CEMA catalogue inside

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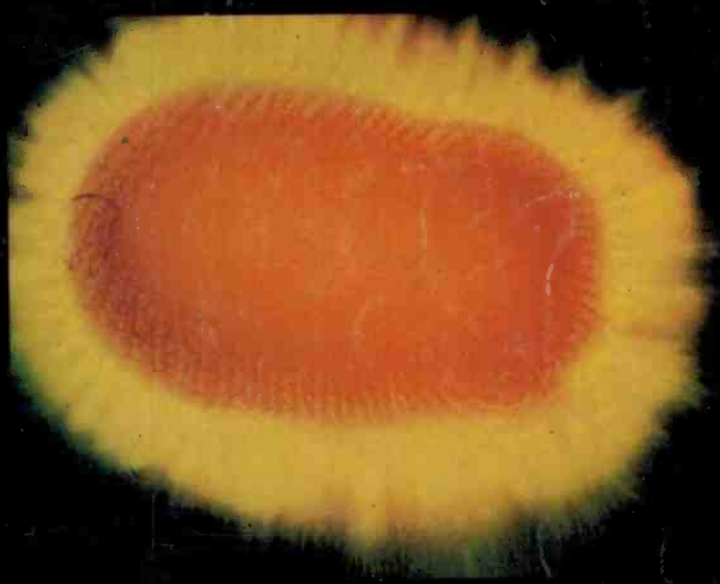
JULY 1979 INTERNATIONAL

KIRLIAN PHOTOGRAPHY -fact or fake?

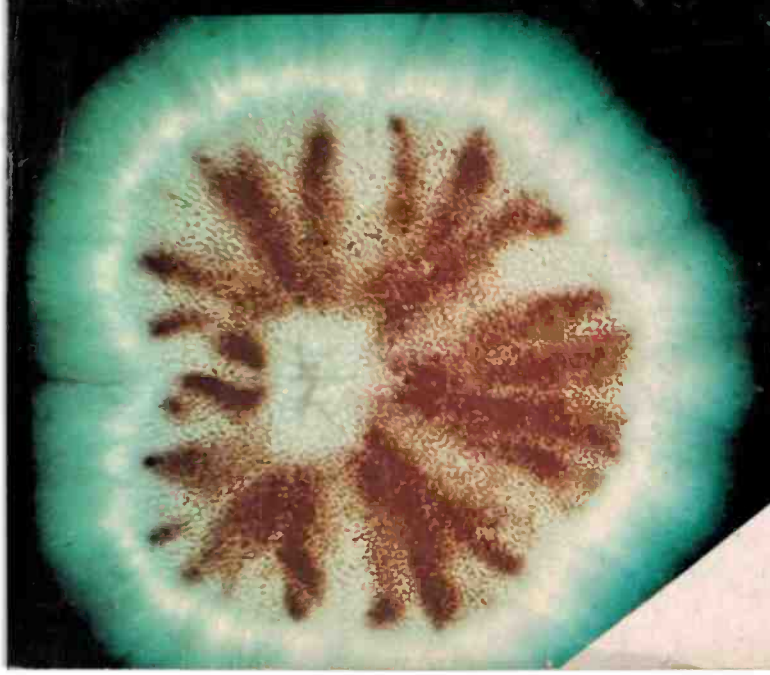


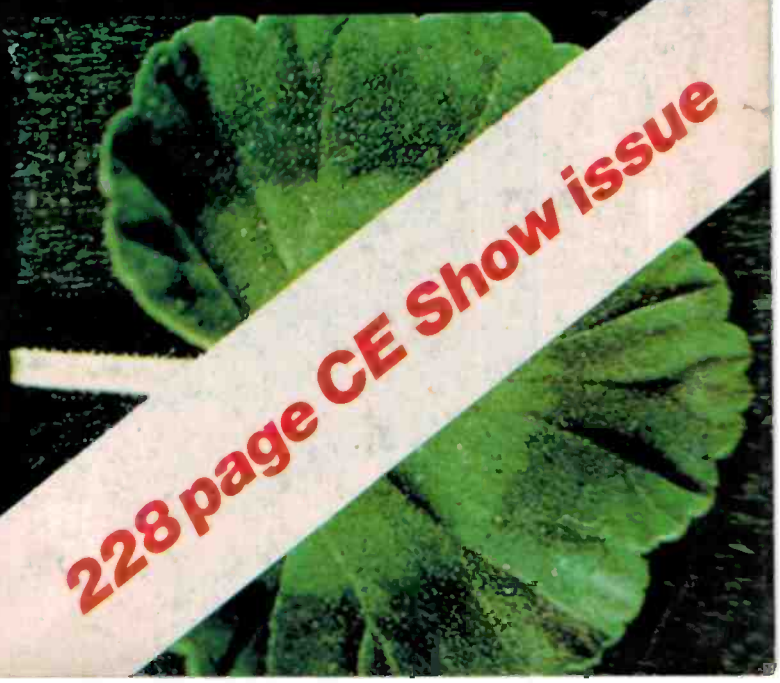
Metafine deck reviewed

Build microwave oven leak tester

Stereo amp

Great Sound Section
-reviews -metal tapes -'adres' explained





228 page CE Show issue

The competition don't like the sound of this at all.

For quite some time, other manufacturers have been trying to produce tape with the qualities of the Maxell UD-XL. At the same time, Maxell have been quietly perfecting an even better series.

The UD-XL I and UD-XL II tapes are designed to attain maximum performance at the ferric and chrome position on your tape deck. Whichever tape position you choose, Maxell can give you a better performance.

UD-XL I TAPE, FOR FERRIC (norm.) POSITION (120*us*)

UD-XL I offers an excellent sensitivity of 1 dB higher than even UD-XL. MOL performance is also 1 dB higher over the entire audio frequency spectrum. The result is a new standard in ferric tape, with wider dynamic range and less distortion than ever before.

How does the UD-XL I compare then, with ordinary low-noise tapes?

Sensitivity is higher by 2.5 dB, and MOL performance by as much as 6 dB.

Yet, for all this UD-XL I requires no special bias or equalization. Simply set your tape selector as you normally would at the ferric position – but there the comparison ends.

UD-XL II TAPE, FOR THE CHROME POSITION (70*us*)

UD-XL II tape is such a dramatic improvement on most other tape that can be used in this position, that comparison is really unfair.

For example, if you're familiar with conventional chromium-dioxide tape, you'll know of the associated problems of poor output uniformity – plus low maximum output level and rather high distortion.

UD-XL II tape offers you excellent MOL, sensitivity, and an output improvement of more than 2 dB over the entire frequency range.

Maxell's unique 'Epitaxial' process gives you absolute sensitivity and stability, and no drop-out problems. What's more, the shells are moulded in diamond cut dies, and made to tolerances 5 times greater than the Philips standard. And, like all Maxell tapes, UD-XL II has the 5-second cleaning leader.

In short, if you're recording in the chrome position, you can now achieve all the advantages – with none of the drawbacks.

A prospect we think you'll find very exciting – even if the competition don't.

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WT3/79

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ELECTRONICS TODAY INTERNATIONAL

THANKS TO all those readers and advertisers who contacted us with comments on the 'new look'. The response was really enthusiastic. As we said last month, there's still some fine tuning to do and we're considering various suggestions people have made.

This month we present a range of articles on the new technologies and equipment you'll find exhibited at the Fourth Australian Consumer Electronics Show. Inside we have a review of **Nakamichi's revolutionary 582 cassette deck** which is designed to play the new **metal particle tapes** — which are discussed in several articles. Electronic reverberation systems for domestic use might **succeed where quad failed** — we review a unit from Sound Concepts with surprising results. The **ADRES** noise reduction technique will undoubtedly excite some interest (we reviewed Toshiba's ADRES deck last month). David Tilbrook explains how it's done.

If you're going to the **CE Show**, don't miss our guide beginning on **page 199.**

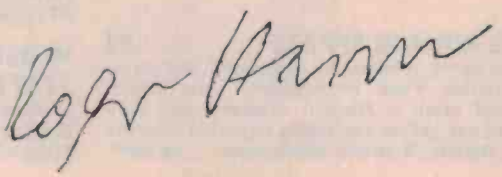
For the keen project builder we present complete construction details this month for our **Series 4000** stereo amplifier, plus a **microwave oven leak detector** (which we promised you last month), a simple **hum filter** for hi-fi's and a **logic test probe** for your workshop. We've started a new, occasional series titled **Lab Notes** this month, intended to fall somewhere between Ideas for Experimenters and full-blown projects. We'll be talking about circuit techniques, notes on projects, interesting circuits etc. And don't miss the **CEMA Catalogue**, 20 pages, commencing on page **115.**

For readers exploring home computing we have a review of the **MicroCon,** a locally made machine; an introductory article on BASIC programming and a run down on the first **Sydney Home Computer Show.**

For the **communications** hobbyist we have an article on recent **propagation research** which has explained an interesting phenomena after 30 years of effort. There's also the regular news and shortwave loggings.

This is our biggest issue for some time, browse through the contents over the page, we trust you find a good month's reading!

Roger Harrison, Editor



Contents

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eti ELECTRONICS TODAY INTERNATIONAL

COVER

Kirlian photography is one of those subjects that one finds rather difficult to decide whether to take seriously or not. These pictures are genuine — our cover feature this month looks at the whole subject in depth.

news

features

projects

sound

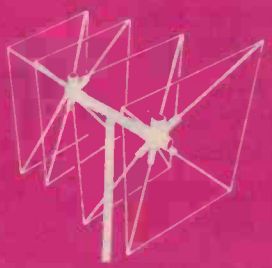
general

next month

SPECIAL FEATURE ON COMMUNICATIONS

FIBRE OPTIC COMMUNICATIONS
Optical fibre 'light pipes' will replace virtually all cable communications in the future. Development is now on the brink of large-scale application.

SPECTRUM SPACE WAR
The World Administrative Radio Conference will be held in Geneva in September. The conference will decide spectrum usage for the next 20 years. Third-world nations may influence the outcome to a large extent — or is it already decided?



BUILDING QUAD ANTENNAS
Popular for 20 years but mechanically 'difficult', we show practical details of how to build your own using a locally-made 'hub'.

POLYPHASE SSB GENERATOR
The elegant way to produce SSB. Cheap, too! A simple, 'universal' SSB generator project using off-the-shelf components.

ACCUPHASE MOSFET AMP REVIEWED
Power MOSFETs have just begun to invade hi-fi equipment. We review a sample of this 'new generation' audio gear.

REVIEW OF THE IC701
ICOM's state of the art HF transceiver incorporates some innovative technology. An in-depth review.

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

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By phone: We can only answer readers technical enquiries by telephone after 4 pm. In enquiring by telephone about back issues or photostats, please ask for the "Subscriptions Department". **33-4282**

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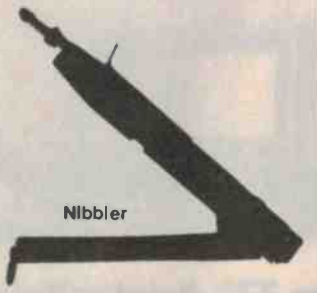

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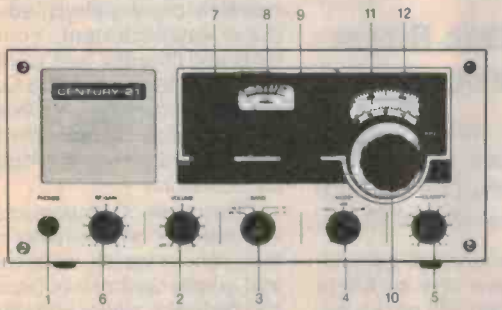

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BC116A use BC213L	
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BC147B60	
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BC157 use BC557	
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NEWS digest

Warning from GEC director

GEC Australia has announced a merger between two of its divisions.

The merger is between GEC Machines Division and GEC Distribution Equipment Division; they are combined under the new name, GEC Industrial Products Division. The merger applies to all States.

The formation of the new Division was announced at a reception at the Sebel Town House on May 23, 1979.

In his address the new Division's Managing Director, Mr. Revill Bird, emphasised the importance of standardisation and warned that **if Australian industry failed to standardise the country would not only lose exports to expanding markets in S.E. Asia, but would be swamped by the products of the rapidly developing nations of the region.**

Australia's manufacturing industries were doomed unless the country had an immediate change of industrial policy.

"If S.E. Asian manufacturing facilities outgrow us, as they are beginning to do, we will become more inward-looking and seek further protection. And manufacturing industry here will die," he said.

A principal aim of the new Division is to supply a complete range of standard products and components to meet the demands of its customers.

It is expected that longer production runs, and other economies resulting from standardisation, will result in the creation of new jobs and enhanced export opportunities.

The complete range of equipment and machines from both former Divisions will now be linked directly in one operation.

New product development will be stream-lined, allowing rapid entry into areas of new technology (particularly solid-state) and the support of the company's Hirst research centre at Wembley, London, will be fully utilised.

Head Office and Works of the new Division are located at: **25 Princes Road, Regents Park, NSW, 2143.**

Magnetic-levitation vehicles

A prototype high-speed, magnetically levitated passenger vehicle capable of carrying 30 people was in service at the International Transport exhibition at Hamburg in May.

Research is being carried out in Japan, and a similar system may be ready for trials next year.

Both systems use magnetic levitation where the track and the vehicle form similar poles of a magnet. The repulsion produced supports the vehicle slightly above the track.

The German prototype moves its 36 tonnes at 80 km per hour over a temporary track 900 metres long. A consortium of German companies which have already tested a 15 seat, 18 tonne vehicle at speeds of more than 200 km/h, plan to build a 122 tonne vehicle carrying 100 passengers at up to 400 km/h over a 32 km track.

The German machines work on the "long linear motor" principle where the stator of the motor is laid along the track. The 'rotor' is contained in the vehicle and the electromotive force provided by ac excitation moves the vehicle along the track. After the machine is loaded it is then levitated and the winding of super-conducting electromagnets shorted to maintain levitation.

Research is being carried out by Japan Airlines to provide fast transport from Tokyo to their new airport at Norita, 70 km away. They use a "short linear motor" principle, the reverse of the German system, with the stator in the vehicle.

The first experimental vehicle weighed one tonne and exceeded 300 km per hour on a test track last year. The Japanese hope to extend their system to provide rapid inter-city transportation, partly replacing conventional railways.

Colour TV Australia's smallest?

If your idea of bliss is a chicken and champagne breakfast in Centennial Park (or Melbourne's Botanical Gardens, etc . . .), but you hesitate to indulge as it means missing Sesame Street, then Toshiba might just solve your dilemma.

Their recently-released colour TV, model C631, is believed to be the smallest on the market. It features 12.7 cm, 55 degree, 'black stripe' picture tube, touch tuning, instant picture, 240 Vac mains operation and a rechargable battery pack (optional). It carries a three-year warranty and will be available through Toshiba dealers around Australia.

Monolithic filters from Reticon

American manufacturer Reticon have recently released a new line of high-specification digital filters.

Requiring no external components, the new line of filters comes in 16-pin DIL packages, with variable centre frequency determined by a clock input.

Using a switched-capacitor technique, the new devices have amazing specifications — how about a six-pole low pass filter with a signal to noise ratio of 70 dB and a corner frequency variable from 1 Hz to 30 kHz and full sweep facility?

New quarterly

Philips have a new quarterly publication called "Electronic Components & Applications."

The book, which covers all aspects of contemporary electronics, is intended for equipment designers, laboratories, research organisations, educational establishment, consultants and libraries, and is jointly published by the Elcoma Components and Materials Division of N.V. Philips Gloeilampenfabrieken, Eindhoven and Mullard Ltd, London.

"Electronic Components & Applications" will derive its content from research, application and quality control laboratories, and factories, where knowledge is available to keep readers informed about components and the best ways of using them.

The subscription rate per volume (four issues) is $8.00 available from Philips Electronic Components & Materials, Technical Publications Department, PO Box 50, Lane Cove, 2066.

Zero One Electronics

Gary Worth, late of Techniparts in Brisbane, has struck out on his own, with a new company called Zero One Electronics.

The company are Queensland distributors for Zilog and Bishop Graphics, as well as offering a wide range of other components (Honeywell, AMP, etc.).

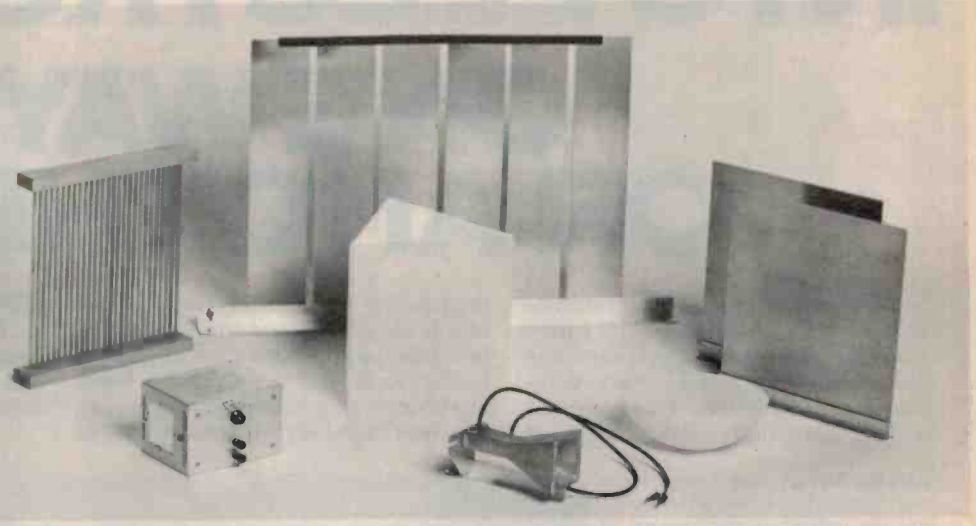
Zero One will also be supplying S100 and EXORciser compatible boards and systems. For example, the Zero One Z-80 CPU card features either 2 MHz or 4 MHz CPU, a Z-80 PIO (two 8-bit parallel I/O ports), 256 bytes of RAM, two 2708 EPROMs, a Tarbell cassette interface and a socket for a National Semiconductor number-cruncher chip.

