Twelve volt impact printer

The latest miniature printer from Daneva Control is designed for 12 V battery operation.

A single board microprocessor controller generates the characters, manages the buffer store and drives the hammers of the Duoprint II.

The complete upper and lower case ASCII 7 x 5 dot matrix character set is standard. Reversed lines, inverted, double width and bold characters can all be selected by ASCII non-printed commands.

The printer measures 110 mm x 175 mm and accepts 55 mm wide paper. It is expected to be used in point of sale terminals, data loggers, ticket issuing machines and label printers.

More info from Daneva Control Pty. Ltd., 66 Bay Road, Sandringham, Vic 3191. (03) 598-5622.

Swiss matrix printer

Wenger Datentechnik of Switzerland announce a microprocessor controlled dot matrix printer for professional data processing applications.

Controlled by an Intel 8080, the Swiss Print Matrix is fully programmable with up to 4K of user program space. A 1K buffer is standard but there is an option for 2K.

The machine can cope with up to six character fonts and will also operate in a graphics mode to print images with a resolution better than 1000 dots per square centimetre.

Standard features on the printer include a fault alarm, parallel and serial interface, vertical and horizontal tabs and form feed. The paper feed tractors are adjustable and are said to have exceptionally fast slewing rates.

For those not directly concerned with the printer but obliged to work near it the Swiss Print Matrix's most welcome feature is its relative quietness. Sound output is claimed to be typically 3 dB less than comparable machines.

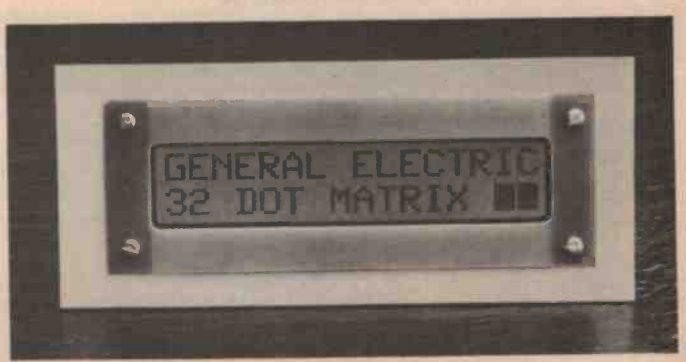
More details from the distributors Datatel Pty Ltd, 3 Raglan St, South Melbourne, Vic 3205. (03) 690-4000.

32 Character 5 x 7 dot matrix LCD display

Liquid Xtal Displays Operation, a part of General Electric Company's Electronic Components Division, has released a 32 character 5 x 7 dot matrix LCD display, configured for conductive, elastomeric connection.

The GE-LXD reflective display consists of two rows of 16 characters 7.5 mm high. Overall dimensions of the display are 33 x 122 mm. This new display (designated 95E) expands the GE-LXD product line, which include 8- and 16- character dot matrix displays, and a complete series of 7-segment two to eight character LCDs.

In other areas, LXD is committed to growing with new developments, and the company anticipates significant market growth in the future.



HARDWARE & SOFTWARE

From DICK SMITH

PROFESSIONAL DAISY WHEEL PRINTER FOR WORD PROCESSOR SYSTEMS

This superb unit is a self-contained printer with in-built asynchronous serial interface conforming to the established RS-232C standard. It prints on business stationery up to 380mm wide at the rate of 45-65 characters per second – three times faster than golf-ball typewriters. Top quality office systems printer that is below competition prices.

$3,390.00 Cat. X-3260

EXIDY S-100 BUS EXPANSION UNIT

The way to go if you want extra versatility from your Sorcerer.

$575 Cat. X-3010

● Allows up to 6 plug-in cards ● Connects directly to Sorcerer's 50-way expansion socket via supplied cable ● All S-100 lines fully buffered ● Separate 2.000MHz crystal clock provided for S-100 cards which cannot use the Ø1 and Ø2 clock signals derived from the Sorcerer's 2.106MHz clock ● Provision for mounting up to six 25 pin "D" connectors for additional I/O ports, etc.

THE SORCERER

Cat. X-3001 SORCERER

Cat. X-1196 MONITOR

The Sorcerer is the expandable Z-80 based microcomputer that allows you to add peripherals to take it from basic computing through to advanced office business systems.

● 16K RAM expandable to 48K (on board) ● Serial I/O and Parallel I/O ● S-100 BUS compatible ● Cassette I/O for two recorders at speeds of 300 or 1200 baud ● Video I/O – 1920 characters full screen ● Full ASCII 128 characters (64 defined characters and 64 undefined characters) ● Graphic resolution 122,880 pixels ● Includes 8K BASIC plug-in ROM PAC™ in MICROSOFT™ ● Dimensions 490 x 330 x 100mm ● Weight 6 kilograms.

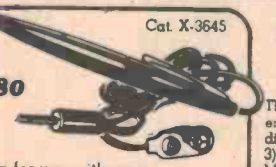
(Ask for our FREE comparison chart between the Sorcerer and other well known computer brands).

Dust cover to suit Cat. X-3005 *$5.95*

$1,395.00

LIGHT PEN FOR SYSTEM 80

Cat. X-3645



$9.95

Fantastic light pen for use with your TRS-80 or System 80 computer. Uses your cassette player as a preamp. Complete with plug & battery snap. Use with program tapes below. *ALSO FOR TRS-80*

NOUGHTS & CROSSES

Just insert this program cassette into your computer cassette player and enjoy playing the game with your light pen.

Cat. X-3647 **$11.95**

MICROPOLIS™ QUAD DENSITY DISC DRIVE

The Micropolis mod 2 drive with controller enables you to store 315,000 bytes on just 1 disc. By adding the mod 2 add-on drive (up to 3) you can obtain up to a maximum of 1.26 Megabytes! Complete with all software to enable you to be up and running in a very short time.

Model 1043/mod 2 with controller.
Cat. X-3205 **$1,350**

Model 1023/mod 2 add-on
Cat. X-3208 **$750**

VIDEO MONITOR

This is a superb 30cm black and white video monitor that can be used on AC and DC. Simple connection to your computer. Features jitter free and distortion free characters. Can be used with most computers on the market.

Cat. X-1196 **$149.50**

WORD PROCESSOR PAC

Remove the plug-in BASIC PAC™ and replace it with the powerful WORD PROCESSOR PAC™ and you will have the basis of an office computer system.

Features: ● Automatic text wrap ● Automatic checking of drastic commands ● Powerful search function ● Auto commands ● Macro programming – all this plus extensive user instructions.

Cat. X-3085 **$275.00**

SOFTWARE FOR SYSTEM 80 and also the TRS-80

TIME TREK
Hunt the Klingons through space and fight an intergalactic war. Has nine levels of play. (4K level I and II).
Cat. X-3650 ..... **$17.95**

STIMULATING SIMULATIONS
10 games on one cassette from monster chase to nautical navigation and lost treasure. (4K level I and II).
Cat. X-3652 ..... **$17.95**

ELECTRIC PAINTBRUSH
Create dazzling real time graphics. Commands let you draw lines, turn corners, change white to black, repeat previous steps or call other programs. (4K level I and II).
Cat. X-3654 ..... **$17.95**

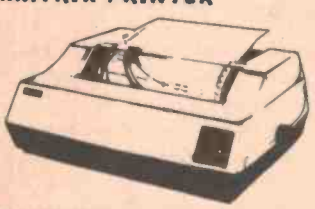
BLOCKADE
Many variations whereby you and your opponent try and make each other collide with a wall. (4K level I and II).
Cat. X-3659 ..... **$17.95**

BRIDGE CHALLENGER
Practice and improve your game of Bridge. (16K level II).
Cat. X-3656 ..... **$17.95**

MICRO CHESS
The computer is programmed to beat you at chess and you are trying to beat it - absorbing & educational.
Cat. X-3658 ..... **$22.50**

SIMUTEK 1
Contains 5 games that would normally cost $19.50 each! Great fun for all the family and friends. (4K level I and II).
Cat. X-3685 ..... **$17.95**

C.ITOH BRAND DOT MATRIX PRINTER



The model 8300P dot matrix printer is a no-nonsense unit that can churn out the full 96 character ASCII at a brisk 125 characters per second on standard fan-fold paper. Character spacing of 80, 40 or 132 columns which are software selectable. A quality unit that costs less than $1,000!!

Cat. X-3255 **$970.00**

DYNAMIC EXPANSION KITS

These are top quality ICs that can expand your basic 16K Sorcerer to 32K or even 48K (expands the 8K to 16K etc). They can also be used with the TRS-80 level I and II and the Apple II computers to expand their on-board RAM. Superb value and complete with installation instructions.

SAVE $19 **NOW $59.95** Cat. X-1186

SOFTWARE FOR YOUR SORCERER

MARTIAN INVADERS
Similar to the very popular 'Space Invaders' you find in amusement parlors.
Cat. X-3626 ..... **$17.95**

NIKE II
Fight off bombing attacks with your missiles and protect the city from heavy casualties.
Cat. X-3627 ..... **$14.95**

TANK TRAP
Render the marauding tank harmless but watch out for slow drying cement and unarmed citizens!!!!
Cat. X-3628 ..... **$14.95**

WOW! SOUND EFFECTS FROM YOUR SYSTEM 80!

(Also suitable for TRS-80 Level II)

SOUND OFF!

Yes! At last there is an add-on sound effects generator for your System 80 or TRS-80 level II computer. It will give you exciting music synthesis and sound effects facilities that you haven't had before!

Here's what you get

● Battery powered amplifier unit which connects to your computer via the normal external cassette recorder cable ● Software cassette with demonstration program plus a 'patch' program ● A comprehensive 8 page user's manual

HURRY! LIMITED STOCKS AVAILABLE AT PRESENT!

Cat. X-3648

'SOUND-OFF' PACKAGE: Includes amplifier module, software cassette and very comprehensive user manual:

ONLY $19.50

JABEL COMPUTER MAINS FILTER

Having trouble with memory crashes? Then the answer is the Jabel Mains Filter – it will remove those annoying spikes from the 240V mains and thereby protect your memory!

Cat. M-9850 ..... **$75.00**

C10 COMPUTER CASSETTE

Dick Smith special grade cassette tape with 5 minutes per side and 38K capacity per side.

Cat. X-3500 ..... **$1.95**

SKETCH 80

For the System 80 and TRS-80

A program tape that allows you to sketch on your VDU - the light pen becomes a real writing tool!! SEE LIGHT PEN ABOVE

Cat. X-3646 ..... **$17.95**

NEW NEW NEW

DUE IN SHORTLY

COGNIVOX™

VOICE INPUT & OUTPUT FOR THE SORCERER

★ Recognises up to 16 words.
★ 16 word voice response vocabulary
★ Easy two pass training
★ Up to 98% recognition accuracy
★ Generates music & sound effects
★ Excellent software support
★ Connects directly to Sorcerer

Cat. X-3150 ..... **$199**

SEE THE OTHER DICK SMITH ADVERTISEMENTS IN THIS PUBLICATION FOR STORE ADDRESSES AND PHONE NUMBERS

0588

MICRO-80 PRODUCTS
FOR TRS-80 AND SYSTEM '80 MICROCOMPUTERS

77 TRACK DISK DRIVES
DOUBLE YOUR CAPACITY

DD-7S **$775**
Micropolis Floppy Disk, 77 Track, 100% larger capacity than most mini-floppy drives, complete with cable, power supply, chassis, and includes NEWDOS '80.

DD-7 ... ... **$649**
Same as above but no cable or Newdos '80.

DC-4 ... ... **$45**
4 drive connector cable.

★ ★ SPECIAL ★ ★
MPI DISK DRIVES
ONLY $339!!

40 track bare drive for TRS-80. Only requires readily available 5 volt 0.7 amp and 12 volt 1 amp power supply to be up and running. Can be mounted in simple cabinet or used bare.

DISKETTES FOR TRS-80

GREENCORP ... ... **$4.50 ea**
VERBATIM 77 TRACK ... **$7.99 ea**
Minimum Order 10

EXATRON STRINGY FLOPPY

$352.50 incl p&p

15 times faster than cassette, infinitely more reliable. Completely under computer control, the stringy floppy is easier to use than disks and is a very much cheaper alternative. Will save and load any L2/16K software. Special software also available.

Wafers for Stringy Floppy
$3.50 ea. Any Size

MICRO-80 MAGAZINE

ANNUAL SUBSCRIPTION ... $24.00
Monthly Magazine dedicated to TRS-80 and System '80 users. Every issue contains at least 6 new programs, plus problem solving columns, hardware articles, readers' letters, hints, etc., etc.

FREE SOFTWARE OFFER

$40 WORTH OF SOFTWARE FOR TRS-80 AND SYSTEM '80 WITH EVERY NEW SUBSCRIPTION TO MICRO-80!
Every new subscriber will receive on cassette, ready to load, 3 x Level I and 3 x Level II programs (includes our fabulous household budget program), with a regular retail value of at least $40.

16K MEMORY EXPANSION KIT

ONLY $97 incl. p&p

These are prime, branded, 200 ns (yes, 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns. chips. Ours are guaranteed for 12 months. A pair of DIP shunts is also required to upgrade the CPU memory — these cost an additional $4.00. All kits come complete with full, step-by-step instructions, no soldering is required. You don't have to be an electronic type to instal them.

THE FABULOUS
NEWDOS 80
IN STOCK NOW!

ND-80 ... ... **$149**
The disk operating system that gives:
- New basic commands that support variable record lengths up to 4095 bytes long.
- Mix or match disk drives — supports any number of tracks from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for basic or machine code programs. User never sees "Dos-ready" or "Ready" and cannot "break" clear screen or issue any direct basic statement including "List" . . .
. . . and much, much more

ND-35+ **$99**
Newdos+ for 35 track drives

ND-40+ **$110**
Newdos+ for 40 track drives

BOOKS

LEVEL II ROM REFERENCE MANUAL
$24.95 plus $1.20 p&p
Produced in Australia by MICRO-80, this book is a must for the machine language programmer or for the BASIC programmer who wants to understand how the BASIC interpreter works. Over 70 pages packed full of useful information and sample programs. Applies to both TRS-80 and SYSTEM 80.

TRS-80 DISK AND OTHER MYSTERIES
$24.95 plus $1.20 p&p
The hottest selling TRS-80 book in the USA. Disk file structures revealed, DOS's compared and explained, how to recover lost files, how to rebuild crashed directories — this is a MUST for the serious Disk user.

INTRODUCTION TO T-BUG
$12.50 plus $1.20 p&p
Describes in detail how to use Tandy's T-bug. Each command explained and discussed in detail with examples. A must for the T-Bug user.

AUSTRALIAN SOFTWARE

BMON (L2/16K) $19.95 plus 50c p&p
The ultimate program to assist BASIC programmers.

TOUCHTYPE (L2/4K) $19.95 plus 50c p&p
22 lessons to teach you to type on your own keyboard and screen!

RPN CALCULATOR (L2/16K & 32K)
$14.95 plus 50c p&p
Turns your computer into a $600 calculator. Ideal for Architects, Surveyors, Engineers, Teachers, Scientists, etc.

U-BOAT (L2/16K) $7.50 plus 50c p&p
You're the Commander, read all the guages, fire the torpedoes, crash dive, get the enemy before his depth charges get you!!

MMM-1 GAMES PACK (L2/4K)
$7.50 plus 50c p&p
3 fast moving games — INDY 500, SUB-HUNT, KNIEVEL

MMM-2 GAMES PACK (L2/4K)
$7.50 plus 50c p&p
3 more games with fast moving graphics — TANK, THIEF, SHOOTOUT

PROGRAMS BY MICROSOFT

BASIC COMPILER $210
Converts Level II basic programs to machine code, automatically. A compiled program runs, on average, 3-10 times faster than the original basic program.
(Requires 48K One Disk)

DISK EDITOR ASSEMBLER
Save $30 ... ... ONLY $109
Supports macros, linking loader, editor, cross reference.
(Requires 32K One Disk)

ADVENTURE ON DISK ... $37.15
This game fills an entire diskette. Endless variety and challenge as you seek to rise to the level of Grand Master (until you gain skill, there are whole areas of the cave that you cannot enter).
(Requires 32K One Disk)

EDITOR ASSEMBLER-PLUS ... $41.15
A much improved editor assembler and debug/monitor for L2/16K machines. Assembles directly into memory, supports macros and conditional assembly, includes new commands — substitute, move, copy and extend.

LEVEL III BASIC $59.95
Loads on top of Level II Basic and gives advanced graphics, automatic renumbering, single stroke instructions (shift-key entries), keyboard debounce. Suitable for L2/16K and up. (Not Disk Basic).

SCOTCH BRAND PERSONAL COMPUTING CASSETTES

C-10 pack of 10 . . . $26.00 Incl. p&p
C-30 pack of 10 . . . $28.00 incl. p&p

To: MICRO-80
PO Box 213, Goodwood, SA 5034
284 Goodwood Rd, Clarence Park,
SA 5034 Phone (08) 272-0966
Please rush me the items checked below:

☐ 12 month subscription to MICRO-80 and my free software cassette $24.00

☐ 12 month subscription to MICRO-80 and the cassette edition, plus my free software cassette $60.00

☐ The lastest Issue of MICRO-80 $2.50

PLUS THE ITEMS LISTED BELOW

DESCRIPTION	PRICE
TOTAL ENCLOSED	

Name .....
Address .....
..... Post Code .....
bankcard welcome here No .....
Please debit my Bankcard $ .....
Expiry date .....
Signature .....
ETI

New family of low cost plotters

Five new models have been added to the successful HI-PLOT range of digital plotters aimed at both the OEM and end user markets.

Anderson Digital Equipment say this new family of UL listed digital plotters are designed to make hard copy output affordable and practical for the small system user in business, science, drafting, architecture, numerical control, mapping, education, personal computing and many other applications.

The DMP family of plotters now comprises six models; two standard and four "intelligent". Both are available with plotting sizes of both 8½" x 11" (DIN A4) and 11" x 17" (DIN A3).

The DMP-2 is a basic A4-size plotter with a built-in RS-232C and parallel interface, it has a pen speed of 2.4"/sec. (61 mm/sec.) and can plot at either 100 or 200 increments per inch (about 40 or 80 increments per cm).

The DMP-5, like the DMP-2, is a "basic" plotter. It suits A3-size and has a built-in RS-232C and parallel interface. The DMP-5 is plug compatible with the DMP-2 and can utilise software developed for the DMP-2.

The DMP-3 is an 'intelligent' A4-size plotter with a built-in microprocessor and features a pen speed of 75 mm per second. Use of Houston Instrument's DM/PL (Digital Micro/Plotter Language) permits minimum software burden on the host computer. For example: a simple print "H" will move the pen to the lower left hand corner, a print "U" instruction will raise the pen. Self-test and pen positioning are easily accomplished via a computer or terminal keyboard. The DMP-3 comes with an RS-232C or Centronics compatible interface.

The DMP-6 is an A3-size version of the DMP-3 and features a built-in microprocessor, easy remote pen positioning and pen speed of 2.4 inches per second (61mm/sec.).

The DMP-4 (A4-size) and the DMP-7 (A3-size) represent the top of the DMP line. Electronic controls facilitate position of the X and Y axes. Self-diagnostics are activated by means of pushing dual buttons on the convenient front panel controls. Through use of the DM/PL instructions, the need for software is minimised.

Prices for the DMP Series plotters start at $1595. Metric versions of all models are available. For complete information and descriptive literature contact: Anderson Digital Equipment Pty Ltd, P.O. Box 322, Mt. Waverley Vic, (03)543-2077; or P.O. Box 341, Pennant Hills NSW, (02)848-8533. ▶

Electronic fund transfer

There is an enormous interest at the present time in systems for the electronic transfer of funds to eliminate cheque books for many transactions and to obviate much of the paper work which takes up so much time in banks, credit companies etc and numerous retail organisations.

It is confidentially anticipated that highly reliable data terminals will be installed at increasing numbers of establishments such as banks, shops, petrol filling stations, hotels and similar establishments.

Electronic fund transfer will undoubtedly have a major impact on the retail world and its international growth potential is extremely large. Eventually it could affect almost everyone who makes a purchase, pays for a service or who uses a bank.

Racal-Transcom Ltd, of Salisbury in England, is to concentrate on the development of electronic fund transfer systems which they believe will revolutionise the banking system in the 1980s.

An important feature of their system is security of information and the equipment will incorporate vital cryptographic circuitry necessary to prevent unauthorised interception or alteration of information. The user will also be provided with a permanent printed record of every transaction.

When a customer wishes to make a purchase in a busy supermarket, he or she will be given a small handheld keyboard and will enter his or her personal code number. The equipment will first check that this corresponds to the account number on the banker's card which the shop assistant has placed in the point-of-sale terminal.

The equipment will then be able to automatically debit the bank account of the customer and at the same time automatically credit the bank account of the supermarket with the amount of the goods purchased.

Although the supermarkets and organisations providing the equipment will have to meet its cost, they will have the advantage that they will receive the money into their accounts immediately the goods are sold with absolute security and this will help to offset the cost of the equipment. In addition, it is claimed the use of this equipment will save much time both for the customer and for the shop assistant.

Normally, an S-100 computer costs hundreds of dollars more.

Ours costs hundreds of dollars less!

This is the Tandy TRS-80 level II computer complete with monitor. With its own non-standard expansion interface, & RS-232C interface, it sells for

$1787.95

(Price as per Tandy 1981 catalogue)

This is the Dick Smith System 80 level II computer, complete with monitor. With an industry standard S-100 bus expansion interface*, it sells for

$1398.50

*Due in stock shortly.

Both computers run with virtually the same software. . .

WHICH COMPUTER WOULD YOU CHOOSE?

STOP PRESS

SYSTEM 80 S-100 EXPANSION INTERFACE DUE IN SHORTLY!

- ★ 3 slot S-100 card cage.
- ★ Inbuilt power supply.
- ★ Mother board.
- ★ 2 vacant S-100 sockets for further expansion.
- ★ Supplied with single S-100 card providing complete floppy disc control.

Specifically designed for the System 80 to expand the basic concept into the world of floppy disc drives, Centronics type parallel printers, serial printers, expansion of the System 80 to 48K of RAM and RS-232C communications facilities – expand your System 80 for added benefits.

ONLY $499.00

Cat. X-4010

P&P $5.50

DON'T NEED A FULL S-100 INTERFACE?

If you don't want to run an S-100 expansion but would like to use a parallel printer such as the Dick Smith Cat. X-3255 ITOH 8300P @ $970, then you can with this parallel interface. Simply connects between your System 80 and the printer.

SYSTEM 80 PARALLEL PRINTER INTERFACE

$89.50

Cat. X-4012

P&P $4.00

DICK SMITH ELECTRONICS

SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

MENSA COMPUTERS PTY. LTD.

Suite 3, 454 St. Kilda Road, Melbourne, 3004. Telephone: (03) 26-5683, 26-6150.

FINDEX — The Real Computer

THE WORLD'S FIRST PORTABLE MICROCOMPUTER
Battery or mains operated

RAM 48K to 2 megabytes, bubble memory to 2MB, gas plasma display, optional audio, printer, mass storage mini floppys to 800K bytes, hard disk to 195 megabytes, acoustic coupler, S-100 bus, battery optional, CPU with real time clock. For dynamic businessmen on the move. Ideal for real estate agents, insurance brokers and accountants.

SUPERBRAIN™ SERIES

BUSINESS SYSTEMS

Priced competitively from as low as $45.00 p.w. lease cost including sales tax and software.

Powerful, multi-purpose microcomputer systems.

TYPICAL APPLICATIONS

Debtors ledger and statements, creditors ledger and remittances, general ledger and trial balance, order entry/invoicing, sales analysis, payroll/wages, enquiry, word processing, mailing, record keeping, ledger card, doctors office, real estate, agency accounting, hotel/motel accounting, branch office accounting.
Facilities management consulting.
Software and computer sales.
Computer data preparation.

OPAL 1000

The OPAL 1000 is an 8 slot S-100 system conforming to the new IEEE standards. A Delta Products Z80a 4 MHz CPU card, with 2 RS232c serial and 3x8 bit parallel ports, is used in conjunction with the Delta Products Disk Controller. Memory is provided by a 4MHz 64k dynamic RAM Board by Measurement Systems and Control. The memory board is fully bank selectable and is designed for upgrading to a multi-user system. Disk drives are 2x8" Shugart SA801R running at double density (480k/drive) and fitted with our exclusive Disk Saver which prolongs the life of the drives and floppy disks by turning off the AC power to the drives 14 seconds after the last drive select and thus reduces routine maintenance. The Disk Saver also reduces the risk of data loss due to power failures. The software is CP/M version 2.2 with Delta Product's utilities which include DTEST (for testing drives and floppy disks) and M2 (a comphrehensive memory test program). The Delta PROM monitor enables fault finding to be carried out independently) of the Disk Drives. The system is mounted in an attractive pressed Aluminium housing with a cast front panel fitted with reset button and key operated on/off switch.

Dealers for Opal in Victoria.
Sole Distributor for Findex, Victoria and NSW.

SUPPLIERS FOR NDKS S-4000

MATHEMATICS

$$F(w) = aT\frac{\text{Sin } wT/2}{wT/2}\ e^{-jwT/2}$$

$$e_{rms}^2 = 4KTR(f_2 - f_1)$$

$$L_1 = 10\log\frac{1}{80} \times S_o\ (dB)$$

$$A^2+B^2=C^2$$

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$$A^2+B^2=C^2$$

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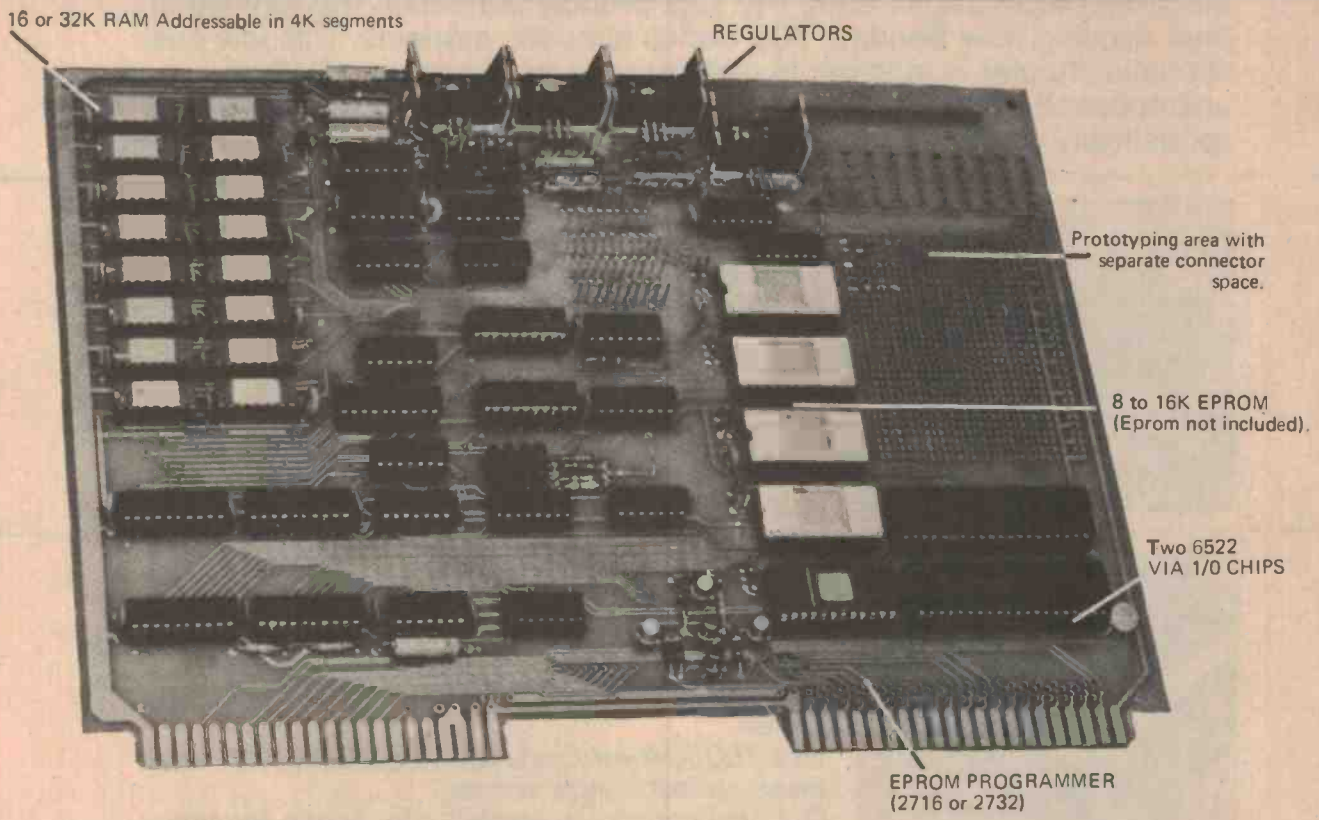


Peripherals for AIM65 and SYM-1 owners

A range of peripherals to suit the AIM65 and SYM-1 micros are stocked and distributed here by Energy Control of Queensland.

Distributorships are held for 'The Enclosure Group's' moulded AIM65 enclosures, the 'Computerist' range of intelligent video, memory and mother boards from Massachusetts, and the 'Microtechnology Unlimited' graphics boards.

The Computerist has recently released a new memory board called the Dram Plus. This provides up to 32K of 4116 dynamic memory and up to 16K of EPROM space on board together with an EPROM programmer for 2716/2516 and 2732/2532 type EPROMs and a 50 mm x 70 mm wire wrap area. Memory test and EPROM programming software is also available on cassette.

Microtechnology Unlimited of New Hampshire has a high resolution graphics board featuring a 320 x 200 bit mapped pixel display matrix together with AIM65 software which allows graphics printing on the AIM65 on-board printer. You can print up to 10 rows with up to 127 characters per row. A multi-harmonic, four-voice music synthesiser is also available.

Details available from Energy Control, 73 Eric St, Goodna (P.O. Box 31) QLD 4300. (07)288-2757.

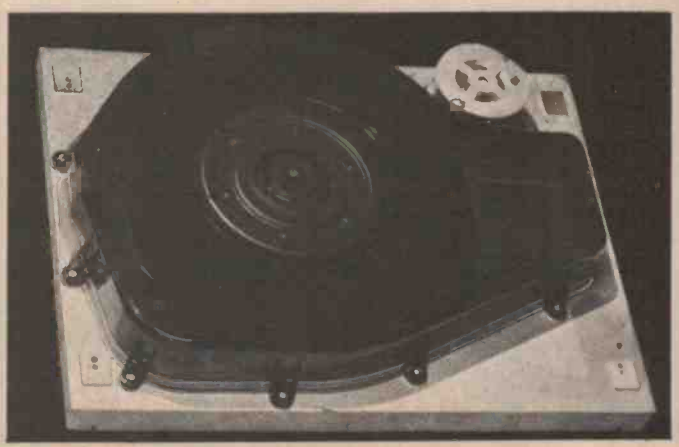
S-100 hard disk drive

A hard disk drive system just released in this country can expand the memory of S-100 systems beyond 100 Megabytes.

The DISCUS M26 system from Morrow Designs of the US has a basic 26 megabyte hard disk drive with a controller and operating system which can cope with up to three additional drives of the same kind.

The single board S-100 controller communicates with the CPU via three I/O ports (for command, status and data) and can generate interrupts at the completion of each command. Each sector can be individually write protected and there is a 512 byte on-board sector buffer.

Further details are available from the distributors, A.E.D., 123 Military Rd, Guildford, NSW 2161. Phone (02) 632-6301.



Attention all computer users

Electro Medical Engineering Pty. Ltd. proudly announce the release of their exciting new Sendata 700 Series acoustic modems. This low cost acoustic coupler is modular in design, easy to operate, and offers unsurpassed performance even when both ends of the connection are acoustically coupled.

700 Originate Only
Operates at up to 300 BPS Full Duplex and up to 1200 BPS Half Duplex.
Powered via the terminal interface or from 9v plug pack.
CCITT V24 (RS232) compatible.
Suits most telephone handsets.