Software supplied with the board includes a 2K monitor designed to operate with the 640 VDU and a parallel keyboard, as well as software to set up the cassette interface and to read and dump in Kansas City format.

Also available is a 6 K BASIC which includes facilities to drive the graphic capabilities of the VDU.

The CPU card is priced at $199.00 inclusive of sales tax and freight, or $211.50 with 4 MHz option, plus $29.50 for the number-cruncher option.

For further details contact: Zero One Electronics, 200 Moggill Rd, Taringa, Brisbane, QLD 4068.



Microwave demonstrator kit for schools, colleges

An Australian designed and produced microwave demonstrator kit designed to illustrate, in a practical way, basic electromagnetic phenomena has just been released by Microwave Developments.

Practical demonstrations of electromagnetic laws and phenomena, and optical analogies, are highly effective as an aid to teaching and the Microwave Developments kit has equipment to encompass demonstrations of the following:

Transmission, reflection, polarisation, diffraction at a straight edge, diffraction from single slits as well as gratings, interference at a thin film, interference by Lloyd's mirrors, Michelson's interferometer, Newton's rings, simple communications, doppler shift and polar diagram measurements of slots and horns.

The kit comprises a microwave source and detector plus two reflector plates, a 60 degree paraffin wax prism, a 250 mm diameter paraffin wax lens, a square wire grating and a variable diffraction grating.

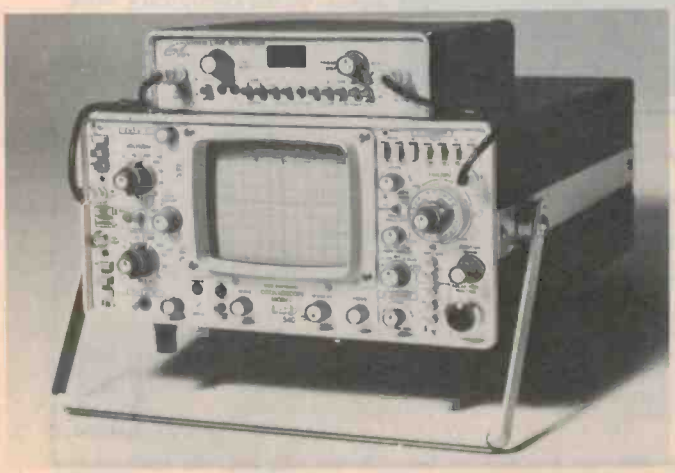
All parts are designed to withstand the rigours of student use. The microwave source is self-contained and uses a Gunn diode oscillator operating at a nominal frequency of 9975 MHz (about 3 cm wavelength) from a 12 Vac supply. The oscillator can be pulse-amplitude modulated from an internal source at either 1 kHz or 100 Hz or operated without modulation (CW). External frequency modulation is also possible.

The detector is mounted in a waveguide with integral horn antenna and uses a video point-contact diode for high sensitivity. The detector may be mounted in either of two orientations to show polarisation effects.

Priced at $175 plus sales tax and freight if applicable, the kits are obtainable from Microwave Developments, 12 Romford Rd, Frenchs Forest 2086 NSW, (02) 451-8429.

Detailed instructions, setting out complete specifications and demonstrations, are obtainable for $2.50.

The kit is currently supplied to NSW schools and can be ordered in this State as 'NSW Department of Education, Item 570, Microwave Kit, 3 cm'.



Video line selector CRO accessory

BWD Electronics Pty Ltd have just developed a video line selector to add to their BWD 540 oscilloscope.

The unit converts a suitable oscilloscope to a video or communication monitor system useful for studio, O/B van, video monitoring from camera to transmitter or teletext applications.

Features include digital readout, two selectable preset lines, back porch or sync tip clamping, chrominance filter, line count and a 40 MHz frequency response.

Further details are available from BWD Electronics Pty Ltd, Miles Street, Mulgrave, Vic 3170, (03) 561 2888. • ▶

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New Zealand: 182 Wakefield Street, Wellington.

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Plugs, sockets and terminals

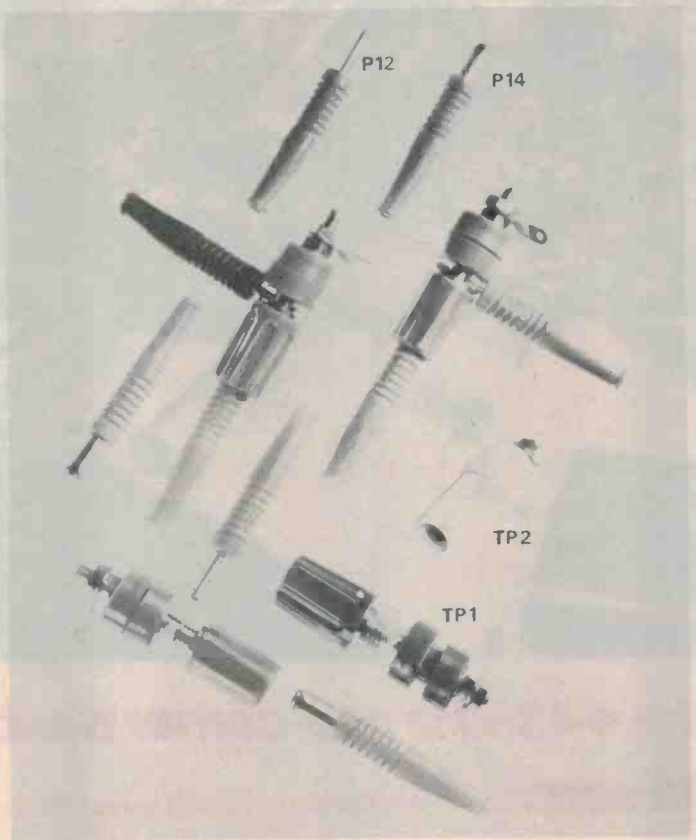
Cliff Plastic Products are high quality English-made components distributed in Australia by Delsound Pty Ltd. The range covers knobs (slider & rotary) plugs and sockets, terminals and terminal plugs, test clips, feet, and a mains quicktest.

The jack plugs in 3.5 mm, 6.5 mm mono and stereo, are produced from solid brass, nickel plated and fitted with tough polypropathene covers in a wide range of eye catching fast colours or chrome-plated brass covers. All plugs have phenolic insulating washers which will not melt or distort during soldering operations.

To complement these is a wide range of sockets which are moulded in high quality unbreakable nylon (giving a fully insulated-from-chassis earth) with pure silver contacts and nickel silver springs for long working life. A recess plate is also available for mounting sockets in speakers boxes or similar applications.

A wide range of bright colours are available in the insulated terminals. All metal parts are machined from brass and finished in nickel plate. All terminals are supplied with panel insulating sets having location keyways, double plain washers and solder tag for wrapped wire or solder connection.

Further enquiries, contact **Delsound Pty Ltd, 1 Wickham Terrace, Brisbane, QLD 4000. Phone 229-6155.**



Some of the many plugs and terminals from the range made by Cliff Plastic Products.

Errata

Project 582
Burglar Alarm — July 77
On page 54 of the July issue, the anode and cathode connections of the LEDs in the overlay should be the other way round.

Project 642
16K RAM Card
February 79
Our thanks to Dr B.W. Hicks of Kenmore for pointing out that in the circuit diagram on page 57, the inputs to IC38c should come from the BLOCK 1 to 4 lines, rather than the CSO to 3 lines.

Project 471
Stereo Preamp
June 79
A couple of minor errors in this project. The first is in the specifications (page 57). The loudness control produces 8 dB boost and cut at 150 Hz and 10 kHz, rather than 15 kHz and 10 kHz as stated. Also, in the circuit diagram the LEDs are shown the wrong way round with respect to the switch, as is the LED power supply with respect to the overlay. The overlay is correct and should be followed, although either version will in fact work!

Also, in the parts list of the preamp, resistors R118 and R119 have been omitted. They are both 15k.

Solar 'phone

Solar energy has been finding increasing use in low power and isolated applications, even in high latitudes where the sun is never high.

This roadside telephone installation in Holland is powered round the clock by the solar panel atop the rear pole. Not bad considering that this picture was taken during the worst winter Europe has had for a long time. We thought this application was really neat.

Bargains for enthusiasts

Enthusiasts interested mainly in experimenting with numerous circuits and techniques will find a host of bargains in all those 'odd' components not found in most electronics hobbyist shops.

Sheridan Electronics, of 164-166 Redfern St, Redfern NSW, in their latest "bargain sheets" list a whole host of goodies bound to make any bargain-hunting enthusiast's mouth water on sight.

Lots of hard-to-get items are included, such as: silver mica capacitors at 25c each, cradle relays at prices ranging from 25c to 60c, standard tuning capacitors (two-gang) for $2.25 or two for $3.95, ten-turn helical pots, plus lots of cermet trimpots, switches and transformers — all at bargain prices.

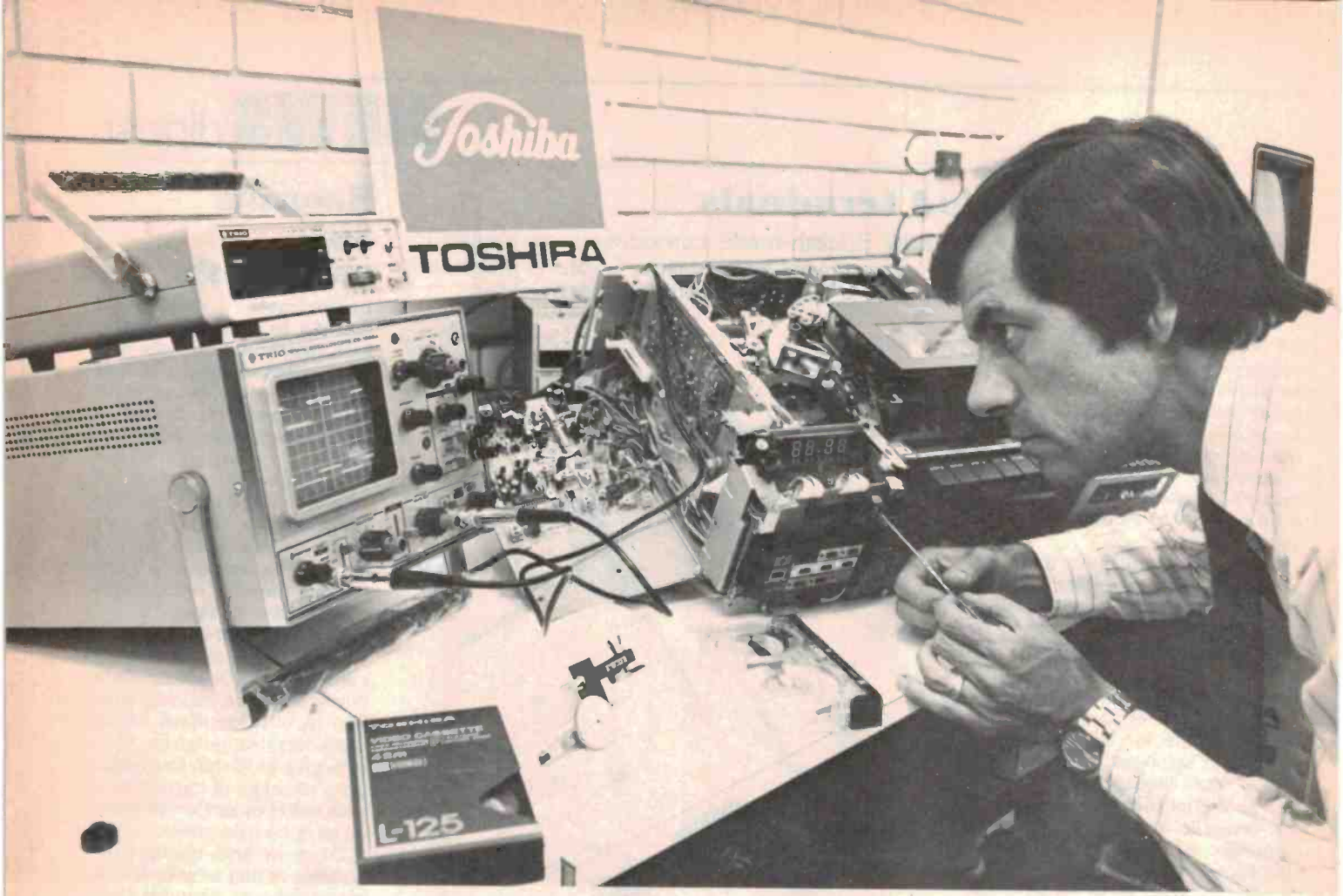
Drop in and inspect the goodies or ring or write for the bargain sheets: Sheridan Electronics, P.O. Box 156, Redfern 2016 NSW (02) 699-5922 or (02) 699-6912.

Electric cars — closer

The CSIRO's Division of Mineral Chemistry in Melbourne is developing a new type of battery for use in electric cars.

Cars with no gears, no exhaust fumes, and much lower maintenance could be on the Australian domestic market within five years. In fact the commercial market will be offered its first electric vehicles later this year when 100 delivery vans developed at Flinders University in Adelaide will be offered for sale.

The CSIRO is researching various types of batteries which weigh less and work better, including lithium-sodium sulphur, nickel-iron, iron-air and zinc-chlorine. We hear they are also particularly interested in nickel-zinc and organic electrolyte systems, and expect short run electric vehicles to be economically attractive by about 1984.



"Resolution of the 4·43MHz sub-carrier was better on the TRIO CS1560A scope..." says Ian West, National Service Manager, Toshiba Australia.

Ian West is responsible for all Toshiba service within Australia. This includes three service divisions and liaison with over 500 service agents. We asked him why he chose the Trio CS1560 scope for service use.

"We found that for TV., audio and VCR servicing, the Trio has a brighter display on H.F. signals. The Resolution of the 4.43 MHz subcarrier is better due to the scopes' 15MHz bandwidth.

"Also my job involves training other technicians, so we were looking for a scope that's easy to drive. The 1560 has proved ideal for setting up VCRs. Using its chop facility we can easily compare counted down signals with the original.

"We are using quite a few Trio instruments. They offer excellent value with just the right extra features that we need."

Check the full Trio range from . . .

CS 1560 15MHz, 10mV, Dual Trace.

TRIO

- 130mm CRT
- DC-15MHz/10mV
- Automatic sweep (AUTO FREE RUN)
- Display modes (CH1 CH2 DUAL ADD SUB)
- Full sensitivity X-Y operation

SPECIFICATIONS

Bandwidth	DC to 15MHz (–3dB)
Deflection factor	10mV/div to 20V/div
Input R,C	1MΩ, 22pF
Risetime	23nsec
Overshoot	Better than 3%
Sweep time	0.5μs/div to 0.5s/div
Magnifier	×5
Linearity	Better than 3%
Calibrator	1Vpp (1kHz square wave)
Intensity modulation	More than 20Vpp
Phosphor	P31
Power	AC 100/120/220/240V, 50/60Hz, 23W
Dimensions	W260 × H190 × D385 (mm)
Weight	8.4kg

PARAMETERS PTY LTD Sydney 439 3288 Melbourne 90 7444

NSW	SYDNEY	George Brown & Co	519 5855
		Martin de Launay	29 5834
		Radio Despatch	211 0191
		Dick Smith Stores	439 5311
		Standard Comps	660 6066
	GOSFORD	Brian Bambach	24 7246
	N'CASTLE	D.G.E. Systems	69 1222
A.C.T.	CANBERRA	Electronic Comps	95 6811
QLD.	BRISBANE	Audiotronics	44 7566
VIC.	MELBOURNE	Browntronics	419 3986
		Douglas Radio	211 1698
		J.H. Magrath	663 3731
		Radio Parts	329 7888
		G.B. Telespares	328 4301
		Tech-Rentals	267 5877
	GEELONG	Teleparts	21 7288
S.A.	ADELAIDE	K.D. Fisher & Co.	269 2544
		Gerard & Goodman	223 2222
		Trio Electrix	51 6718
W.A.	PERTH	Henderson Inst.	381 4477
		W.J. Moncrieff	325 5722
		Willis Trading Co	321 7609
TAS.	HOBART	Imbros Scientific	28 5997

PM98

Adtech power supplies

Tecnico Electronics recently announced the addition to their product line of a quality range of power supplies manufactured by Adtech Power Inc. of California, USA.

The range includes single, dual and multiple output micro-processor power supplies. Also included is a range of AC to DC and DC to DC switching supplies and AC line conditioners.

For further details contact — Tecnico Electronics, PO Box 75, Marrickville, 2204 NSW, or at PO Box 118, Northcote, 3070 Vic.

Stackable LEDs give more light

PHILIPS Electronics Components and Materials have introduced new stackable LEDs, available in three colors: super-red, green and yellow, each with a choice of four different levels of luminous intensity.

The super-red LED produces many times more light at low currents than standard LEDs.

The new LEDs have flat plastic envelopes with a rectangular lens measuring 2.54 x 5.08 mm. They can be mounted end-to-end or side-by-side on standard pitch printed circuit boards and used as bar graphs, tuning dials and scales on car radios, hi-fi equipment, televisions and instruments.

Designed CQX10, CQX11 and CQX12 for super-red, green and yellow, respectively, the stackable LEDs provide a luminous intensity from 0.7 mcd to 3.5 mcd at a forward current of only 10 mA, according to choice of type.

For further information try Philips-Elcoma, 67 Mars Rd, Lane Cove, NSW, (02) 427-0888.

Rear window heater becomes antenna

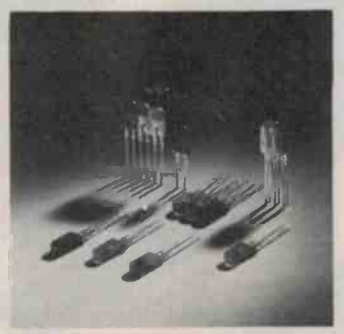
Car radio antennas always seem to cause trouble.

Firstly you've got to drill a great hole in your new auto, sometimes even a square one. If it comes with an antenna already fitted they almost always eventually give trouble.

O'Donnell Griffin have come up with a novel product to solve the problems. Called a Bi-Fi internal car aerial, the device allows the element on your heated rear window to act as a heater and car radio antenna as well.

The device is tube-shaped, 100 mm long by 38 mm in diameter. It mounts as close as possible to the heated rear window, either in the boot, behind the back seat or in the rear window pillar. It is connected to the wiring for the heated rear window. The aerial extension lead then runs from the Bi-Fi to the radio.

The Bi-Fi is only available for negative earth vehicles, sold by O'Donnell Griffin Pty Ltd, 150 Canterbury Road, Bankstown, NSW, 709-4455.



New Fluke DMM

Elmeasco have just released a lower priced hand held Fluke digital multimeter, the DM8022A.

Identical in appearance to the well known Fluke 8020A, the new meter boasts all of the features of its brother less the two, little used, conductance ranges. A wide range of accessories are available for the 8022A including a 40 kV probe, 600 amp AC current probe and 1 GHz RF probe.

The meters are priced for hobbyist as well as professional use at $144 plus tax and are available from Elmeasco Instruments Pty Ltd, 15 MacDonald Street, Mortlake, NSW (02) 736-2888.

Watron watches — owners note

An item in News Digest on page 7 of our May issue warned owners of Watron watches purchased from the Chan Merchandising Co. that the solar cells, intended to supply charge assistance to the batteries, were incorrectly connected.

Phil Diggerman, of Diggerman Electronics, rang to say that many firms around Australia had sold these watches featuring solar-assist, including his own.

Not all Watron watches were afflicted with solar-desist, he said. In order to avoid confusion, and the possible damaging of a watch through an unnecessary repair, the following check should be made to determine whether the timepiece needs attention:

On the four-digit stopwatch model with solar assist, the solar cells, if correctly installed, should be laid **overlapping** each other from **right** to **left**. A connection to the cells may be visible. It is a soldered wire and this should appear at the left hand edge of the cells.

Zerostat
The Static Killer
Now Costs Less!

The British Zerostat is the original and the most effective zerostat pistol available in Australia, or the world.

One gentle squeeze of the trigger removes the destructive static and crackle caused by handling, playing or simply removing a record from its cover.

It works for at least 50,000 applications.

And it's fully guaranteed.

The only improvement we could make was to lower the price. And thanks to Zerostat's growing world wide demand that's exactly what we've been able to do.

Grand Prix International Award

Awarded to Zerostat by the 6th Annual Japan Stereo Components Grand Prix for their unique contribution to the alleviation of static charge on records.

The amazing Zerostat pistol. The original. The best. Now only **$23.95**
Available where all quality Hi Fi is sold and leading accessory stores.

Now $23·95

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JMA 4893

sound news

Standards on pulse-code discs

The recently-formed Digital Audio Disc council, composed of virtually every interested manufacturer world-wide, has announced guide-lines for PCM (pulse-code-modulation) audio discs.

Guide-lines include: signal band up to 20 kHz, dynamic range exceeding 90 dB, four-channel capability, playing time of not more than 40 minutes per side (!), and a disc size not to exceed 300 mm diameter.

The signal code calls for quantization of 16 bits, the use of parity or redundancy codes to correct drop-outs, and an address code to enable automatic random access to any track.

The guide-lines, if subsequently translated into industry standards, will enable a 'unified-format' disc to be produced which would be usable with various types of players including optical or mechanical pick-up systems. Current industry speculation is that agreement will be reached in about one to two years and that the new technology of 'super hi-fi' will materialise round about 1982.

Fantastic claims for Epicure 14 speakers

Epicure's new model 14 bookshelf speaker is claimed to have a response which is effectively flat (plus or minus 3 dB) from 20 kHz all the way down to 28 Hz!

The size of the unit is only 610 x 343 x 229 mm and is recommended for use with 15 to 80 watts RMS.

The makers say that the unusually good bass response is due partly to the use of a "low mass, controlled excursion woofer with specially matched driver".

International Dynamics, 23 Elma Rd., Cheltemham, Melbourne 3192. Ph. (03) 95-0366.

Unusual features in Sansui's new tuner

Featuring special detector circuitry plus a number of other design innovations, Sansui claim new standards of performance on stereo FM and high fidelity AM reception for their new TU-X1 tuner.

The FM receiver section incorporates specially designed IF filters and a wide-range, high power ratio detector for improved linearity and wide dynamic range through the whole receiver system.

Conventional AM broadcasts have been regarded as generally inadequate owing to their susceptibility to noise and interference, which limitations in tuner and detector design have previously been unable to eliminate.

The TU-X1 tuner incorporates a phase-locked-loop (PLL) AM detector. Distortion and interference are dramatically reduced using this technique, Sansui claim.

On stereo FM reception, the TU-X1 has a claimed 80 dB (at 65 dBf) signal to noise ratio and a THD less than 0.03% at 1 kHz. Stereo separation is quoted as 50 dB at 1 kHz, 40 dB at 10 kHz. Overall frequency response is quoted as 20 Hz to 18 kHz, plus 0.2 dB, minus 1.5 dB.

The AM section has a claimed THD of less than 0.2% at 30% modulation and signal to noise ratio of 65 dB.

The TU-X1 will be exhibited by Vanfi at the CES. For more information though, you can contact them at 283 Alfred St, North Sydney 2060 NSW: (02) 929-0293, 929-2419.

Easy to Install Teletext Decoder

Many Teletext decoders have to be fitted into your existing TV set — or have to be bought (at great expense) already built in to a special Teletext set. The TAD-100 just plugs into the antenna line of a black and white or colour set.

Most Australian TV stations are at present experimenting with Teletext broadcasts — which can be seen by adjusting the set to give a 'rolling' picture by altering the vertical hold. The Teletext part of the transmission is seen as a changing pattern of dots at the top of the picture.

These dots are pulses which convey text information to the decoder, which then displays it on the screen. This information can include share prices, recipes, programme information and other useful items.

Due to be released here around June-July, the TAD-100 will be marketed by **G.F.S. Electronic Imports, 15 McKeon Rd, Mitcham 3132 Vic. Phone: (03) 873-3939.**

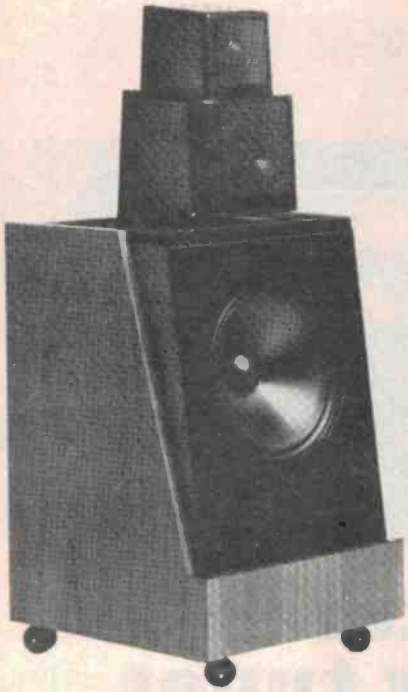
Electro-Voice acquires Tapco

Electro-Voice Australia Pty Ltd, announced recently that their parent company, Electro-Voice Inc USA has acquired the Technical Audio Products Corporation (TAPCO).

From 1st May, 1979 Electro-Voice Australia will be handling all Tapco Sales and Service in this country.

Several new TAPCO products will be released over the next few months. ▶

KEF MODEL 105 COMPUTER MATCHED.



To get the best possible stereo image, you need the best possible match between the loudspeakers.

At KEF we produce matched sets of high, mid and low frequency units, using our unique computerised test facilities. Moreover, our total system approach to the design of the enclosures and the electronic dividing networks, means that we can deliver Model 105 in pairs that are nearer to the ideal 'match' than any previous loudspeaker. KEF pioneered the use of computer digital analysis in loudspeaker design, and you, the listener, can now hear the results: the most lifelike musical quality and the most astonishing stereo perspective.

Write for the full technical story and the name of your nearest dealer, who will be glad to give a demonstration.

KEF CALINDA

The big reason why the Calinda sounds so good is the engineering that's gone into it.

The component parts—drive units, dividing networks and enclosures—have all been designed and tested with computer aid. They've been matched together more closely than ever before, to work as a total system giving the highest quality reproduction.

The enclosure is narrow, to give wide dispersion of sound without diffraction; deep from front to back, to cut down disturbing reflections from walls; and tall, so that the mid-range unit is well away from the floor, reducing reflections which would otherwise cause a nasty double impression.

And while the Calinda's performance will do full justice to your music, its elegant shape is sure to enhance your room.

Listen to the Calindas, discuss them with your local dealer, and discover just why KEF call themselves "the speaker engineers."

Distributed in Australia by Audioson International Pty. Ltd., 64 Winbourne Road, Brookvale, N.S.W. 2100.

KEF

The Speaker Engineers

Grace — two new arms

Interdyn recently announced two additions to their popular range of Grace tone arms.

Both unipivot designs, the G 945 and G 945S are sure to gain the interest of the growing number of moving coil enthusiasts.

The use of jewelled bearings and silicon damping are claimed to provide control of unwanted vibrations whilst giving excellent trackability of todays high velocity recordings.

Model G 945S features high conductivity silver wiring from the headshell leads right through to the amplifier. Grace state that its use dramatically reduces transmission losses.

Both arms share all other specifications including an overall length 302 mm (min), 330 mm max; and an effective length of 237 mm.

Range of usable cartridge weights are from 3 gms to 14 gms or up to 30 gms with the optional heavy counterweight.

See: Interdyn, 23 Elma Rd, Cheltenham North, Melbourne 3192 Vic; Phone (03) 95-0366.

Ortofon's new cartridges

The 'Concorde' and 'LM' series of cartridges, just released by Ortofon, promise a new standard of performance, claimed to approach the theoretical limits of an idealized arm and cartridge.

The LM units, designated LM30H / LM30 and LM20H / LM20, weigh only 2.6 grams a piece while the Concorde 30 and Concorde 20 each weigh 6.5 grams.

The cartridges all feature Orotfon's world-patented VMS principle transducer and have replaceable stylus units.

The LM series are intended for mounting in conventional headshells while the Concorde series may be mounted on tone arms having standard sockets. Models LM30H and LM30 are high and medium compliance units, LM20H and LM20 are high and low compliance, the Concorde models being medium compliance units.

For more of the good oil, contact Harmon Australia P/L, 271 Harboard Rd, Brookvale NSW 2100.

Stereo AM delay

America's move into stereophonic AM radio appears to have been delayed once again.

The Federal Communications Commission has been assessing five competing systems during the latter part of its two year inquiry and it had been hoped that a decision would be made this month.

However, it is now improbable that a speedy decision will be reached.

Firstly; Sansui has just patented a system which is fundamentally different from the existing contenders. This involves **simultaneously transmitting three separate carriers** of the same frequency but separated in phase — the left and right programme channels being split between the three carriers.

Secondly; Sony plans to submit a proposal for its own system before the FCC inquiry closes late this month. **The company has already conducted tests** of its system using a New York radio station.

Finally: there are fears that international interests may block any FCC choice — a 1950 treaty between the USA, Mexico and Canada provides that any major changes — such as the introduction of the AM stereo system — **must firstly be approved** by the other signatories.

Auto Acoustics — car sound specialists

Specialising in hi-fi installation in cars, Auto Acoustics recently announced the release of two new products from the US-based firm of Fosgate Electronics.

First up is the Fosgate PR252 system. The power amp features 50 watts per channel into 4 ohms at less than 0.05% THD across 20 Hz to 20 kHz. It operates from the car battery supply (nominally 14.5 volts) and draws 20 amps at peak output, 800 mA idling.

The preamp of the PR252 system, designed to match the power amp, has less than 0.02% THD at 5 V RMS output, claim Fosgate.

Second item of interest is the Tetra-1 system. Developed by Tate Audio and adapted for vehicle use by Fosgate, the Tetra-1 is used to convert your ordinary car stereo and tape player into four separate channels. The Tetra-1, Fosgate claim, analyzses a stereo signal to determine the "intended direction of the various musical events and converts them into a multi-channel format". It is not a quad or delay-reverb system. The Tetra-1 incorporates a control that allows you to control your 'presence' in relation to the recorded sound. You can move yourself "... forward into the orchestra or back into the auditorium ..."

It could certainly make a car ride an interesting event!

For more information on these Fosgate units, contact Auto Acoustics at 144 Brougham St, Kings Cross NSW 2011; phone (02) 357-1810, 357-3470.

Nakamichi 530 — no compromise

Classed as a receiver that '... does not take a back seat to separate components ...', Nakamichi's new model 530 FM receiver offers impressive specifications.

In their literature, Nakamichi say that, in designing this receiver, they gave much consideration to what a receiver should and shouldn't do.

Boasting a power output of 55 watts per channel into eight ohms at less than 0.02% THD and a bandwidth of 10 Hz to 20 kHz in the power amplifier section, the receiver features motorised touch-tuning and less than 0.2% distortion at 1 kHz in stereo reception.

Overall, the Nakamichi 530 boasts the performance of their outstanding separates, the 410 preamp, 420 power amp and 430 FM tuner ... and costs about two-thirds as much!

sound briefs

Record shock

A recent High Court decision in the UK now makes it **illegal for record and hi-fi stores** to demonstrate recordings or equipment unless licenced by the Performing Rights Society.

Licence fees for this purpose **cost between fifteen and thirty-five pounds** and stores must purchase these back-dated to January 1976. The **only exception** to this ruling applies to recordings heard via headphones in sound-proof booths.

The Act concerned (Copyright Act 1956) **is essentially similar throughout the Commonwealth**, however it is not yet known whether the recent ruling will be enforced in Australia.

Revox switch

Revox' B790 'child-proof' turntable will in future be **supplied with AKG cartridges** instead of the Ortofons previously used.

According to Revox the AKG cartridges have 'the special sound of moving coil cartridge without the disadvantages . . .

Plasma drive

Helium, bled in minute quantities into **glowing plasma** (ionised gas), is used in a tweeter manufactured by Plasmatronics Inc (2460 Alam S.E. Albuquerque, N.M. 87106, USA).

The modulated incadescent plasma **excites air molecules directly**. Reports from listeners confirm designer Alan Hill's claim of **startling realism**.

One drawback is the need to supply helium — the current model **uses a bottle every 300 hours** or so! Full details of the drive system are not currently available as **patent protection is still pending**.

RIAA — change

The USA's Recording Industry Association has made **changes to the RIAA standard** for disc recordings. The revisions are fairly minor but include the extension of the frequency range covered by the standard — **from 30Hz — 15 kHz to 20Hz — 20 kHz.** Details of the changes may be obtained (free) from the RIAA, 1 East 57th St, New York, 10022. Ask for bulletin E-1.

Liquid cooled Speakers

Loudspeaker manufacturers are now using **ferro-magnetic fluids to cool speaker voice coils** and improve dynamic damping. The liquids were originally developed by NASA to enable weightless rocket fuels to be manipulated in tanks (but were never actually used for that purpose).

Originally used in the audio industry as an **aid to assembly**, the fluid automatically centres the voice coil in the air gap of conventional moving-coil speakers.

It was quickly found that the fluid helped heat transfer from the coil to the surrounding metalwork, thus enabling the **drive units to handle more power without overheating.**

Another unexpected bonus arises from the fluid's viscosity. It can be tailored to specific applications **to improve dynamic damping** thus minimizing resonances, decreasing distortion and flattening unwanted peaks.

At present, Acoustic Research and Epicure are using the technique and many others are doing research.

Strange but true: The better your system, the noisier it sounds.

PHASE 1000 AUTOCORRELATOR

Once you've graduated from "a stereo" to true component quality, you're amazed at the snap, crackle, pop you never heard before.

And the hiss.

That's because a quality high fidelity system provides much wider frequency response and far greater dynamic range. Which means it has a better ability to reproduce irritating flaws in the source material. The snap, crackle and pop. And the hiss, rumble and hum.

So what to do?

Phase in a Phase Linear 1000 Autocorrelator noise reduction system. It's the only system designed to remove 10dB of the hiss, hum and rumble that is contained in unencoded records, tapes and FM.

This is how it works: As you reproduce the recorded music, the Phase 1000 analyses the millions of incoming waveforms to find signals similar to a sine wave – a highly "correlated" wave-form with periodic repetition. Like a guitar note. Or a piano note. Or a vocal note.

The Phase 1000 electronically analyses the signal to find fundamental musical tones and their harmonics. When these are missing, there is no music. The Phase 1000 then safely assumes there is noise, and it orders one of its silent bandpass gates to remain shut. Which removes 10dB of hiss, hum and rumble without affecting music.

On the other hand, if it identifies a fundamental waveform – presto! The gate opens.

The Phase 1000 overcomes another flaw. Dynamic compression. Live music has a broad dynamic range, as much as 100dB between the loudest and quietest passages. But tape recorders have limited range, so studio engineers compress that range to less than 50dB. FM broadcasters compress the range even more to facilitate transmission.

The Phase 1000 is the only noise reduction system that can correct this compression on unencoded material. It expands dynamic range by a full 7.5dB for a more open, lively sound.

It's easy to utilise with any stereo receiver, integrated amplifier or preamp, and is a valuable addition to Dolby* and dbx systems, as well.

Ask your audio specialist to play any record, tape or FM broadcast through the Phase Linear 1000 Autocorrelator. Then listen to the music...not the noise.

Distributed in Australia by Acoustic Monitor Co Pty Ltd (Member of the Thomas & Coffey Group) 12-18 Gould Street, Enfield, NSW 2136. Phone: (02) 642-7888. Telex: 26778. Cables: "Tomcoffy" Sydney.

*Trademark of Dolby Laboratories, Inc.

Phase Linear®

THE POWERFUL DIFFERENCE

SMA/AM11

KENWOOD needs 25 audiophiles...

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

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

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

Not all applications will necessarily be accepted.

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

TRIO-KENWOOD (AUSTRALIA) Pty. Ltd. PO Box 425, ARTARMON. NSW. 2064.
TELEPHONE: SYDNEY 439-4322

This offer closes on the 31st August 1979

To: TRIO-KENWOOD (AUSTRALIA) Pty. Ltd.
I am interested in your Audiophile Kenwood Evaluation Proposal. Please send me addresses of Hi Fi Centres where Kenwood direct-drive systems can be seen.