Use 700 Originate Only for portable terminal applications.
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Use 700 Answer/Originate to establish your own message exchange service.
Optional carry case available for above terminals ideal for portable applications.

700 Originate/Answer suits most home computers.
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The 700 Series is available in 1200 Half Duplex form or with split baud rates of 1200/75BPS.

Electromeds eight years experience in the design and manufacture of a range of acoustic couplers ensures highest possible performance.

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Printout

Voice recogniser for TRS80

A speech recognition unit designed for use with the TRS80 microcomputer is claimed to have an accuracy of 98% on a 40 word vocabulary.

The VET-2, from Scott Instruments of the USA, has a four kilobyte operating system housed on a 133 mm disk that also stores up to seventeen 40 word memory templates. Response time with a single 40 word memory is said to be 200 ms but may be slower with more extended vocabulary.

The system will only respond to particular speakers, which is clearly an advantage in some applications and a disadvantage in others. Each operator must repeat the desired vocabulary words several times to register the voice pattern templates in memory. When the operator subsequently speaks to the machine, it compares his or her speech to the template patterns and makes its recognition decision.

VET-2 uses two new software techniques to improve speed and accuracy. In the first of these, the system analyses the number of syllables in a sentence before making any comparisons with the templates. This automatically eliminates from consideration those words in the vocabulary that do not contain the correct number of syllables — anything from a third to a half of the vocabulary.

The second software technique, known as variance weighting, divides the vocabulary into two parts — those words that are commonly pronounced in much the same way by different speakers or at different times and those whose pronunciation varies more from person to person and time to time. In some cases, the makers claim, this technique allows the VET-2 to be operated by two different people using the same set of templates.

More information from Scott Instruments, 815 North Elm, Denton, Texas 76201, USA.

NMOS micros unveiled

Seven new single-chip micros using N-channel MOS construction have been unveiled by American Microsystems Inc.

Designated the S2200 series, the new devices feature on-board memory ranging from 512 bytes to 2048 bytes. Three members of the family also have 8-bit a-to-d or d-to-a conversion capability.

The California company also took the wraps off its new microprocessor development station, Phoenix-1, at the giant Wescom/80 electronics show last month. The Phoenix-1 supports the company's new S2200 family as well as Motorola's 6800 and Texas Instruments' 990 microprocessors.

Microsoft Z80 for Apple

A "Z80 Softcard" that allows the Apple to run software written for Z80-based computers has just been announced by Computerland.

The Z80 Softcard is a plug-in peripheral that actually contains a Z80 microprocessor and you can use it with the Apple II or Apple II Plus, but you'll need 48K of memory.

Each Softcard comes with Version 2.0 Microsoft BASIC, Version 5.0 Conversion Utilities complete documentation plus two disks, each containing CP/M — you get one 13-sector disk for use with DOS 3.2 and one 16-sector disk for use with DOS 3.3 or Language Card.

Enquiries to Computerland, 555 Collins St, Melbourne Vic 3000. (03)62-5581, 62-6737.

For Sorcerer Apprentices

Being the proud owner of a Home Computer can not only bring hours of joy but a certain amount of frustration as well. Most non-computing people would not know the difference between a bit and a byte, and probably still think a buss is something to get you from here to there. We hope this column might help shorten some of those sleepless nights.

This column is intended for the non-professional Home Computer Owner — specifically the growing number of Exidy Sorcerer users. Over the next few months, this column will present hints and tips for Sorcerer users and also provide a forum where any problems or hints you have can be aired. We invite readers to forward any queries or other material to this column care of Roger Harrison, Editor ETI, 15 Boundary St, Rushcutters Bay, NSW 2011.

Hint:

There is a way to switch your printer on and off from a BASIC program, and that is to poke the CENDRV address into the SEND vector of the Monitor to switch it on and to poke VIDEO into the vector to switch it off. Here is how you do it:

Include the following lines at the beginning of your program:

```
0 VE=PEEK(-4095)*256+PEEK(-4096)-47
1 IF VE>32767 THEN VE = VE-65536
```

Then, to switch printer on, simply use:

```
POKE VE,147
```

and to switch it off:

```
POKE VE,240
```

Simple, isn't it?

Hint:

Ever wondered how to make your cursor flash? Here is how it is done:

Choose a convenient part of memory that is not being used for anything else. (0 to FF can sometimes be convenient in a BASIC programme). Enter following code from the Monitor (BYE from Basic):

```
0000: 06 18 CD 18 E0 10 10 CD D6 E9 3E 5F BE F5 C4 CC
0010: E9 F1 CC E8 E9 18 E9 28 E9 C9
```

Now, all there is to do is to set your input vector to the start address of the routine using the Monitor command:

```
SE I=xxxx
```

Of course, our example has been entered from 0 to 19, but your version could run elsewhere. The above code needs no modification to run anywhere in memory.

Question:

I am trying to write a small BASIC program and I'm having trouble clearing the screen. Is there a neat way of doing this?

Answer:

Certainly. Simply include in your programme the statement PRINT CHR$(12). This will effectively clear the screen and put the cursor in the top left position (HOME).

Question:

I have heard that it is possible to RESTORE data halfway through a program. Is this correct?

Answer:

Yes. One of the un-documented functions in Exidy BASIC is its ability to RESTORE to a line number. Thus the statement RESTORE 100 will restore the data pointer to line 100. The next data will be read from line 100 onwards, and any data before line 100 will be ignored.

A.P.F. Fry

Computer Country Pty. Ltd.

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Thinking of purchasing a microcomputer system or adding to the one you already have? Make a good investment — invest a little bit of time to talk to the professionals at Computer Country. Remember the quality of the after-sales hardware service and continual after-sales software and hardware advice you get is just as important as the price of the system you buy. Come and have a chat with the professionals of Computer Country just once and you'll realise how much help we can be in enabling you to get the most out of your microcomputer system.

Computer Country stocks a wide range of microcomputer hardware including the Apple, Northstar, Commodore, Texas Instruments, NEC, Impact Data and many more. We carry a wide range of software for many systems including the TRS-80. We can also help you in customising software for your specific application.

Our service department not only completely backs up all hardware purchased from us, but invites enquiries from those who have purchased elsewhere and have hard-to-fix problems.

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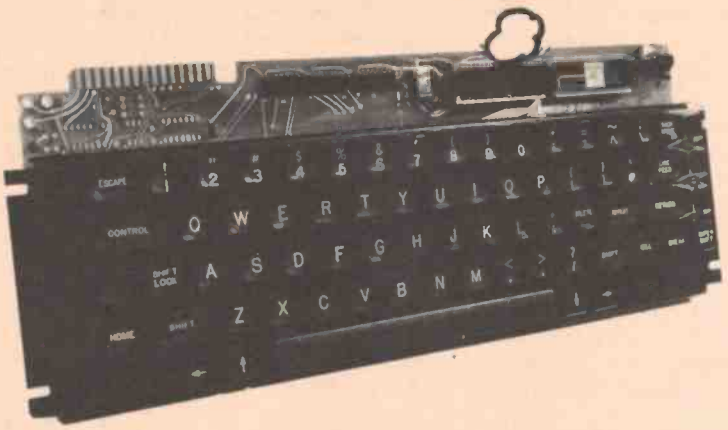
C70MGP

General Instrument's* NEW! Thinking Cap' Keyboard



General Instrument's Keyboard Division has combined state-of-the-art microprocessor technology with the reliability and simplicity of capacitive keys to create a highly flexible, low cost keyboard for OEM's and hobby projects.

The C70-MGP is chock full of features like 4 level ASCII encoding, serial and parallel outputs, N-Key rollover, provision for RS232 and 20MA loop connection, cursor control and user definable keys and programmable baud rates, all for around $150, plus tax. At a dealer near you.

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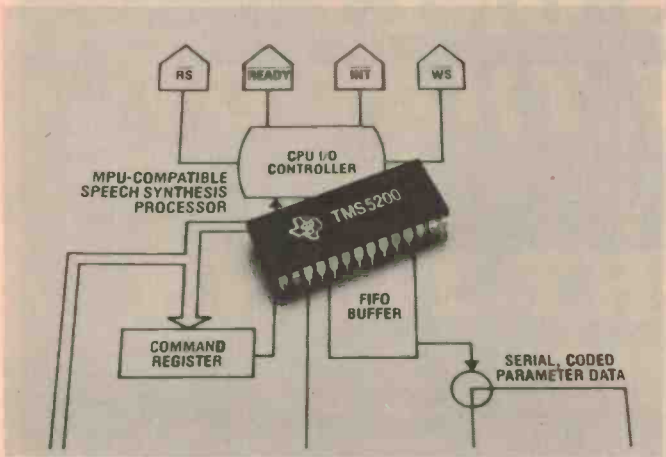
daneva control pty. ltd.

66 Bay Road, Sandringham, Vic., 3191. Ph: 598-5622 Telex: AA34439



Texas gets another voice

The family of Texas Instruments speech synthesis chips has a new baby called TMS5200.

His most interesting feature is that he contains an onboard buffer organised on a first in first out (FIFO) basis, 16-bit parallel in and serial out. This buffer frees the CPU for the 50 milliseconds that it takes to exhaust itself and allows speech data to be stored in PROM, RAM or any other random access storage medium.

Like his elder brother TM5100, the new chip is P-channel MOS and uses an encoding method called Linear Predictive Coding. Texas explain this as 'a technique of analysing and synthesising human speech by determining from original speech a description of a time varying digital filter modelling the vocal tract.

"This filter is then excited by either periodic or random inputs. An on-chip 8-bit digital-to-analogue converter transforms digital information passed through the filter into synthetic speech." So now you know!

Enquiries to Texas Instruments Asia Ltd, Serangoon Rd, P.O.138, Singapore 9132.

'SABER' data repeater

A single integrated circuit device which can physically extend a common buss between close-coupled or remote digital data processing or communications equipment and repeat and retransmit signals without signal degradation has been introduced by Signetics.

The new integrated circuit is the 8X41, otherwise known as the Signetics Asynchronous Bi-directional Bus Extender and Repeater (SABER).

In contrast to more complex retransmission schemes which may involve six or more separate integrated circuits, the eight-channel 8X41 SABER can transfer data between up to either pairs of elements in a data processing or communications system without external logic.

By inserting the 8X41 in series with a properly terminated open collector buss, the signals passing through the buss in either direction can be repeated without degrading buss drive capability or signal rise and fall time.

The SABER's eight data channels are controlled by the lines which determine whether or not data is to be transmitted, the direction of transmission or whether the device is to simply repeat the data on either buss.

Potential use of the chip would be any application where data is exchanged over a common parallel buss, especially where direct memory access (DMA) is required. This would include EDP, CPU and peripheral equipment, multiprocessor distributed networks and systems, as well as automatic test and measurement systems.

The high output drive of the 8X41 can sink up to 70 milliamps of current and drive a buss on which up to several hundred peripheral devices are connected. Input current requirement is only 100 microamps!

The 8X41 has a maximum delay time of 30 nanoseconds, is TTL compatible, has open collector outputs and operates from a single 5 V power source.

The SABER is available in 24-pin plastic dual in-line package. Detailed specifications, delivery and pricing are available from Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW 2066. (02)427-0888.

Support for the Z8000

Support and development hardware for the Z8000 sixteen bit microprocessor is arriving thick and fast.

First of all, Zilog has released news of an intelligent microprocessor emulator subsystem called ZSCAN 8000 which they say represents a new modular approach to development systems.

Previous systems have combined the software development capability with the emulator in a single unit, which meant that the system was restricted to a single microprocessor.

ZSCAN 8000 interfaces to Zilog's PDS 8000 development systems for use with both versions of the Z8000, but it can also be used easily with other microcomputers, minicomputers and mainframes — in fact any host with a standard RS232C interface.

Priced at around $4500, ZSCAN 8000 will be available here in about three months.

Next there's the Z8010 Memory Management Unit, which offers dynamic segment relocation and memory protection for each of the Z8001's address spaces. It's designed to give the memory space a logical rather than a physical structure and to protect the user from inadvertent errors and the operating system from unexpected access by the user.

Each Memory Management Unit has 64 randomly accessible segments ranging in size from 256 bytes to 64 kilobytes and these can be mapped into a total physical address space of 16 megabytes. Introductory price is $187 each for ten or more.

The Z8000 MPU is the first of a new series of microcomputer boards based on the Z8001 processor. It can function either as a stand-alone single board microcomputer or as the master in a set of several peripheral boards. There are 32K bytes of onboard RAM with parity protection and 8K bytes of additional ROM space. Priced at $2295 it's available now.

A new system-level backplane buss structure can be used with all three of Zilog's micros, the Z8, Z80 and Z8000. Its 32 address/data lines and 28 control lines mean that it will also be able to accommodate future 32 bit micros.

Complete information on all of Zilog's family of microcomputer components is contained in their new 'Microcomputer Components Data Book', a 254 page catalogue which provides technical data consisting of functional descriptions, architecture and programming information, pin descriptions and electrical specifications.

More info on all Zilog products from the distributors, Zap Systems Pty Ltd, 51-53 Chandos St, St Leonards, NSW 2065. Phone (02) 438-4533.

WITH THE PRICE OF OUR DISK DRIVES ONLY ABOUT HALF THAT OF TANDY'S, PEOPLE MIGHT THINK THEY MUST BE INFERIOR.

HERE'S WHAT A REVIEWER HAS TO SAY IN THE "TANDY & SYSTEM 80" NEWSLETTER.

AUGUST ISSUE, VOL. 11 PAGE 3

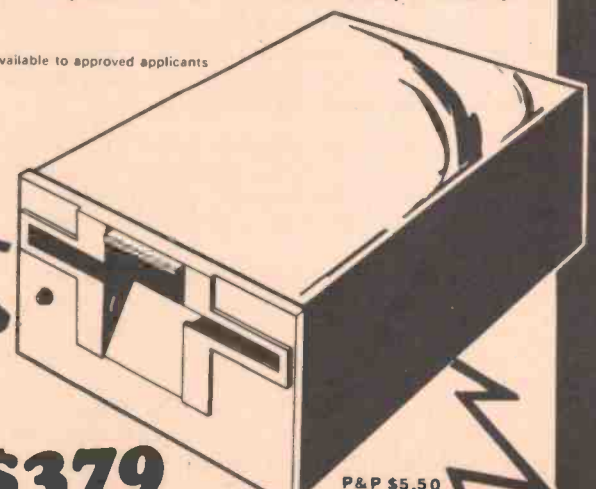
'"DICK SMITH DRIVES" are in reality a Pertec 40 track drive they have a 20ms track to track seek and are generally quieter in their running. They have separate power supply allowing the unit to run cooler and because of their 40 tracks they store 102.4K bytes. Both sides of the diskettes can be used without modification.

"TANDY DRIVES" have been made by 2 suppliers, the earlier drives were Shugart, whereas the later models are Teac. Both these drives are 35 track units and have a track to track of 40ms. The total storage is 89.6K bytes and because of an inbuilt power supply they run quite hot and in enclosed spaces are prone to motor speed errors!! Only one side of the diskette can be utilized. Slightly noisier than the Pertec.

As the all up cost of 4 DICK SMITH drives is about $1000.00 cheaper than the TANDY unit, the DICK SMITH drives seem a far better buy.'

PERHAPS WE SHOULD HAVE MADE THEM $100 DEARER!

Credit terms available to approved applicants



$379

Cat. X-3230

P&P $5.50

Power supply to suit 2 drives
Cat. X-3234 **$60.00**

SEE THE OTHER DICK SMITH ADS IN THIS MAGAZINE FOR STORE ADDRESSES

DS83

ETI READER OFFER

computer users —

FANTASTIC OFFER ON FLOPPY DISKS

SPECIAL PRICES	10-19	20-49	50-99	100+
133 mm (SS, SD)	$4.95	$4.39	$3.99	$3.29
200 mm (SS, SD)	$5.95	$4.86	$4.25	$3.95

Both sizes can be mixed to qualify for the quantity discount.

Packing and delivery

10-19	$1.50
20-49	$2.00
50-99	$2.50
100+	$3.00

Floppy disks are the highly convenient magnetic media used for mass storage with minicomputer systems. Dindy Marketing (Aust.) Pty Ltd has made available a quantity of 133 mm (5") diskettes and 200 mm (8") floppy disks for ETI readers at special prices. These single-sided, single-density disks are manufactured in the USA and are identical to those marketed here by two large well-known electronics retailers.

Each precision coated disk is enclosed in a PVC jacket with a protective liner. This material has low frictional properties and resists mechanical shock and heat. Minute foreign particles are absorbed by the liner, leaving the disk 'clean' for optimum recording performance. The disk itself consists of oriented polyester coated with a uniquely formulated gamma-ferric oxide, encapsulated in a wear resistant binder providing minimum friction with maximum durability. The smooth, polished surface results in low head and pad wear and gives long performance life.

All stages of manufacture of these disks are carried out in environmentally 'clean' rooms and each stage is continuously monitored to ensure accuracy in accordance with rigid industry standards. Before being consumer packed, the specially coated material is tested for signal levels, modulation and resolution, and the disk certified free of errors.

NOTE: ***Offer closes 13 November***

Money back guarantee: Dindy offer to refund the purchase price in full if you are not completely satisfied and provided you return the goods within 14 days of receipt.

Mail this coupon now and ensure delivery of your order before Christmas. Make out your cheque or money order to 'Dindy Disk Offer', don't forget to include post and delivery charges.

NOTE: This offer is made by Dindy Marketing (Aust.) Pty Ltd and ETI is acting as a clearing house only. Cheques or money orders should be made payable to **'DINDY DISK OFFER'** and sent, together with the coupon (or a photostat or clear, hand-written copy of same), to Disk Offer, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. We will then process your order and pass it on to Dindy who will send you the goods. Please allow up to four weeks for delivery.

Send coupon to:
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Please supply:

Quantity ..... 133 mm ..... $.....

..... 200 mm ..... $.....

Packing and delivery: ..... $.....

TOTAL: $_____

(Disks may be mixed for quantity discounts)

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- Individual output regulation of 1 percent
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Diode Test range
This is a 0.3% basic instrument with 200 hour continuous operation from a single battery.

ONLY **$95** +$14.25 S.T.

SEND TO:

'SANSEI' 2000A DIGITAL MULTIMETER, with a 3½ digit LCD display. We are now able to offer an AUTO RANGING D.M.M. for the price of a normal D.M.M. It has an accuracy of 0.3% and features low battery warning, and overrange indication. Test leads, spare fuse and battery supplied.

RANGES
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AC . . . . . 2, 20, 200 and 700 V
OHMS 2K, 20K, 200K, 2M
DCA 200mA
This is a 0.3% Basic Instrument with 30 hours continuous operation.

ONLY **$138** +$20.70 S.T.

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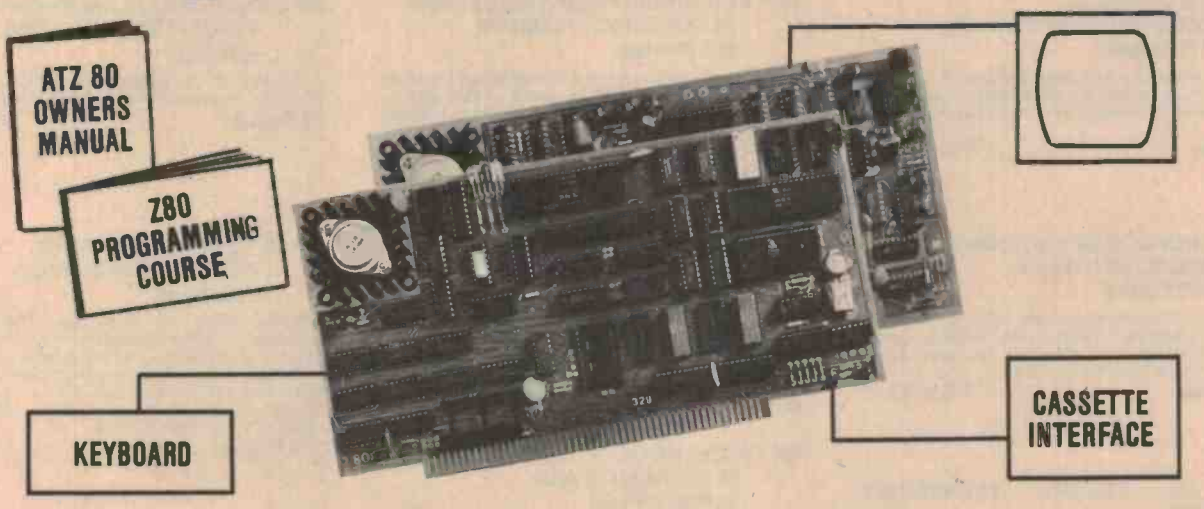

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Now you can build your own S100/Z80 based micro computer and learn this exciting new technology as you go.
Based on the DGZ80 (ETI November 1978), you are assured of a proven versatile design. Hundreds have already been sold to hobbyists in Australia, New Zealand, Hong Kong and to Government Departments such as C.S.I.R.O. Defence, Transport and to industry such as I.B.M., Rothmans, Leeton Steel Works etc.

The ATZ80 is a complete computer. You just add a tape recorder and a modified T.V. and you have a system equal to those costing $1,000 or more. Because it is already based on the S100 system you can readily expand your system adding extra memory boards, I/O boards and peripheral such as printer and floppy disks. Full program support is available, BASIC, EDITOR, ASSEMBLER etc. now readily available.
Your Z80 is supplied with detailed construction manual and an exclusive step by step programming course that seems so lacking in other kits.
You can add options as required such as the CLARE C70 keyboard (**$165.00**) and extra memory 16K S100 Static memory card (**$259.00**), Card frame (**$49.50**), 19 slot Mother board (**$49.50**).
With the ATZ80 you have a complete, self contained microprocessor which you can apply immediately or expand to equal computers sold for $20,000 or more.
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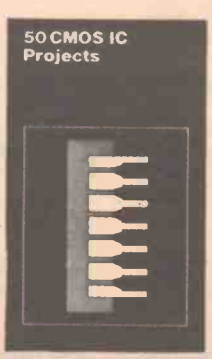

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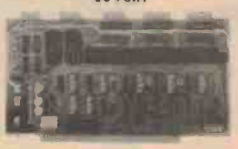

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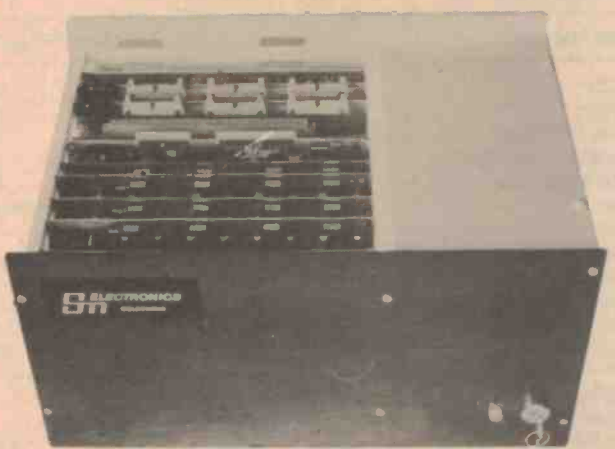

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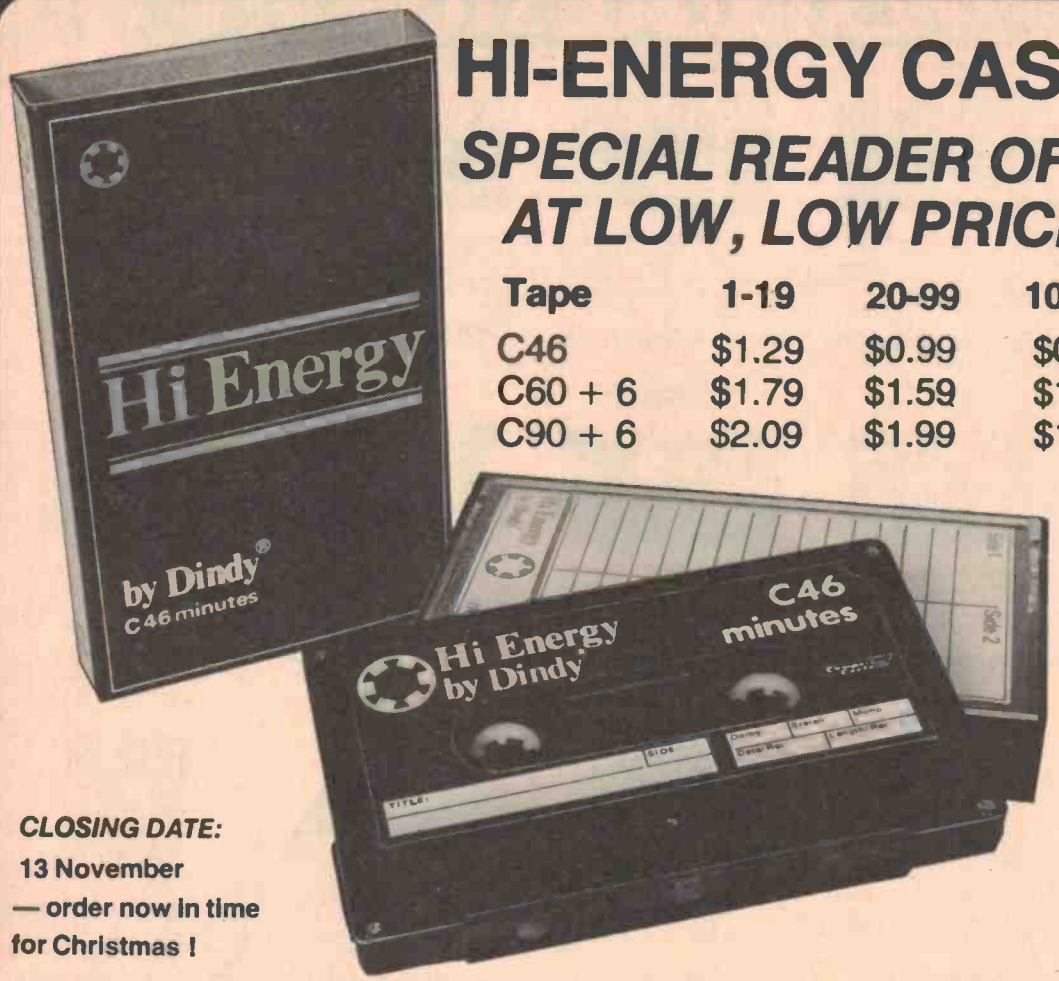

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Length	m	90	135	180
Base Thickness	um	11.5	7.5	6.0
Coating Thickness	um	3.8	3.8	3.0
Total Thickness	um	15.3	11.3	9.0
Colour		Brown	Brown	Brown
Magnetic Properties				
Coercivity (Hc)	Oe	320	320	320
Retentivity (Br)	Gauss	1100	1100	1100
Max. Inductance Bm	Gauss	1350	1350	1350
Squareness	Ratio	0.82	0.82	0.82
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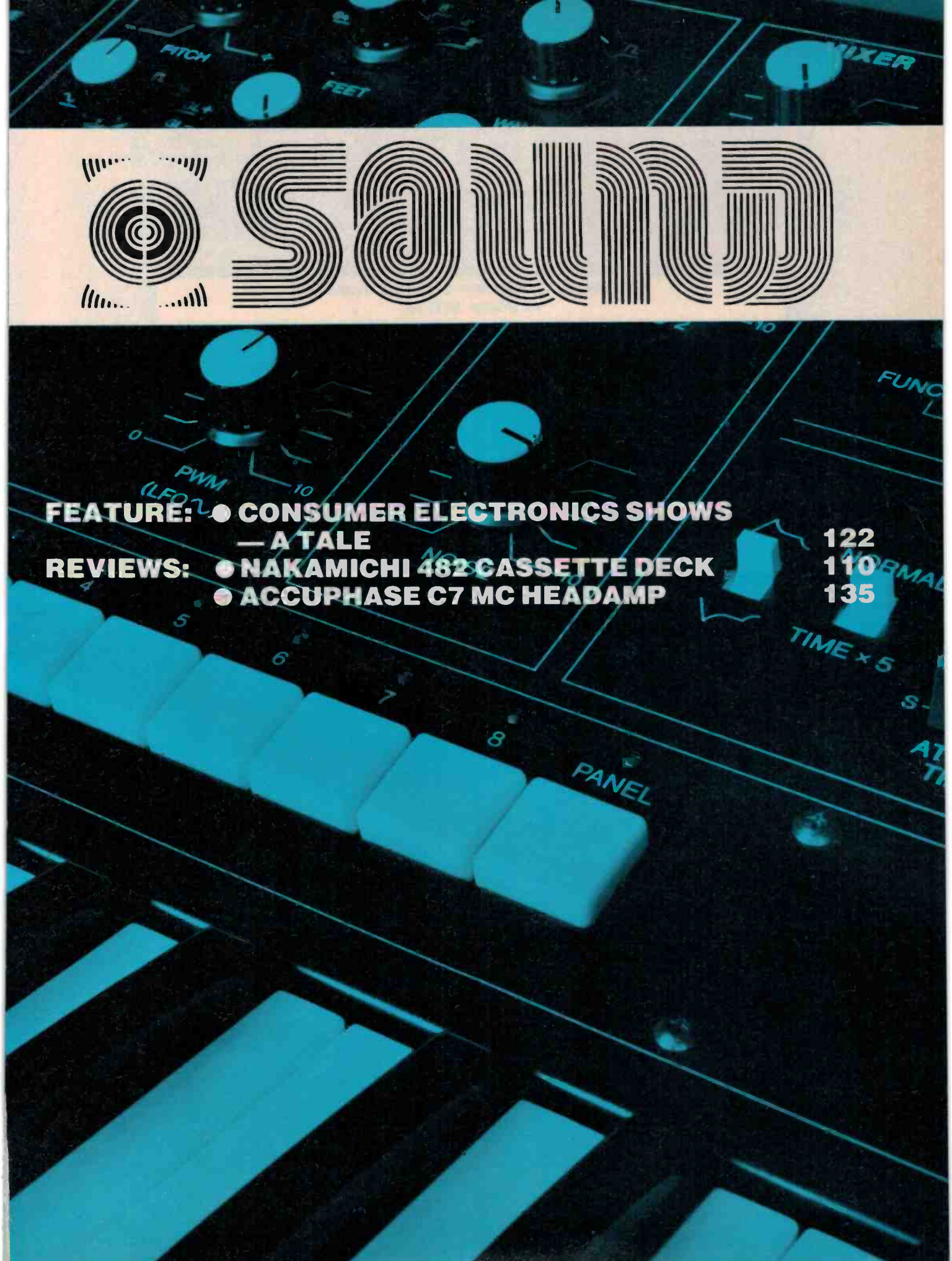
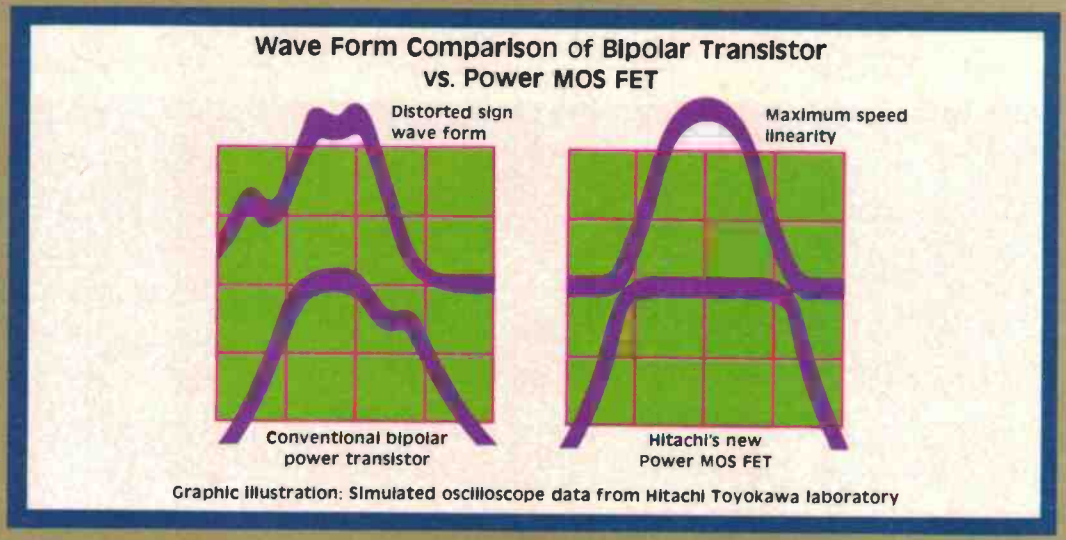
Variation of Sensitivity	dB	+/−1.0	+/−1.0	+/−1.0
MOL 333 Hz/3% THD	dB	+4.0	+4.0	+4.0
10 kHz/3% THD	dB	−9.0	−9.0	−9.0
Signal/noise ratio (NAB)	dB	58	58	58
Signal/noise ratio (MOL/NAB)	db	64.5	64.5	64.5
Print through	dB	−59	−59	−59
Third Harmonic Distortion				
250 nwb/m	%	0.8	0.8	0.8
160 nwb/m	%	0.2	0.2	0.2



sound

FEATURE: ● CONSUMER ELECTRONICS SHOWS — A TALE 122
REVIEWS: ● NAKAMICHI 482 CASSETTE DECK 110
● ACCUPHASE C7 MC HEADAMP 135

The world's fastest integrated amplifier



Hitachi Power MOS FET

HA-7700

The HA-7700 Stereo Integrated Amplifier brings you stunning sound reproduction. The Hitachi Power MOS FET offers ultra-high switching speed for dramatically reduced distortion and outstanding transient response. It features the same incredible technology that went into our renowned HMA-7500 Stereo Power Amplifier and HA-8700 Stereo Integrated Amplifier.

Power output is 70 watts per channel with no more than 0.008% total harmonic distortion from 20 to 20,000 Hz. And all stages are direct coupled, so you get the purest waveform reproduction fidelity from input to output.

The RIAA phono equalizer is a top-precision design employing only the highest-quality components for low-distortion and true-to-life disc playback. There's a full complement of control and convenience features for maximum system flexibility.

The HA-7700. True purity in waveform reproduction is here.

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Kodak Elite 35 Prints set a new standard of excellence in color reproduction for 35mm camera owners.

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2. Kodak Elite 35 Prints are processed from negatives individually assessed by computer.
3. Kodak Elite 35 Prints are subject to extremely strict quality controls.
4. Kodak Elite 35 Prints are returned to you with the negatives in special plastic sleeves for complete protection.

Kodak Elite 35 Prints take slightly longer to process and cost a little extra, but that's what you'd expect for wanting the best.

Another Kodak processing service from 35 mm color negative film.

ELITE 35 PRINTS

Kodak Elite 35 Prints are available from all C41 compatible 35mm color negative film.

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sound news

TEAC offers dbx !

The TEAC corporation are now offering dbx noise reduction units to support their range of cassette and open reel tape recorders.

The dbx system of logarithmic compression before recording and expansion before playback was explained in last month's ETI review of the dbx 3BX dynamic range enhancer.

It can give an improvement in dynamic range of more than 30 dB, compared to the 10 dB or so that is possible with Dolby systems.

TEAC's A-550RX cassette deck has built-in dbx circuitry and is also provided with Dolby circuits for playing back Dolbyised recordings or recording tapes that will be played back on other machines (e.g. in the car) which do not have dbx. Like all new high quality cassette decks these days it's compatible with metal tape.

Other TEAC decks can also be upgraded to dbx standards of noise suppression. The RX-8 is a dbx unit designed to complement the C Series cassette decks, the DX-2A model is for use with the X-10 and X-10R open reel decks and the RX-9 is made to match the A-3440 multitrack open reel recorder.

TEAC have an interesting array of new equipment for 1980/81, which they released at a function in Melbourne during August. We've more 'goodies' to tell you about in later issues.

Pioneer play it safe

DC or not DC? That is the question currently plaguing amplifier designers. Pioneer's answer is — neither!

Their SA-710 integrated amplifier and SX-D5000 receiver released at July's C.E. Show, both feature what they call 'DC with a difference'.

The difference is that they have retained the input capacitors.

This way they reckon to avoid the risks of overload inherent in amplifiers that are entirely direct coupled, while still eliminating the disturbing effects of capacitor-induced phase shifts in the negative feedback loops.

The power amp section of the SX-5000 receiver uses an unusual (but not unique) principle, which seems set to become very fashionable. It's a form of class AB operation. Neither of the paired output transistors on each channel is ever cut off, but unlike class A, the bias current is not held constant. Instead, a 'Vari-bias' circuit monitors the incoming signal level and adjusts the bias current accordingly, feeding less bias current to the transistors during low signal periods.

This cuts down thermal losses and hence improves efficiency. Pioneer claim the circuitry involved is so simple that it does not limit the transient response at all.

The same company also released three new capacitor-coupled amplifiers at the C.E. Show, SA-610, SA-510 and SA-410 with outputs of 45 W, 30 W and 20 W per channel respectively. The most interesting feature of these three is that their tone control networks are incorporated in the negative feedback loops of the power amplifier section, not the preamp.

AGFA-GEVAERT

Sound safe.

Agfa SUPERFERRO–the sound safe–will record and store your music safe in sound, ready for when you want it. And we mean all the music. The outstanding performance of Agfa SUPERFERRO is achieved through the use of a particular form of ferric oxide particle that is uniform in shape and size. The second factor is an Agfa technique that enables more particles to be deposited per sq. mm of tape, with each particle separated and in line to eliminate cross-over interference.

The advanced technology of the SUPERFERRO tape results in five big improvements:

1. Reduced background noise.
2. Better maximum output level.
3. Improved dynamic range.
4. Improved high frequency output level.
5. Reduced harmonic distortion.

In addition, Agfa SUPERFERRO cassettes feature a special mechanism for improved running properties.
Agfa SUPERFERRO–the sound safe you can bank on for outstanding performance.

Agfa*

*Registered trademark of AGFA-GEVAERT Antwerp/Leverkusen.

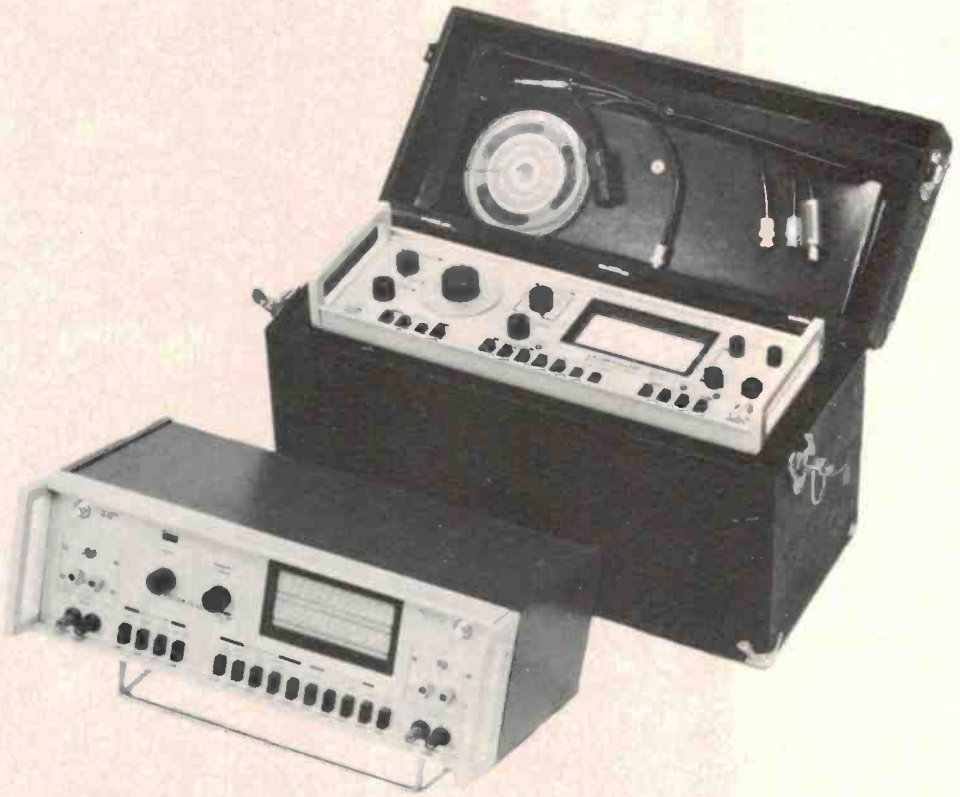
AGFA-GEVAERT FOR STILL CAMERAS, FLASHGUNS, COLOUR FILM FOR SLIDES, PRINTS AND MOVIES, MAGNETIC TAPES. E314

All-in-one audio test kit

Neal-Ferrograph of the UK have produced a single instrument which performs a variety of useful audio measurements.

Their RTS 2 combines an audio oscillator, a millivoltmeter, a distortion-measuring filter and a wow and flutter meter in a small unit that weighs less than six kilos. Pushbutton switches are used to select the different functions.

Only one input and output lead is connected to the equipment under test, which is one reason why the instrument is claimed to reduce testing time by up to 30%. Another is that the readout is expressed directly in dB or percentage terms, which saves the time otherwise spent on arithmetic (and avoids errors too).



The oscillator covers the frequency range from 15 Hz to 150 kHz and has a maximum output of 3 V.

THD from 0.1% to 100% can be measured by the distortion section of the instrument, which has an output for connecting an oscilloscope or additional filters.

The millivoltmeter can be switched to read voltages either at the output of the oscillator or at the high impedance input. It can be used to read drift, distortion, wow and flutter or voltages from 1 mV to 100 V in eleven ranges.

There are three ranges of measurement for wow and flutter, with full scale deflections of 0.1%, 0.3% and 1% respectively. Variations in mean speed of up to 2% either way are within the scope of the instrument.

The RTS 2 also includes an external 40 dB attenuator and a test tape for checking azimuth alignment and replay characteristics of tape recorders.

A separate Auxiliary Test Unit is available, which enables the RTS 2's oscillator and meter sections to be used either simultaneously or separately for a variety of weighting and monitoring test on equipment of professional standard.

Further information can be obtained by writing to Neal-Ferrograph, North East Audio Ltd, Simonside Works, South Shields, Tyne and Wear NE34 9NX, England.

Bouquet for Philips

Philips' unique feedback-controlled belt-drive turntables have won them a coveted Hi-Fi Grand Prix citation for turntable technology from the American magazine 'Audio Video International'.

Such citations are awarded as a result of a ballot of over 1500 hi-fi retailers in all parts of the United States.

The 'Direct Control' turntable design aims to provide the same accuracy as direct-drive turntables without the expensive constructional techniques they involve.

The platter is belt driven by a dc motor and has a tachometer built under it. The output of the tachometer is converted into a dc voltage proportional to the turntable speed and this voltage is continuously compared to a stable dc reference voltage. The difference voltage is fed back to regulate the motor speed.

According to Philips, turntables using this system can achieve wow and flutter figures of less than 0.03% (WRMS) and rumble lower than −70 dB.

Sansui

Only hi-fi, everything hi-fi.

Non-compromise computerized

Fully computerized operations have many powerful advantages. Flawless decisions, meticulous monitoring, foolproof functions, record protection and the desirable convenience of random band selection are only a few.

But some audiophiles have had reservations about such systems and their reasons are not mysterious. Until now, you had to accept the one particular cartridge that came with the system.

From now, with Sansui's new XR-Q11, you can freely select whichever cartridge you like. This important freedom is possible because Sansui engineers have perfected a dual sensor system which is independent of the cartridge.

Until now, the specs and performance of band selector turntables were usually not the very best. The XR-Q11 now changes the sound picture. Speed is better than 99.99% perfect! Wow and flutter is under 0.015%. And performance is peerless thanks to the direct-drive quartz-servo motor. Speed monitoring is exceptionally fast and accurate with Sansui's dual-heads that read the 960 magnetic "marks" coating the platter's inside rim.

Carefully examine the unique, straight D-O-B tonearm. Using basic principles of physics in a new configuration, this tonearm radically reduces all kinds of spurious vibrations, including feedback from the stylus. Combined with the BMC super-dense cabinet and PAT. PEND. floating sub-base, mechanical interferences of the most overt and subtle types have been virtually eliminated for superb reproduction of even the most difficult dynamic musical qualities.

The facts are clear. The XR-Q11 is one of the world's finest turntables by any standard. And it is the only turntable in its class with the sophisticated convenience of computerized operation including Sansui's Computerized Track Sequence Selection (CTSS).

The new XR-Q11 CTSS turntable: when you want to approach the ultimate.

SANSUI

XR-Q11

SANSUI ELECTRIC CO., LTD.
14-1 Izumi 2-chome, Suginami-ku, Tokyo 168, Japan
VANFI (AUST.) PTY. LTD.
297, City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293

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

You get precise azimuth alignment,* equal record and playback head-to-tape pressure, and reduced magnetic leakage flux.

It's a unique three-head system, with two-motor, closed-loop dual capstan drive with metal tape compatibility.

The new TC-K81 also has microcomputer control and feature-touch operation, and LED Peak Programme Meter, bias and record level calibration system, and Dolby** NR.

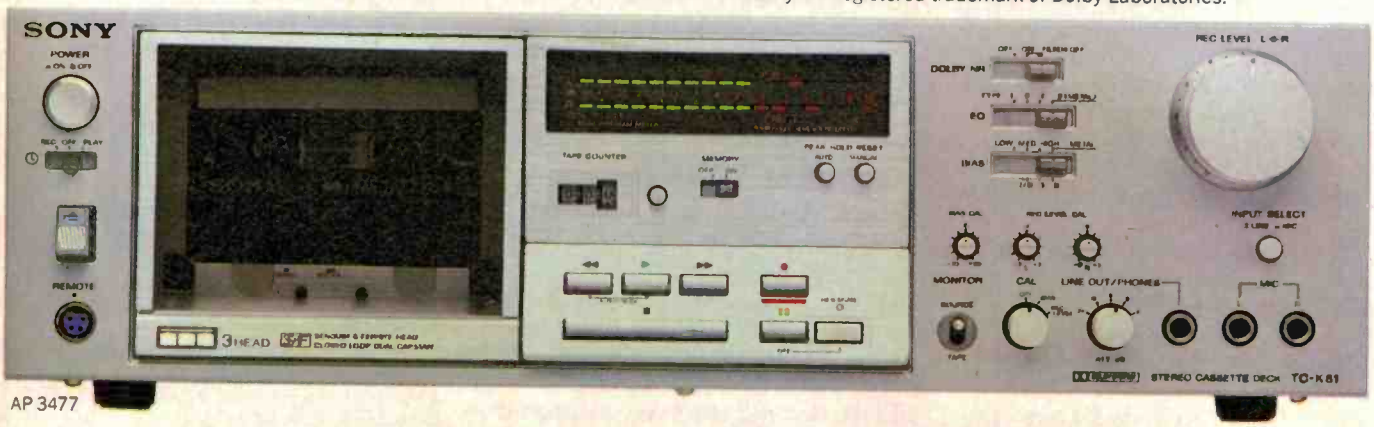
It's an exceptional new system, at an excellent price. And it's Sony.

So in three-head technology, we're three-ways better.

Sony's 3 head system. It's 3 ways better.

SONY®

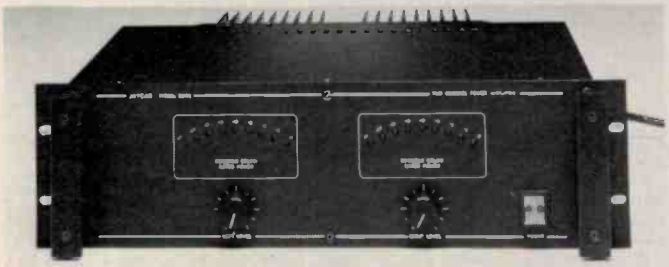
*Factory aligned.
**Dolby is a registered trademark of Dolby Laboratories.

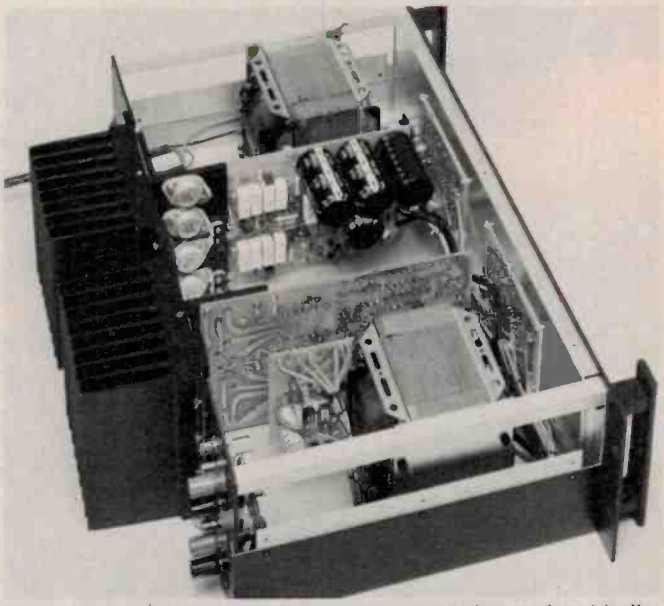


AP 3477

High power amp from Jaycar

Jaycar's model 3002 power amp gives 300 watts per channel into four ohms and is ruggedly designed for sound reinforcement applications.





It's a modified version of one of our own designs, the ETI-466 amp featured in last February's issue. One of these amps is used for each channel of the 3002, with a separate power supply for each to allow maximum power output with both channels driven and to minimise crosstalk.

Multiple protection circuits enable the 3002 to stand up to the abuses which any amp used "on the road" has to face sooner or later. Loadline protection allows the full power to be delivered into either four or eight ohm resistive and reactive loads and the amplifier will withstand almost any load condition, including short circuits at reduced power.

A relay network protects loudspeakers in case of faults in the amp, which are indicated by a LED on the front panel and there's an inbuilt turn-on delay to protect speakers against switching transients.

The twin, peak reading level meters are also an ETI design — they're the ETI 438 meters which first appeared in the December 1975 issue and are reprinted in our 'Test Gear' and '30 Audio Projects' books. These meters have a fast attack time of less than one millisecond to detect very short transients and a relatively slow release time of half a second for good indication of average levels.

The whole amplifier fits a standard 19 inch rack (430 mm) and is less than 133 mm high. Input connections are by RCA socket (two per channel paralleled to avoid looping to other amps) and speaker outputs are via heavy duty binding posts.

Visitors to the ETI stand at the recent Consumer Electronics Show in Sydney will have heard the Jaycar 3002 doing a splendid job of driving our demonstration Series 4000 speakers.

More information from Jaycar Pty Ltd at P.O. Box K39, Haymarket, NSW 2000. Phone (02) 264-6688.

You can't believe your ears !

Engineers at Rank Wharfedale's factory in the UK have conducted a series of tests showing that hi-fi systems can often outperform listeners' ears.

They deliberately 'clipped' the signals fed to loudspeakers and found that the extent to which listeners noticed the distortion depended on the kind of music that was playing. Disco music could be clipped as much as 5% of the time before people noticed anything was wrong. (At least one member of ETI's staff thinks disco would sound much better clipped down to zero 100% of the time, but that's another story!)

Classical music, especially piano, is much more sensitive. Listeners began to notice something was wrong even when clipping occurred less than one per cent of the time.

When the music was played loud, the results were even less encouraging for audiophiles. At high volume as much as 15% clipping on pop music and 5% on classical pieces passes unnoticed. This is because the human ear introduces its own distortion at these levels, which masks the clipping.

Similar results were obtained when Wharfedale's testers experimented with the subjective effects of speaker coloration. They mixed a controlled amount of synthetic coloration with a clean sound and found that the degree to which this was noticed also depended on the type of music.

With some pieces of music coloration was scarcely noticeable; on others it was glaringly obvious. And some people can tell the difference between a coloured and a flat response, but actually prefer the coloration!

Single-chip FM receiver

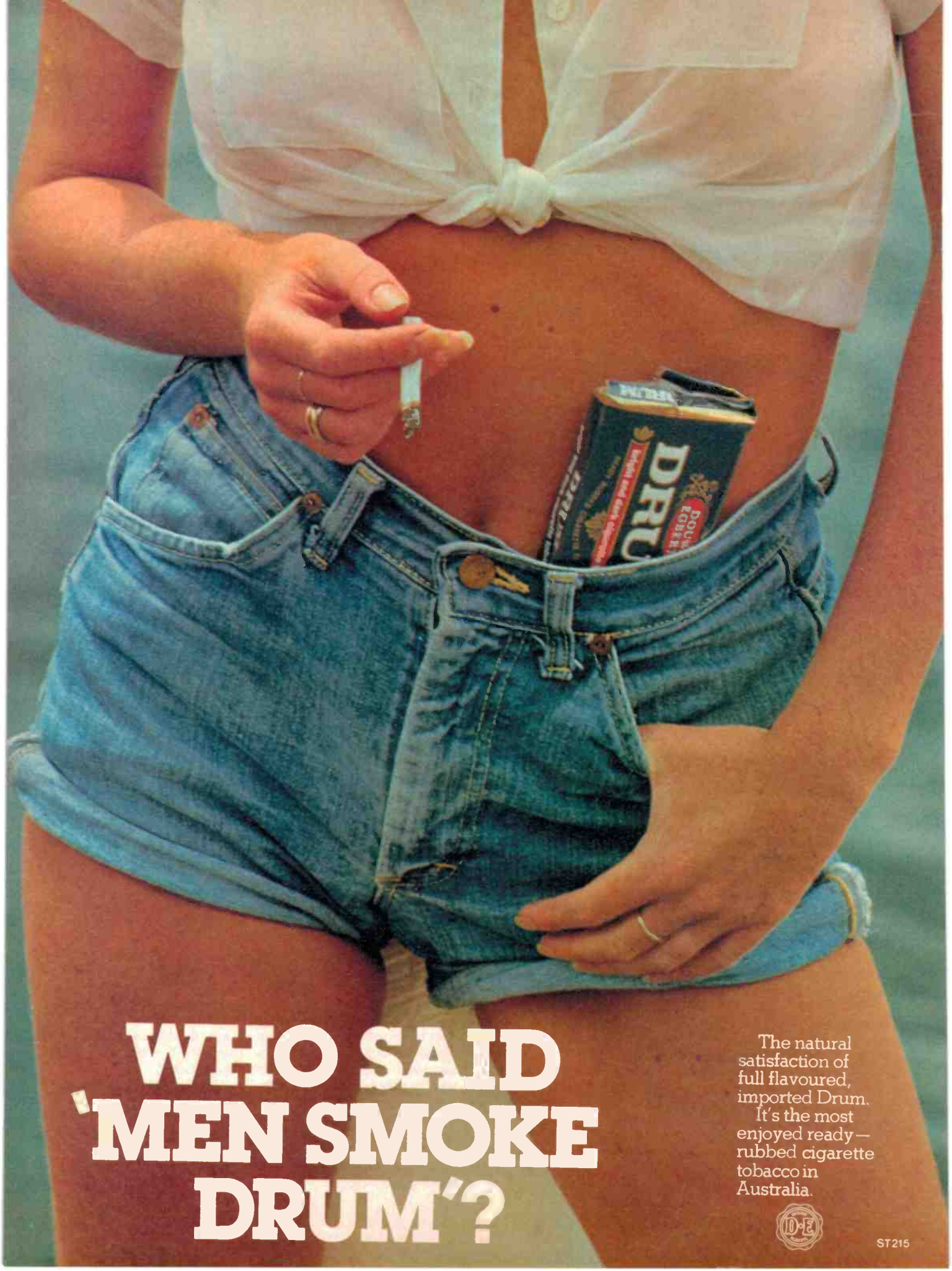
An experimental 3.5 mm square chip contains virtually all the components of a complete frequency modulated broadcast receiver.

Engineers at Philips Laboratories in Holland have achieved this remarkable miniaturisation by reducing the intermediate frequency from 10.7 MHz down to only 70 kHz. This means that the critically tuned L-C or ceramic filters usually used can be replaced by simple low-Q R-C networks which are much easier to incorporate into integrated circuits.

FM broadcast stations use a maximum of 75 kHz deviation which would lead to audio distortion in a normal receiver with a 70 kHz intermediate frequency. To avoid this, the Philips chip has frequency feedback circuitry which 'compresses' the modulation to +/− 15 kHz, resulting in virtually no harmonic distortion.

The chip also includes a new kind of muting system, which depends on the correlation between the IF signal and an inverted, delayed version of itself. These two signals should be identical if the receiver is properly tuned, in which case the correlation is high and the muting circuitry switches the demodulated audio signal to the audio output. When the receiver is detuned, the correlation between the two signals is small and the audio signal is suppressed.

The receiver uses standard bipolar technology and comprises about 280 circuit elements. Supply voltage range is 3 to 18 volts, with a current consumption of 9 milliamps at 6 volts.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The natural satisfaction of full flavoured, imported Drum.
It's the most enjoyed ready—rubbed cigarette tobacco in Australia.
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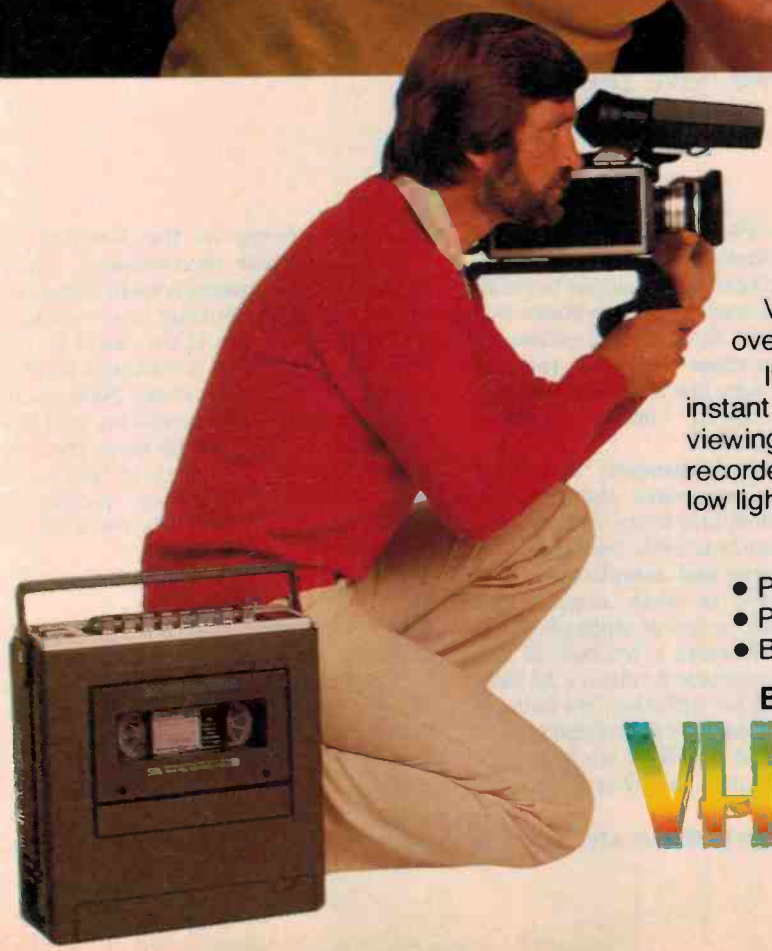

Remember how great she looked last summer.

National Colour Video Camera and Portable VHS lets you keep those moments and relive them over and over.

It's so simple. Point the camera, shoot . . . instant result. No processing is required with automatic viewing on TV, through your National Portable VHS recorder. Light to carry and will operate under low light conditions.

Other features include:

- Power zoom control
- Brilliant colour reproduction
- Pause control
- Electronic viewfinder
- Built-in microphone
- Low power consumption.

Because time doesn't stand still...

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Nakamichi 482 discrete head cassette recorder

"Impeccable . . . the best performance we have seen from any cassette deck to date."

WITH SO MUCH talk about digital techniques, one could be forgiven for thinking that conventional reel to reel and cassette tape recorders were about to be eclipsed. Actually, nothing could be further from the truth. Both of these tape recording systems are well established in their respective fields and will continue to be so for some time.

The cassette recorder, which now dominates the consumer market, has undergone remarkable technical development, particularly in the last five years, which has resulted in truly outstanding improvements in performance. They are now able to satisfy discriminating buyers who are looking for frequency linearity, wide dynamic range, acceptable wow and flutter and low distortion.

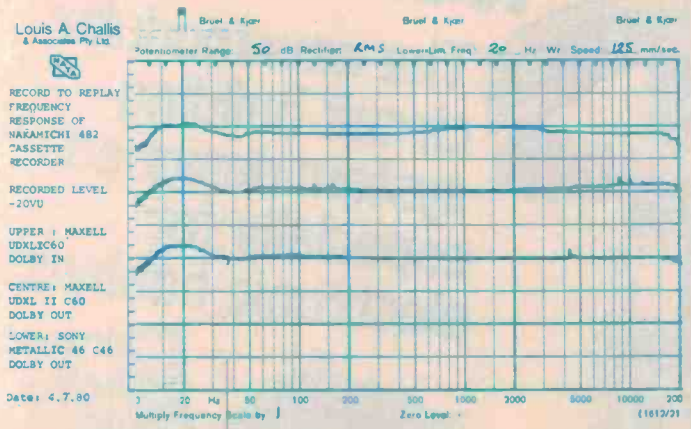
Five years ago few machines could do better than a 13 kHz bandwidth, very few had a significant output below 50 Hz and most produced distortion greater than 1% at −6 VU. The almost universal adoption of Dolby systems had achieved reasonable signal-to-noise ratios for the majority of machines but wow and flutter figures were generally so inferior to those of reel to reel recorders that very few serious amateurs really considered using cassette recorders at home.

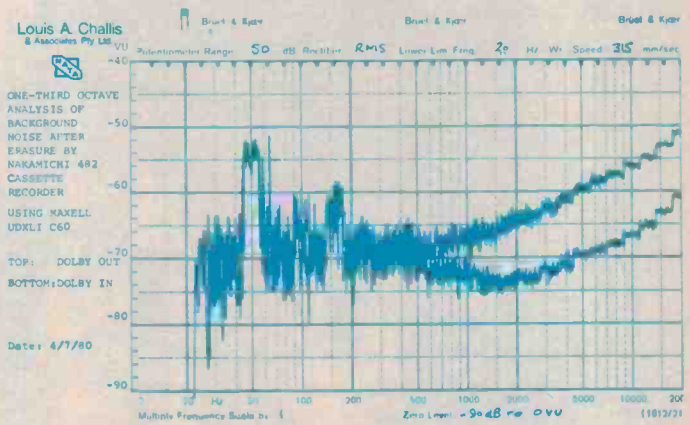
The original Nakamichi 1000 and 700 series of recorders changed the opinions of most amateurs (and quite a few professionals as well), but they were large, expensive and complicated. The Nakamichi 482 is much smaller, designed to stack on top of other pieces of equipment and costs a fraction of the price of its illustrious forebears. In fact, after allowing for inflation, we believe the real cost of today's 482 is about one-fifth the cost of the 1000 when it was first released, and the 482 is a superior machine.

Nakamichi's products are now regarded as being in the forefront of cassette recorder development. Their reputation has generally been enhanced by each new model they have released and the 482, which is the latest in the line, is no exception. It attains a level of performance which even Nakamichi will find it hard to improve on. At $599 the 482 costs about $200 more than its predecessor the 480, mainly because it incorporates three crystal permalloy heads (which are basically the same as those on the 582 model).

The unit close up

Externally the 482 looks very similar to the 480 series, with the same black brushed aluminium escutcheon and large pneumatically damped cassette well. (A satin-finish model is also available). On the right are a pair of peak reading VU meters covering the range from −40 dB to +7 dB, and beneath them are two slide recording level





attenuator controls. While these two controls look good, we were critical of their ergonomic design in the 480 series and are still critical of them in the 482.

There are three interlocked push-buttons for selecting EX, SX, and ZX tapes, which is shorthand for low noise gammaferric oxide tapes (EX), chromium dioxide or chromium equivalent tapes (SX) and metal alloy tape (ZX). An equalisation switch selects equalisation time constants of 70 or 120 microseconds. At the rear are two pairs of coaxial sockets for input and output and a 5 pin DIN type socket for connecting a remote control unit.