Name .....

Address .....

.....

..... Postcode .....

If you thought REVOX made the world's finest integrated Hi Fi equipment

B790 turntable
B77 tape recorder
B750 stereo amplifier
B760 digital FM tuner
Speaker systems
Accessories
Audio rack

You're right.

For details and name of your nearest Revox dealer, contact . . .

Syntec International Pty Ltd — 53 Victoria Ave, Chatswood. NSW. 2067. Telephone: (02) 406-4627.
Syntec Victoria — 136 Langridge St, Collingwood. Vic. 3066. Telephone: (03) 419-4644
Athol M. Hill — 33-35 Wittenoom St, East Perth. WA. 6000. Telephone: (09) 325-7811.
Sydney G. Hughes — 154-158 Arthur St, New Farm. Qld. 4005. Telephone: (07) 358-1422.
Blackwood Sound — 4 Coromandel Pde, Blackwood. SA. 5051. Telephone: (08) 278-6888.

REVOX

Trade enquiries welcome

An examination of

The ADRES noise reduction technique

David Tilbrook

Last month's issue featured a review of Toshiba's PC-X6AD cassette deck which incorporates the ADRES technique; this month we take a look at the system and what it is designed to do.

CASSETTES and cassette decks are being continually improved and have reached a level of performance acceptable to the vast majority of tape deck users. Nevertheless, the cassette deck still has its problems. Compared to record or reel to reel performance most cassette decks suffer from reduced dynamic range, a more limited frequency response – especially at higher recording levels – and inferior signal to noise ratio.

Recently, Toshiba announced a new compression/expansion technique that aims at relieving some of these problems. Called "ADRES" (Automatic Dynamic Range Expansion System) it is primarily a noise reduction system and boasts some impressive figures. Used with an average cassette deck, Toshiba claim that a dynamic range of up to 86 dB can be achieved with an improvement in signal to noise ratio at 10 kHz of 30 dB!

Compander systems

The compander (compressor/expander) noise reduction technique has been around for quite some time. Most compander systems suffer from a problem known as the 'breathing effect' or hunting and Toshiba claim to have reduced this to a minimum.

Like most noise reduction systems, ADRES relies on an encoding/decoding process. During recording, the incoming signal is compressed as a function of the frequency and the input level. When the signal is played back it is expanded to its original form by a function that counteracts exactly the effect of the original compression. As the signal is expanded the noise is reduced. Or that's the theory anyway.

In reality, the encoding and processes never match exactly, leading to some inaccuracy and consequent colouration of the recording. Furthermore, every noise reduction unit will have slightly different characteristics, simply because it is a different unit made from components with different tolerances.

Since every cassette deck will have different gains in the playback amplifiers they will present different signal levels to the decoder. The moment you consider the number of different tape formulations and their different sensitivities it becomes obvious that very big differences in signal level will be seen at the input to the decoder.

The noise reduction system must be designed so that it is relatively insensitive to these types of mismatches. Testing with pink noise and one-third octave spectrum analysis reveals insignificant variation of frequency response as a result of level variation with the ADRES.

'Breathing effect'

The breathing effect is normally the biggest problem encountered when using a compander with a relatively narrow dynamic range medium such as the cassette deck.

The problem is caused by gain variations in the compression and expansion processes giving rise to audible increases and decreases of signal or tape noise. The sound can be heard "swaying in and out", becoming very noticeable and objectionable if high compression/expansion levels are used. ▶

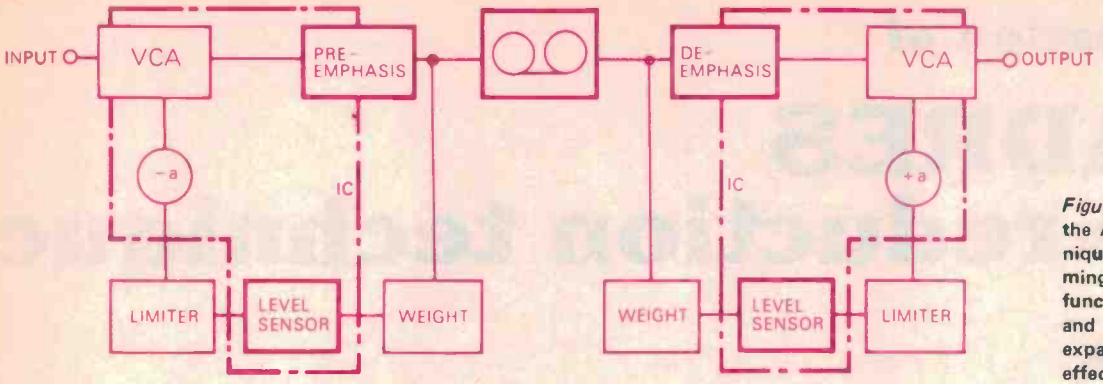


Figure 1. Basic block diagram of the ADRES noise reduction technique. During recording, the incoming signal is compressed as a function of the frequency range and input level. On playback, expansion counteracts this, effecting a reduction in noise.

These gain variations are caused by two effects operating simultaneously: signal level variations and modulation noise.

If a -60 dB input signal is compressed by a compander system operating at a compression/expansion factor of 1.5 then the compander will compress this signal to -40 dB and this is recorded on the tape. During playback the signal is expanded to -60 dB again. At the same time noise that may have been at the -60 db level is compressed by 20 dB. The amount of improvement in signal to noise ratio therefore will depend on the amount of input signal level, and this varies. As a result of this the background tape hiss can be heard to increase and decrease as a function of signal level changes. This is the major cause of 'breathing' at low to medium signal levels, but at high signal levels an effect called modulation noise becomes the dominant factor.

Modulation noise is an effect that always occurs in magnetic tape recording, be it cassette or reel to reel. It is greatest when the signal level is highest and is caused by interaction between signal, noise and mechanical vibrations intrinsic to the tape transport mechanism.

It is little mentioned in reference to cassette decks, not because it isn't present but simply because it has generally been below the level of tape noise. This is not to say that it is unimportant. In fact, it probably accounts for some of the differences in sound quality between cassette decks that have otherwise very similar specifications.

With the introduction of more effective noise reduction systems and developments such as metal tape formulations, we could be hearing a lot more about modulation noise in the future; simply because these developments are likely to expose this problem.

Where modulation noise becomes great enough it effects the decoding or expansion process — producing the breathing effect. ADRES greatly reduces this effect from both sources by ensuring that the circuit is tolerant of level variations caused by modulation noise or signal level variations.

How it works

The internal structure of an ADRES system is shown in Figure 1.

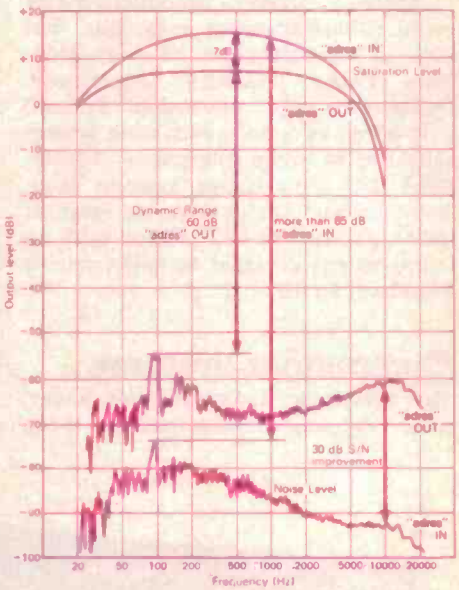
The signal to be recorded is applied to the input of a voltage controlled amplifier — an amplifier with variable gain which can be controlled by varying the voltage on a control point. In ADRES this amplifier also has a variable frequency response. Gain is reduced for high frequencies at a high input level. The purpose of this is to avoid tape saturation that occurs when high level high frequency signals are recorded onto a cassette tape. Thus, ADRES not only reduces noise but will also decrease distortion that would otherwise have occurred at high recording levels.

The output of the voltage controlled amplifier (VCA) is fed to a pre-emphasis circuit and then to the cassette deck. This pre-emphasis boosts the high frequencies to lift the high frequency content even further above the noise level.

Because the frequency response of the VCA attenuates high frequencies when they are at high levels the effects of the pre-emphasis becomes negligible as the signal level is increased. At lower levels however, the pre-emphasis circuit has substantial effect.

During playback the effects of the pre-emphasis circuit are removed by

Figure 3. An improvement of more than 85 dB in dynamic range is claimed for the ADRES system.



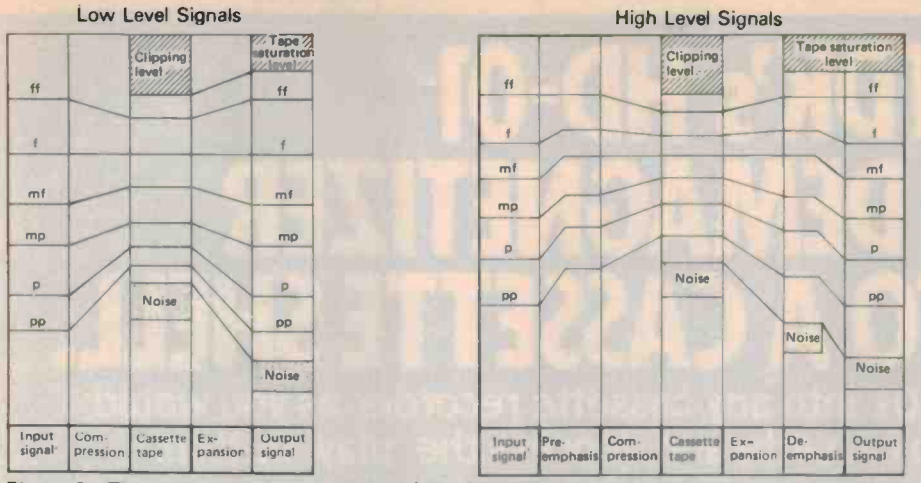


Figure 2. **The basic operating principles of the ADRES noise reduction technique. At left, the operation is shown for low level signals. At right, operation for high level signals shows the role of the pre-emphasis and de-emphasis circuits.**

attenuating the high frequencies by an amount that returns the overall frequency response to flat. This attenuation process also attenuates the noise content and an improvement in signal-to-noise ratio results.

This pre-emphasis/de-emphasis procedure is not unique to ADRES. It's the combination of this and carefully controlled compression/expansion that results in the excellent noise reduction that ADRES is claimed to achieve.

As well as going to the cassette deck, the output of the pre-emphasis stage is sent to the level sensor through a weighting network. The level sensor generates a DC voltage which passes through a limiter and controls the gain of the VCA. The weighting network assists the VCA by reducing high frequencies for high level signals. The level sensor consists of a very wide dynamic range logarithmic rectifier. It is the logarithmic nature of this level sensor that generates the compression effect and the rectifier converts the varying signal into a DC voltage.

The limiter restricts the output voltage from the level sensor to some constant voltage. It does this gradually and thereby prevents the VCA from varying the overall high frequency response incorrectly. It is this process that produces the relative insensitivity of the ADRES system to level variations etc, that would otherwise cause colouration of the sound.

The total effect of the circuit is such that at high signal levels the gain is low and high frequency response is reduced. As input signals become lower the circuit gain is increased and the high frequency attenuation is reduced.

The decoding circuit is used during playback to return the signal dynamic range and frequency response back to their original level — or as close as possible.

The results claimed by Toshiba using ADRES are shown in Figures 3 and 4. As can be seen, ADRES will provide a significant improvement in signal to noise ratio, an increase of dynamic range and substantially lower distortion at high recording levels. ●

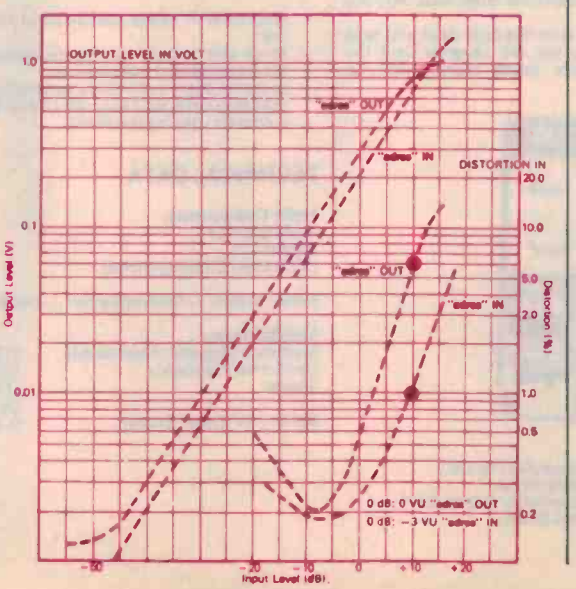


Figure 4. **Toshiba claim a considerable reduction in third harmonic distortion when ADRES is used.**

TDK's HD-01 HEAD DEMAGNETIZER BUILT INTO A CASSETTE SHELL.

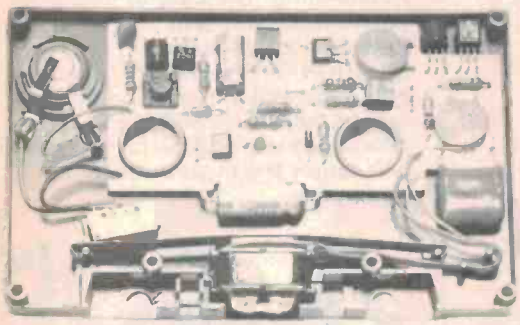
Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

WHY IS DEMAGNETIZING SO IMPORTANT?

TDK, in conjunction with many cassette deck manufacturers, recommends that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

Record/Playback heads do generate a residual magnetic field over a period of time. This can be strong enough to act as an erase head, is capable of partial erasure of high frequency signals, and at the same time loads additional noise/hiss onto the original recording.
The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.



The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.

The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.
The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

— records with heads positioned in the front of the unit but which point to the rear.
— those with 'pop up' loading mechanisms which cannot be detached, thus making the heads almost inaccessible.
— cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
— automatic loading machines.

TECHNICAL DATA

Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply — Control Section — Oscillation Section — Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

TDK®

TDK (Australia) Pty. Ltd.,
4 Dowling Street,
Woolloomooloo. N.S.W. 2011
(02) 358-2088

THE ULTIMATE MACHINES.

SA CASSETTES: OVERTURE TO THE WORLD OF QUALITY MUSIC

Features of SA:

• Greater coercivity and much finer magnetic particles with greater length-to-width ratio than conventional magnetic materials. • Magnetic particles of SA gives personal treatment to each and every signal, thereby helping to yield a clearly defined sound which is crystal clear. It extends the flat frequency response range from the lowest lows to the highest highs, giving expression to the many sounds and moods of music as they were intended to be heard. • It handles exceeding high signal inputs without distortion which is due to increased MOL providing a full dynamic range for both recording and playback. SA uses the 70 micro-second playback equalization position (High or CrO_2) on your deck for a greatly enhanced signal-to-noise ratio and reduced noise level.

AD CASSETTES: FAITHFUL 'REAL LIFE' REPRODUCTION

Features of AD:

• High MOL (Maximum Output Level) at the high end is perfectly capable of recording and playing pop, rock and jazz music sources with plenty to spare.
• Frequency response which extends right up to the high ends. That is why the treble comes through loud and clear.
• Features a bias curve which is broad and this enables the tapes to cope with a wide range of different tape decks.
• Does not require selection of special bias and equalization settings, the Normal position will do. This means that anyone can play back and record the tapes on any kind of deck.

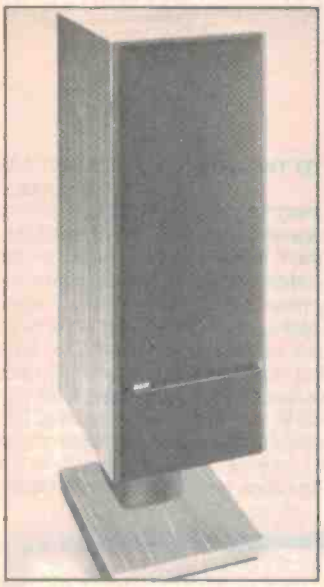
Both SA and AD feature the new TDK super precision cassette housing made to 10 times the accuracy of the original specifications.

TDK®

TDK (Australia) Pty. Ltd.,
4 Dowling Street,
Woolloomooloo. N.S.W. 2011
(02) 358-2088

B&W Loudspeakers

Far be it from us to boast but . . .



B&W DM2/II

An excellent three-unit loudspeaker of medium size, the DM2/II is heir and successor to the tremendously popular DM2; but it is a completely new speaker design making the fullest use of the latest B&W technical expertise.
The DM2/II is as elegantly pleasing in appearance as it is impressive in performance. The option of a pedestal stand or wedge-shaped plinth (illustrated) provides a choice of two different 'looks' in the furnishing sense — both of them in the modern idiom, but each with a character of its own.

HEIGHT
Cabinet 710 mm (28"); stand 188 mm (7 3/8"); plinth 60 mm (2 3/8")
WIDTH
270 mm (10 5/8")
DEPTH
330 mm (13")
WEIGHT
22 kg (48.5 lb)
CABINET
High density board and mechanical damping panel laminate.
FINISH
Standard: teak or walnut veneer. Special: satin white or veneers of rosewood or black ash.
FREQUENCY RESPONSE
Plus/minus 3dB 50Hz to 18kHz at centre of listening window.
SENSITIVITY
9 volts rms for a spl of 95dB at 1 metre.
POWER HANDLING
Suitable for ampliflers 25 to 200 watts rms into 8 ohms (music content).
OVERLOAD PROTECTION
1.6 amp fuse protects the system.

B&W DM4

The three-driver DM4 offers an ideal synthesis of monitor performance and compact size (suitable for shelf mounting or free standing).
New design technology and materials are employed in a system which reproduces remarkably natural sound in the smaller room. The sensitivity is such that even when coupled to a modest amplifier, its performance is superior to that of other speakers of comparable size.
The DM4 is also an excellent choice as a second speaker system, providing good rear-channel information in four-speaker installations.