The most prominent feature inside the machine is a large and beautifully fabricated printed circuit board installed in an inverted position. All the components are on the underside of the board so that when the cover is removed one finds oneself face to face with the circuit designations and probe points, which is just the kind of layout that service engineers need for trouble-shooting.

We removed the bottom to look at the components and found that they told us only a little more about the unit than the printed circuit board did with components on the top. Dolby circuitry is in the form of parallel dual in line ICs for the encoding and decoding circuits. A double Dolby facility allows Dolbyized material to be directly monitored through the decoding Dolby circuitry while it is being recorded. Nakamichi have gone to a lot of trouble to select their chips so that the encoding and decoding characteristics are very closely matched, avoiding thereby some problems that other manufacturers have experienced because of imprecise matching of randomly selected chips.

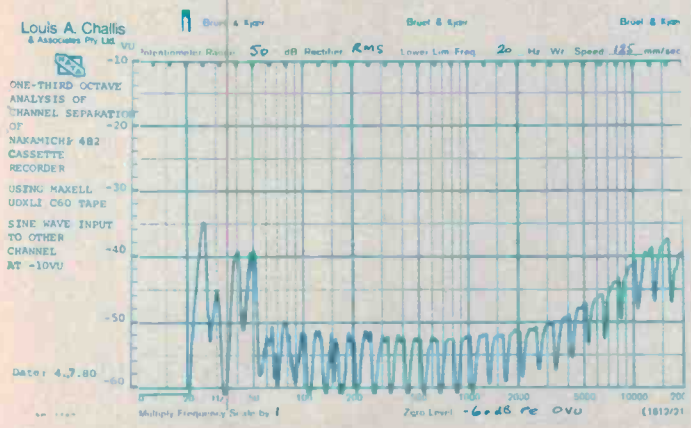
The integrated circuits are mounted in sockets to simplify installation and replacement. Like other Japanese manufacturers, Nakamichi try hard to avoid unnecessary wiring operations, so the majority of connections on this board are direct to ancillary circuitry. The board incorporates one plug-in socket and most other terminations are made by wire wrapped connections for harnesses leading to the motor drive, recording heads and front panel switches.

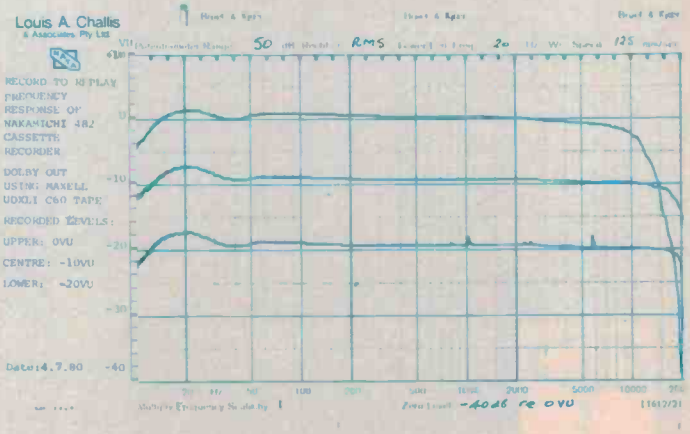
The cassette drive mechanism appears to be the same as that previously seen in the 480 version and features solid plastic mouldings combined with aluminium plates to achieve what appears to be an extremely rugged and stable drive mechanism, which is obviously stronger than the previous generation of drives.

On test

The first area where this deck outperforms its predecessors is the replay frequency response. Here it gives the best performance we have seen from any cassette deck to date. On the Maxell UDXL-1 the response is better than 10 Hz to 20 kHz, on TDK SA it is every bit as good and even flatter and on TDK MA-R60 it is 10 Hz to 14.5 kHz and only 6 dB down at 20 kHz. The flatness of these responses equals that of many high quality reel to reel recorders.

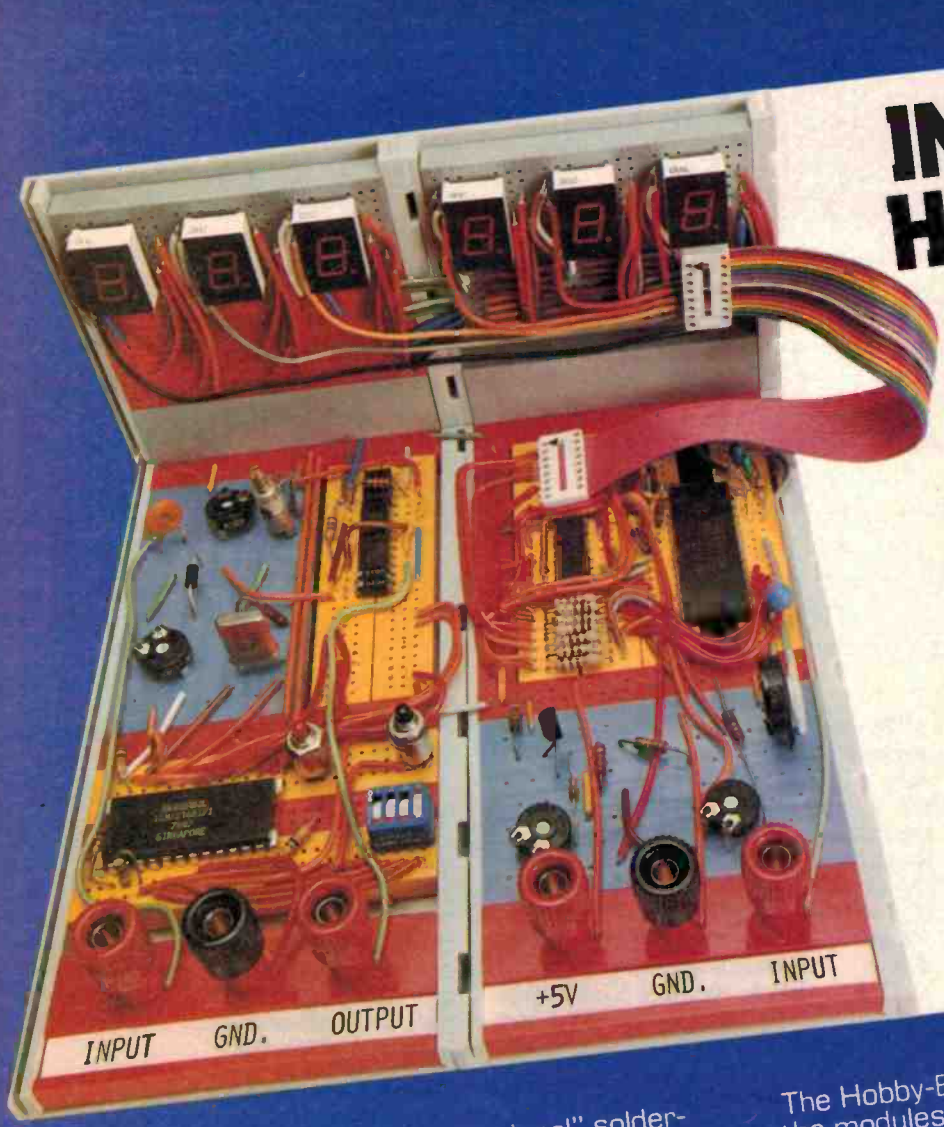
— turn to p.116 ▶

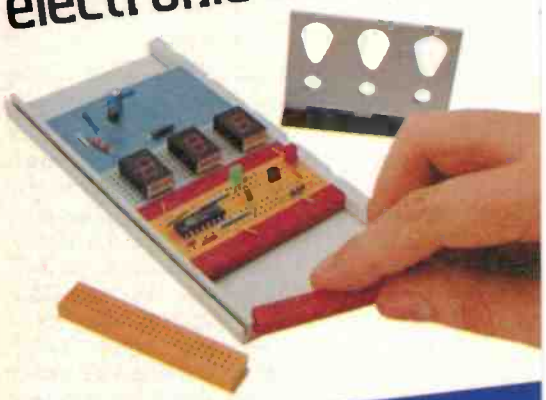




INTRODUCING HOBBY-BLOX™

The new modular circuit building system designed especially for electronic hobbyists.





Until now, you had to buy "professional" solderless breadboards for your projects and pay "professional" prices. Now there's Hobby-Blox, a totally new circuit-building system that's not only economically priced but offers many more advantages to the hobbyist.

At the core of the system are two expandable starter packs, one for discrete component projects, the other for integrated circuit projects. Each comes with a number of Hobby-Blox modules that fit into a tray and an illustrated project booklet. In addition, the system includes 14 separate component packs you can purchase individually — terminal, distribution and bus strips, speaker panels, binding posts, etc.

The Hobby-Blox system is easy to use because the modules are color-keyed and letter/number indexed. It's time-saving, because they're solderless. It's compatible with DIP's of all sizes and a wide variety of discrete components. And you save money, because the parts can be reused again and again.

How far can you go with the Hobby-Blox system? Take a look at the example above. Then you'll know why we say, "your only limit is your own imagination!"

Patents Pending
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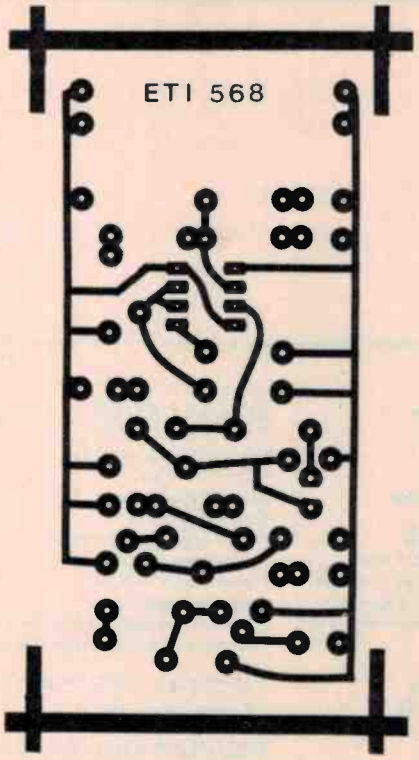
A P PRODUCTS INCORPORATED
1359 West Jackson Street
Painesville, Ohio 44077
(216) 354-2101

For a free catalog, contact your local HOBBY-BLOX™ dealer:

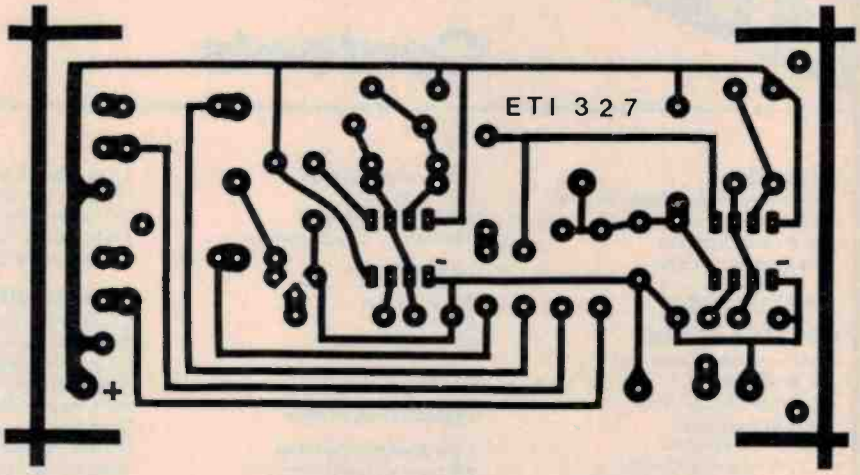
N.E.T. PTY. LTD.
92 Woodfield Boulevard
Caringbah, N.S.W. 2229
TEL: 525-6090

RIFA PTY. LTD.
P.O. Box 485
Cross House, 2 Cross Street
Hurstville, N.S.W. 2220
TEL: 570-8122

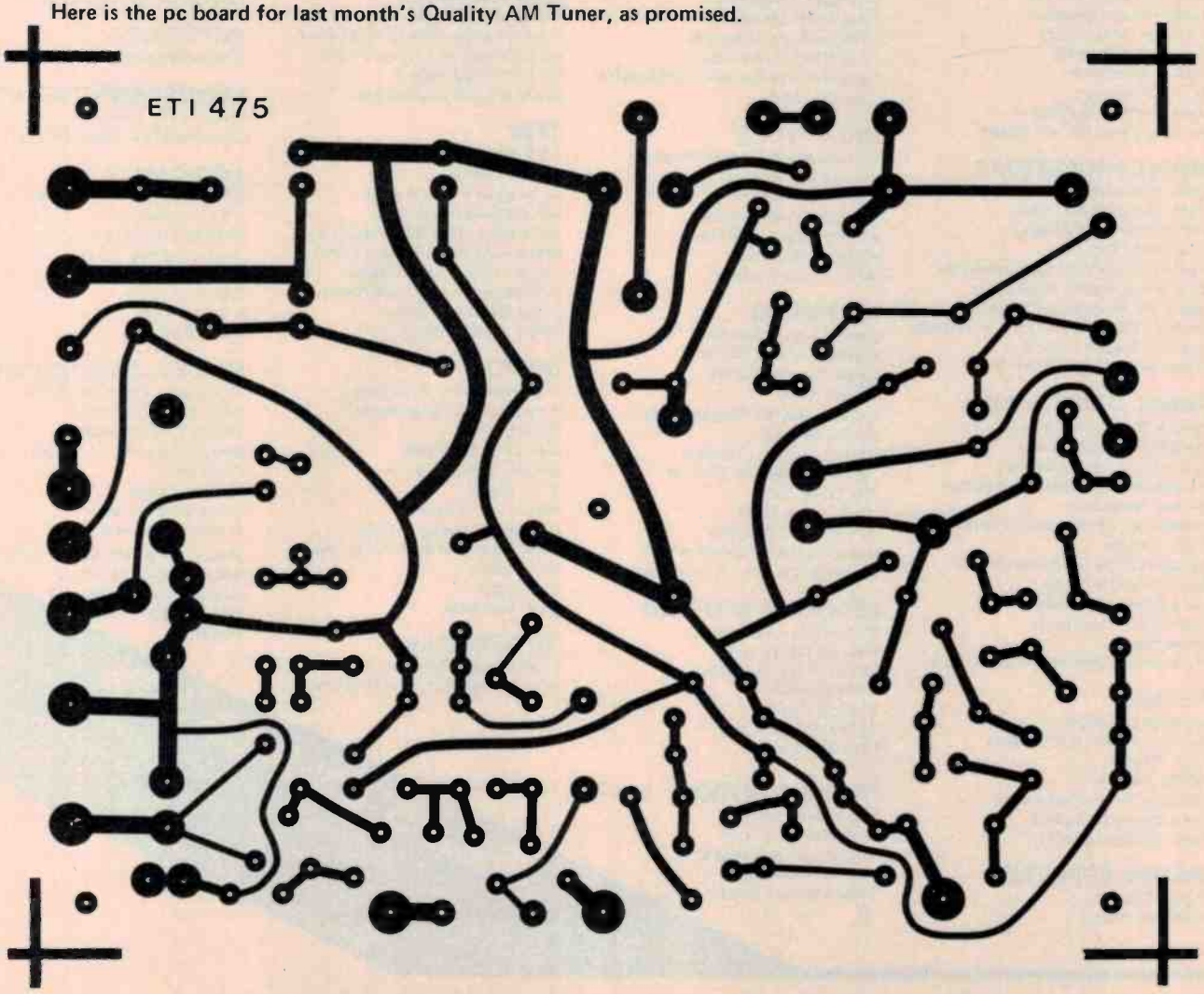
RIFA PTY. LTD.
P.O. Box 95
202 Bell Street
Preston, Victoria 3072
TEL: (03) 480-1211



Instructions on how to make your own pc boards using the Scotchcal method and exposing through this page may be found on page 113 of the March '80 issue.



Here is the pc board for last month's Quality AM Tuner, as promised.



Number Two ETI CIRCUITS

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AC Amplifire, Simple
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Recording Pickup
Direct Coupled Power
CMOS Power Booster
Photocell Amplifiers
12 Volt PA System
Class A Amplifier
Clipper Preamp
Headphone Amplifier
Op-Amp Circuits, Standard

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Track and Hold, Simple
ADSR Envelope Shaper
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Frequency to Voltage Converter
Frequency Meter, Analogue
Digital to Analogue Convertor
Schmitt Trigger, Without Hysteresis
Schmitt Trigger, Simple
Pulse Lengthener, Optical

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Square Wave Generator
Monostable Multivibrator
Triangular Waveform Generator
Marker Generator
Voltage and Frequency Calibrator
VCO, Simple
Voltage Controlled Oscillator
Sine Wave Oscillator
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Thermistor Oscillator
Theremin
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Schmitt, 555

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Logic Touch Switch
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Audio Switch
Touch Switch, Thermo
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OR Gate, SCR
AND Gate, SCR
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– from page 111.

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF NAKAMICHI 482

SERIAL NO. A114 04415

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Dolby	Lower -3dB Point	Max Point and Frequency	Upper -3dB Point
Maxell UDXLI C60	OUT	10Hz	+ 2dB @ 20Hz	>20kHz
Maxell UDXLI C60	IN	12Hz	± 0.5dB @ 21Hz	20kHz
Maxell UDXLII C60	OUT	<10Hz	+ 2dB @ 20Hz	>20kHz
Sony Metallic 46	OUT	<10Hz	+ 2dB @ 20Hz	20kHz

SPEED ACCURACY: 0.1%

WOW AND FLUTTER:

WOW: Average 0.1% P-P

FLUTTER: Uweighted 0.13% RMS

Weighted 0.06% RMS

HARMONIC DISTORTION:

Tape: Maxell UDXLI C60

		100Hz	1kHz	6.3kHz
OVU:	2nd	-	-	-
	3rd	-56.7dB	-42.9kB	-34.1
	4th	-	-	-
	5th	-56.1dB	-56.5dB	-
	THD	0.21%	0.73%	1.97%
-6VU	2nd	-	-	-
	3rd	-53.8dB	-58dB	-43.7dB
	4th	-	-	-
	5th	-	-	-
	THD	0.20%	0.13%	0.65%

MAXIMUM INPUT LEVEL:

(for 3% third harmonic distortion at 1kHz)

Tape: Maxell UDXLI C60 +6VU

DYNAMIC RANGE:

Tape: Maxell UDXLI C60

Dolby Out	51dB(lin)	55.5dB(A)
Dolby In	58dB(lin)	64.5db(A)

ERASURE RATIO:

(for 1kHz signal recorded at +6VU: 3% third harmonic distortion)

Tape: Maxell UDXLI C60 >83dB

A TOTAL DEPARTURE

CHADWICK EXECUTIVE MONITOR ME 12

SPECIFICATION

ENCLOSURE	Bass reflex.
FREQUENCY RES	25Hz – 22kHz.
IMPEDANCE	8 ohms.
SENSITIVITY	91 dB.
POWER RATING	120 Watts RMS.
CROSSOVER	480Hz, 3.5kHz, 10kHz.
DIMENSIONS	816 x 400 x 430 mm.
WEIGHT	35 kg.

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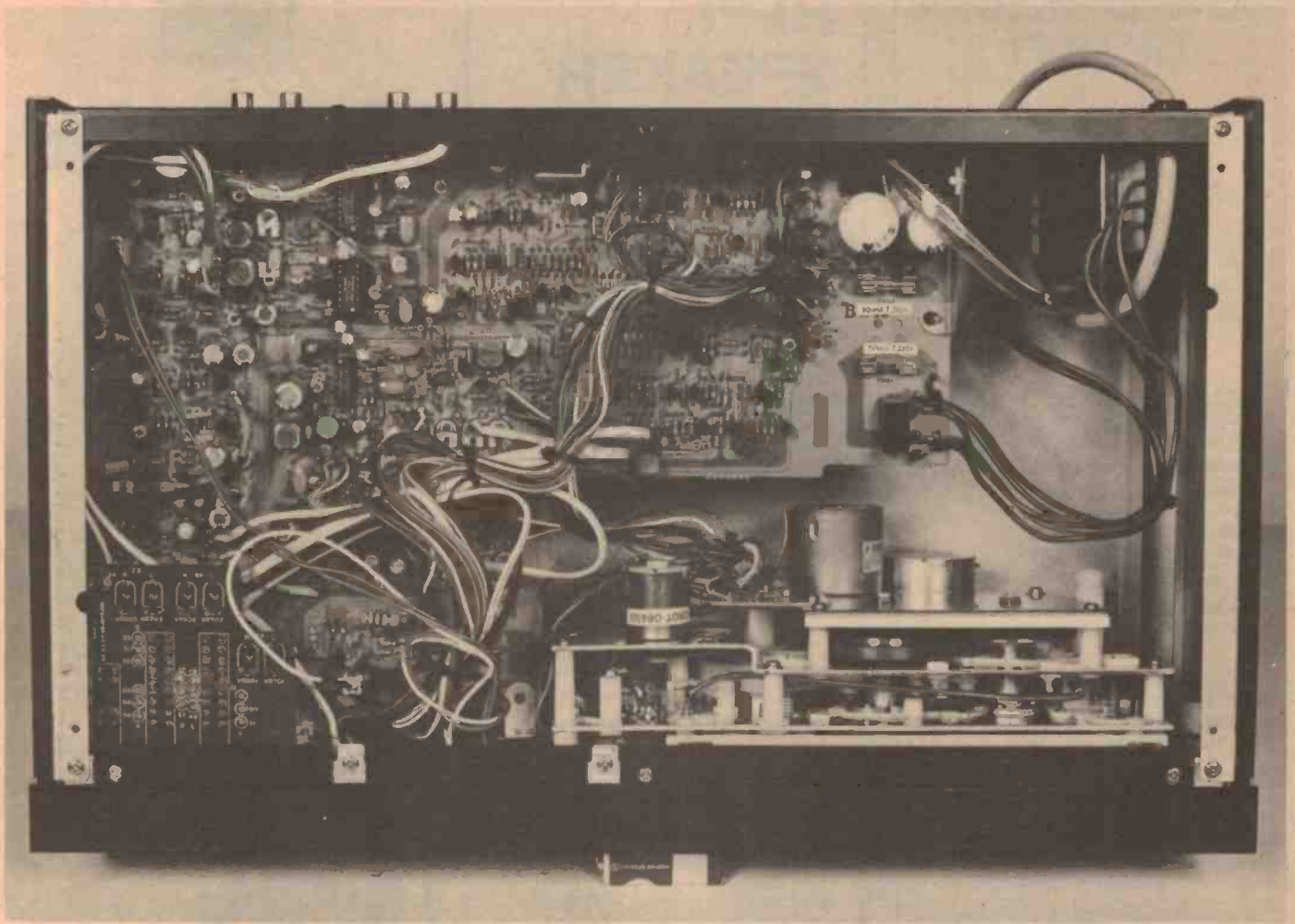

If the replay response is impressive, the record to replay response is even more so. On Maxell UDXL-1, Maxell UDXL-2 and Sony metallic tape the response extends well beyond the normal specification limits of 10 Hz to 20 kHz, with a flatness of response which is truly exemplary. Anybody who would complain about this frequency response (or ask for more) needs his head examined. Having said this, we still don't doubt that Nakamichi themselves are working right now on refinements to improve this performance!

The noise figures are likewise impeccable. With the Dolby in, the dynamic range is 58 dB unweighted and 64.5 dB A-weighted; without Dolby, the figures are 51 dB unweighted and 55 dB A-weighted. The distortion figures are in many respects even more impressive with total harmonic distortions of 0.21% at 100 Hz, 0.73% at 1 kHz and 2% at 6.3 kHz at 0VU. At −6VU these figures have dropped to 0.2%, 0.13% and 0.65% respectively.

Wow and flutter performance is particularly good for a cassette recorder, although it is slightly inferior to that of the model 480. The erasure ratio is also slightly down, being 83 dB, compared to the 94 dB achieved by the 480. The channel separation is also not quite as good, but is nonetheless fully acceptable or consumer use.

Our subjective evaluation of this machine was also particularly pleasing. We used a number of prerecorded cassettes, including metal alloy tapes brought back from Japan, as well as other demonstration tapes. While they were all good, none of them developed all the performance that this machine can provide. The record to replay performance was outstanding and the very low distortion, coupled with the low wow and flutter made it particularly difficult to detect the difference between source and tape in an A-B test.

Conclusion

The Nakamichi 482 outshines the 480 in a number of important areas, justifying the $200 price differential. The 482 is an outstanding machine and we would confidently recommend it to anybody who wants above average performance and an unsurpassed frequency linearity. ▶

NAKAMICHI 482 DISCRETE THREE-HEAD STEREO CASSETTE RECORDER

Dimensions: 450 mm wide x 135 mm high x 289 mm deep.
Weight: 6.4 kg *Serial No: A114*
Price: $599 rrp
Manufactured by Nakamichi Corporation, Tokyo, Japan.

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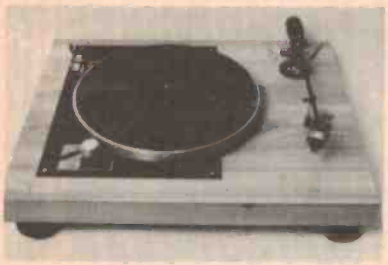
ATTENTION CONNOISSEURS OF HI-FI



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The Woodland Audio Turntable Base is available in three tasteful veneered finishes either direct from the manufacturer or in Brisbane from Stereo Supplies, Roma STreet, City.

Pictured above is the Woodland Audio Turntable Base with the Connoisseur BD1 Kit, Grace G707 Tonearm, EEI MC 555 Moving Coil Cartridge and Micro Shock Absorbing Feet.

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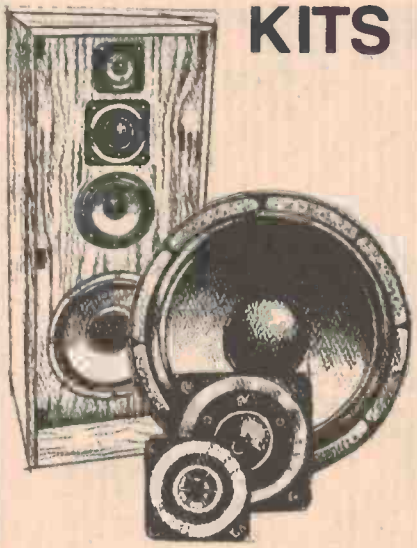

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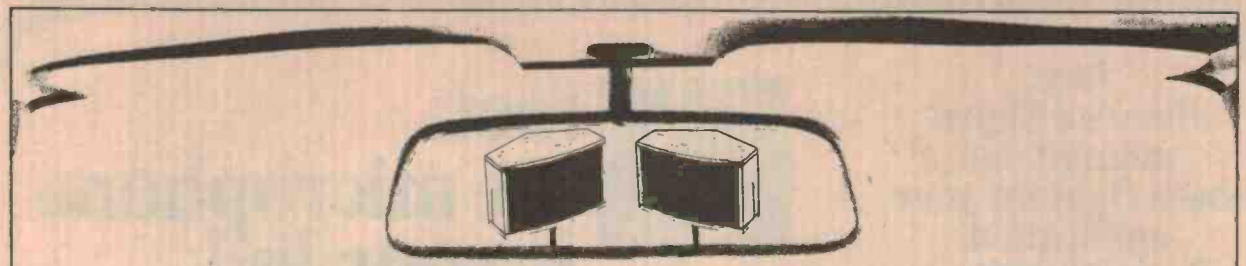
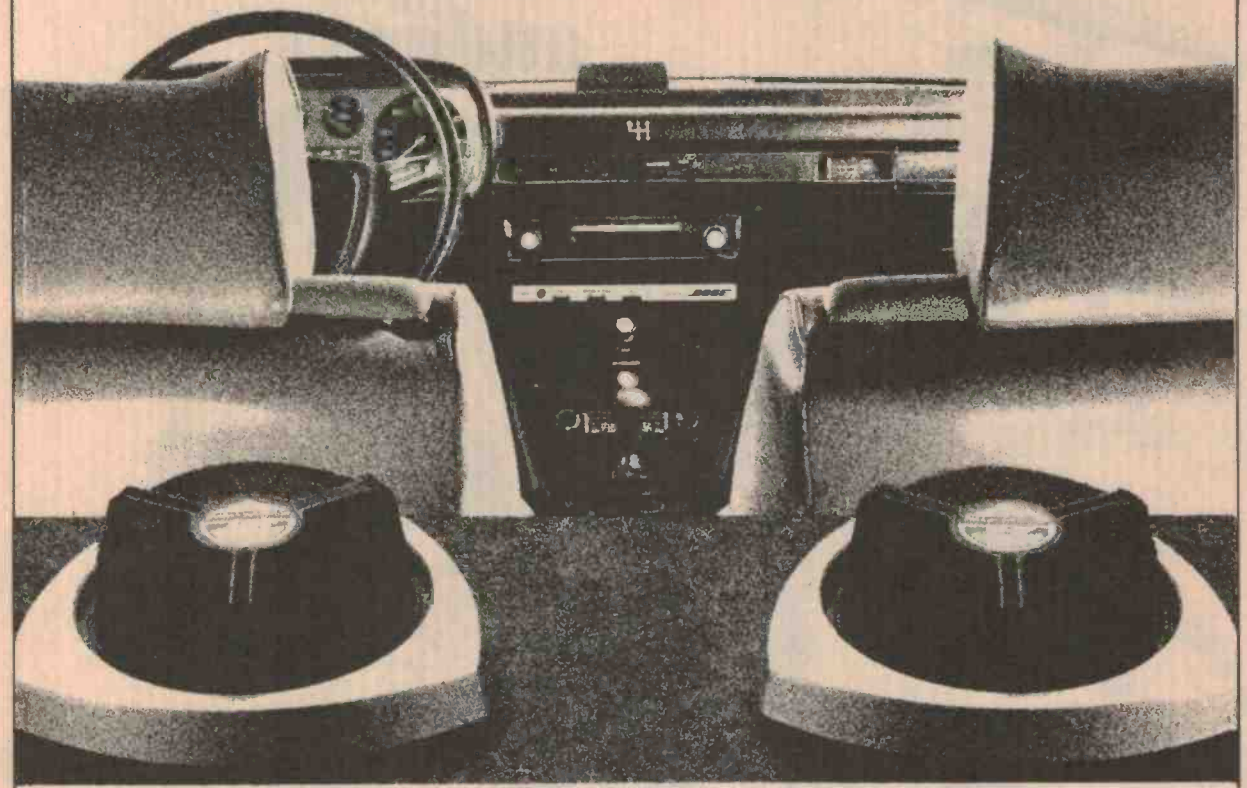


You can't take your home stereo with you in the car, but now you can take its sound.



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Bose introduces the Model 1401™ Direct/Reflecting® car stereo.

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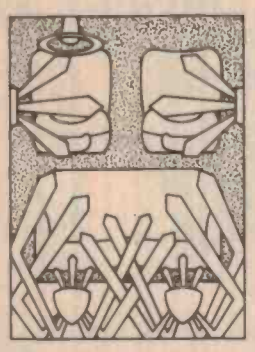

And two accessory speakers can be mounted in the doors to bring even greater dimension and fullness. And all speakers are full-range speakers based on the famous Bose 901® system.