HEIGHT
530 mm (21")
WIDTH
255 mm (10")
DEPTH
256 mm (10")
WEIGHT
11.1 kg (24.5 lb)
CABINET
High-density board throughout.
FINISH
Standard: teak or walnut veneer. Special: satin white or venners of rosewood or balck ash.
FREQUENCY RESPONSE
Plus/minus 5dB 80Hz to 20 kHz, 1 metre on axis.
SENSITIVITY
6.2 volts rms for a spl of 95 dB at 1 metre.
POWER HANDLING
Suitable for ampliflers 10 to 30 watts rms into 8 ohms (music content).
OVERLOAD PROTECTION
2 amp fuse protects the system.

For more information and leaflets, please contact:

Convoy International
4 Dowling St. Wooloomooloo, NSW, 2011.
Tel: 358-2088. Telex: AA23111

Silence...is where sound begins.

From the moment you begin using the Nakamichi 580, you'll know it's no ordinary cassette deck.

The transport doesn't make distracting noises because there are no solenoids. A high-speed cueing system makes program location a breeze. A unique "Direct Flux" erase head wipes the tape clean like no other erase head ever made. And modulation noise is incredibly low, thanks to an asymmetrical "Diffused Resonance" tape-drive mechanism.

But it's silence that makes the 580 different. It doesn't sound like a cassette deck. It doesn't sound like anything...except what you originally recorded. You hear the music, not the machine.

If you find the 580 uncommon, you'll be similarly impressed by the companion 530 Receiver—the performance of Nakamichi's highly acclaimed separates at a fraction of the cost, *plus* motorized auto-tuning and station memory presets.

Write for more information: CONVOY,
4 Dowling St, Woolloomooloo, NSW 2011.

Nakamichi

Products of unusual creativity and competence...

Nakamichi 582 stereo cassette deck

A diffused resonance transport, direct-flux erase head and superb engineering put this deck way out in front.

SINCE WE SAW our first Nakamichi machine in 1973, their product range has grown ,with the incorporation of many innovative ideas and features that have given the company a reputation for good design and excellent production.

The 582 has one primary feature that runs counter to the industry trend in that it reverts to two discrete heads for record and playback mounted adjacent to one another, rather than the more usual separate positions. This ostensibly bridges the gap between conventional two-head configurations and normal three-head machines which combine record and replay in one physical assembly.

The transport

Nakamichi, like most other manufacturers, have always appeared to aim for the widest, flattest frequency response in compact cassettes in order to match the performance of conventional reel-to-reel machines. The original heads in the 700 and 1000 series machines offered exceptional performance when new but these suffered significant wear, particularly with the early chromium dioxide tapes.

The 582 machine has crystalloy record and playback heads, guaranteed for 10 000 hours playing time which we believe is enough to satisfy most users. Nakamichi have not stopped at the recording heads but have devoted considerable attention to improve what they claim is one of the most important deficiencies of conventional transport mechanisms: transport resonances including modulation noise. They claim this is due to the significant internal resonance effects caused by the interaction of individual parts and elements of the transport mechanism having common dimensions and thus common resonances.

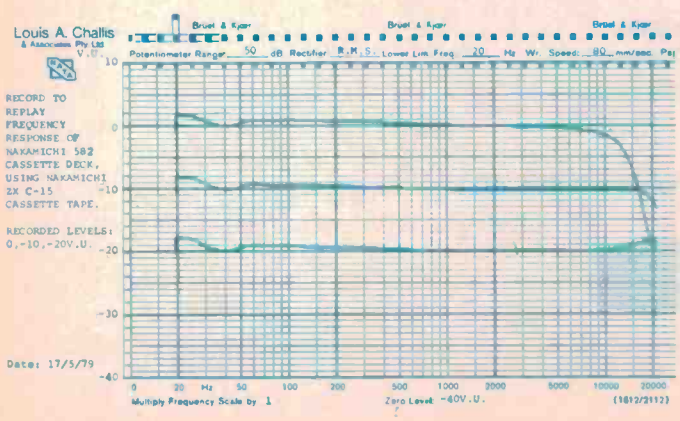
They describe the characteristics of their new drive mechanism as a "diffused resonance" double capstan transport system. Whilst a good double capstan transport system normally offers improved performance over a single capstan machine, Nakamichi claim that this automatically results in an increase in the number of resonant components and, more significantly, identical resonance components.

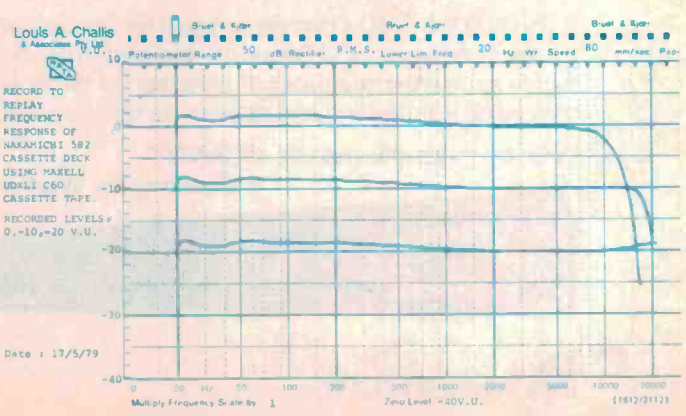
By contrast, the double capstan system of the 582 utilises two large fly wheels which differ from one another in size and mass and rotate at different speeds as do the two pressure rollers and the other drive components of the system. Nakamichi's research has clearly shown that this approach provides a significant reduction in the magnitude of the dominant wow and flutter components in the frequency range zero to 20 Hz They also claim that some of these components are audible on certain types of programme content.

Our previous research has shown that the characteristics of most cassette recorders, including Nakamichi, are audible but we have never previously carried out a spectrum analysis of these components to compare the frequency components of modulation produced.

Nakamichi have presented an analysis of the modulation noise in the frequency region 0 to 100 Hz showing that the 582 transport mechanism generates lower modulation components than both conventional double capstan machines and even better still than single capstan drive systems.

The 582 also contains another feature which is brand new. This is a tape selector switch which allows the use of standard low noise gammaferric oxide, chromium dioxide or equivalent tapes and, significantly, the new metal alloy tapes (the first sample we have seen came with the machine!). This tape, which appears to have been developed





under the aegis of Nakamichi will apparently be produced by a number of manufacturers during 1979 and 1980, but more about that later.

Other features

The other main features of the unit are:- electrically operated push button controls with integral bezel lights; separate controls for output, channel balance and recording level; monitoring switches for switching between tape and source, and a test tone switch which selects and activates one of two built-in test tone oscillators. These are, respectively, at 400 Hz a 0 dB tone for record calibration and 15 kHz tone at -20 dB for bias adjustment. A small number of manufacturers are now sensibly incorporating this feature within their machines.

By selecting this control, placing a cassette tape in the machine and pressing the record and play buttons, as one would normally do during a recording process, it is possible, by setting the monitor switch to "tape", to read directly the level of the 15 kHz signal coming off the tape via the play back head. Provided this signal level is within 1 dB of the 0 dB for this purpose,in order to use the most sensitive region of the meter scale.

One additional control on the front panel is a timer and memory switch. This allows an external timing unit to control recording or play back of this unit at pre-selected times. The memory mode allows the tape to stop at the 999 position during the re-wind mode.

In keeping with other Nakamichi machines, the two peak level meters covered the range -40 dB to +7 dB (relative to a 20 nanowebers per metre flux density for the 0 dB position). This feature is, in our opinion, better than the conventional VU meter covering a 20 dB range. – *to page 34.* ▶

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF

NAKAMICHI 582 DISCRETE HEAD CASSETTE DECK, SN 01325

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Dolby	Lower -3dB Point	Maximum Point	Upper -3dB Point
Maxell UDXL I	Out	<20Hz	+1.5dB (60Hz)	>20kHz
	In	<20Hz	+3.0dB (1.5kHz)	>20kHz
Maxell UDXL II	Out	<20Hz	+2.5dB (20Hz)	>20kHz
Nakamichi ZX	Out	<20Hz	+2.0dB (20Hz)	>20kHz

SPEED ACCURACY:

0.16% low

WOW AND FLUTTER:

0.042% weighted RMS

0.076% unweighted RMS

TOTAL HARMONIC DISTORTION:

	Maxell UDXL I Tape		
	100Hz	1kHz	6.3kHz
At -6dB	0.15%	0.16%	0.42%
At 0dB	0.22%	0.47%	1.41%

NOISE:

(re 0dB)

	Maxell UDXL I Tape		Nakamichi ZX Tape	
Dolby Out	-44dB(Lin)	-48dB(A)	-47dB(Lin)	-51.5dB(A)
Dolby In	-51dB(Lin)	-55.5dB(A)	-54dB(Lin)	-61dB(A)

MAXIMUM INPUT LEVEL:

(for 3% third harmonic distortion at 1kHz)

Maxell UDXL I Tape	Nakamichi ZX Tape
+9.5dB	+10.0dB

ERASURE RATIO (for 1kHz signal recorded at 0dB) <-62dB

D.F. CRAIG
17th May, 1979.

Mighty Midget

"It seemed hardly possible that such a high level of sound could come from such a tiny package."

Stereo Buyer's Guide 1979 Manual

And this isn't the only rave that Stereo Buyer's Guide gave in their review of our remarkable little AR-1 two-way speaker system. Phrases like "so versatile it can be placed almost anywhere" and "we were impressed by the level of good sound" and "the high frequencies were extended and shimmering in quality" and "dispersion was really excellent".

In fact, we think the Audio Reflex is a mini masterpiece (with price to match)... small enough to be held in one hand, (wght. 2kg.) tucking away conveniently in book-cases where space is precious, ideal for top-grade extension speakers. Yet with 50W RMS handling capacity, it is ideal for people who want performance in confined spaces that's equal to some of the most expensive systems. An "Autostat" self re-setting circuit breaker protects against overload since it performs best with amplifiers punching out anywhere between 25W-100W RMS per channel. If you're worried about bass response . . . don't be. It's down to 50hz – possibly the lowest ever achieved with a 5" woofer, and incredibly robust. So why take up valuable floor space with convention enclosures when the amazing little AR-1 cleverly condenses everything but its astonishingly big sound? Ask for a demonstration today.

AUDIO REFLEX

You'll hear more from us.....

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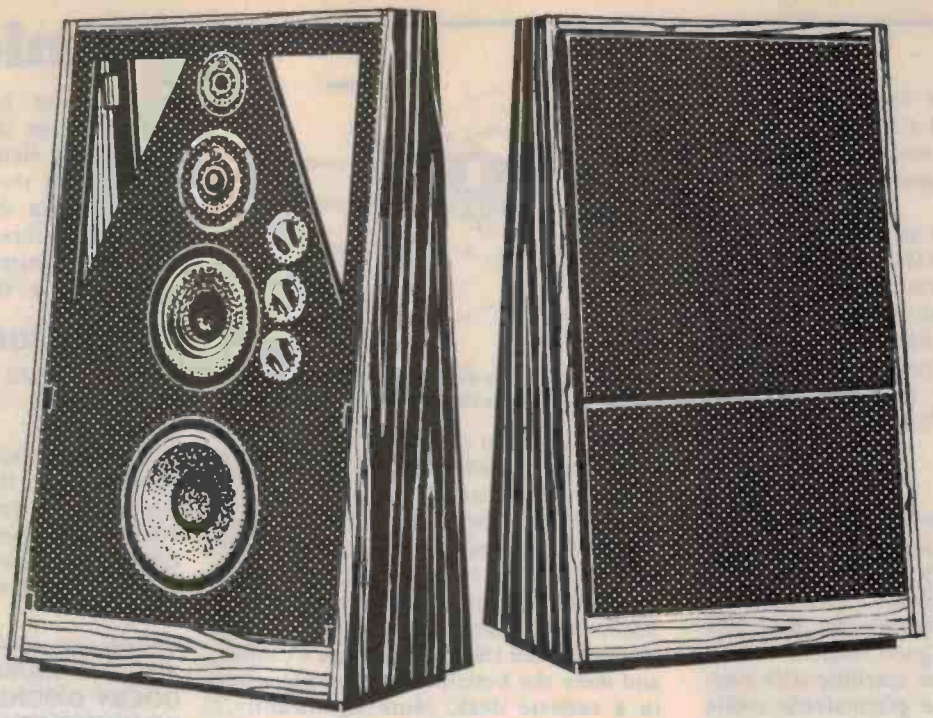


New shape of sound from RTR: The trapezoidal 800D 4-way system.

RTR has applied its most advanced technology to the development and integration of transducers, crossover and enclosure to achieve virtually the ultimate in a single system. The RTR 800D soft dome speaker.

Its flawless, faithful reproduction more closely resembles the original musical source than you thought possible. Instruments sound exactly as they do in life; performance realism is retained while maintaining linearity, focus, imaging, sublety and sense of depth perspective.

An incredible performance you must hear to appreciate.

The 800D 4-way system

1 A 10" woofer specifically designed for accurate low bass response, from 30Hz to a cut-off at only 190Hz. With 1½"high-temperature voice coil assembly and 4 lb. magnet structure, it employs special fibre cone and foam surround impregnated with damping and sealing fluid for better air seal, greater resistance to break-up and optimum energy absorption.

2 The 8" upper bass/lower mid driver is of similar construction, and covers the range from 190 to 1900Hz.

3 The 1½" soft dome midrange radiator employs a unique carbon-fluid damping and sealing compound applied to the dome for greater longitudinal and torsional rigidity for true piston action and high power operation. Covers the range from 1900 to 9500Hz.

4 The new 1" soft dome tweeter for performance from 9500Hz to well beyond audibility at 25,000Hz perfectly complements the midrange.

Significant achievements

The high efficiency and ruggedness of the 800D permits it to be driven by 25 watts, yet it takes 125 watts with ease. Lightning fast transient response combines with wide dynamic range to respond to sudden changes in programme level without clipping or distortion. Bass is smooth, tight and accurate without muddy or boxy sound. A new, sophisticated crossover has virtually no transient or IM distortion, with driver parameters precisely determined. Level control on 8" upper bass/lower midrange permits compensating from room response.

Hear the RTR 800D difference at your specialist dealer, or write for specifications.

Distributed in Australia by Acoustic Monitor Co Pty Ltd (Member of the Thomas & Coffey Group) 12-18 Gould Street, Enfield, NSW 2136. Phone: (02) 642-7888. Telex: 26778. Cables: "Tomcoffy" Sydney.

Listen... you'll be hearing more from RTR.

SMA/AM2

The rear of the case has a remote control socket and a DC output socket as well as the conventional coaxial line input and line output sockets and DIN plug.

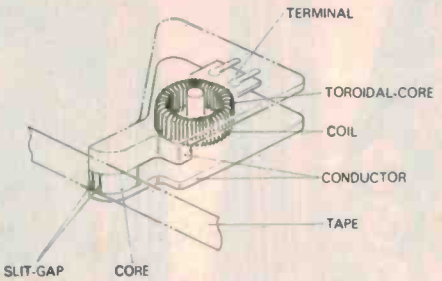
Nakamichi offer as an optional extra their well-proven RM10 remote control facility with a 5m extension cable. This was developed for the Nakamichi 1000. They now offer a new "wireless remote control" type RM580 which utilises an optical infra-red carrier to control the unit from distances of up to 10m.

Evaluation

In use all the controls proved to be easy to use. Provided one stayed with nominally the same tapes in each of the three classifications available, virtually no adjustment is required to the bias controls to achieve good results.

We evaluated the machine with conventional low noise gammaferric oxide tape; with TDK SA and with a new Nakamichi ZX tape. With all three the frequency performance was outstanding. **With the new ZX metalloy formulation the record/replay frequency response was the flattest that we have ever seen any machine produce at -10 dB.** Over the frequency region 30 Hz to 18 kHz, the deviation did not exceed ±1 dB.

We tried to use the machine with the ferrichrome tapes but the performance, as we have previously experienced with other Nakamichi machines, showed that they never intended this machine to be used with ferrichrome.



Nakamichi's Direct-Flux erase head, developed for their 580 series cassette decks.

Without exception, all the major parameters evaluated were good and the wow and flutter in particular, at 0.042% weighted RMS or 0.076% unweighted RMS, was particularly good. These clearly exceed the manufacturer's claims and were the best that we have yet seen in a cassette deck. More significantly, the performance of recorded material "sounds better" than on other machines we have evaluated.

The total harmonic distortion figures were particularly good, better than those claimed by the manufacturer.

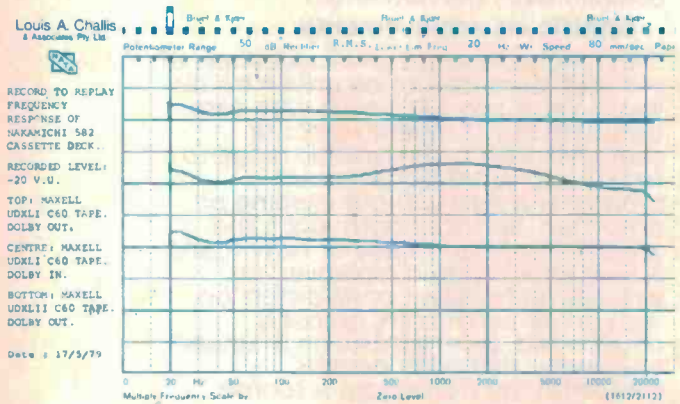
Nakamichi make one claim which is a little unusual. This relates to the erase characteristics of this machine, which they claim are better than other machines on the market. Nakamichi have developed and patented a 'direct flux' erasure head which features a lower leakage than conventional erase heads. They claim an erasure ratio comparable with the best bulk erasers. Our measurements showed clearly that the new direct flux head works well and achieves erasure ratio of better than 62 dB relative to a 0 dB 1 kHz signal.