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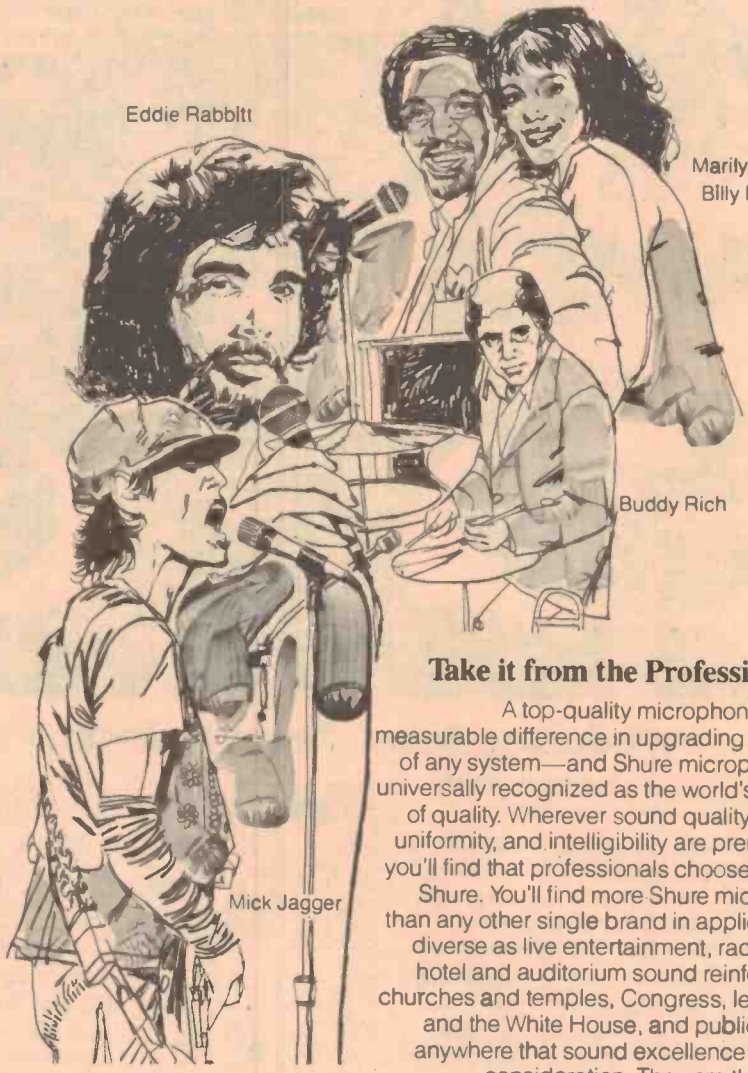
fact: the microphone is your link with your audience



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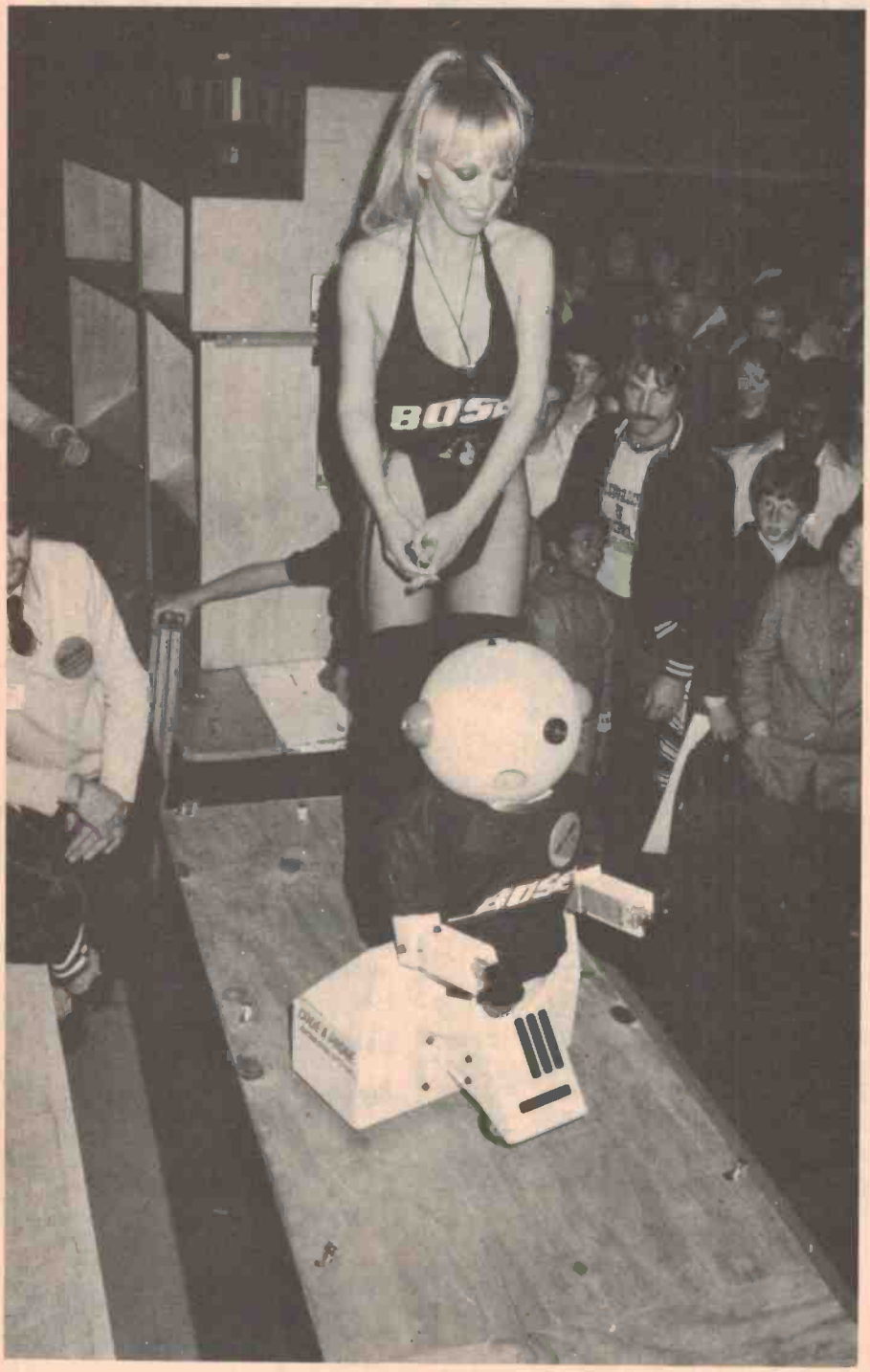
AHEARN EL 35

Consumer electronics shows — a tale of two cities

East-West rivalry contributed not a little to the success of this year's Perth and Sydney electronics shows.

Dennis Lingane



A small robot steals the limelight from the Bose disco dancer at Sydney's show.

THE Perth Electronics Show is now firmly established, but its success has not been well received by big brother in Sydney.

The national body that stages the Sydney Consumer Electronics Show gave the Perth industry committee an ultimatum this year — "Change your name or we will organise an industry boycott". Since the members of the Perth committee are only the State minions of the Sydney bosses they were not in a very good position to refuse.

To get the show on they had to accept the ultimatum of the Easterners and change the name to the Perth Electronics Show, dropping the previous Consumer Electronics title.

Why is the national committee so uptight about the Perth show? Because they are afraid, it would appear, that Perth may take the national show away from Sydney.

Last year when Perth staged its electronics show for the first time it pulled an attendance of over 20 000, even though it had been pre-empted three weeks earlier by a very large and successful hi-fi show run by the local hi-fi tycoon Hal Wallis and a number of manufacturers.

At that time, the Sydney national committee had tried to stop the Perth organisers calling their show the Consumer Electronics Show, but couldn't, because the name hadn't been registered in Perth by the national body. When they tried to register it they found the WA Hi-Fi Industries Association had jumped in ahead of them.

However, they weren't really worried because it was generally believed that the Perth show would be a second-rate affair. They were in for a shock, because interstate representatives who attended the Perth show came back wide-eyed!

Sydney's 1979 C.E.S. put through little more than 20 000. Perth, with a quarter of the population, put through the same number of people in four days as Sydney did in seven. The venue, the Perth Entertainment Centre, is top quality and was bathed in stage light-

ing with theatrical effects throughout the show.

Members of the national association must have begun to realise that a well organised show in the right venue in Perth could be more attractive than Sydney to the national retailers who are the main target for the national show. Apathetic dealers who can't be bothered to attend the Sydney show might be more interested in flying to Perth with their wives for a tax-deductible holiday.

Products shipped from Japan could be off-loaded at the Fremantle docks, where dockers are far less inclined to strike than their Sydney brothers. And a "suitable venue" might just be the arrival and departure terminals at the Fremantle Harbour, which is a massive two-floor barn type building stretching for hundreds of metres. This would mean the industry could off-load from the ships straight into the terminal.

So the pressure was really on the organisers of the Sydney show to produce the goods in 1980 — or else!

The national body followed the Perth lead and allowed electrical appliances and white goods into this year's show, doubled the advertising budget to $80 000, booked four pavilions in the Sydney showgrounds, crossed their fingers and prayed.

The result was a terrific success story. Over 50 000 people attended the show, and for the first time it had plenty of exposure on the TV news, radio news and newspapers, thanks to major attractions like a swag of robots, and a first-class PR company.

With a sense of relief the national committee met after the show and elected the same committee stalwarts to run the industry and the show again for 1981.

Sydney highlights

While the Perth show is consumer oriented, the Sydney show is mainly for the trade with the public being allowed in to help pay for the cost of running it. But although the signing of order books may be the main criterion for the success or failure of the Sydney show it is in fact only one of the benefits it offers the industry.

The comradeship, fun, involvement, camaraderie, brotherhood and everything else the show creates amongst the manufacturers, wholesalers and retailers, are a priceless investment.

With characteristic one-up-manship, John McTavish from Bose stole most of the limelight by offering a free T-shirt to anyone putting it on and wearing it around the show. Thousands were given away and everyone seeing the Bose T-shirt asked "Where do you get it?". One girl even stripped off on the stand to don ▶

Model, Linda Ferguson gazes admiringly at Marantz's two-speed cassette decks.

Penthouse Pet Tracey Wallace demonstrating the Bose car stereo at Sydney's show.

LIGHTING FOR ENTERTAINMENT

BULLET BEAM

The Bullet Beam uses the seal beam, cool running Par 36 Ultra narrow spot lamp. It is particularly effective for display purposes, club and restaurant high lighting, and also illuminating Mirror Balls.

- Ideal for mobile disco.
- Positive location for colour frames and colour wheels.
- Available in colour of your choice.

SPECIAL

BULLET BEAMS — ONLY $40.00 EACH
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With Par 36-4416 lamp. Gives out rectangle shape — great for dance floors.
(Offer to 30/11/80 only)

MIRROR BALLS

Large range of shapes and sizes.
16" (40cm)
24" (60cm)
36" (90cm)
16 x 24" (40 x 60cm)
Motor Drives are also available.

MIRROR MAGIC

SATURN 4

The Starchaser Controller is designed to control Snakelights and other lamps. It is a four channel unit using the latest in electronic technology to provide low cost, high quality performance.
The Snakelights plug straight into the rear panel via a flexible lead to socket.
Auto Chase is adjusted by the speed control from one change per 7 seconds, to 30 per second. By switching to Audio Level and again varying the Speed Control a wide range of effects can be achieved such as pumping, whizzing, bouncing and auto reversing sound to light sequencing can be achieved. During music breaks it will "pause-hold" on the last channel the music was picked up. Pattern indication is given by four easy to see large indicators.

PAR 56 SCANNER

- All steel construction.
- Built in colour frame (never needs replacing).
- All black wrinkle finish, or colour of your choice (red, blue, purple, etc.).
- Fully portable.
- Par 56 300W lamps.

Powerful beam scanning across the dance floor. Best effect can be obtained by connecting this fitting to a Lighting Controller in order to achieve a pulsating rhythm etc.
Ideal for mobile discos, bands, clubs etc.

THE QUAD LIGHT

The Quad Light is a versatile lighting fixture accepting 4 spot lamps (each 75 or 100 watts), and can incorporate an adjustable bracket.
The Unit is of rugged steel construction with a durable wrinkle finish. (Colours again available).
The Quad Light can be used free-standing or wall or ceiling mounted and the integral swivel bracket gives precise positioning of the lighting. This fitting is an effective, low cost lighting unit, suitable for many applications. When four different coloured globes are used, unusual multi-coloured shadows are produced. This is particularly effective for display lighting.
For Discolighting, the Quad Light is the ideal unit to use, especially with a sound to light controller.
Also available — Tri Light, Duo Light and Uni Light.

PAR 56

- All steel construction.
- Par 56 300W lamps.
- Barn Door if required.
- Colour Wheel.
- All black wrinkle finish (or colours).
- Ideal for mobile disco, bands, clubs etc.
- Built in Colour Frame (never needs replacing).

ACCESSORIES

- Roscolene, Supergel, Lee Filters.
- Cables, plugs, stands.
- Lamps, — Philips, Osram, Tungsram.
- SA Dealer of Nashua Gaffa Tape.

To be released soon — PAR 64's.

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THE PROFESSIONAL LIGHTING EQUIPMENT

The robots fascinated kids and adults alike . . . er, the small one in the clearing is the robot.

Marantz made sure they couldn't be missed. This structure was great with the kids — as a slide !

her shirt and brought the whole pavilion to a standstill!

Blondie the disco dancer achieved a magic double act with Huggy the US robot who became a star of the show. Les Black, the chairman of the show committee, still talks about the morning when the half-metre dictator rolled out of the Boulevard Hotel lift in Sydney's William Street, went straight up to the bell captain and said: "Would you please call me a taxi"!

Nightly, the exhausted executives went on the town and the Bourbon and Beefsteak Restaurant, Rogues Nightclub and many other night spots became the scene for industry interchange and show anecdotes.

Like the man who rolled a wad of bills out of his pocket and tried to buy the ETI series 4000 four-way loudspeakers right off their stand because "they were the best things he'd heard anywhere"!

Another moment of excitement for ETI was the kidnapping of its R1D1 robot, who disappeared overnight and was later found lurking amongst the rubbish cans behind one of the show's fast food stands.

The West strikes back

Once the formalities of the Sydney show were over, all eyes turned to Perth, where Leo Overington, who heads the committee, has almost single-handedly pulled the show through its various crises.

Would he be able to match the Sydney attendance? Not possible, said everyone. There was no chance that in only four days the Perth show could even approach the 50 000 attendance of the seven day Sydney effort.

By lunchtime on the Saturday (30 August), with the afternoon and evening, plus all of Sunday to go, Perth passed its 1979 figure. The atmosphere in the massive Perth Entertainment Centre, which housed the show on two floors, was electric.

Penthouse Pet, Tracey Wallace, flown over by John McTavish as part of his Bose circus, had sold out of Penthouse magazines and the crowds queued to sign a petition to elect her as Penthouse Pet of the Year.

Overhead, a laser show went through its 'Star Wars' act every hour on the hour. The Atari electronic games stand, manned by W.A. Futuretronics rep Jeff Krasnostein, collapsed three times under the pressure of the hundreds of kids and adults.

Bob Purvis established a recording studio where children were allowed to sit at a professional 24-channel desk and mix down musical instruments off an 8-track tape. Bob was demonstrating harmonisers and voice pitch control gadgets so energetically that even his well-trained tonsils gave out.

Lowry and Technics fought out an electronic organ battle only yards from each other, and mesmerised members of the public sat for hours in the W.A. Astronautical Society exhibition watching movies on the NASA and European space research programmes.

After Saturday lunchtime the attendance figures were kept deadly secret and a sweepstake was organised. Through the noise and the excitement the question kept being asked: "What do you think the number is now?"

The final figure of 40 000, announced at the after-show party, brought the house down. "That will shove it up those ▶

Aiwa's extraordinary slide-out turntable from their minis.

Pioneer launched their 'domestic' video disc player at the Sydney show.

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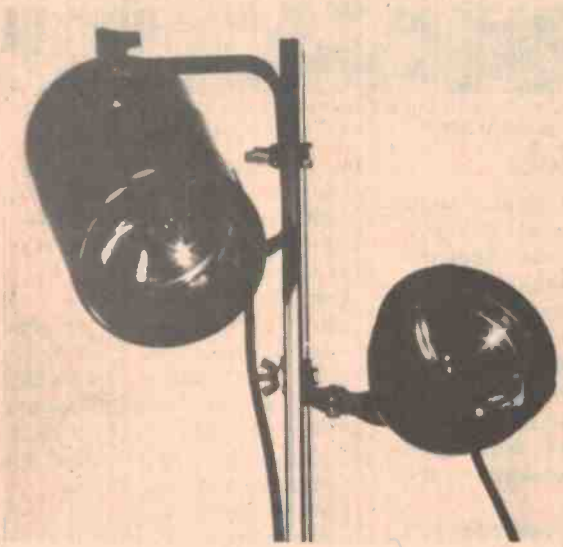
The great Hotspot and Solo sale!



We are overstocked on Par 36 Pencil Beams. The incredible pinbeam spots used in discos, clubs, by bands — for rainlite curtains, mirrorballs — effects — everything. So buy now at the old prices.

HOTSPOTS: Complete pencil beam lantern to accept the PAR 36 display lamp 25w, 5.5V.

RRP only $49.00 (This time last year Hotspots sold at $56.00, so you are saving even more).

SOLO'S: PAR 36 lamp housing without transformer — great where huge numbers of PAR 36 lamps are needed for giant effects. Complete with colour filter clip.

RRP only $19.99 (Last year — $25.00 — save).

PAR 36 DISPLAY LAMPS: The long life PAR 36 lamp — 5.5V, 25w.

RRP only $9.70 (Last year $12.00).

OTHER PAR 36 PRODUCTS AVAILABLE

RAINLIGHT: The high powered version, 50w, 12V Quartz lamp.
SPACEBEACONS: 4, 8 or 16 rotating PAR 36 lamps.
SPINNERS AND SCANNERS: Single rotating or scanning PAR 36 lamp.

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The ultimate multiple controller for installations or mobile work.

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- audio chaser
- colour organ
- auto dimmer

The Colourgram 4 is a selectable controller offering either dimmer or effect functions with dimmable background levels. The Colourgram 4 will handle inductive loads like Hotspots and Rainlights without problems up to 20 amps max. load.

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- 4 preset switchdesk with flash buttons and chaser
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The KLH analogue bass control unit attracted some attention.

The Porta-printer II data terminal — a new product this year.

b . . . s in the East." was the jubilant reaction.

But the animosity that now exists between the two shows should never have happened, and can be directly attributed to the pressure the Sydney people brought on the W.A. show.

Seriously

But seriously folks, industry politics and show antics apart, what did this year's Sydney CES have to offer?

Pioneer and Philips both showed their video disc systems and the hot rumour now is that we will see the launch of the PAL video disc system before the end of 1981. Philips is due to complete a factory in Belgium this year and will start making the players by the beginning of 1981. Meanwhile a software factory is due to be completed in the UK by the beginning of 1981 and will be in production by mid-1981.

Philip's Ron Ward says that his company has now developed a new video disc software production system using a photographic technique which will reduce the complexity and expense of manufacturing the discs. Pioneer's Les Black says that as soon as PAL software is available in Australia he will launch the Pioneer video disc here. Meanwhile, the two companies appear to be manoeuvring for the kudos of being "first off the rank in Australia".

Philips also showed their eight hour flip-over video system which won't be released until the end of this year. However, Grundig, who are their partners in this venture have already started shipping in stocks and there appears little doubt that Australia is once more to become a three-format market.

Not that it is important now. With the video disc about to be launched the software is going to become less important in the video cassette market and the only point of interest will be the recording ability of the cassette.

On the hi-fi side there were no takers for the Thorens $13,000 turntable, but plenty of interest in the unique new Aiwa slide-out turntable. Ian Woodehouse of Aiwa says that the orders he received at the show are treble the initial order he placed with Japan. "People have freaked out over the new turntable," he says. "It's different, and at $430 is priced right."

Aiwa and several other companies increased their mini hi-fi range and are still expecting this market to do well in coming years as Australians switch from "big is beautiful" to "small is nicer" because it takes up less room.

Sansui's colour display 'fading' sound system created a lot of interest. Instead of switching from phono to tuner, to tape, you fade from one to the other and at the half way stage can actually run both inputs together. A colourful screen ▶

Philips' remarkable eight hour flip-over video cassette recorder.

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Frequency Response — 20-20,000Hz plus or minus 3.5dB.
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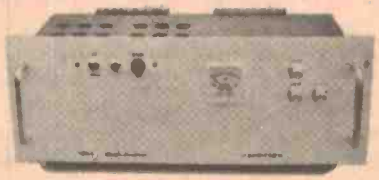

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the Australian magazine dedicated to the art and craft of sound

Sonics is a magazine for everyone who has an interest or involvement in music or musical electronics. Published quarterly, in March, June, September and December, each issue contains features, equipment reviews, constructional projects, distributor and brand indexes and much, much more.

Sonics October 1980 line-up:
FEATURE — Fairlight C.M.I: Australian digital synthesis goes world-wide
RIGS — Country music with Bose under the 'Big Top'
SOUNDPROOF — Paradise Studio: prime facilities in a lavish atmosphere
PROFILE — Ian Moss, Cold Chisel's guitarist
HARDWARE — Teac's 144 Portastudio and Crown's PSA-2 amplifier
SHOP — Billy Hyde Drum Clinic
SHINE ON — Latest products and news in the lighting game
LEFTY CLEF — The saga begins...
PLUS — extra features, a B.I.Y. project, and all the news, views and happenings in electric music and musical electronics. Rendezvous with Sonics in October.

Also available..... Sonics 1980 Yearbook is Australia's first comprehensive directory of electronic musical equipment, featuring articles on keyboards, guitars and pick-ups, amplifiers, speaker systems and microphones. The Yearbook is still available from most newsagents, or direct from Sonics, 4th Floor, 15 Boundary St, Rushcutters Bay, NSW 2011 — Price $4.35 plus 75 cents post and packaging.

AR's High Tech speakers attracted a lot of attention at Perth.

Philips' laser video disc player.

changes colours as the inputs change.

Yamaha showed their PX2 turntable, and the new T7 tuner. Both the turntable and tuner are lower-priced versions of the expensive prototypes shown last year. The T7 tuner replaces the T1, with better specs and a lower price and the PX2 is only $1000 compared to the PX1 price of $6000.

Pioneer launched 35 new products including two tuner systems for the launch of FM commercial radio, and a new digital display, electronic-tune car radio cassette unit. Their new car music director speakers also raised a lot of interest.

The Bose car stereo created interest with its 100 watt amplifier and four-way speaker system.

National showed its new rear projection 1140 mm (45-inch) TV on a retailer's stand (they declined to take part in the show this year), and with a price of approx. $3000 it is expected to be a big seller. National did exhibit in Perth, and showed the much-awaited model 7000 video recorder that is National's answer to Sony's infra-red remote control market leader.

Wharfedale, AR and KLH released new speakers. The KLH speakers are 'computer bass boosted' and this really appealed to the public's love of gimmicks while Arthur Muldoon of AR spent hours trying to explain to one customer that the new AR Hi-Tech speakers are not wireless units with their own receivers.

Last year Arthur put all the speaker wires through a garden hose to keep them neat and one customer afterwards commented that he loved the fluid-cooled AR speakers, but was there any other way of getting the fluid to the speakers because his wife wouldn't tolerate a garden hose in the lounge!

Sharp showed their new card-operated computerised microwave oven. The inclusion of this kind of item helped to attract more wives to this year's Sydney show, giving them something to take an interest in while Dad drools over the hi-fi and video and the kids inspect the computers and electronic games.

Hi-fi still retains its star rating in the show and so far this year hi-fi sales are up 50% nationally, proving that exhibiting with the rest of the industry hasn't harmed the business. ●

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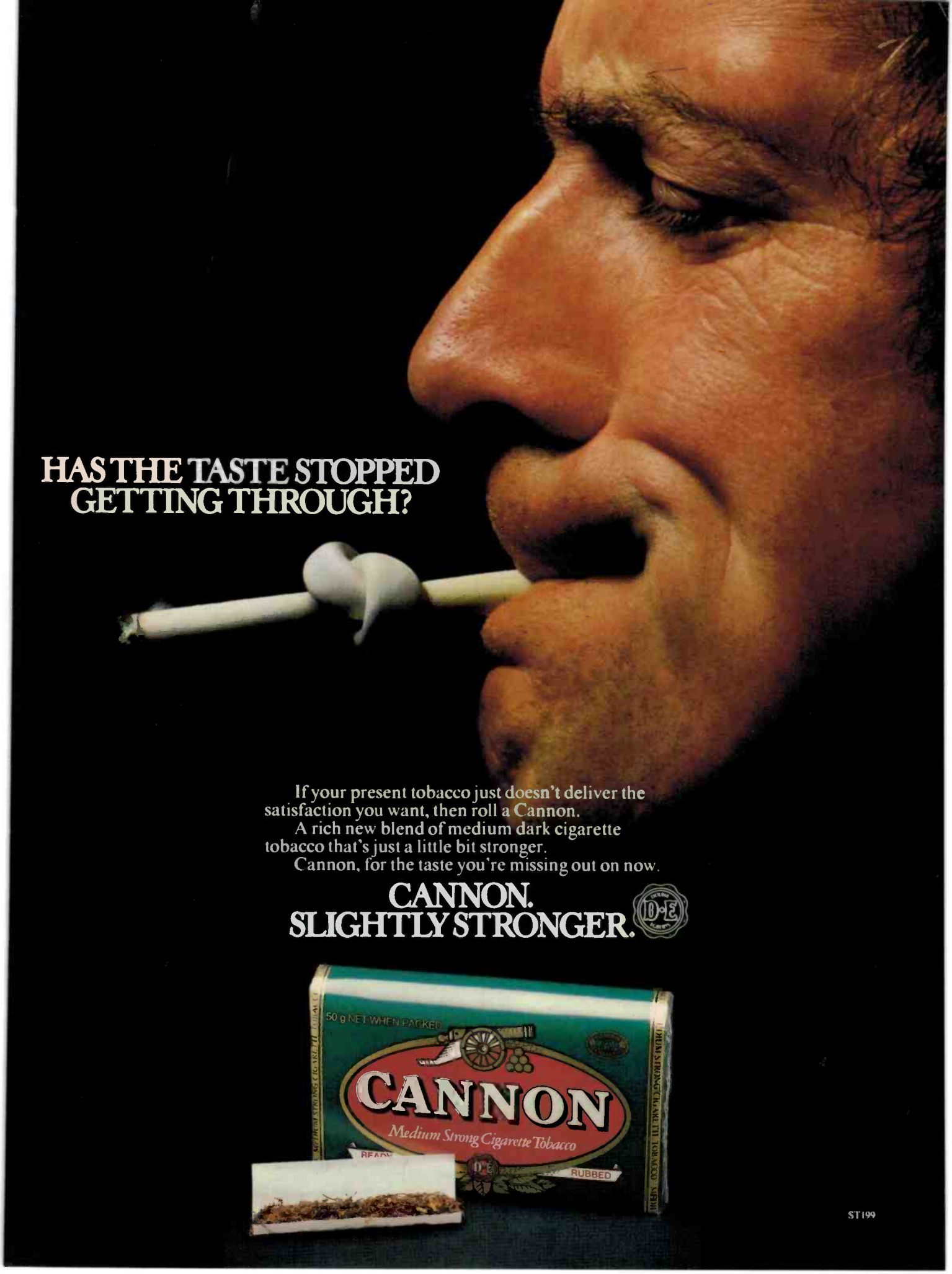
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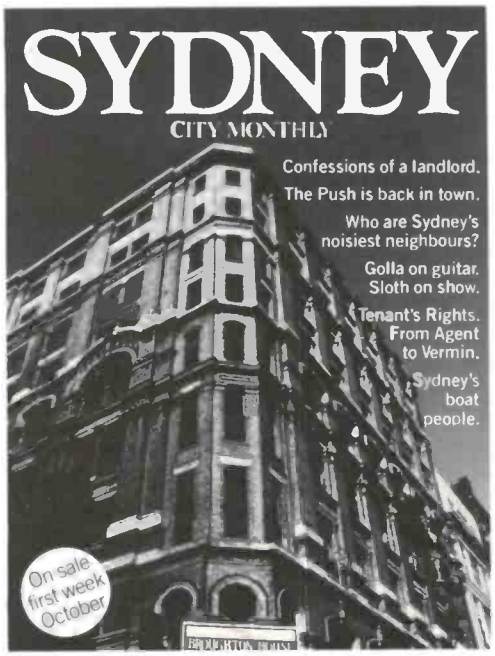


What goes on in this town would fill a magazine. And that's what Sydney City Monthly is all about.

Every month you can check out what's on; galleries, the theatre, conferences, opera, dance, rock, jazz, classical.

Every month Sydney City Monthly reveals and reviews; restaurants, exhibitions, movies, books, wine, art.

And every month you meet the people who make this town buzz with fashion, gossip, politics, money, fun.

Sydney City Monthly has become just about as popular as Sydney itself.

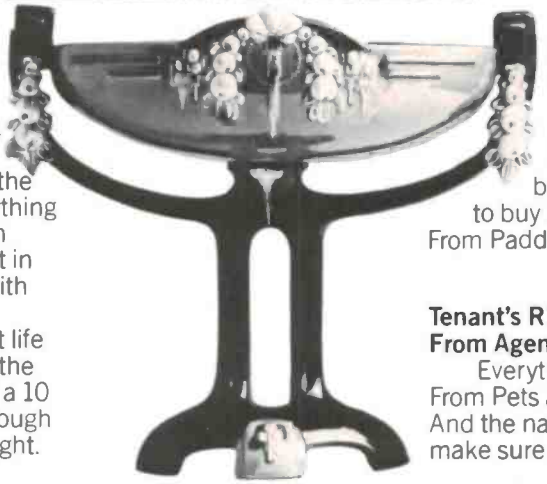
The Push is back in town.
The Money.
The Gentry.
The Speculator.

Here they come. Back from St. Ives. Up from Moss Vale. Down from Palm Beach. Not to work. But to live. In Liverpool Street, Clarence Street, even George Street.

Golla on guitar. Sloth on show.

Sunday at the museum is anything but dead. It can mean a concert in the fossil hall with George Golla.

Or a look at life under water in the marine hall. Or a 10 minute trek through the desert at night.



How to tell a William & Mary from a George & Anne.

Unless you know your antiques you may be better off with Danish modern. You can be duped. Even dealers can be duped. An investigation into where to buy and what to buy.
From Paddo to Lane Cove, from auction to markets.

Tenant's Rights. From Agent to Vermin.

Everything you need to know about renting. From Pets and Privacy to Late Rent and Eviction. And the names of ten organisations who will make sure your rights are protected.

Sydney's boat people.

There are just 4 houseboats left on Sydney harbour. Soon there may only be 3.

Who's on board and why? And who's left them high and dry?

Who are Sydney's noisiest neighbours?
A. Stereo freaks?
B. Party givers?
C. Dog lovers?

And who can you call to dob them in?
1. The police?
2. The council?
3. The Noise Pollution Control Commission?

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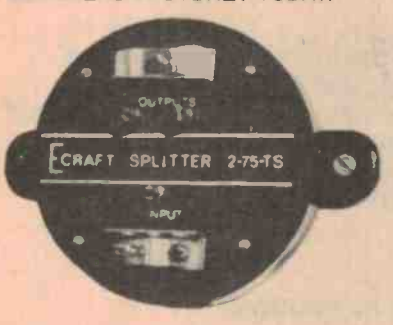

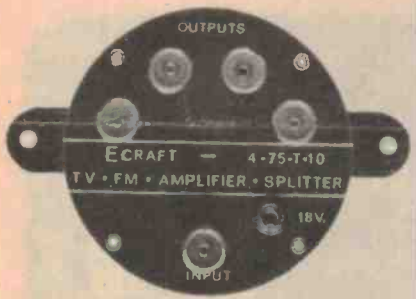

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Around Australia.

If you can answer three questions about their drive you could win a brand new Holden Commodore.

The questions you'll need to answer are in the September, October and November issues of Wheels magazine.

And the clues to the answers are in a report written by Matt Whelan in September Wheels.

It's not an easy contest.

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here's what the laboratory says about

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"The Audio Technica AT-12E, although very modestly priced, features one of the flatest responses provided by any of the cartridges we have reviewed over the last 15 years . . . this cartridge performed as well as many cartridges selling at five times the price . . ."

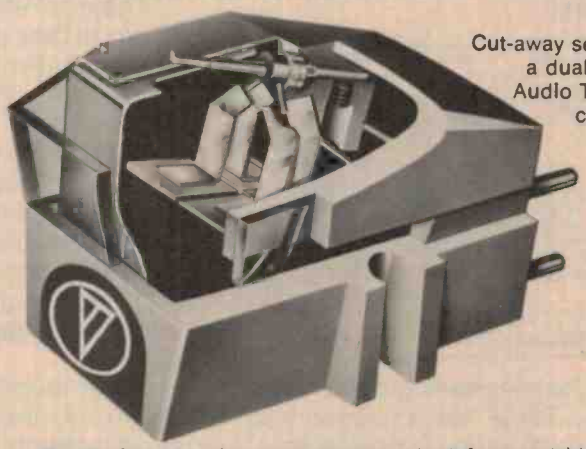
Reproduced from a review in ETI Feb. 1980, by Louis A. Challis & Associates Pty. Ltd.