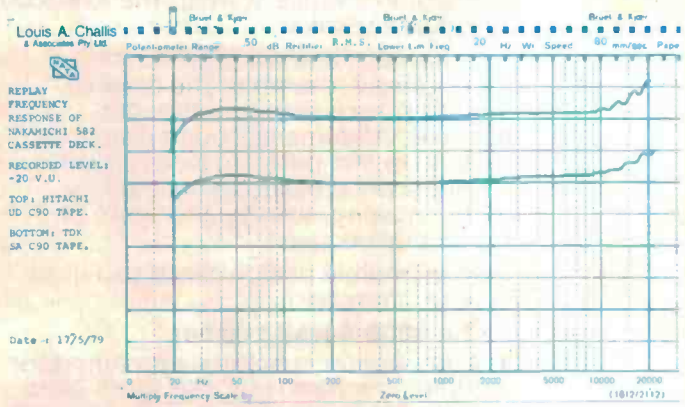
Conclusion

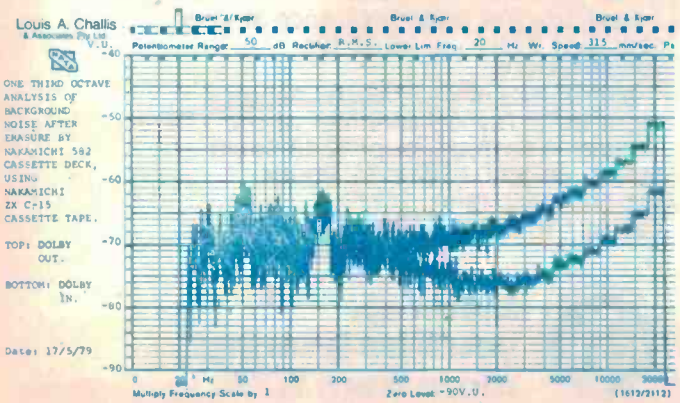
The Nakamichi 582 is an innovative machine and its performance as a record/replay machine or even a straight playback machine is exceptionally good. Its performance in some respects is better than the Nakamichi 1000 (the current 'industry standard'). Given the choice of Nakamichi 1000 or the 582 we think we would choose the 582. ●

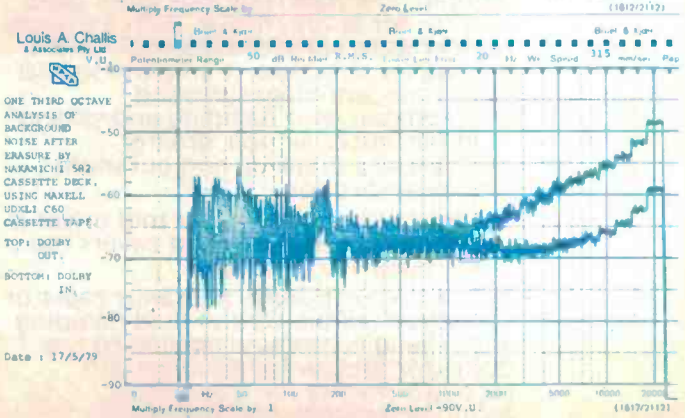
THE NAKAMICHI 582 STEREO DOLBY DISCRETE HEAD CASSETTE DECK IN METAL CASE

Dimensions: 500m wide x 130mm high x 350mm deep; Weight: 8.2kg. Price: $799.00. Manufactured by Nakamichi Research Incorporated, Tokyo, Japan. Serial No. 01325.









Only hi-fi, everything hi-fi.

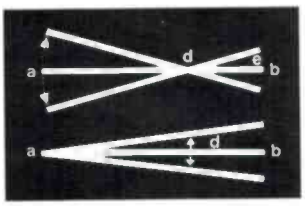
Sansui

Official test results: "Fantastically low distortion unmeasurable under any realistic use"

America's prestigious Stereo Review uses Hirsch-Houck Laboratories for its equipment test reports, and Sansui's DD/DC amplifier was found to have "fantastically low distortion (quite literally unmeasurable under any realistic use conditions)..."* The explanation for such demonstrable results is Sansui's design philosophy and carefully honed audio electronic skills.

One of the most effective ways to reduce THD is with negative feedback circuitry. When such NF circuitry is carefully designed, improved steady-state response can be achieved. But other types of distortion, specifically TIM (transient intermodulation distortion) may result when reproducing dynamic signals which typically occur in the reproduction of musical passages. A truly outstanding amplifier must, therefore, not only have a very low THD but also a very low TIM.

The more rapidly an amplifier can deliver more power, the lower the TIM. The accurate reproduction of pulsive music signals necessitates new parameters, particularly rise time and slew rate, to evaluate TIM. Sansui's exclusive Diamond Differential DC circuit (DD/DC) achieves rise times and slew rates that leave the competition far behind. Tonal quality comes closer than ever toward absolutely perfect reproduction of even the most subtle nuances of the original sound.



D-O-B theory and practice. If a rod of uniform mass is held at point (a) and flexed back and forth, point (d) is stationary. If the rod is now held at point (d) and flexed, point (a) now becomes stationary. The fulcrum of Sansui's D-O-B tonearm is precisely at point (d)—dividing the mass of the arm into 1/3 and 2/3 segments to eliminate vibrations from the turntable base to the stylus (d), to assure free stylus movement (a) and prevent stylus oscillations from exciting tonearm resonances.

Perhaps the best sign of originality is the ability to rethink and analyze anew basic assumptions. Sansui's Dyna-Optimum-Balanced tonearm is an instructive example. Lately everybody seems to be putting new twists and new shapes into tonearms. For a revolutionary improvement, Sansui's engineers took a big step back wards and began with some fundamental theories of physics and arrived at the D-O-B tonearm.

Spurious vibrations from the record player cabinet and tonearm can make even the best cartridge sound like the worst. And if mechanical oscillations of the stylus are transmitted to the tonearm — as they usually are — music is inevitably muddied. One fundamental principle of physics is that the affect of an impact on the extremity of a rod of uniform mass is zero at one point on that rod. The point is precisely two-thirds the length of the rod from the struck extremity. Applied to a tonearm, it would mean placing the fulcrum precisely at that point. [See illus. above] Such mechanical precision is a rare achievement in the world of audio. The two-fold important improvement that results is (1) virtual elimination of all vibrations from the turntable base to the stylus, and (2) virtual elimination of spurious arm resonance caused by stylus movements. Sansui's rare achievement not only radically reduces important sources of distortion (frequency modulation), it also allows more accurate stylus tracing for cleaner sound. The D-O-B system is the closest approach to free stylus movement that we know of.

From digitally quartz-locked tuning for Sansui tuners, to highpowered three-way speakers systems utilizing special overlapping woofers in parallel and a Direct-O- Matic cassette deck, Sansui's original ideas in audio bring you closer to the original sound.

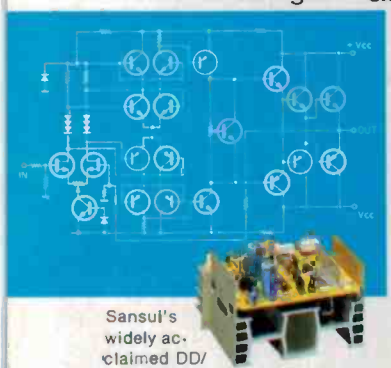
* Stereo Review, March, 1979

Steady-state vs. pulsive signal response

A straight wire with gain is a simple idea. But pure amplification of complex pulsive music signals is terribly complex. Maybe that's one reason why so many audio makers design components and measure performance using only steady-state response as their chief standard.

Facts, however, are facts. An amplifier with good steady-state specs may fall apart reproducing complex pulsive signals. That is why Sansui research and design go far beyond ordinary measuring devices and referents. Sansui — as a maker devoted exclusively to hi-fi — designs its audio components for excellence under fire. Sansui uses the latest technology to achieve accurate reproduction of actual musical signals. That is why, for example, Sansui is a leader in the fight to eliminate TIM (transient intermodulation distortion), an important form of distortion which is particularly evident in reproduction of high level pulsive signals.

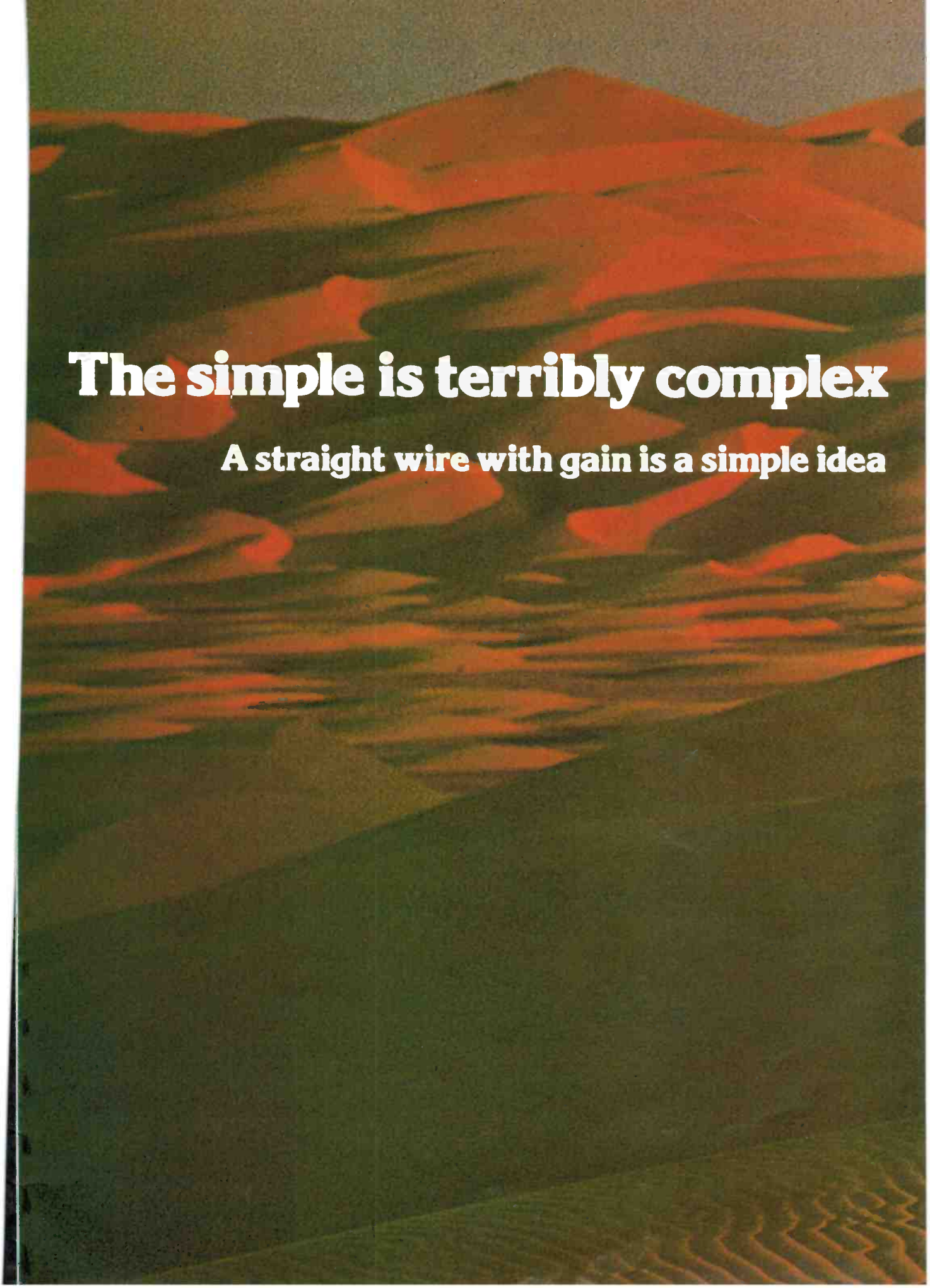
Every single Sansui component — from the most basic — is the careful result of ceaseless testing which is based on realistic parameters for accurate reproduction of the most complex musical passages. Master craftsmanship of the highest order is required for success.

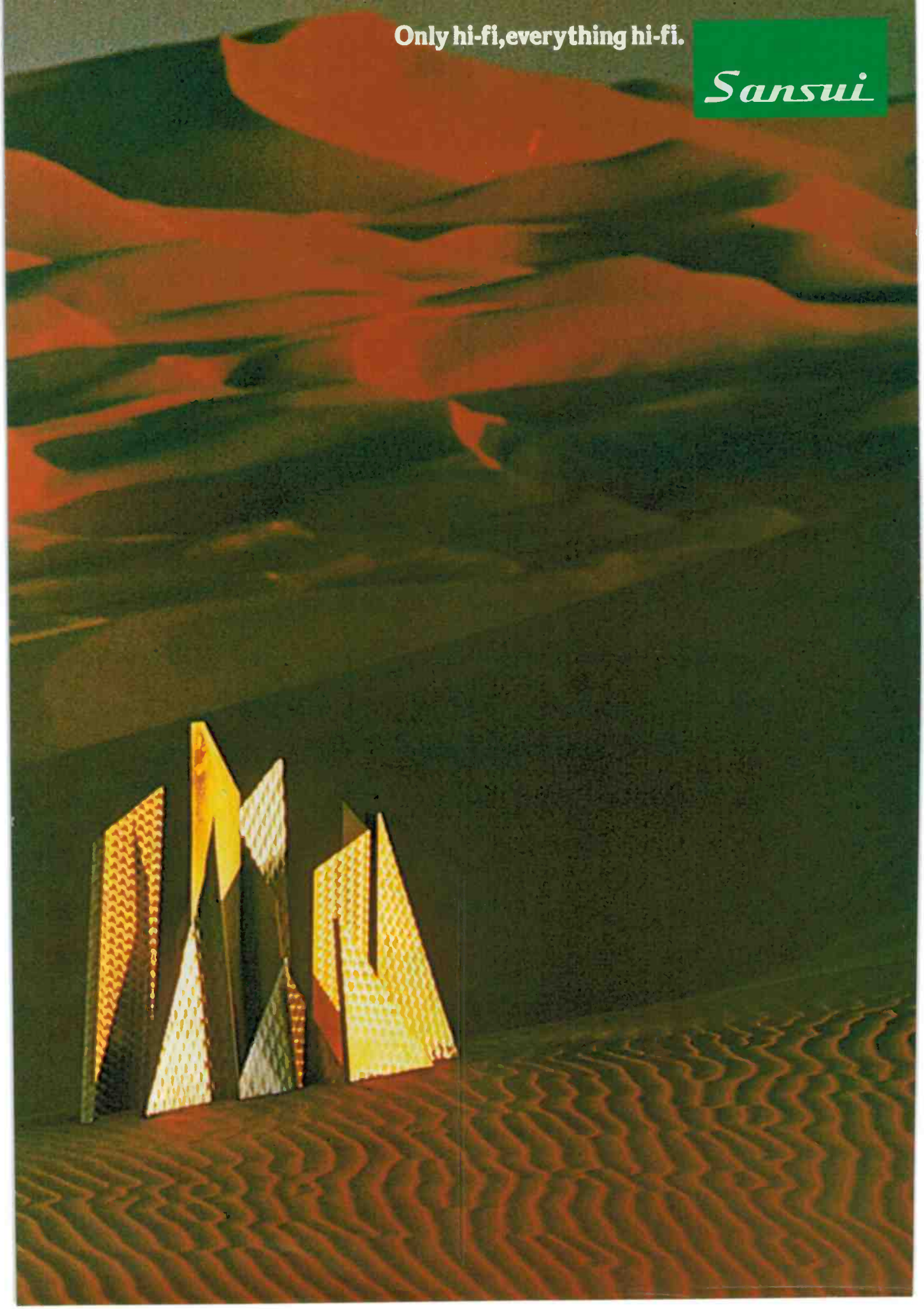


Sansui's widely acclaimed DD/DC circuit. Four PNP and NPN transistors are used.

FR-Q5: Computerized full automatic DD quartz-servo turntable with D-O-B tonearm. Wow & flutter: 0.018%. S/N Ratio: 75dB (DIN-B).
TU-719: Digitally quartz-locked tuning. FM Sensitivity: 16dBf (stereo) FM T.H.D.: 0.07% (stereo).
AU-719: DD/DC amplification. Continuous Power: 90W × 2 (8Ω, 0.015% T.H.D., 10-20,000 Hz). Slew Rate: ±170V/μSec. Rise Time: 0.5 μSec.
SC-3110: Direct-O-Matic loading. Dolby NR system. Wow & flutter: 0.06% (WRMS)
SP-L700: Dual-woofer speaker system. Max. Input Power: :200W. Sensitivity: 93dB/W.

GX-7 rack


The simple is terribly complex
A straight wire with gain is a simple idea


Only hi-fi, everything hi-fi.
Sansui

to each other for outstanding sound. First: every Sansui component is designed with every other component in its class in mind. This means, for example, that in testing the AU-117II integrated amplifier, the SP-X3300 speaker system (among others) is used and both are continuously modified until perfected for best results. Second: especially in moderately priced components, every manufacturer's own particular priorities are audibly evident. Low distortion and excellence in reproduction of pulsive signals consistently receive high priority as part of Sansui's sound philosophy. That is why a Sansui cassette deck and Sansui tuner and Sansui amplifier in any given class will produce more accurate, cleaner sound than any other equivalent combination.

Sansui system racks have also been carefully designed for convenience and handsome styling by our sound engineers. They match Sansui components like no other racks can.

The final audible result is the superior sound quality — unmatchable sound quality — of each of the four matched systems on these pages.

FR-D3: Automatic return DD turntable. Wow & flutter: 0.028%. S/N Ratio: 72dB. (DIN-B).
TU-217: Phase-locked loop IC Stereo demodulator. FM Sensitivity: 20dBf (stereo). FM T.H.D.: 0.13% (stereo).
AU-217II: Differential input and OCL output. Continuous Power: 40W × 2 (8Ω, 0.06% T.H.D., 20-20,000 Hz).
AX-7: Versatile Audio Consolette.
SC-1110: Direct-O-Matic loading. Dolby NR system Wow & flutter: 0.08% (WRMS).
SP-X4400: 3-way bass-reflex speaker system. Max. Input Power: 65W. Sensitivity: 93dB/W.