AT-12E

AT-11

AT-11E

AT-10



Cut-away section of a dual magnet Audio Technica cartridge.

To obtain top performance you must look for a cartridge with a dual magnet system, as perfected by Audio Technica.

AT 12E

Value leader among elliptical stylus models. Employs finely-crafted 0.4 x 0.7 mil bonded diamond mounted to thin-wall cantilever. Dual Magnet design assures flat response and excellent stereo separation. For all modern record changers and turntables.

•AT-12E technical data
Frequency Response: 15 ~ 26,000 Hz
Tracking Force: 1.0 ~ 2.0 g (Optimal Force 1.5 g)
Output Voltage: 4.2 mV (1 kHz 5 cm/sec)
Channel Separation: Minimum 23 dB (1 kHz)
Static Compliance: 25 x 10^{-6} cm/dyne
Load Resistance: 47 kΩ

Replacement Stylus ATS-12

AT 11

Flat response and remarkable tracking ability distinguish this Dual Magnet cartridge. Spherical bonded tip is best for use with older or budget record changers. High output matches moderately-priced systems.

•AT-11 technical data
Frequency Response: 15 ~ 22,000 Hz
Tracking Force: 1.5 ~ 2.5 g (Optimal Force 2.0 g)
Output Voltage: 4.8 mV (1 kHz 5 cm/sec)
Channel Separation: Minimum 21 dB (1 kHz)
Static Compliance: 22 X 10^{-6} cm/dyne
Load Resistance: 47 kΩ

Replacement Stylus ATS-11

AT 11E

Our lowest cost elliptical stylus cartridge yet built to high Audio-Technica standards. Bonded 0.4 x 0.7 mil elliptical tip and thin-wall cantilever combine to offer unusual high frequency tracking ability in this price category. Excellent replacement for older cartridges to improve your system.

•AT-11E technical data
Frequency Response: 15 ~ 25,000 Hz
Tracking Force: 1.5 ~ 2.5 g (Optimal Force 2.0 g)
Output Voltage: 4.8 mV (1 kHz 5 cm/sec)
Channel Separation: Minimum 21 dB (1 kHz)
Static Compliance: 22 x 10^{-6} cm/dyne
Load Resistance: 47 kΩ

Replacement Stylus: ATS-11E

AT 10

Almost identical to the AT-11, the AT-10's flat response and remarkable tracking ability enables high quality stereo sound reproduction. Uses bonded spherical stylus. Has same characteristics that fit moderately priced systems so well.

•AT-10 technical data
Frequency Response: 20 ~ 20,000 Hz
Tracking Force: 2.0 ~ 3.0 g (Optimal Force 2.5 g)
Output Voltage: 4.8 mV (1 kHz 5 cm/sec)
Channel Separation: Minimum 20 dB (1 kHz)
Static Compliance: 20 ~ 10^{-6} cm/dyne
Load Resistance: 47 kΩ

Replacement Stylus ATS-10

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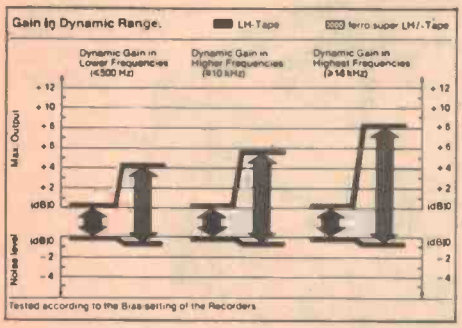
The new BASF high precision cassette.
An unbeatable case for buying The Green One.

Dubbed The Green One for ease of identification, the new BASF ferro super LH I displays high precision and performance throughout.



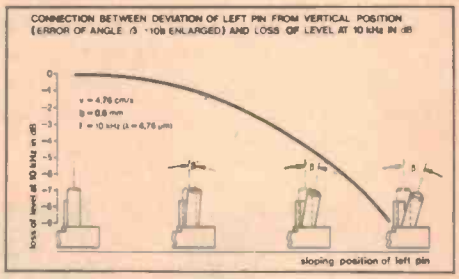
In the mechanics of the cassette, BASF has achieved new standards of azimuth precision, taking full advantage of the outstanding LH I quality.

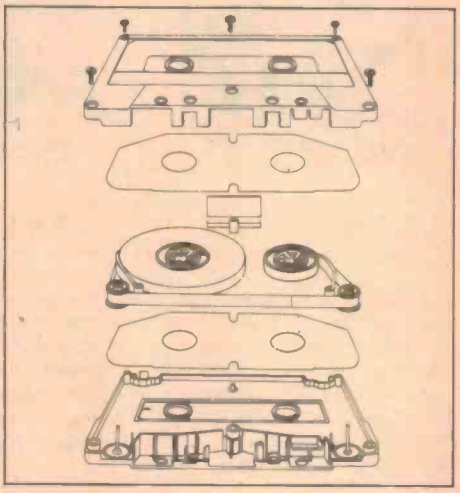
A dense coating of super-fine ferric oxide particles has produced a mirror-finish tape with extremely strong magnetic direction preference.

The end result – true Hi-Fi in the normal bias position I (Ironoxide or Fe 120 μs EQ). Plus higher volume levels with minimised distortion.

One common cassette fault. Deviation in vertical position of the pins diminishes high-frequency output, which results in loss of sound brilliancy. Minimum tolerances ensure that no fault can occur with the new BASF ferro super LH I.

In the tough, screw-together polystyrene, precision moulded shell, slip sheets eliminate tape edge damage. A mu-metal shield blocks stray magnetic fields. A felt pressure pad on a phosphor bronze spring ensures precise head contact on any deck. Flanged roller guides on lubricated stainless steel pins provide precise tape feed and azimuth alignment.





The patented BASF Security Mechanism (SM) prevents scrambling of tape and guides the tape smoothly within the cassette. A large strong window gives clear visibility to the best BASF ferro super I tape yet.

So spend a little more, and get more for your money.

Go for The Green One. Step up to Hi-Fi precision.

BASF

Quality across the range.

FCB/SPASM/BAS/40R

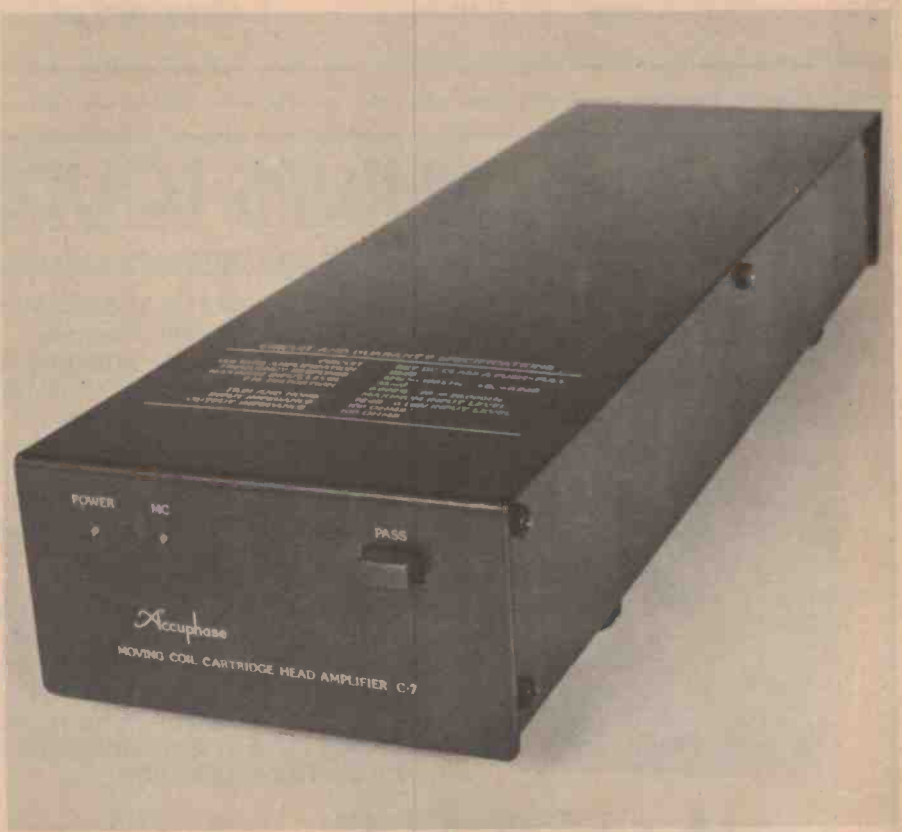
Accuphase C-7 moving coil cartridge head amplifier

Louis Challis found this unit so sensitive and accommodating he could hardly bear to part with it!

THE BEST moving coil cartridges have a clarity and transparency which is exciting to say the least. So it's not surprising that more and more manufacturers are adding at least one moving coil model to their range of moving magnet types.

This must be disconcerting for many audiophiles, because moving coil cartridges need an amplifier with a higher input sensitivity and signal-to-noise ratio than most conventional amplifiers or receivers can achieve at present. It's true that some amplifier makers do now provide a moving coil input stage, but this is usually only on their newest and most expensive models. If you already have a good amplifier you obviously don't want to replace it just so you can try out a different kind of cartridge, so you have to look for an alternative.

Some moving coil manufacturers offer a solution with a step-up transformer designed for their own particular cartridges, but many others do not. The Accuphase C-7 Head Amplifier is designed to fill this gap by providing an active preamplifier with a frequency response which is flat from 20 Hz to 20 kHz and only 0.5 dB down at 5 Hz and 100 kHz.



Description

It's a simple unit, housed in a long, thin box with coaxial input and output sockets and a mains lead for 250 volt, 50 Hz operation. The metallic case is sprayed in the same Hammertone colour as other Accuphase equipment and features an additional grounding wire to be connected to the main amplifier to minimise earth loop problems.

The manufacturers provide very little detail or data with the unit, except a ▶

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF ACCUPHASE C-7 M/C HEAD AMPLIFIER

FREQUENCY RESPONSE:
(-3dB)

Left	2.2 Hz to > 100kHz
Right	2.3 Hz to > 100kHz

SENSITIVITY:
(for 1 Watt in 8Ω)

	Left	Right
Phono Pass	0	0 dB
Phono Gain	25.4	25.7dB
Overload M/C	20 mV	19 mV

INPUT IMPEDANCE:

	Left	Right
Phono M/C	100	100 Ω

OUTPUT IMPEDANCE:

Left	110 Ω
Right	110 Ω

HARMONIC DISTORTION (M/C):
(Input of 5mV)

	100Hz	1kHz	6.3kHz
2nd	-84.2	-88	-85.5 dB
3rd	-85.3	-96	-94.2 dB
4th	-95.2	-	- dB
5th	-	-	- dB
THD	0.007	0.0043	0.0044 %

TRANSIENT INTERMODULATION DISTORTION: < 0.01 %
(3.15kHz square wave and 15kHz sine wave mixed 4:1)

NOISE & HUM LEVELS:
(re 1 Watt into 8Ω)
(with volume control set for 1 watt output with:
5mV input (Phono Pass)
0.5mV input (Phono M/C)

Phono Pass	-64 dB(Lin)	-82 dB(A)
Phono M/C	-67 dB(Lin)	-76 dB(A)

(figures are degraded by high hum content)

MAXIMUM OUTPUT M/C: 260mV VRMS

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warning that, because of the 100 dB gain that is possible from the input of this preamplifier to the output of the main amplifier, it is desirable to minimise unwanted electrical pickup. For this reason, they say the unit should be located as far as possible away from the amplifier, record player, cassette deck or any other equipment which radiates spurious and unwanted magnetic fields. They also take special care to point out the need to take the normal safety precaution of turning down the volume control of the main amplifier when making any connections on the head amplifier.

Accuphase claim that the fixed input impedance of 100 ohms provided by the C-7 matches the output impedance of *every* available moving coil cartridge, from the two or three ohms of some Ortofon models up to the 40 ohms of the EMT cartridges.

To make sure that you do not copy their design, they go to the trouble of encapsulating the 26 transistors, nine FETs, two integrated circuits and eight diodes in thermal epoxy. Frankly we do not believe the claim in the data sheet that this has been done to achieve a greater immunity to hum pickup. Without X-raying the encapsulated circuitry we could find out precious little about what it contains. The only other control provided is a bypass switch to disconnect the head amp from the rest of the amplification chain.

In the lab

Objective testing of this unit proved to be more complex and difficult than we expected. In the first place, most of the manufacturer's claims were readily substantiated in the first phase of our testing program. Frequency response was almost perfectly flat from dc to 20 kHz. The distortion figures, while they were excellent, were a shade higher than those claimed by Accuphase, although we did note afterwards that their performance figures were obtained at a lower input level than we used. The amplifier gain was 25.4 dB for the left channel and 25.7 dB for the right, which is a little different from the precise 26 dB claimed by the manufacturer. However, these differences are probably of only academic interest in the overall assessment.

We initially experienced considerable difficulty in the laboratory in achieving the order of hum and noise rejection that Accuphase claim — 72 dB A-weighted with respect to an input level of 0.1 millivolts. In fact we wasted many hours before recording our final figures of 67 dB unweighted and 76 dB A-weighted. We simply had no idea there were such high ac magnetic field strengths within our laboratory and spent a lot of time finding the right spot in which to perform the measurements.

Even so, these figures are quite commendable and we were also particularly impressed by the 19 millivolt overload point recorded for the input. In real terms I was unable to fault the objective performance of the unit.

Subjectively

I was even more impressed by the C-7's performance with a series of moving coil cartridges which I used for my own subjective evaluation. The first of these cartridges was an Audio Technica AT30E with which I have been evaluating the unit for three months.

So satisfied was I with its performance that I must admit I was in no hurry to finish the review! Truthfully, my subjective assessment of this unit took far longer than any I have previously carried out. I played hundreds of records, including a wide range of new 'direct to disc' records, ten digitally recorded discs from Telarc and Sony CBS, a range of Sheffield records and many of my other favourites. On all of these the amplifier performed impeccably.

Conclusion

The Accuphase C-7 Head Amplifier performs its function exceptionally well and provides a performance that neither subtracts from, nor adds unwanted effects to the performance of quality moving coil cartridges. These are now a force to be reckoned with in the latest generation of record players and the C-7 head amp is a convenient and very effective way of expanding the amplifier chain to accommodate them.●

ACCUPHASE C-7 MOVING COIL CARTRIDGE HEAD AMPLIFIER

Dimensions:
102 mm wide x 61 mm high x 350 mm deep
Weight: *2.5 kg*
Price: *$530 rrp*
Manufactured by Kensonic Laboratory Inc., Yokohama, Japan.

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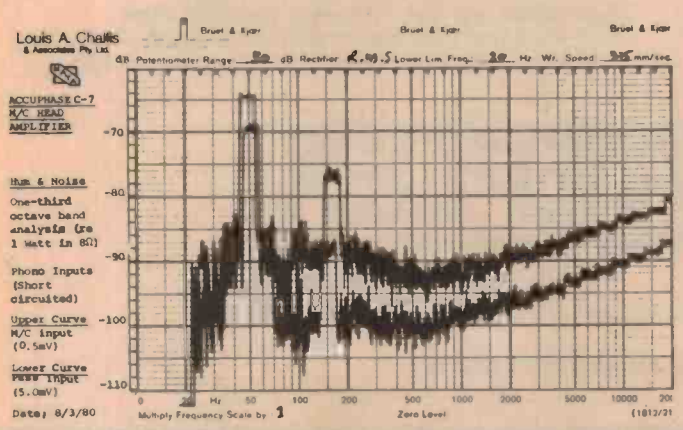
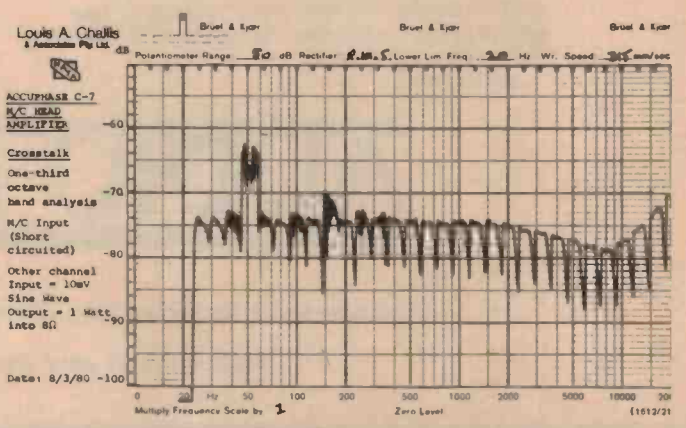
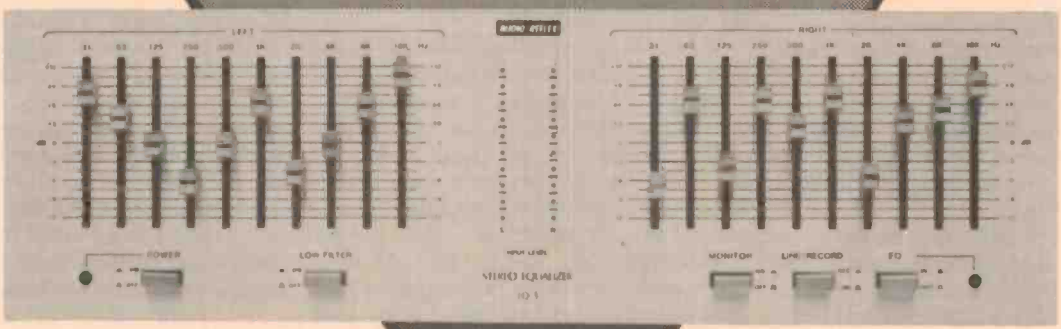




All audiophiles weren't created equal!



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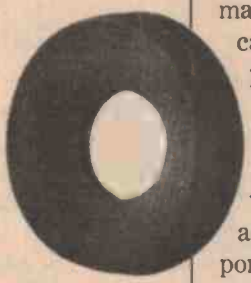
Introducing a totally new concept in stereophones.

The new Koss HV/X high velocity stereophone represents a remarkable breakthrough in hear-thru stereophone design and performance. For the first time, Koss engineers have been able to create a lightweight, hear-thru stereophone that combines the transparency of high velocity phones with the superior bass performance of closed-type phones. The result is a breathtaking musical experience.

Koss HV/XLC

CONTOURED VARIABLE-DENSITY EARCUSHIONS

While most lightweight, hear-thru stereophones have earcushions that fit against the ear, the new Koss HV/X features a unique, contoured, variable-density cushion that fits around the ear. Not only does this unique earcushion design create a far more comfortable stereophone but it has also allowed Koss engineers to create a dramatically better element design as well.



These new variable-density earcushions are made up of a very porous material that is acoustically transparent at the perimeter of the earcushion yet compressed toward the center region. This varies the pattern of acoustic resistance over portions of the earcushions creating the proper seal for specific bass frequencies while allowing the flow of middle and high frequencies at the perimeter of the earcushions.

LIGHTWEIGHT ELEMENT

The uniqueness of the new variable-density earcushions made it possible for Koss engineers to design a lightweight element that reproduces a Sound of Koss you have to hear to believe. Incredibly, even though the overall weight of the element was reduced, Koss engineers were able to develop a magnet with enough magnetic density to drive an extra large diaphragm. With a response range of 15 to 35,000 Hz, the new Koss HV/X will drive you into ecstacy and our competitors nuts.

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Slip into the new Koss HV/X or HV/XLC with volume/balance controls at your audio dealer soon. You'll like the best of both worlds: the open, airy, up-front sound of hear-thru stereophones and the deep, rich bass performance of closed-type stereophones.

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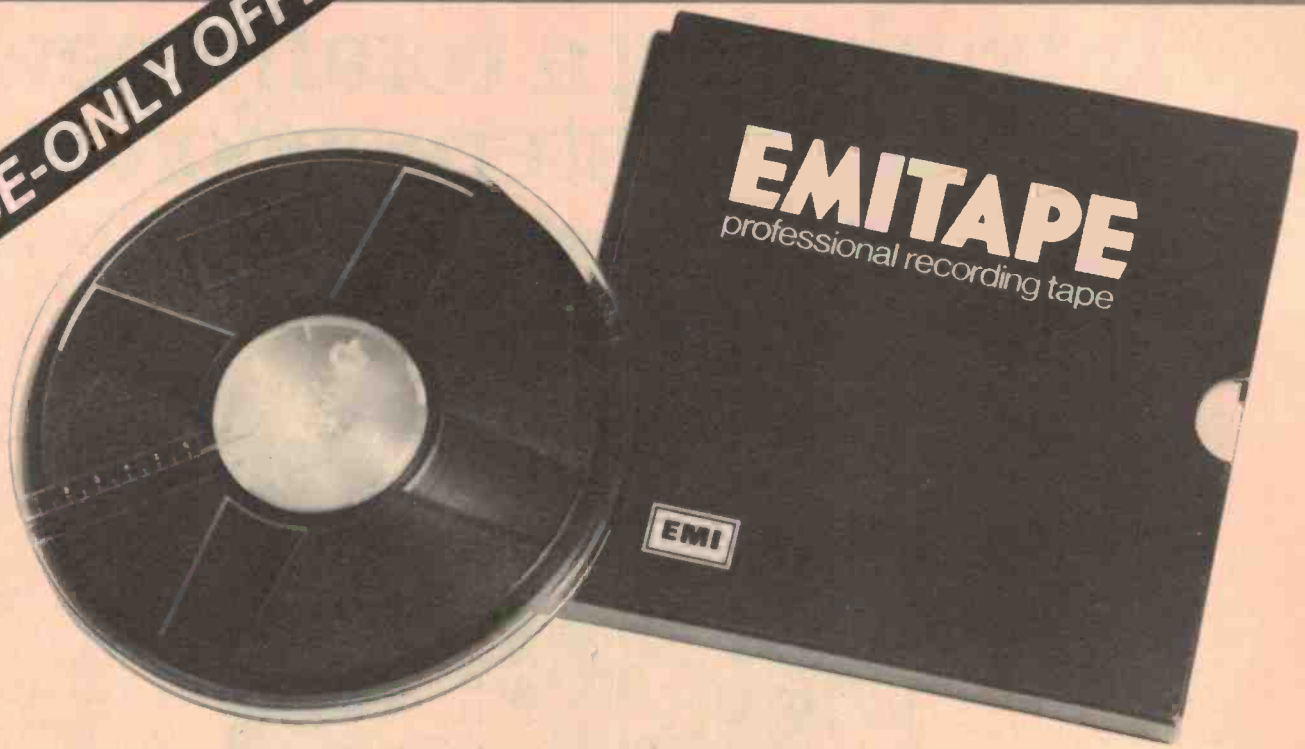

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EMITAPE 816 MATT BACKED PROFESSIONAL AUDIO TAPE

The advantages of back-coated tapes — such as high spooling speeds and uniform wind under adverse conditions, together with the reduced risk of edge-damage — are already widely recognised. These advantages are frequently obtained, however, at the expense of other, no less important characteristics. The most significant adverse effects are deterioration in amplitude modulation noise, caused by imprint effect from the backing on to the oxide during storage, and a higher degree of head and guide wear.

The development of **EMITAPE 816** has been concentrated on eliminating these disadvantages while combining the benefits of matt backing with the stringent audio performance. **EMITAPE** 816 is a standard play professional audio tape, its polyester base having a specially treated back coating.
EMITAPE 816 is not recommended for use on recorders using pressure pads.

AUDIO PERFORMANCE SPECIFICATION
38.1 cm/sec (15in/sec)

REFERENCE BIAS 1 dB over bias at 1 kHz (this condition is that with increase of bias current the 1 kHz output level has fallen by 1 dB from its maximum value).

1. Sensitivity at	1 kHz	0 dB
	4 kHz	+1.5 dB
	10 kHz	+2.5 dB
	16 kHz	+4 dB
2. Bias current ratio at 1 dB over bias (at a frequency of 1 kHz)		0.87
3. Maximum Output Level for 3% third harmonic distortion at 1 kHz (Ref. 1)		+6 dB
4. Maximum Output Level for saturation at 10 kHz (Ref. 1)		+5.25 dB
7. The ratio of the 1 kHz Maximum Output Level to Bias Noise		74.5 dB full track (6.25 mm tape width)
8. The ratio of the 1 kHz. Maximum Output Level to Bias Noise		66 dB full track (6.25 mm tape width)
9. The ratio of the 1 kHz Maximum Output Level to print first pre-echo after storage for 72 hours at +20° C.		58 dB

Ref. 1 Relative to an RMS flux of 320 nWb/m tape width (32 mMx./mm.) at a frequency of 1 kHz.

Ref. 2 Measured in accordance with the paper by E.G. Trendell entitled "The Measurement and Subjective Assessment of Modulation Noise in Magnetic Recording". Journal of the Audio Engineering Society, December 1969, Volume 17, Number 6.

Tapes available
EMITAPE 825 900ft (274 m) on 5" (133 mm) reels (quantity: 800)
EMITAPE 825 1800ft (549 m) on 7" (178 mm) reels (quantity: 4500)
EMITAPE 816 2400ft (732 m) on 10½" (267 mm) metal reels with NAB hub (quantity: 1100)
Metal Reels — 10½" (267 mm) with NAB hubs; boxed.

Tapes can be mixed for quantity discounts.
These prices are around half what the tapes were selling for originally.

OFFER PRICES	1 - 9	10 - 29	30+
900 x 5, 825 tape	$3.99	$3.69	$2.98
1800 x 7, 825 tape	$6.99	$6.28	$5.88
2400 x 10½, 816 tape	$16.99	$15.27	$13.85

10½" Metal Reel — $9.97, any quantity.

Order now and ensure delivery before Christmas !
Offer closes 13 November

EMITAPE 825. LOW NOISE LONG PLAY PROFESSIONAL AUDIO TAPE

EMITAPE 825 is a low noise long play audio tape which was specially developed for professional studio mastering and broadcasting. This tape has an excellent signal to print ratio and a specially treated coating which gives extremely low head wear and low modulation noise. The wide frequency response obtainable from this tape ensures an excellent high fidelity performance when used in conjunction with any good quality tape recorder.

AUDIO PERFORMANCE SPECIFICATION

	19.05 cm/sec (7½in/sec)	9.53 cm/sec (3¾in/sec)
Recommended Bias	1 dB overbias at 1 kHz (the value of bias used by the majority of professional recording and broadcast engineers)	The value of bias current required to record a 333 Hz signal which when reproduced gives an output level of +3 dB (Ref. 1a) with a third harmonic distortion content of 5%
Frequency Response (when compared with EMI Standard Tape S.4)	Within +/−2 dB from below 31.5 Hz to 16 kHz	Within +/−2 dB from below 31.5 Hz to 16 kHz
Maximum Output Level	+3 dB (for 3% Third Harmonic Distortion at 1 kHz (Ref.1))	+3 dB (for 5% Third Harmonic Distortion at 333 Hz (Ref.1a))
Maximum Output Level (for Saturation at 10 kHz)	−1 dB (Ref.1)	−7 dB (Ref. 1a)
Maximum Output Level (for Saturation at 10 kHz)	−1 dB (Ref. 1)	−7 dB (Ref. 1a)
Signal to Noise Ratio (a) Weighted in accordance with IEC 123A, BS3489-1962 (A Curve) and ASA Standard S1-4-1961 (A curve) using a measuring instrument with the same dynamic characteristic as a Standard Volume Indicator (BS3489- 1962 and ASA Standard C16-5- 1961)	66 dB (Ref. 2)	58 dB (Ref. 2a)
(b) Weighted using a filter and a quasi peak measuring instrument in accordance with DIN45405	57 dB (Ref. 2)	51.5 dB (Ref. 2a)

Ref. 1	Relative to an RMS flux of 320nWb/m tape width (32mMx/mm) at a frequency of 1 kHz.
Ref. 1a	Relative to an RMS flux of 250nWb/m tape width (25mMx/mm) at a frequency of 333 Hz.
Ref. 2	The ratio of the 1 kHz Maximum Output Level to Bias Noise.
Ref. 2a	The ratio of the 333 Hz Maximum Output Level to Bias Noise.
Note	The figures quoted are mean values and subject to manufacturer's tolerances.

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The Mini Alarm Car Clock measures only 62 (W) x 43 (D) x 9 (H) mm and has a small magic fastener, easel support on the back. Just set the alarm and the electronic beep will wake you up. The clock movement is totally solid state, and is a unique product of the latest Quartz technology. It is accurate to within twenty seconds per month (at normal temperature). It costs only $26.00 plus $2.00 postage/handling — a special price to our readers. Simply fill in the coupon below and mail today.

Complete the coupon and mail together with your payment to this magazine's Mini Alarm Car Clock Offer, G.P.O. C102, Sydney 2000. Make your cheque payable to Murray/Modern Magazines and endorse with your name and address.

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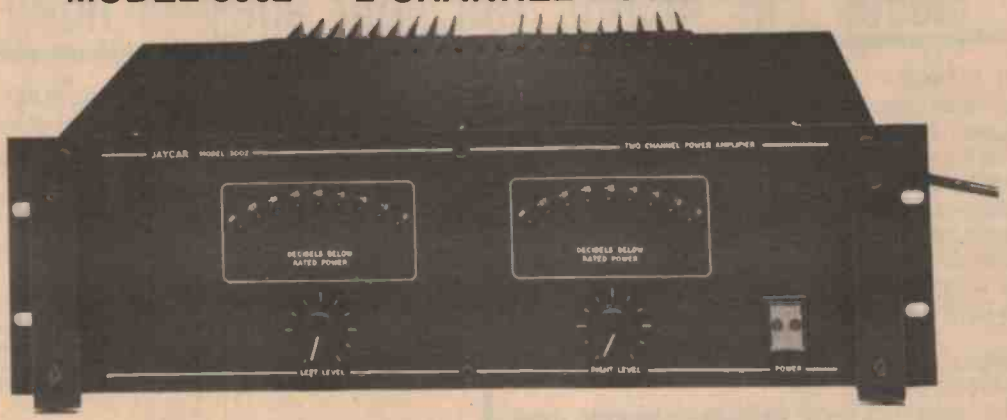
PROFESSIONAL AUDIO EQUIPMENT

MODEL 3002 — 2 CHANNEL POWER AMPLIFIER



FEATURES

- 300 Watts per channel.
- Massive rear mounted heatsinks.
- Multiple speaker protection circuits.
- Peak output power meters.
- Constructed to withstand the tortures of 'On the road' use.
- Standard 19" rack mounting.
- Separate power supplies for each channel.
- Dual RCA input sockets to allow bridging to other amplifiers.
- Equally suited to Hi Fi use or P.A./Disco situations.

BRIEF SPECIFICATIONS

Output Power — 300 watts/channel into 8 ohms.
200 watts/channel into 4 ohms.
Frequency Response — 20Hz to 20kHz ±0.5dB.
Hum and Noise — 105dB below rated output.
Harmonic Distortion — Less than 0.05% to 80 watts.
Less than 0.15% at rated power.
Input Sensitivity — 1.0 volts for rated output.
Dimensions — 482mm x 133mm x 340mm.
Weight — 20 kgs.

$452.00 plus freight.

MODEL 2801 — ⅓ OCTAVE EQUALISER

The 2801 is a single channel graphic equaliser that divides the audio spectrum into twenty-eight one third octave bands. Each frequency segment is controlled by a slider that provides up to ± 10 dB of adjustment in standard ISO steps.

The 2810 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality. In P.A. application the equaliser may be used to improve sound quality and increase intelligibility by attentuating problem frequencies that cause ringing, boominess, or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be "tuned" according to the special acoustics of a room, to maximise output and minimise feedback. As a creative tool in sound recording or re-recording the 2801 allows complete freedom in contouring response over the complete audio spectrum from 31.5 Hz to 16 KHz.

$198.00 plus $3.00 freight.

MODEL 2010 — 2 CHANNEL EQUALISER

The 2010 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to ± 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of ± 14dB.

The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel.

Included amongst these are the ability to equalise both recording and playback when dubbing tapes.

The 2010 has been designed to be compatible with all commercially available equipment and is ideal for use in a HI Fi system or P.A. system.

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For further information, please send a 35c stamp for full specification sheets, or call at our showroom for a demonstration.

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We want to know what you the amateurs want from your hobby so that we, as a company, can serve you and Australia better. So we're asking you to tell us, in fifty words or less, 'The best way that Dick Smith Electronics can promote the fantastic hobby of Amateur Radio to the benefit of Australia'.

Entry to the competition is only open to purchasers of any Yaesu equipment from Dick Smith stores or authorised Dick Smith Yaesu resellers, between 1/8/80 and 1/11/80 - enter and you could win and be on your way to Hong Kong.

Entries will be judged initially by a panel from Dick Smith Electronics to produce five finalists: these will be judged by Neville Williams, MIREE, Editor-in-chief of Electronics Australia magazine.

The winner will be notified by Dick Smith, and will be announced in Electronics Australia and Electronics Today International.

So if you're thinking about buying Yaesu, why not buy it in the next few weeks: of course, only from Dick Smith Electronics or authorised Dick Smith Yaesu re-seller!

RULES AND CONDITIONS

Entries will only be accepted on the official entry form, which is available only with the purchase of any item from the Yaesu range from a Dick Smith store or Dick Smith authorised re-seller.

All entries must show the model number and serial number of the item purchased, (if applicable), and be signed by the store manager or authorised person.

In the space on the entry form, write in one paragraph of not more than 50 words.

'The best way that Dick Smith Electronics can promote the fantastic hobby of Amateur Radio to the benefit of Australia'.

Post your entry to: Amateur Radio Contest
Dick Smith Electronics
PO Box 321,
North Ryde NSW 2113.

Entries close at 5pm on Monday, 3rd November, 1980. Entries received after this date will not be considered. Final judging will take place on 10th November, 1980. The judge's decision will be final and no correspondence will be entered into. The winners flight departs from, and returns to Sydney, the winner must travel to Sydney at his/her own expense. All entries become the absolute property of Dick Smith Electronics Pty. Ltd who may use such entries as they see fit.

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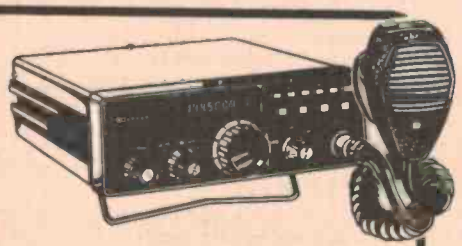

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COMMUNICATIONS

Heard Island expedition gets up steam

The Heard Island DX Association is making steady progress towards its aim of reactivating the uninhabited subantarctic island and is now confident of success in early 1981.

As we reported in the July ETI, the idea is to mount a full scale DX-pedition and spend a minimum of fourteen days actually on the island. It is intended to offer a place on the expedition to a professional scientist who will be able to assist the DXers with his experience of Antarctic conditions as well as pursuing his own research.

The Australian government have advised that "... there is no objection in principle ..." to the activation of Heard although they have stipulated a number of conditions that must be met to ensure the safety of personnel and the protection of the native fauna and flora.

Negotiations are underway to charter a vessel for the voyage, which is expected to take about ten days each way and will be the main expense the expedition has to meet.

Donations so far received amount to about $800, roughly what was anticipated following the initial low-key announcements of the project. Now that the mission is 'all systems go', the organisers expect the flow of funds to increase.

If you would like more information, or can help with cash or equipment, please write to:

Jim Smith,
Heard Island DX Association,
P.O. Box 2053,
Konedobu,
Papua New Guinea.

Amateur radio weekend

The Blue Mountains of NSW will be the delightful springtime setting for an amateur radio weekend scheduled for the 17th to 19th of October.

The function, which will include courses in theory, regulations and Morse code, has been specially designed to help people studying for the November novice examination, but the organisers emphasise that anyone with an interest in amateur radio will be welcome.

An amateur radio station will be continually in operation, so that scouts and guides will have a chance to participate in the world-wide jamboree-on-the-air.

The all-in charge for food and accommodation is $22 for adults, $18 for full time students and instructors, $7.50 for children two to four years old and $2.00 for the under-twos.

The exact location is Camp Carey, which is about one and a half kilometres walk from Wentworth Falls railway station. All those interested in attending, instructing or supervising are invited to write to:

Amateur Radio Weekend,
Craig Robinson VK2PDF,
P.O. Box 35,
Croydon, NSW 2132.

Phone (02) 74-0316.

High power combiners

Five high power band II TV/FM combiners have been built for Telecom by Antenna Engineering Australia.

The picture above shows the unit which will be installed in Bunbury, Western Australia, where it will enable the two 20 kW transmitters of TV channels 3 and 5 to be combined with a 10 kW FM transmitter to a common antenna.

Design features include a channel separation of 800 kHz, which together with the modular design allows for future system expansion with minimal disturbance to existing services.

Club News from SA

The Naracoorte district of South Australia now has its own amateur radio club whose callsign is VK5ARN.

The organisation, which has an active membership of about twenty at present, is officially known as **'Naracoorte Amateur Radio Club'** and its address is P.O. Box 45, Naracoorte, SA 5271.

Meetings are held on the fourth Friday of the month at 8.00 pm CST and the venue is usually the Department of Further Education buildings in Naracoorte, but it's advisable to check this with the DFE on (087)62-2199, or Rob Smith VK5NRR, on (087)62-2134.

. . . and Brisbane

The Brisbane Amateur Radio Club informs us that they now meet at S.E.S. — 'C' Group Headquarters, on the corner of School and Ipswich Roads, Yeronga, on the second and fourth Fridays of each month at 1930 EAST.

Audio impulse noise limiter

THIS CIRCUIT is particularly intended for those interested in DXing, that is, listening for distant radio stations. However, the same circuit has other uses such as reducing the scratch level on very old records (Note that this is not the normal type of scratch filter circuit normally associated with hi-fi equipment). It also has uses in PA equipment where it can limit the input to the final stages and prevent overload distortion; distortion will still be present when an overload occurs but it is not as objectionable as that usually produced.

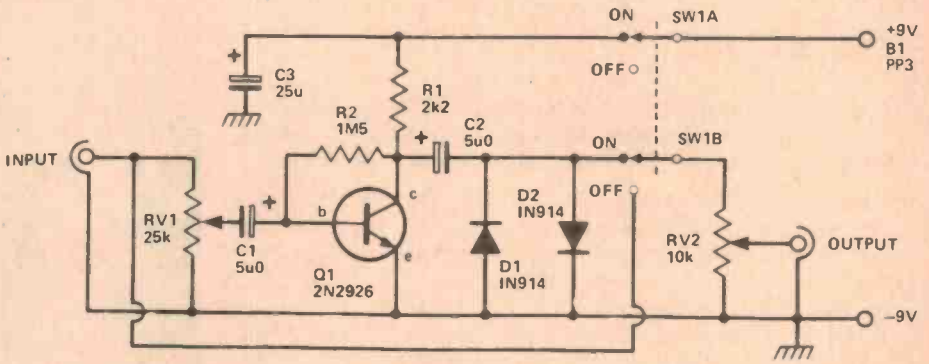
The circuit is designed to take almost any audio input but the output will have all peaks above a certain level (which can be adjusted) eliminated.

Anyone who has listened to a really weak radio signal will know the limitations imposed by the noise. At any one time there are literally thousands of thunderstorms taking place somewhere in the world and sensitive receivers will hear lightning a considerable distance away. Often, the level of noise is much higher than that of the radio signal that is wanted.

Apart from lightning, there is more local interference such as that produced by poorly suppressed motor cars or electric motors. With a powerful radio signal these are just not noticeable since the noise level is well below that of the radio signal, but on distant stations the noise level all but buries the signal.

The circuit can either be wired into a receiver circuit or directly from a headphones socket in which case the headphones are wired to this unit instead. If wired into a circuit permanently, RV1 should take the place of the normal volume control and the output (RV2) should be control slider. An extra control plus a switch will also have to be mounted on the receiver front panel. The circuit can either be left in permanently, as at most settings it will not affect the signal, or it can be switched out.

The output of the receiver, which, as we have said, can be from the volume control or the headphone socket, is taken to the input and amplified by Q1 which is connected in the common emitter mode. This transistor will considerably increase the audio level and this is applied via a dc blocking capacitor, C2, to the two silicon diodes D1 and D2.



In the normal way these diodes will not have any bias voltage applied across them and so they will present a high resistance, and will not affect the output in any way. However, as soon as the output from the amplifier exceeds about 0.6 V the diodes will conduct and short the output to the line. Two common (0V) diodes are needed, connected 'back-to-back' so that both positive and negative going peaks are shorted out.

The idea of the amplifier is to make sure that whatever the input level across RV1, it can be amplified so that at least 0.6 V can be applied across the diodes. Since RV1 is adjusted so that the level is always the same, a volume control has been included in the circuit so that the output level can be controlled in the usual way; this is accomplished by RV2.

To limit the noise, the input level is increased until the audio signal that is wanted is just distorting and then backed off slightly so that no distortion is heard on peaks above that level. 'Spikes' will hardly be heard in the output as they will be clipped by the diodes above the preset limit. RV2 is then used as a volume control.

If RV1 is adjusted well below the limiting level and RV2 is adjusted for normal listening levels, the circuit has no effect. However, it is a simple matter to include SW1 which will bypass the circuit. The supply voltage can be taken from a battery as shown in the circuit, the current drain being very small, or from the receiver's supply. If this is transistor operated with 9 V then there will be no difficulty but if the receiver is a valve type or uses a supply potential higher than 9 V then a suitable dropping resistor from the HT supply rail will have to be included. The value will depend on the supply voltage but for 250 V a resistor in the order of 150k ohms will be about right; this should be connected between the HT line and the slider of SW1a.

The effect of the noise limiter is quite remarkable and by switching the circuit in and out it is possible to compare the results. The noise will still be there but not at an annoying level and the signal will be very, very much clearer. ●

SHORT CIRCUITS is a feature that lies somewhere between Ideas for Experimenters and complete Projects. Generally, the items published in Short Circuits will involve tried circuits that have not necessarily been fully developed, but fairly complete details are included as a guide to readers. Unfortunately, owing to the nature of these items, we cannot give further details other than what is provided in the article. Contributions for Short Circuits are always welcome.

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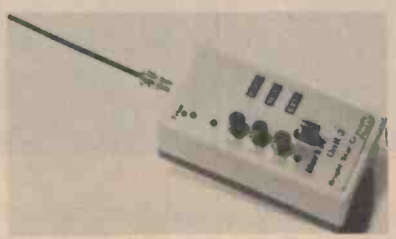

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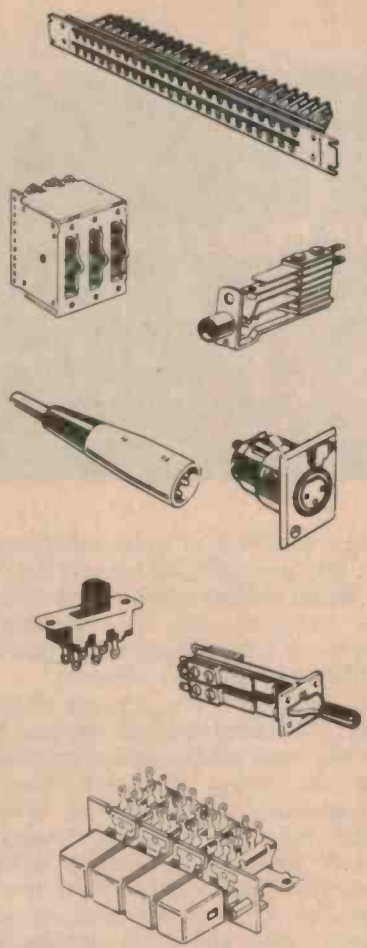

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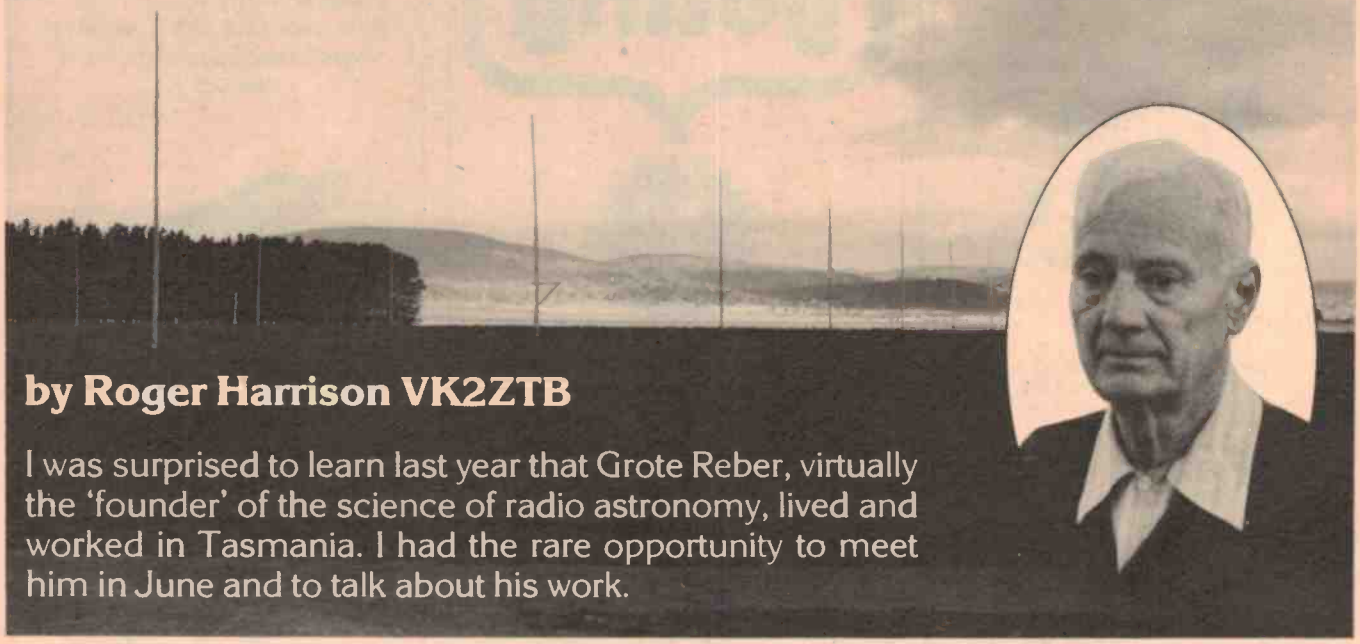
A unique individual —

Radio astronomy's original pioneer — Grote Reber



by Roger Harrison VK2ZTB

I was surprised to learn last year that Grote Reber, virtually the 'founder' of the science of radio astronomy, lived and worked in Tasmania. I had the rare opportunity to meet him in June and to talk about his work.

THE SCIENCE of radio astronomy is not fifty years old, yet it has had a more profound influence on our knowledge of the universe and the fundamental physics of nature than has Galileo's invention of the optical telescope.

In the late 1920s, a young engineer from Bell Telephone Laboratories, Karl Jansky, was set the task of investigating the cause of interferences on transoceanic telephone links. Between 1929 and 1932, with his "merry-go-round" antenna, he made a series of observations. Along the way he detected a source of noise that appeared to be fixed in space and which came from the centre of our galaxy. Upon the completion of his research and the publication of a scientific paper, Karl Jansky was transferred to other work. He did not pursue the matter further and the significance of his discoveries was not realised by the astronomers of his day.

Some years later Grote Reber was looking for something "a little more exciting" to extend his hobby of amateur radio. He had come to know Karl Jansky, who suggested to the 22 year old Reber that he "look to the heavens".

Reber designed and built the world's first 'radio telescope', a 10m diameter parabolic dish, constructed of wood and galvanised iron sheeting. He designed and prefabricated every part prior to assembling the dish in his back garden. That dish is preserved in the Smithsonian Institute's museum in the US.

Grote Reber first attempted observations near 3000 MHz but results were inconclusive, largely owing to the limitations of the technology of the time. He subsequently modified his equipment for use on 900 MHz and later 160 MHz, eventually succeeding in making what was the first 'map' of the sky ever to be completed using radiation other than that of the visible spectrum. He also detected and described radio emissions from the sun.

The science of radio astronomy was born.

Reber's observations were taken up and extended by others following publication of his results, but work was interrupted by World War II. Following the war, interest in radio astronomy burgeoned, propelled by the explosion in technology as a result of the war effort. Whilst most workers in the young science headed for higher and higher frequencies, Grote Reber thought he might go in the other direction. In the late 1940s and early 50s, it was thought that the lowest possible observation frequency was about 10 MHz, a limit set by the 'opacity' of the ionosphere — the region of ionised gases extending from about 100 km to about 800 km that encircles the earth and refracts radio waves, permitting communications over long distances on the 'shortwave' bands between 1 MHz and 30 MHz.

Reber was interested in what the sky 'looked like' at frequencies below 3 MHz, but many of the ". . . experts of the day, self-appointed and otherwise . . ." said it would be "impossible" to make observations at these frequencies. Firstly, the ionosphere 'got in the way' like an invisible curtain or shroud, and secondly interference from man-made signals, along with atmospheric noise, would mask even strong cosmic signals.

Fortunately, Reber, having a determined nature (a "cussed streak", as he puts it) took no notice of ". . . these Cassandras . . ." and set out to thoroughly research the problems of making observations below 3 MHz.

He sought to find a 'window' through the ionosphere, where the vertical incidence critical frequency (that frequency where a signal beamed directly overhead will pass through the ionosphere)

dropped below 1 MHz on occasions. He made a search of the available ionospheric data (ionospheric research was then itself still a fledgling science) and found several regions around the world where the ionosphere behaved as required. However, there were a few restraints. He had to choose an area that was remote, to be away from sources of man-made noise and interference, but in a 'civilised' country so that he could avoid any political problems and build a suitable antenna without incurring large transport and construction costs. Climate was another factor in Reber's choice.

He chose the highlands of Tasmania.

Meeting the man

I was introduced to Grote Reber on a cold, windswept afternoon last June. It was the shortest day of the year and I had driven from Launceston with a friend of Grote, Jim Davis, VK7NOW, and Jim's friend Bill Carter, VK7AK, who knew the mountain roads like the back of his weatherbeaten hands.

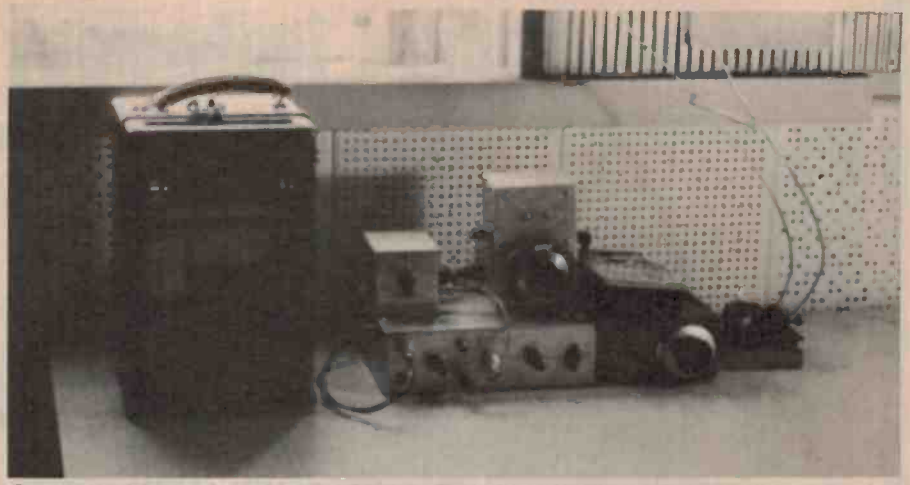
We arrived at the house Grote rents from a neighbour to find him sawing timber for the 'solar house' he's working on — of which more later. We discussed the project briefly and then drove to the radio astronomy installation just a handful of kilometres away. The casual observer, if he noticed at all, would no doubt be mildly curious about the lines of stark, grey poles set up some distance from the road on an expansive tract of flat land but there is little to give away their purpose. The entrance to the 'observatory' is unprepossessing and unmarked — just another paddock gate. A 3 km long dirt road, broken by several cattle grids, leads to the small hut located in the 'centre' of the antenna array. An ingenious sign at the first cattle grid says "Warning: Radio Astronomy". Grote says it's quite effective in "... keeping out the idly curious".

At the hut, Grote Reber gave us a description of his work and the equipment he uses and has used. He talks in a clear, well-reasoned manner and his mid-west American accent is still strong. It's a fascinating story that he tells.

What and how

Reber came to Australia in the early '50s and searched out a suitable site for his antenna. This was to be an array covering some 400 acres, consisting of 128 dipoles centred on a frequency near 2 MHz!

Construction commenced in 1953 and Reber began observations the following year. The whole structure, supported on a series of locally-felled eucalypt hardwood poles each some 20m high, was erected on a level area on a farm located in a natural depression in the mountains east of Lake St. Clair.



Current receiving equipment is all solid state. The antenna feedline can be seen to the right, chart recorder on the left.

The entire array was constructed on a "shoe string" budget, on money obtained from a research grant, with the assistance of local people. A great deal of effort was made to ensure that the structure would last 20 years or more. The poles are clearly still in good condition and should exceed the design life by a wide margin.

The 128-dipole antenna array is an 'aperture synthesis' type and has a beamwidth of 7° ! In its original configuration the beam pattern could be 'steered' electronically by changing the phasing on the network of antenna feeders. While it sounds simple enough, the job had to be done by physically moving a series of clip-on shorting straps on the open-wire feedlines. This task takes two men about half a day!

The array could be set to 'view' a particular sector of the sky, the rotation of the earth 'sweeping' the beam across the selected path. The beam can be steered in elevation from near the northern horizon, through the zenith ('straight up') and almost to the southern horizon.

Each dipole in the array has been constructed to cover the range between about 1800 kHz and 2000 kHz. This is done using a cunning technique involving the antenna length and a specially-constructed tuned matching transformer that provides a response similar to a double-tuned circuit.

Each dipole is cut a little 'short' for the desired operating frequency and its feedpoint exhibits a capacitive reactance along with the antenna's characteristic radiation resistance. The dipole feedpoint is tapped onto a large, high-Q inductor that resonates near 2 MHz with its own self-capacitance and the capacitive reactance of the antenna. Inside this coil, and thus tightly coupled to it, is another which is tuned by a variable capacitor. The open-wire feedline to the rest of the system is tapped onto this coil to provide the desired impedance match. The whole assembly forms an over-coupled transformer which exhibits the classic 'double-humped' wideband response. Grote carefully designed this transformer arrangement to have minimum loss (about 0.5 dB) and an acceptably 'flat' response (2 dB, or less, variation) across the band of interest.

128 of these assemblies were constructed, each housed in a weatherproof box made of galvanised iron sheet with ceramic feedthrough insulators for the feedline connections. Most were disassembled from the antenna system and stored some years ago.

Grote Reber has a self-confessed "obsession with measuring things". After all, isn't that what radio astronomy's all about? True to form, he *measured* the variation in ground resistance beneath his antenna array, plotted equal-resistance contours and calculated the overall ground resistance.

The receiver and recording system are housed in a small hut located near the centre of the large array. Power is obtained from batteries, which was some problem with the original receiver system as it used valves! About 18 years ago Grote constructed a solid-state receiver which is still in use. It is considerably smaller than the old valve 'monster' which took up the whole of the small table provided for the purpose. The receiver is tunable so that an observation frequency can be selected which is clear of ground wave propagated (and some ionospherically propagated) signals. The receiver only has four stages (plus an audio stage for headphone use) and includes several selectable bandwidths and integration times on the detector output. Hooked ▶

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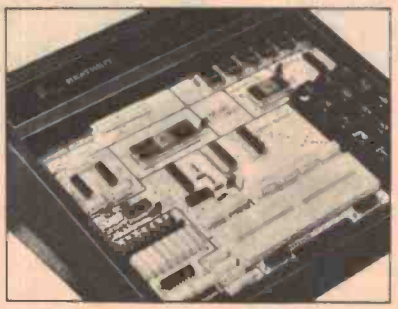
The EE-3401 is complete with 62 electronic components required to complete the experiments. These components include two 2112 256 x 4-bit RAM's, 6820 PIA interface chip, 1406 d/a converter, 741 and 301 op amps and a variety of other microprocessor-oriented devices. The ET-3400 Computer Trainer is required for the experiments in the Microprocessor Course.

Course EE-3401 $155.00

Microprocessor Trainer for EE-3401 Program



Functioning as a miniature digital computer, the ET-3400 Microprocessor Trainer is essential for the experiments in the EE-3401 self-instruction program. After completing the program, the ET-3400 is ideal for breadboarding, prototyping and system design.

The ET-3400 features a built-in 1K ROM monitor program for controlling unit operation; 6-digit hexadecimal 7-segment LED display for address and data readout; 17-key hexadecimal keyboard for entering programs and data. Has 256 bytes of random access memory (RAM) built-in, expandable to 512 bytes with the RAM's supplied in the EE-3401 program. Also has 8 buffered binary LED's for display of breadboard logic states, 8 SPST DIP switches for binary input to breadboard circuits, a breadboarding socket for prototyping, interfacing and memory circuits.

All microprocessor address, control and data busses are buffered and terminated on the front panel for ease of connection to prototype circuits. There's also provision for a 40-pin external connector to extend memory and I/O capacity. Built-in +5, +12 and −12 volt power supplies.

Kit ET-3400 $347.00

Microprocessor Trainer Accessory

The ETA-3400 gives you the additional I/O and memory you need to turn your ET-3400 Microprocessor Trainer into a complete, personal computer system. It provides an audio cassette interface so you can store programs on convenient cassettes. It also provides an additional 1K bytes of memory so you can run longer and more sophisticated programs through the ET3400. The memory can be expanded to 4K bytes with the optional 3K chip set (ETA-3400-1). A serial I/O with EIA 20mA loop format provided in the ETA-3400 accessory lets you hookup a video terminal such as the H9. The new ROM monitor-debugger program provided with the accessory lets you implement the standard trainer monitor functions through the external terminal. Memory locations can be examined or changed, break points can be initiated, and program debugging can be accomplished with a single instruction step feature. A tiny BASIC interpreter is provided in ROM to let you do actual programming using the BASIC language. 11" W x 3" H x 12" D (279 x 76 x 305mm).

Kit ETA-3400 $270.00

ETA-3400-1, Optional 3K Chip Set $ 86.00

NOTE: a terminal such as the H9 is required to operate in BASIC or with the new monitor.

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onto the output is a simple spring-driven chart recorder used to collect the data. Grote also uses an outboard BFO to detect the presence of weak signals that may interfere with his measurements.

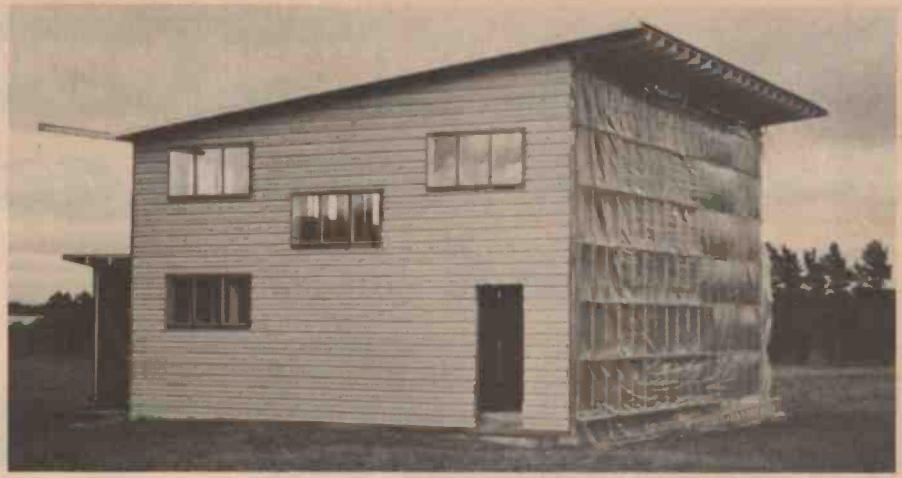
If you tune around 2 MHz of an evening you'll find the region 'alive' with signals. How does Grote Reber hear the stars? It works like this: When the critical frequency of the ionosphere above his antenna dips below 2 MHz, all those signals that usually 'bounce' off the ionosphere no longer have any ionosphere in the region to 'bounce' off. The ionospheric curtain 'withdraws', all those interfering signals head off into space and the cosmic noise 'comes in'. It sounds like the 'hiss' of a radio receiver not tuned to any signals. Grote Reber estimates the cosmic noise to be around 20 microvolts at the antenna terminals of his receiver.

The ionosphere will only 'open up' at certain times, however. These times are greatly influenced by the diurnal (daily), and seasonal cycles of ionospheric activity and the longer term influence of the solar activity cycle which has 'peaks' and 'troughs' roughly spaced at 11 year intervals.

During a trough, or minimum, in solar activity, the ionospheric critical frequencies are much lower than during a peak, or maximum. As a consequence, Grote Reber can only make his observations during a solar minimum and suitable conditions generally last only 18 months or less. To make matters worse, the critical frequencies are only low enough during the winter months and at night — generally between 11 p.m. and 3 a.m. or so!

Grote made his first observations during the winter of 1954, a solar minimum year. He then had to wait until 1963-64 for the next solar minimum! From data compiled during those observing years, he built up a 'map' of the sky at a wavelength of 150 metres — quite an achievement, since the longest wavelength observations to date had been at a wavelength around 10 metres (about 30 MHz). His results were published in The Journal of the Franklin Institute (USA) in 1968. He last made observations during the solar minimum of 1975-76 and he's currently waiting for the next solar minimum (due around 1986 or so).

In the meantime, a curious limitation has arisen. It seems that long term solar activity is reducing the period over which he can make observations and the number of days during that period when the critical frequencies are low enough. The 'smoothed sunspot number' (a statistical measure of solar activity) during the 1954 minimum was as low as two but during the minimum just past it was greater than 10, with a consequent general increase in the ionospheric critical frequencies.



The 'solar house' Grote Reber is constructing in Tasmania. He designed and prefabricated the complete framework from oregon he bought direct from a mill in Oregon, USA, and imported here.

Quite undaunted, having proved the "Cassandras" conclusively *wrong*, Grote is preparing for the next minimum and another series of observations during those long, cold Tasmanian winter nights.

Other projects

The radio astronomy observations at 150 metres wavelength don't occupy all of Grote's time. He is employed part of the time by a local division of the CSIRO in a field quite removed from radio astronomy. He's also engaged in constructing and researching an electric car — this project is currently in America undergoing wind tunnel trials; he spends part of his time each year in the US. Apart from that, he is currently engaged in constructing a 'solar-powered' house which was partly completed when we saw it on our visit. This project is typical of his thorough, carefully thought-out approach to everything he does. The frame is timber and was completely designed and prefabricated prior to erection. He sought a local supply of oregon for the frame but found the timber offered of too poor a quality. On a trip to America last year he bought a container load of oregon and had it shipped to his Tasmanian address! Not only did he get the quality of timber he wanted, but he saved a considerable amount of money in the process.

The house is a two-storey structure with a slanted roof and the largest external wall facing due north. This wall is made up of 102 'cells'. About 12 are used for windows; the rest collect heat from the sun, raising the temperature of the air in the cell. This heated air is drawn by fans down into a deep basement which takes up the entire area under the house. This basement is to be filled with rocks, each about the size of an egg. The heat will be stored in these rocks during the day and during the night, heat will be obtained from the rocks by drawing air from the basement and circulating it through the house.

The eaves overhang the front of the house so that it is shaded during the middle of the day in summer, preventing the house from becoming overheated.

The outer cladding and the roof are of aluminium siding with internal reflective insulating sheet and asbestos batts. Grote has designed his house so that there will be no need for any heating or cooling system fuelled by that precious and increasingly expensive commodity — petroleum oil. Light and power will be obtained from the Tasmanian SEC grid — as it's hydro-electric power (and thus, ultimately, solar-derived) he figures that's fair enough.