SR-B200; Precision, high-torque auto-return turntable. Wow & flutter: 0.07%. S/N Ratio: 65dB (DIN-B).
TU-217: Phase-locked loop IC stereo demodulator. FM Sensitivity: 20dBf (stero). FM T.H.D.: 0.13% (stereo).
AU-117II: Darlington-arranged power output. Continuous Power: 25W × 2 (8Ω, 0.17% T.H.D., 20-20,000 Hz).
SC-1110: Direct-O-Matic loading. Dolby NR system Wow & flutter: 0.08% (WRMS).
RX-100: Drawer-type audio accessory case.
SP-X3300: Proven 2-way bass-reflex speaker system. Max. Input Power: 55W. Sensitivity: 91dB/W.

GX-5II rack

Sydney, N.S.W. 2060, Australia Tel: 929 0293

Only hi-fi, everything hi-fi.

Sansui

How Sansui's in-depth component matching delivers superior sound quality

If you take any tuner, any amplifier and any speaker and connect them, you're almost certain to hear sound. But if your selection is haphazard, you won't find such sounds very satisfying.

Careful matching of component characteristics will give better results, and will usually be more economical. Contrary to popular belief, however, truly accurate matching isn't easily achieved.

Here are two critical inter-related ways Sansui components in a hi-fi Sansui system are superbly tuned

FR-D4: Computerized full automatic DD turntable with D-O-B tonearm. Wow & flutter: 0.028%. S/N Ratio: 72dB (DIN-B)

TU-317: Frequency linear FM frontend. FM Sensitivity: 19dBf (stereo). FM T.H.D.: 0.09% (stereo).

AU-317II: DC amplification. Continuous Power: 60W × 2 (8Ω, 0.03% T.H.D., 20-20,000 Hz).

AX-7: Versatile Audio Consolette for mixing and live/recorded special effects.

SC-3110: Direct-O-Matic loading. Dolby NR system. Wow & flutter: 0.06% (WRMS).

SP-X5500: 3-way high-definition speaker system. Max. Input Power: 85W. Sensitivity: 94dB/W.

GX-5II rack

GX-5II rack

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokkyo 168, Japan
VANFI (AUST.) PTY. LTD. 162, Albert Road, South Melbourne, Victoria 3205, Australia Tel: 699 5473/283 Alfred Street, N

DEALER LIST

VICTORIA

Denman Audio
70 St. Kilda Road,
ST. KILDA, 3162.

Soundair Centre
135 Hawthorn Road,
CAUFIELD, 3162.

Kenwall Electronics
8 City Arcade,
433 Nepean H'way.,
FRANKSTON, 3199.

Southern Sound Pty. Ltd.
337 La Trobe Street,
MELBOURNE, 3000.

A.G. Smith & Co.
159 Leibig Street,
WARNAMBOOL, 3280.

Prouds Audio World
100 Mitchell Street,
BENDIGO, 3550.

Western Hi Fi
71 Gellibrand Street,
COLAC, 3250.

Martin Peeters Hi Fi
1st Floor, Co-op Building,
Ann Street,
MORWELL, 3840.

Instrol Hi Fi
375 Lonsdale Street,
MELBOURNE, 3000.

E & S Trading Co.
246 High Street,
ASHBURTON, 3147.

Reliance Home Appliances
49 Leeds Street,
FOOTSCRAY, 3011.

Steve Bennett Audio
53 Little Ryrie Street,
GEELONG, 3220.

Penny Lane Audio
412 Toorak Road,
TOORAK, 3142.

G & J Beaumont
50 McBride Avenue,
WONTHAGGI, 3995.

Sound City
360 Lonsdale Street,
MELBOURNE, 3000.

Camin Sound
212 Raymond Street,
SALE, 3850.

Multi Sound
327 Lonsdale Street,
DANDENONG, 3175.

E & S Trading Co.
304 Doncaster Road,
NORTH BALWYN, 3104.

Buy-Rite Electrix
459 Bridge Road,
RICHMOND, 3121.

Southern Sound Pty. Ltd.
963 Nepean H'way,
MOORABBIN, 3189.

Bronts T.V.
23 Church Street,
TRARALGON, 3844.

Haig Hi Fi
Shop 8B, Marcade,
463 Main Street,
MORDIALLOC, 3195.

N.S.W.

Sound City
29-31 Baylis Street,
WAGGA-WAGGA, 2650.

Haberechts Radio
610 Dean Street,
ALBURY, 2640.

Insound Hi Fi
Cnr. West & Hayberry Streets,
CROWS NEST, 2063.

Eastern Hi Fi
519 Hunter Street,
NEWCASTLE, 2300.

Audio Corn
Shop 49, Eastwood Centre,
EASTWOOD, 2122.

Woollahra Electronics
264 Oxford Street,
WOOLLAHRA, 2025.

Kent Hi Fi Pty. Ltd.
3 Townshend Street,
PHILLIP, 2606.

Magnetic Sound
32 York Street,
SYDNEY, 2000.

Miranda Hi Fi
Shop 8B, Gallery Level,
Roselands Shopping Centre
ROSELANDS, 2195.

Miranda Hi Fi
Shop 64, Top Level,
MIRANDA FAIR, 2228.

Sound Centre
Johnstone Street,
BYRON BAY, 2481.

North Shore Hi Fi
236 Military Road,
NEUTRAL BAY, 2089.

Southern Hi Fi Pty. Ltd.
Shop 420, Westfield Shopping Town,
HURSTVILLE, 2220.

Goulburn Audio
209 Auburn Road,
GOULBURN, 2580.

Lismore Hi Fi
6 Star Court Arcade,
LISMORE, 2480.

Hunter Valley Electronics
478 High Street,
MAITLAND, 2320.

Hi Tel
145 Queen Street,
ST. MARYS, 2760.

Park St. Hi Fi
38A Park Street,
SYDNEY, 2000.

Miranda Hi Fi
Shop 151, Market Level,
Westfield Shopping Centre,
PARRAMATTA, 2150.

Springwood Hi Fi
147 Macquarie Street,
SPRINGWOOD, 2777.

Audio Corn
Shop 62, Westfield Shopping Centre,
NORTH ROCKS, 2151.

Kent Hi Fi Pty. Ltd.
99 Bellconnen Mall,
BELLCONNEN, 2617.

Miranda Hi Fi (GOSFORD) Pty. Ltd.
34 Williams Road,
GOSFORD, 2250.

Audio Corn
307 Pacific H'way,
LINDFIELD, 2070.

Len Wallis Audio
Shop 3, 50-54 Burns Bay Road,
LANE COVE, 2066.

Hi Fi House
268 Keira Street,
WOLLONGONG, 2500.

Dubbo Hi Fi
85 Talbrager Street,
DUBBO, 2830.

Nowra Hi Fi
111 Junction Street,
NOWRA, 2540.

Records International
299 Chapel Street,
BANKSTOWN, 2200.

Lagmans Sound Centre
Shop 15, Treasure Island,
COFFS HARBOUR, 2450.

Hi Fi Hut
309 Victoria Street,
GLADESVILLE, 2111.

SOUTH AUSTRALIA

Alleyn & Jacob
59 Commercial St. West,
MT. GAMBIER, 5280.

Track 1 Hi Fi
96 Gawler Street,
ADELAIDE, 5000.

Sound Dynamics
303 Pulteney Street,
ADELAIDE, 5000.

Hi Fi Discounts
28 Peel Street,
ADELAIDE, 5000.

Revolver Hi Fi
66 King William Road,
GOODWOOD, 5034.

Instrol Hi Fi
57 Flinders Street,
ADELAIDE, 5000.

WEST AUSTRALIA

The Audio Centre
883 Wellington Street,
WEST PERTH, 6005.

The Audio Centre
VICTORIA PARK, 6100.

Airport Shopping Centre
PORT HEADLAND, 6721.

QUEENSLAND

Stereo World
139 Sheridan Street,
CAIRNS, 4870.

Stereo F.M. Centre
288 Adelaide Street,
BRISBANE, 4000.

Ipswich Hi Fi
61 Limestone Street,
IPSWICH, 4305.

Vints Electrical
17 West Street,
MT. ISA, 4825.

Handos Hi Fi
66-70 High Street,
TOOWONG, 4066.

Disco & Stereo Supplies
Dal Roberts Arcade,
398 Flinders Street,
TOWNSVILLE, 4810.

Gold Coast Hi Fi
Cnr. Young & Davenport Streets,
SOUTHPORT, 4215.

Sound Centre
143 Griffith Street,
COOLANGATTA, 4225.

Hi Fi Sales Pty. Ltd.
Shop 24, Upper Level,
Kippa-Ring Village,
REDCLIFFE, 4020.

Tel-Air
187 George Street,
BRISBANE, 4000.

Audio Laboratories
12 Douglas Street,
MILTON, 4064.

Todds Hi Fi Factory
308 New Cleveland Road,
TINGALPA, 4173.

Mackay Audio
Arcade Rio, 45 River Street,
MACKAY, 4740.

Premier Sound
239 Musgrave Street,
ROCKHAMPTON, 4700.

Tel-Air
Indooroopilly Shopping Centre,
INDOOROOPILLY, 4068.

Living Sound Centre
Cnr. Ashgrove Ave. & Waterworks,
ASHGROVE, 4060.

TASMANIA

Bel Canto
138 Liverpool Street,
HOBART, 7000.

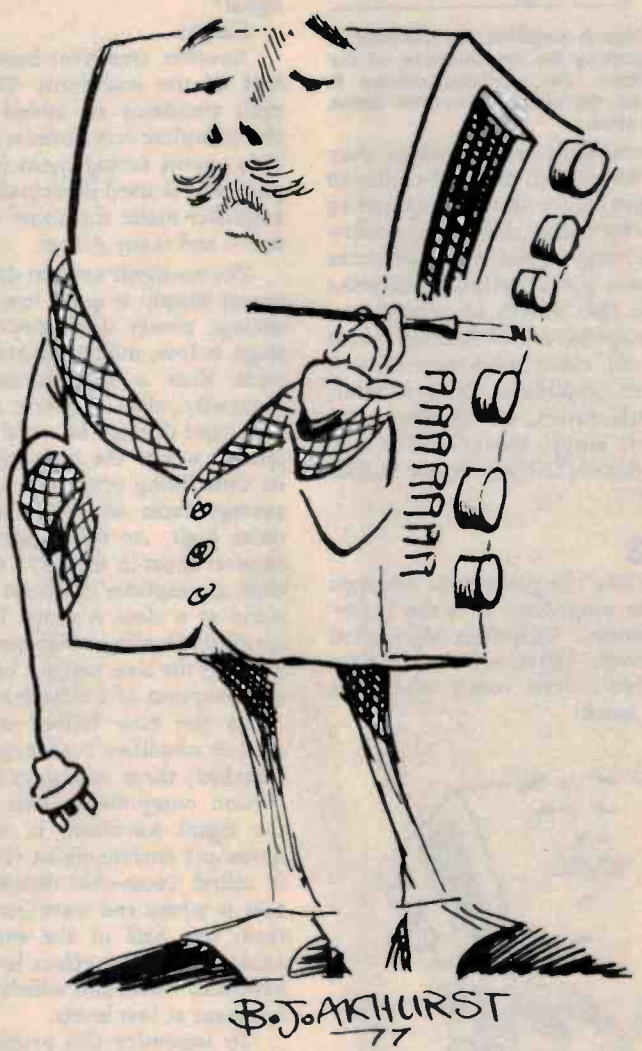
Centresound
Shop 11, Centreway Arcade,
LAUNCESTON, 7250.

The Sound Shop
105 Reiby Street,
ULVERSTONE, 7315.

Belmont Stereo
73 High Street,
BELMONT, 7315.

Class distinction and amplifiers

"From each according to its bias — each draws power according to its needs."



MOST PEOPLE interested in hi-fi have heard of 'class A' and 'class B' amplifiers. The latter are commonly used in hi-fi components these days whereas class A amplifiers were common during the valve era. A 'class D' amplifier has also been produced — Sinclair marketed such an amplifier in kit form in the 60's. More recently, Hitachi's 'class G' amplifier has gained some publicity.

Roger Harrison

These alphabetical classifications describe the electrical operating conditions of the amplifier and how the signal waveform is handled from beginning to end of a full cycle.

Unlike the Aristrocratic classes, the Bourgeoisie and the Proletariat, the various classes of audio power amplifier produce from each according to its bias — and each draws power according to its needs! Technical concepts sometimes have their social parallels . . . which I should perhaps explain.

Class A

Class A power amplifiers belong to the aristocracy. These days they're very thin on the ground! They have excellent linearity — what goes in comes out with nothing added, just stronger. But, as some people believe about the aristocracy, they tend to be inefficient.

The transistor performing the amplification is biased so that current flows through it during the complete signal cycle. This is illustrated in Figure 1. The current drawn at full signal output varies between about twice no-signal (or 'quiescent') current and almost zero over the signal cycle. The average current passing through the transistor is constant whether there is a signal present or not as the signal waveform is symmetrical about the no-signal line (Io).

As most hi-fi amplifiers operate at low signal levels much of the time (unless you're a hard rock fanatic) the overall efficiency of a class A amplifier is very low. Near zero in fact. This means that it is constantly drawing current from the power supply but delivering little output. The class A power amp spends most of its time bludging off the state.

Even at full power output, most class A amplifiers are only about 30 percent efficient. Maximum theoretical efficiency is only 50 per cent. Whilst they add 'dignity' to occasions, they laze on the job whilst doing so! Their saving grace is low distortion — they have superb linearity. And we all know how essential *that* is in hi-fi.

The low efficiency is not a problem in preamp or other low-level stages of a system where class A voltage ampli- ▶

Class distinction and amplifiers

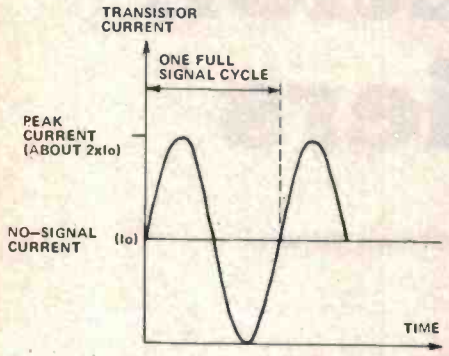


Fig 1. **In a Class A amplifier the transistor is on and conducting for the duration of the signal waveform. The no-signal current is quite high and the class A amplifier draws power all the time.**

fiers are commonly used, because they consume little power. When it comes to power output stages that are required to deliver 20-100 watts, the power dissipation of the stage is three or four times the maximum power output. Heatsinks to dissipate this power are enormous, heavy and expensive. Not daunted, some companies do make solid-state class A audio power amplifiers. Even weirder, some manufacturers are making *valve* class A hi-fi amps! Where will it end (. . . steam-driven Stirling engine output stages . . .)?

Class B

Class B is truly the proletariat amongst audio power amplifiers. It is the "common workhorse.. Output is high when properly driven, efficiency is attractive and they don't draw much when not required to work!

Class A: aristocratic with excellent linearity – tendency to be inefficient.

In class B operation, the transistor stage conducts for close to half the signal cycle (See Figure 2.) The no-signal or quiescent current in a class B stage is quite small compared with the peak current drawn at the top of the signal waveform. When the signal waveform goes below the quiescent current the output waveform is 'clipped' at this point. Surely that produces lots of distortion; and what about the rest of the signal?

Simple.

Another transistor handles the other half of the waveform. The outputs of each transistor are added together and the complete waveform is reconstituted. This circuit arrangement is called 'push-pull' and is used in virtually every audio amplifier made for home entertainment use – and many others.

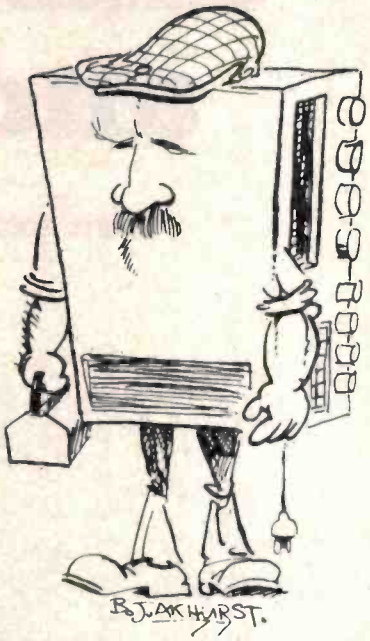
The no-signal current drawn from the power supply is quite low, and thus the average power dissipated by a class B stage is low, making it much more efficient than a class A amplifier. Consequently, class B power amplifiers run very cool during the usual sort of programme where the amp spends much of its time doing very little as the peak-to-average ratio of music and speech is quite high. At full power output (the cannon shots in the 1812 Overture!) the class B amplifier is about twice as efficient as a class A amp. This results in amplifiers having a high power capability without the size, weight, cost and power consumption of a class A amp.

As the two 'halves' of a push-pull class B amplifier can never be perfectly matched, there is always a residual distortion component. This occurs where the signal waveform is cut off at the quiescent current point (Figure 2). This is called 'cross-over distortion' because that is where the waveform crosses over from one half of the amplifier to the other. The main effect is objectionable harmonic distortion which is particularly apparent at low levels.

To minimize this problem, the stage can be biased more towards class A operation. This reduces output and efficiency, but linearity is improved. Called 'class AB' operation, one might think of it as the 'bourgeoisie' of the audio power amplifiers.

Class C

This class of amplifier is widely used in radio frequency transmitters. A class C stage conducts for much less than half the period of the signal cycle. This produces enormous distortion but efficiency



Class B: the common workhorse – output is high if properly driven.

is very high (theoretical maximum 100 per cent) as the stage is biased so that it is 'cut off' or not conducting for most of the period of the signal cycle. Simple tuned circuits filter out most of the distortion components. They are quite useless in audio amplifier applications so we won't concern ourselves with them further.

Class D

Even though class B power amplifiers are quite efficient, their heat dissipation requirements are still substantial. If only the amplifier could be made even more efficient – was the question considered by designers for many years.

The heat dissipation in a transistor is lowest when it is either conducting 'fully on', or not conducting at all. In a normal amplifier situation, the transistor

– *to page 41.* ▶

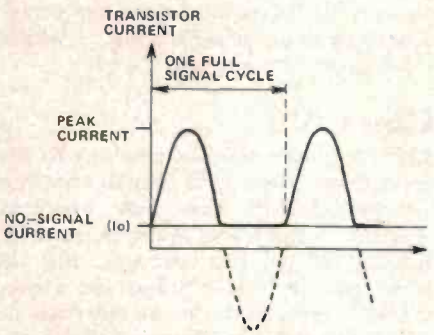


Fig. 2. **Class B power amplifiers are arranged in a 'push-pull' circuit configuration. Each half is biased so that each transistor conducts for about half the duration of the signal cycle. Transistors conduct during alternate cycles.**

A splendid performance....

deserves a splendid performer

Priced at around $350.