The windows, though smaller than are fashionable, are designed to provide adequate natural lighting while minimising heat loss.

At a stage in life when most people have either retired or are rapidly approaching the end of an active working life, Grote Reber's pioneer attitude is as strong as ever and he continues to march forward, with well thought-out and carefully executed strides, where others merely 'dabble their toes' or turn away seeking easier paths. ●

Epilogue

It was at the suggestion of Jim Davis that I took the opportunity to meet Grote Reber who, I must confess, was one of the heroes of my youth. Jim arranged the meeting at *very* short notice and he and Bill Carter proved able navigators. I am indebted to both gentlemen.

For those interested in further reading on radio astronomy, 'Radio Astronomy for Amateurs' by Hey, obtainable from some technical bookshops makes good reading. The author wrote a series on 'Radio Astronomy for Amateurs' published in ETI between December 1971 and April 1973.

Radio Australia gets Darwin go-ahead

The Federal Government recently approved reconstruction plans for the Radio Australia transmitter complex on Cox Peninsula, across Darwin harbour. If all goes to plan, the transmitters of Radio Australia on Cox Peninsula should be fully active by Nov 1982.

Radio Australia operated three powerful shortwave transmitters, each of 250 kilowatts, at Cox Peninsula until Christmas Day in 1974 when cyclone Tracy wrecked the antenna arrays and cut off the power supply to the peninsula.

Submarine power cables across to Cox Peninsula will need to be repaired before regular broadcasts can recommence, although some irregular test broadcasts have been made in the past year by using an emergency power generator at the transmitter site.

Main costs in reactivating the Cox Peninsula transmitters will be the installation of the submarine cables across Port Darwin, and the installation of a new antenna system.

New curtain antenna arrays are to be installed, which could be lowered to ground level to avoid damage from any future cyclones. These antennas are of a type similar to those installed at Radio Australia's Carnarvon (West Australia) transmitter site, which have proved very successful during cyclonic conditions.

Amazingly, the transmitters themselves suffered little or no damage from cyclone Tracy. However, the buildings housing the transmitters are to be cyclone-strengthened for added security.

An earlier proposal to re-site the Radio Australia Darwin station at Humpty Doo, 60 km south east of Darwin was rejected. Although the Humpty Doo site would be less prone to cyclone damage, the re-siting of the transmitters would have entailed greater costs and further delays in re-activating what will be Radio Australia's most important transmitting station.

World Radio Television Handbook 1981

This publication is an essential reference book for all those even slightly interested in radio, be it shortwave, mediumwave or FM.

The Australian Radio DX Club will again be co-ordinating orders for the upcoming 1981 edition. The 1981 edition should cover well over 500 pages listing shortwave, mediumwave and television stations throughout the world together with station addresses, personnel and policy towards reception reports.

For further information about ordering your copy of the 1981 World Radio and Television Handbook, please send a stamped, self-addressed envelope to the address in this column. The edition should be published around early February 1981.

NOTE ! All times are given in Greenwich mean time (GMT). To convert to Australian Eastern Standard Time, add 10 hours (11 hours during Daylight Saving Time, November to February). To convert to Central Standard Time, add 9.5 hours and Western Time add 8 hours.

All frequencies are given in kHz.

These notes are compiled by Peter Bunn on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of the ARDXC may be obtained from P.O. Box 79, Narrabeen, NSW 2101, for a 22¢ stamp.

New service from Ecuador

Station HCJB, the Voice of the Andes in Quito, has recently introduced a new service for Australia in Spanish. This has meant a cut in the English language Australia service of 30 minutes.

HCJB has replaced the last half hour of the 0700-1100 English broadcast with a Spanish programme especially for Australian listeners. The programme is heard on the same channels as the English service, that is: on 6130, 9745 and 11 900.

HCJB is also not pleased with the performance of their 11 900 frequency, realising that it suffers quite a deal of interference from jamming on the adjacent 11 905.

The station would be glad to receive recommendations from Australian listeners for alternative frequencies to 11 900, within the 25 metre band.

Change brings Iceland within reach

Iceland has for some years operated a 7.5 kilowatt shortwave transmitter on 12 175 with a daily broadcast for local seamen from 1200-1300. This time period made reception of Iceland almost out of the question here in east Australia.

However, a time change for this daily broadcast means Iceland is now within the bounds of possibility for Aussie DXers.

Iceland now broadcasts the daily programme between 1855 and 2000, still using 12 175, and this transmission should propagate into east Australia. However, due to heavy utility activity on 12 175, Reykjavik makes a difficult catch.

Reports from DXers in south Asia indicate that the signal has made it to that region so we can hold out hope that should the utility transmitters clear 12 175, we in Australia will also be able to log this very rare country.

Colombia returns

After an absence of well over 18 months, Radio Super de Cali in Colombia has returned to shortwave, and on a new frequency.

Radio Super de Cali is now heard on 6085, and gives best reception between 0730 and 0930 in Melbourne. Cali previously used 6120 when on shortwave when last heard in 1978.

That frequency often varied to 6125 and the station was never known for regularity in their broadcasting schedule.

Meanwhile, the other Radio Super currently well heard is Radio Super de Bogota, on 6065, best signals being between 0700 and 1000.

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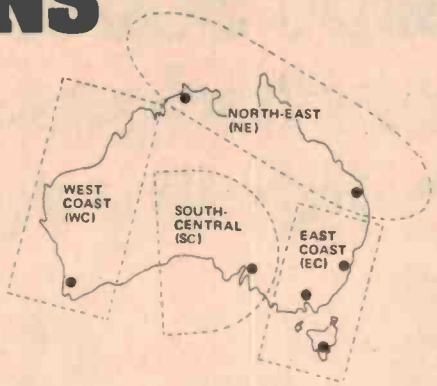
PREDICTIONS NOVEMBER 1980

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time – commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

ETI – Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.



These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

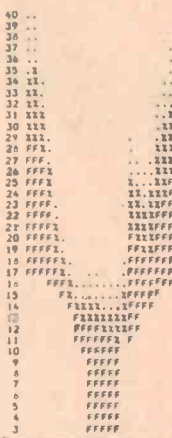
M . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

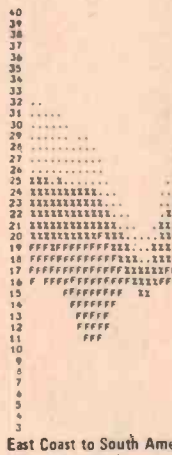
A . . . . . High absorption indicated. Expect weak signals.

East Coast to Japan (Also serves N.E. and S.C.)

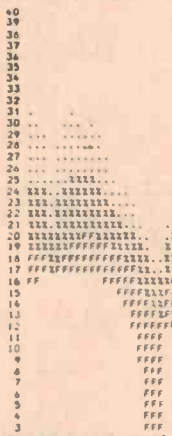
East Coast to South Pacific



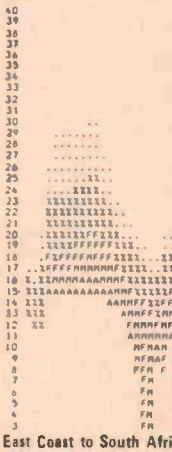
East Coast to North America (Also serves N.E. and S.C.)



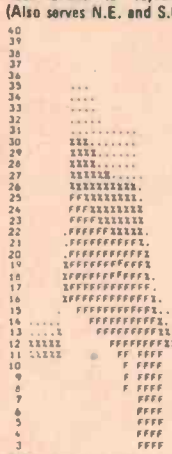
East Coast to South America (Also serves S.C.)



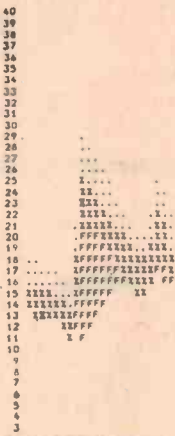
East Coast to North Africa (Also serves S.C.)



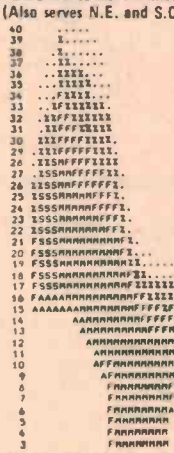
East Coast to South Africa (Also serves S.C.)



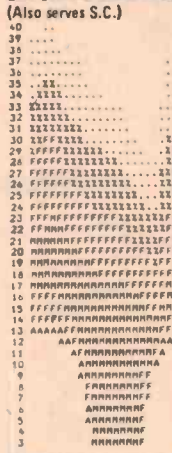
East Coast to Europe (Short Path)



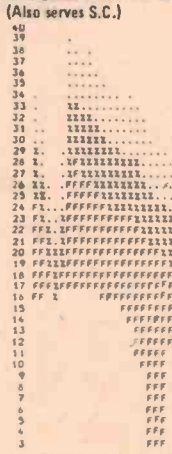
E.C. and S.C. to Europe (Long Path)



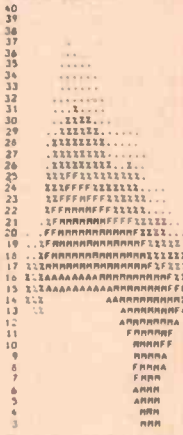
East Coast and S.C. to Persia



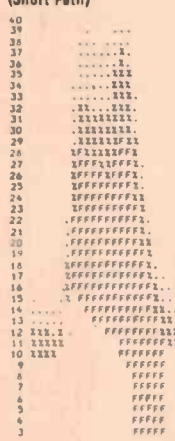
North East to South Pacific (Also serves S.E.)



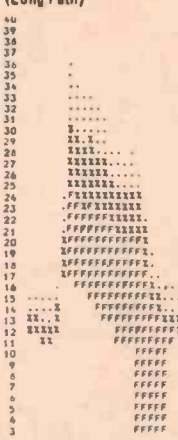
North East to North Africa



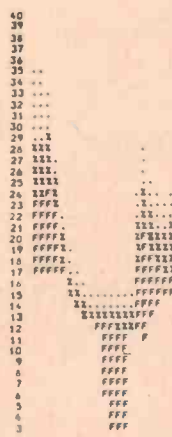
North East to South Africa



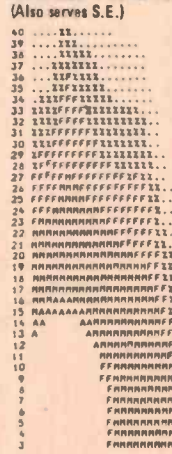
North East to Europe (Short Path)



S. Central & W.C. to Europe (Short Path)



West Coast to North America

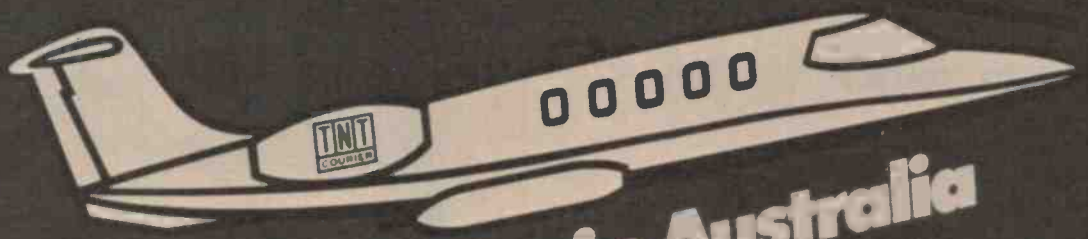


West Coast to Japan

West Coast to North Africa

West Coast to South Africa

TNT COURIER AUSTRALIA WIDE SATCHEL.



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- **Learn how to make your own printed circuit boards**
- **How to use a multimeter**
- **How to solder**

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They're all built on printed circuit boards – so we'll not only give you step-by-step instructions, we'll also show you how to solder! And there are attractive cut-out labels in the back of the book to give your projects a really professional appearance.

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KITS OF PARTS FOR FUN WAY II PROJECTS:

Full kits of parts for all projects in 'Fun Way 2' will be available with the release of the book. These kits include all components required, the printed circuit board, solder and wire etc. For details of the projects, the kit prices, etc, please refer to the 1980 Dick Smith catalogue, page 25.

DICK SMITH ELECTRONICS

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• Conditions: Name and address plus phone number (if required) must be included within the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.
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TRANSMISSION LINE loudspeakers PRO 9TL. Salter, 33 Belvedaire Way, Lynwood, WA 6155. Phone (09) 350-7254 b.h.

SELL: ETI 4000 amp with toroidal transformer $220; Hitachi TRQ 262D cassette deck $90; Echosound AM/FM Tuner $45. I. Hawke, 44 Enfield Ave., North Richmond, NSW 2754. Phone (045) 73-2068.

LUXMAN L3 D.C. 50W/CM amp, B.E.S. V60 Geostatic speakers, Technics SL1300 direct drive turntable, Top Pickering mag cartridge. All in immaculate condition, cost over $1500, sell $1200 o.n.o. Alan Calleja, 48 Elgin St., Morwell, Vic 3840.

COMMUNICATIONS

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BUY: Barlow Wadley or synthesised receiver. SSB amateur mobile transceiver (Swan, Drake, Alda). Cheap. ZL4BT care N. McMillan, 25 Daphne Ave., Bankstown, NSW 2200.

AUSTRALIAN Radio DX Club for shortwave, mediumwave Dxers. For a sample copy send one 22¢ stamp to P.O. Box 79, Narrabeen, NSW 2101, mentioning this ad.

LINEAR HF amplifier, 1 - 30 MHz, Yaesu Musen FL-2100B, uses two Eimac 572Bs, as new, purchased March 1980. 1.2 kilowatt DC input, maximum ham power all bands and overlap for new bands, $395 sacrifice. John Berry, 40 Grosvenor St, Woollahra, NSW 2028. Phone (02) 389-6455 b.h.

COMPUTERS

TRS-80 green screens, ⅛" perspex with adhesive pads for easy mounting. $12 incl. postage. D. Silver, Flat 1, 'Kenley Close', Leonard St., Parkville, Vic 3052.

SELL: Computer system. KT9500 2650 computer, 14K RAM; 5V/10A, +/−12V power supply; VDU includes Honeywell keyboard, EME-1; TV monitor; cassette recorder/interface; software. (Parts cost $1600) $1400 o.n.o. David (02) 663-2559.

OLIVETTI I/O electric typewriter, u/case and l/case characters, suit word processor and computer applications. $225. Long, 46 Gloucestor St., Sydney, NSW 2000. (02) 27-2982 a.h.

Computer power supply. IN3209 15 amp rectifiers, 3 x 37,500 uF condensers, voltage stabilised type. Transformer 24, 5, 40 V output, 240 V input, $40. R. Long, (02) 27-2982 a.h.

OHIO C2-4P computer. 8K RAM, 8K BASIC, all documentation, lots of software, as new. $600. M. Finn 16 Inga St., East Burwood, Vic. (03) 288-5116.

MICRO 2650 (KT9500), 16K RAM, 110/300 baud, keyboard, EME VDU, cassette interface, 10 amp p/s, BASIC, considerable software, full documentation. $400. Phone Mick (03) 288-5116.

WANTED: Dead or damaged EPROMS — will reimburse postage. Send to Mark Berndt, 213 Cape St., Heidelberg, Vic 3084.

WANTED: Controller, disc drives, software and documentation for 8080/S100 based system, any condition. Phone Bill Bencke (062) 31-6935 reverse charges.

NORTH COAST persons interested in computers contact Ray Evans to share NSW Uni correspondence courses in BASIC and microprocessors. P.O. Box 36, Iluka, NSW 2460. Phone (066) 46-6173.

8K static S-100 RAM board low power 450ns memory assembled and tested, $115. Brian Aird (047) 21-5333.

SELL: Dream 6800, assembled and tested $200, power supply extra $50. Phone (08) 31-1222.

OMEGA (OSI Microcomputer Enthusiasts Group Australia) has details on software and hardware mods for your OSI C1, C2 or C4. It is only $5 per year, including the newsletter (bimonthly). Contact Geoff Cohen, 72 Spofforth St., Holt, ACT 2615. Phone (062) 49-2688 b.h., (062) 54-7608 a.h.

SORCERER USERS — software group and program interchange. Join forces to solve the software shortage. Contact J. Stephenson, 4 Melinga Pl., Tarooma, Hobart, Tas 7006. Phone (002) 27-8770.

WANTED: SS50 or SWTPC 6800 computer printer, terminal, disk drive, boards, etc. Ray Evans, P.O. Box 36 Iluka, NSW 2460. Phone (066) 46-6173.

FOR SALE: 3 S100 WW pcbs $30; 16K x 1 dynamic memory (4116) chips $8 ea, plus other items. Write to F. Macri, 7 Winifred Av., Caringbah, NSW 2229.

MISCELLANEOUS

SPECTRUM Analyser Meguro-MAT 142 dual trace, audio frequency tracer, as new. Hewlett-Packard 120B rack mounted, from $350. Phone (02) 46-5451.

150 in 1 Dick Smith experimenters kit exc. cond. $25. Phone Leon (062) 54-2662 a.h.

APPRECIATE circuit diagrams and pcb patterns for Road Race TV game using AY-3-8603 IC or Warfare TV game using AY-3-8605 IC. D. Stafford, 20 Rigby St., Annerley, Qld 4103. Phone (07) 48-2378.

WANTED: Old Astor super delux 6 valve or (5) short wave (any condition). G. Bracey, P.O. Exeter West, Tamar, Tas 7251. Phone 94-4126.

CASIO FX-502P owners; anyone interested in forming users group to sell/swap programs? Send s.a.e. suggestions to Clive Conway, 80 Third Ave., Joslin, SA 5070.

WANTED: Oscilloscope, single or dual trace depending on price, prefer B.W.D. brand, to suit serious hobbyist. Phone (03) 232-5725 a.h.

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KITS for projects

WE GET MANY enquiries from readers wanting to know where they can get kits for the projects we publish. This list is a guide to suppliers of kits and components for ETI projects.

We have listed here most of the projects published over the last few years which are either available as kits or can still be made up by shopping around for components. Suppliers listed against a particular project will either stocvk it as a kit or stock the pc board plus the other components.

Printed circuit boards

Those suppliers listed against specific projects here are able to supply pc boards for those projects. Printed circuit boards for every project ever published in ETI are available through the following companies (to the best of our knowledge):

RCS Radio
651 Forest Rd
Bexley NSW

Radio Despatch Service
869 George St
Sydney NSW 2000

For current projects and a more comprehensive list of pc board suppliers refer to the Shoparound page in this and previous issues. This list will be updated roughly every four months.

Key to Companies

A Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077. Ph. (02) 487-2711.

B Bill Edge Electronic Agencies, 115 Parramatta Road, Concord (PO Box 1005, Burwood North 2134). Ph. (02) 747-6472.

C J.R. Components, PO Box 128, Eastwood, NSW 2122. Ph. (02) 85-3385.

D Dick Smith Electronics P/L, Cnr Waterloo & Lane Cove Roads, North Ryde, 2113. Ph. (02) 888-3200.

E All Electronic Components, 118 Lonsdale Street, Melbourne, Vic 3000. Ph. (03) 662-3506.

F Tasman Electronics, 12 Victoria Street, Coburg, Vic 3058. Ph. (03) 354-5062.

J Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000. Ph. (02) 211-5077.

K S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109. Ph. (03) 842-3950.

L Ellistronics, 289 Latrobe Street, Melbourne, Vic 3000. Ph. (03) 602-3282.

M Mode Electronics, PO Box 365, Mascot, NSW 2020. Ph. (02) 666-6324.

N Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011. Ph. (02) 33-5850.

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

P Pre-Pak Electronics, 718 Parramatta Road, Croydon, NSW 2132. Ph. (02) 797-6144.

R Rod Irving, PO Box 135, Northcote, Vic 3070. Ph. (03) 489-8131.

V Silicon Valley, 23 Chandos Street, St. Leonards, NSW 2065. Ph. (02) 439-4655.

W Willis Electronics, 993 Hay Street, Perth, WA 6000. Ph. (09) 321-7609.

Y Trilogy, 40 Princes Highway, Fairy Meadow, NSW 2519.

Project Electronics

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

Test Equipment

132 Experimenter's Power Supply (Feb 77) ... E,O
133 Phase Meter (Apr 77) ... E
134 True RMS Voltmeter (Aug77) ... E
135 Digital Panel Meter (Oct 77) ... E
136 Linear Scale Capacitance Meter (Mar 78)
137 Audio Oscillator (May 78) ... W,D,E
138 Audio Wattmeter (Nov 78) ... E,B
139 SWR/Power Meter (May 78)
140 1GHz Frequency Meter-timer (Mar 78)
141 Logic Trigger (Jan 79) ... E
142 High Current Power Supply (Feb 79) ... W,E
143 Curve Tracer (Jan 79) ... W
144 Expanded-scale RMS Voltmeter (Jun 79) ... E
148 Versatile Logic Test Probe (Jul 79) ... E,L

Simple Projects

243 Bip Beacon (Apr 77)
244 Alarm Alarm (Feb 77) ... F
245 White Line Follower (Nov 77) ... F
246 Rain Alarm (Apr 78) ... F
248 Simple 12V to 22V Converter (Jul 78) ... W
249 Electronic Combination Lock (Apr 79) ... E
252 The Passionmeter (Aug 79)
253 Electronic Grenade (Hot Potato) (May 79)
254 Egg Timer (Jun 79) ... W

Motorists' Projects

316 Transistor Assisted Ignition (May 77) ... W,E,O,K
317 Rev. Monitor Counter (Jul 77) ... E
318 Digital Car Tacho (Jul 78) ... W,E,K
319 Variwiper MK II (Sep 78) ... W,E,O
320 Battery Condition Indicator (Apr 79) ... E,L

Audio Projects

448 Disco Mixer (Nov 76) ... W
449 Balanced Microphone Amp (Nov 76) ... W,D,E,J,F,Y
450 Bucket Brigade Audio Delay Line (Dec 77) ... W,E
451 Hum Filter (Jul 79) ... D,E,F
470 60 W Amp Module (May 79) ... W,R,E,F,B,P,L,A,V
471 High Performance Stereo Preamp Control Unit (Jun 79) ... W,R,E,F,B,P,A,V,L
472 Power Supply — the Series 4000 Stereo Amp (Jul 79) ... W,R,E,F,B,V,L
473 Series 4000 Moving-coil Cartridge Preamplifier ... F,J
480 50-100 Watt Amp Modules (Dec 76) ... A,W,R,D,E,J,O,Y,L
481 12V 100 Watt Audio Amp (May 77) ... R,E
481 High Power PA/Guitar Amp (Jun 77) ... W
482 Stereo Amp (Jan 77) ... O,E
482 Stereo Amp Part 2 (Feb 77) ... O,E
483 Sound Level Meter (Feb 78) ... E
484 Simple Compressor Expander (Jul 77) ... A,E
485 Graphic Equaliser (Jun 77) ... W,E,J,O
486 Howl-round Stabiliser (Nov 77) ... J
487 Audio Spectrum Analyser (Feb 78) ... E
489 Audio Spectrum Analyser 2 (Apr 78) ... E,J
490 Audio Compressor (Dec 78)
491 Simple Graphic Equaliser (Mar 79) ... W,E
495 Transmission Line Speakers (Aug 77)

Miscellaneous

546 GSR Monitor (Mar 77) ... W,E
547 Telephone Bell Extender (Jun 77) ... E
548 Photographic Strobe (May 77) ... W,E
549 Induction Balance Metal Detector (May 77) ... W,D,E,L
550 Digital Dial (Aug 78) ... E,O
551 Light Chaser (Sep 78) ... W,E,O
552 LED Pendant (Sep 78) ... A
553 Tape/Slide Synchroniser (Oct 78) ... E
556 Wind Speed/Direction Indicator (Dec 78)
557 Reaction Timer (Feb 79) ... E
558 Mast-head Strobe (Feb 79) ... E
559 Cable Tester (Mar 79)
575 Portable Fluorescent Light Wand for Car, Camping (Aug 79) ... W
577 General Purpose Power Supply ... J
581 Dual Power Supply (Jan 77) ... W,E,Y
582 House Alarm (Jul 77) ... W,E,O,A,
House Alarm — Installation Instructions (Aug 77) ... W
583 Marine Gas Alarm (Aug 77) ... D,E,M
585 Ultrasonic Switch (Sep 77) ... R,D,E,O,F
586 Shutter Speed Timer (Oct 77) ... E
587 UFO Detector (May 78)
588 Theatrical Lighting Controller (Nov & Dec 77 Jan & Mar 78) ... N
589 Digital Temperature Meter (PCB135) (Dec 77) ... E
590 LCD Stopwatch (Oct 78) ... O,N
591 Up/Down Presettable Counter (Jul 78) ... D,E
592 Light Show Controller (Aug 78) ... E
593 Colour Sequencer (Dec 78)
594 Development Timer (Apr 79) ... E
595 Aquarium Lamp Controller (May 79)

Electronic Music

602 Mini Organ (Aug 76) ... W,D,E,A
603 Sequencer (Aug 77) ... W
604 Accentuated Beat Metronome (Sep 77) ... E
605 Temp Stabilized Log-exponential Converter (Sep 78)

Computer Projects

630 Hex Display (Dec 76) ... E,A
631 ASCII Keyboard (Dec 76) ... W,E,O,A
631 Keyboard Encoder (Apr 77) ... W,E,O,A
632 Video Display Unit (Jan 77) ... A,E,O
633 TV Sync Generator (Jan 77) ... A,E
634 8080 Educational/Prototyping Interface (Jul, Aug 78)
635 Microcomputer Power Supply (Sep 77) ... O
637 Cuts Cassette Interface (Jun 78) ... V,E,A
638 Eprom Programmer (Jul 78) ... W,E,A
639 Computerised Musical Doorbell (Mar 78) ... A
640 S100 VDU (Apr, May, Jun 78) ... W,O,A,V
641 S100 Printer (Sep 78) ... O
642 16k S100 RAM Card (Feb 79) ... K
650 STAC Timer (Nov 78) ... A,E,L
651 Binary to Hex Number Converter (Jun 79) ... E

Radio Projects

712 CB Power Supply (Jun 77) ... W,E
713 Add-on FM Tuner (Sep 77)
714 VHF-Log-Periodic Antenna (Feb, Mar 78)
715 VHF Power Amplifiers (Nov 77)
716 VHF Power Amplifiers (Jan, Feb 78)
717 Crosshatch Generator (May 78) ... W,D,E,A,Y
718 SW Radio (Oct 78) ... E
719 RF Field Strength Indicator (Nov 78)
720 2m VMOS Power Amp (Jan 79)
721 Aircraft Band Converter (Mar 79) ... W,E
722 Antenna for Aircraft Band Converter (May 79)
724 Microwave Oven Leak Detector (Jul 79) ... D,E,B
725 Simple SSB Generator employs Polyphase Network using Standard Components (Aug 79) ... E,L
730 Get Going on Radioteletype (Aug 79) ... E,L

Electronic Games

804 Selectagame (Nov 76) ... O
804 Selectagame (Rifle Project) (Mar 77) ... O
805 Puzzle of the Drunken Sailor (Oct 77)
806 Skeet (Jan 78) ... O
810 Stunt Cycle TV Game (Jun 78) ... D,O
811 TV Tank Game (Oct 78) ... O
812 Wheel of Fortune (Dec 78)
813 Race Track Game (Jan 79) ... O
814 The 'Dinky-Die' (Aug 79)

10

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DREGS

DREGS' junior correspondent likes to go dancing in clubs where the bands play fast and loud, and he likes to be right in front of the stage where the sound levels are only just below the threshold of pain. In these conditions it's very difficult to hold any kind of conversation — you have to shout at the top of your voice and repeat yourself several times to convey the simplest message.

He was more or less resigned to this until the other day when he caught sight of our September 1978 issue, whose cover features the LED pendant project. This was intended simply as a novelty item, but our little rager realised its possibilities as a communications device. The level of ambient light in the average rock club is quite low enough to allow a LED display to stand out clearly and a small keypad mounted on the wrist would allow simple messages to be conveyed.

Eventually our minion intends to produce a sophisticated version with an eight character display on which real words can be shown, but for the time being he's making a number of simple one-digit versions. The idea is to use some kind of code, along the lines of the ten-codes used by CBers. Common questions and answers could be assigned a conventional number code, so for example to convey the message, "Hi, you were here last night weren't you?", you might flash 6 followed by 8 and "This band are boring, let's go back to my place" might be indicated by a 4 followed by a 9.

Coding is still a bit of a problem because the code has to be understood by half-wits and those who may be a little 'off the planet' (Dregs' junior won't say in which category he belongs), but the range of conversation in rock clubs is never very wide and most people should have no difficulty memorising the codes for the few phrases they habitually use.

The Great Dregs Awful Puns Competition

Well, well... since kicking off the competition on this page in the July issue we've seen some great examples of awful puns ! First off the mark was H. Meallin, VK3ATK, of South Oakleigh in Victoria, with "Your sample pun Hertz". Maybe so, maybe so but Managing Editor, Collyn Rivers, didn't agree ! Then Trevor Bartlett of Nurioopta in South Australia came up with several. His best/worst was: "Are integrated circuits used in Antarctica known as IC(e) chips ?". Hmm. One reader had a very obscure story about dynamic ROMs but the one that takes the prize in this first round came from 17 year old Evan Troup of Frankston in Victoria. It reads: "The reason that no one will ever be able to program a computer to compose music is that their Bach is worse than their byte" ! Your copy of Computers & Computing is on its way, Evan.

Right-oh folks, keep those awful entries coming. Send to: The Great Dregs Awful Puns Competition, ETI Magazine, 3rd floor, 15 Boundary St, Rushcutters Bay NSW 2011.

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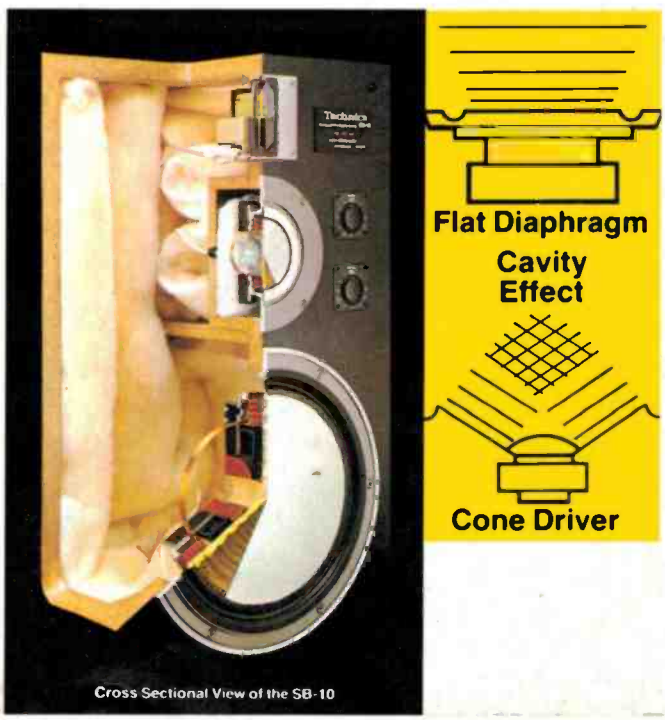

Cross Sectional View of the SB-10

The most obvious difference... between the new Technics honeycomb disc speaker system and conventional speaker systems is that the speaker units are flat instead of conical. This flat sound radiating surface at last puts an end to all of the distortions inherent in the traditional cone-shaped design. Cone shaped drivers suffer from something called the 'cavity effect' which causes peaks and dips in the upper end of the driver's frequency range.

But cone shaped drivers do have their advantages, namely a combination of low mass and high rigidity which contributes to pistonic motion. In designing this new Technics honeycomb speaker system we were faced with the problem of retaining or improving upon the cone-shaped speaker's low-mass, high-rigidity characteristics while developing a flat speaker surface. We found the answer in the 'axially symmetric honeycomb diaphragm.' It is well known that honeycomb structures are very light and strong, which is why they are extensively used in aircraft construction. In spite of the honeycomb's low mass, it is very rigid and difficult to bend.

Technics