The TEAC A-300 is a surprisingly affordable 3-head cassette deck that really gets down to business when it comes to reproduction performance. The reason is an exceptionally stable transport system.
With three heads, the requirements for tape-to-head contact, flutter and tape speed stability are critical.
An inferior transport can actually result in reduced recording and playback quality—even though the unit may boast independent erase, record and playback heads.
That's why we put so much effort into making sure that the A-300 transport complements the three-head system perfectly.
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Technically, the result is improved recording efficiency and extended frequency response with playback level fluctuation and dropouts virtually eliminated.
To you, it simply means stunning sound quality plus the convenience of real-time monitoring.
You can even monitor your tapes Dolby-decoded as you record,
since the A-300 has a double Dolby NR system—four processors instead of the usual two.
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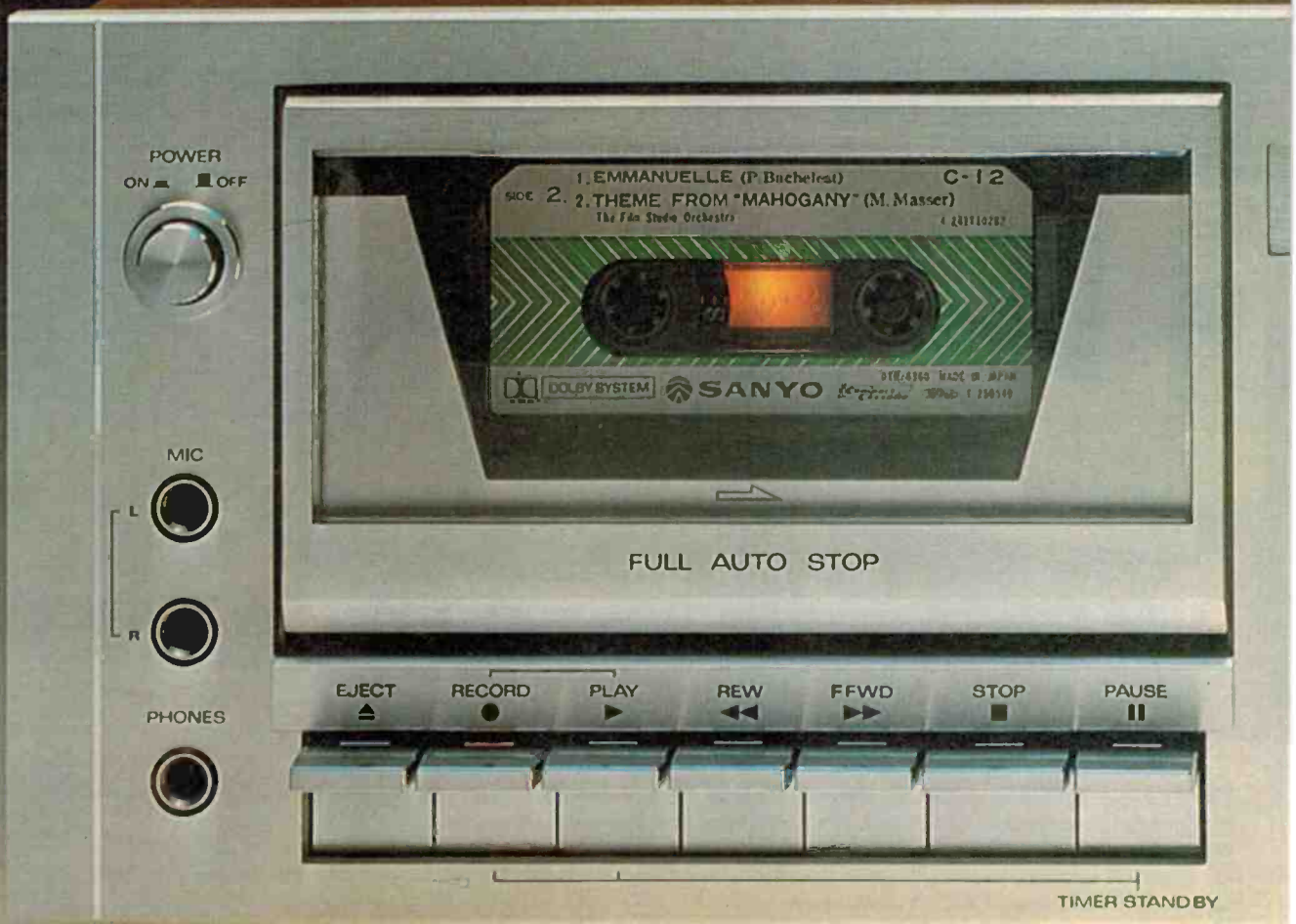
PLL, CrO_2, Fe Cr, 0.05% WRMS,



The translation of the above line goes something like this.

The RD5350 (featured) has PLL (Phase Locked Loop) speed control. This method of governing motor speed is considered the most precise in the world.

It has bias and equalisation settings for normal, CrO_2, and Fe Cr tapes. And a super hard permalloy head that gives up to 10 times the life of conventional permalloy. The frequency response is 30-17,000 Hz and wow and flutter is kept to a remarkably low 0.05% WRMS.

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Class distinction and amplifiers

varies between these two states with the signal waveform. A transistor driven by a series of pulses spends its time either fully on or off. Class D amplification makes use of this.

The pulses can be used as a 'carrier' of the audio signal. Class D amplification employs a pulse-width modulation scheme. A series of ultrasonic pulses, at around 200-300 kHz, far above the audible range, is passed through the amplifier. The audio waveform is used to vary the width of these pulses. Switching transistors are used rather than the conventional types found in audio amplifiers as their efficiency is much higher.

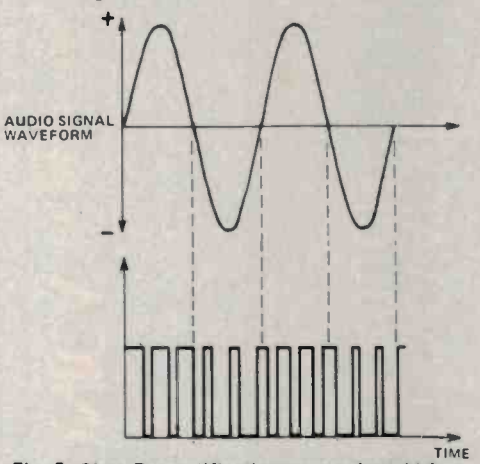

Fig. 3. **Class D amplification uses pulse-width modulation. Pulse amplifiers are very efficient and the pulse-width modulation process can be made very linear.**

As illustrated in Figure 3, the width of the pulses varies in sympathy with the signal waveform. During the positive portions of the signal the pulses increase in width. The pulse width decreases during the negative portion.

A low pass filter, similar to the cross-sover network used for a mid-range speaker in a multi-speaker enclosure, is all that is required to restore the original waveform. This filter passes the 'slow' audio signal variations while excluding the ultrasonic pulses.

As the modulation can be made *very* linear the distortion figures of such an amplifier are extraordinarily low.

The advantages of the class D system make it quite attractive. For a given power output a class D amp will be much smaller, require very much less heatsink and will be cooler than conventional designs.

However, the powerful high frequency pulses produce harmonics which will be radiated by the amplifier circuitry. These harmonics can interfere with broadcast and television reception!

Class AB: the bourgeoisie – a compromise but quite effective in practice.

Apart from that, other technical difficulties have prevented the widespread adoption of class D amplifiers.

A good worker with no place in the bureaucracy – as yet. Sort of Democratic party.

Class G

This was originally called class E by Hitachi who later changed the nomenclature.

In the class G amplifier a low power and a high power stage work together in an arrangement that permits each to operate with relatively high efficiency and low distortion.

At low signal levels the low power stage drives the speakers; the higher power stage takes over at a point where it is advantageous to do so. The low power stage operates from a separate higher voltage supply. These supply voltages are selected so that the 'transition' between stages occurs smoothly so that the waveform remains largely undisturbed and the efficiency of each stage is optimum.

Efficiency of this arrangement is much higher than for a conventional class B amplifier. This has the obvious advantages of reduced weight, size and power consumption. The heatsink requirement is much less than for a class B amplifier of similar power rating.

The operating area where one stage takes over from the other, the transition point mentioned previously, is a potential source of distortion. It is similar to cross-over distortion in push-pull class B amplifiers. Hitachi claim to have reduced this source of distortion to negligible proportions with an inexpensive circuit addition. The result, so Hitachi tells us, is an amplifier with distortion at least comparable with similar conventional amplifiers.

The Quad 'current dumping' amplifier seems to be based on a similar concept. It is however, somewhat different in realisation. It employs a class A amplifier to drive the speakers at low levels – voltage drive operation – and a class B power amplifier to provide the necessary high current drive at high power levels. Thus, at low levels, where distortion is critically evident, is where the highly-linear class A amplifier operates. The class B power amplifier operates in its most efficient and linear region at the high power level. This arrangement massively reduces cross-over distortion in a high-power amplifier.

Now. The aristocracy work hand-in-hand with the bourgeoisie and become the new proletariat!

New classes

A relatively new approach, but using an old idea, is to vary the class of the output stage according to the signal demands.

Special circuits in the amplifier monitor the signal level and adjust automatically the output stage bias as the signal level demands. This arrangement was once known as the 'sliding bias' technique but is a little more sophisticated here. The amplifier operates, from moment to moment, nearest the class that produces the desired results with respect to distortion, power output and efficiency. At low signal levels for example, the output stage will operate in class A. As the signal level increases, the output stage will shift from class AB to class B, at peak power. Two-way social climbing – up the ladder and down the ladder.

Which is best?

Well, that really remains unanswered. Some amplifiers may have audible advantages over others. It is difficult, in practice, to choose an amplifier with superior characteristics that are clearly linked to its class of operation.

Companies, their designers or their marketing staff, advocate a certain approach for many good reasons. Results achieved, according to the depth of your pocket, is inevitably the best way to judge rather than on the technique used to achieve such results. ●

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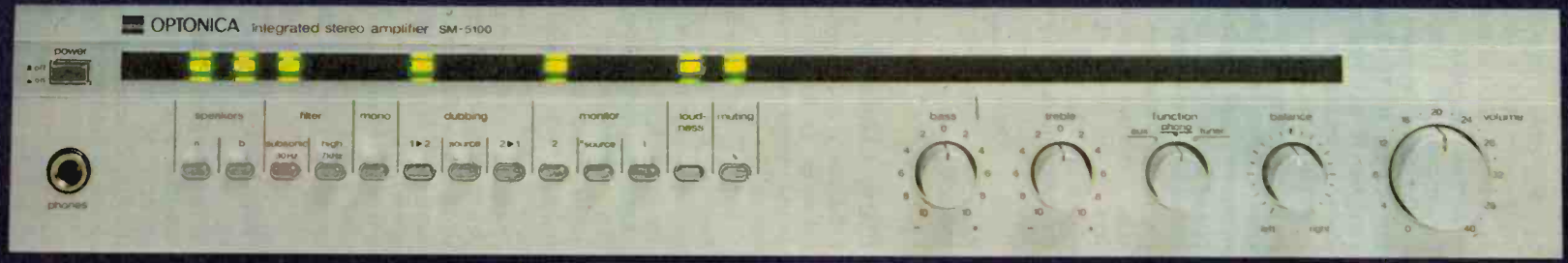

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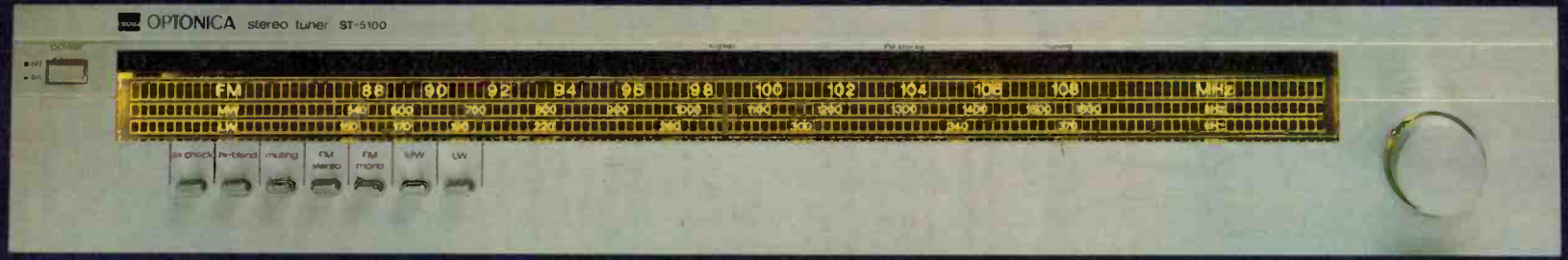

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SHA 40B

sound business

QUITE A FEW new amplifiers have cropped up of late, most of them designed with a view to minimising transient distortion effects and providing stable performance into real speakers whose load characteristics are far less kind than the simple resistors often used as test loads.

Sydney specialist Modular Electronics has come up with a very fine power amplifier rated at 150 watts per channel and based on an enormous 1 kilowatt power transformer. Conventional bipolar transistors have been used throughout and the output stage is an interesting configuration operating in Class A mode to an output of some 14 watts, switching at this level to Class B.

The power supply has been designed to provide plenty of reserve for transient power demands and smooth clipping characteristics give the amplifier a very powerful, effortless quality when combined with good ancillaries. My most recent acquaintance with the unit was at the Modular Electronics showroom, where it was feeding a pair of Otoscan 1 speakers of which more later.

The most immediately noticeable characteristic was of a very tight, controlled bass performance with remarkable extension and delightful delicacy — no mean feat into the four ohm load provided by the Otoscans in the low frequency range. The impression of effortless delicacy persisted right across the frequency spectrum, regardless of level; the amplifier never sounded strained, even when playing very loud indeed.

Peter Stein, who designed the amplifier, is currently working on a 50 watt version.

The Modular Electronics range includes a comprehensive preamp devoid of tone controls and similar superfluity, and a moving-coil preamp called the 'Zed'. This latter looks like quite a bargain at $99 r.r.p., offering as it does superior performance to many imported models costing considerably more.

West Australian amp.

Another locally produced amplifier is the H.S.A., designed and made in Western Australia where it has already achieved a phenomenal degree of success. The designer, Hans Bertina, has worked on the basic philosophy that an amplifier should be compatible with any cartridge at the preamp end and with any speaker at the power amplifier end.

When the amplifier was launched at a reception in Sydney in February, Managing Editor Collyn Rivers and I were immediately impressed by the smooth neutrality of the system, using a Stanton 881S cartridge and KEF Calinda speakers.

The Otoscan 1, discussed on page 45

with Richard Timmins

Allowing for a less than satisfactory match for the cartridge with an ADC LMF-1 arm (fitted to a Thorens RD 125 turntable) the result was dramatically better than I would have expected using the Calindas, which I have always regarded as competent but not outstanding speakers.

The overall characteristic was a very smooth neutrality, free of harshness and very dynamic. The chief aim of the design, according to Bertina, was to provide adequate overload margin through-out the signal path but particularly at the pickup input. Here, a two stage equalisation configuration has been used to achieve low noise performance and minimum reactance with the cartridge.

An effective maximum input level of 1.5 volts can be accepted without overload.

The configuration also provides a very high signal-to-noise ratio, the H.S.A. specification claiming that noise levels are determined by the pick-up system, not the preamp.

The preamp is quite basic and in place of the normal balance control, separate level controls (one for each channel) have been provided. These are linked to a pair of vertical LED displays for level indication, the idea being to obtain precise channel balance without dependence on one's ears.

Though not fitted to the prototype preamp, a switch for turning off the display will be provided — a good idea in view of the distraction value of those twin lines of flashing LEDS!

Rather than tap the signal path to provide a line level output signal for tape recording, Bertina has included a complete amplifier stage for the purpose; this appears to be a result of a logical extension of the high overload margin requirement.

The power amplifier is relatively conventional but reflects latest trends in its ability to handle awkward speaker loads without complaint. It has plenty of reserve output capability for short-term high-power transient demands and there is a facility for bridging the two channels, turning the amplifier into a very powerful single-channel unit.

I was given a second opportunity to listen to the H.S.A. after its launch, this time using Rogers Export Monitor and LS3/5A speakers, and an STD/ Hadcock/Decca London turntable system. Results on this occasion more than confirmed my earlier impressions, and the sense of unobtrusiveness gained previously was, if anything, increased.

I'm hoping for an opportunity of examining this amplifier again before long and a more detailed description should result from that. ▶

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The new Series II C-200 Pre-Amplifier and P-300 Power Amplifier are exceptional even by Accuphase standards

The technology embodied in this new combination is so advanced that it is no surprise that it was the outright winner against all comers.

Its design specification is 300 watts RMS power output frequency response of 1-250,000 Hz (+ - 3dB) direct current power amplifier; fully Class A pre-amplifier with ultra low transient intermodulation distortion and minimal negative feedback.

Tests using Arena's sound technology 1710B analyser have proven these specifications to be very conservative, with actual output tested to 380 watts RMS with .01% distortion at full power.

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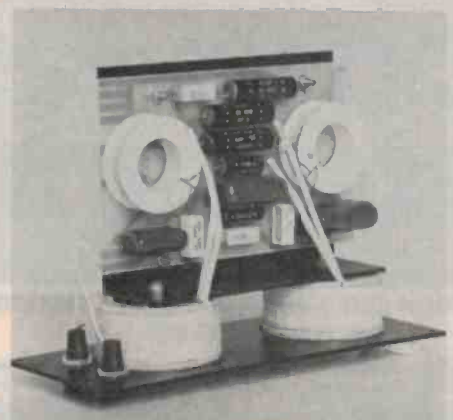
Otoscan speakers

Colin Wait, who designed the original enormously successful AMW SM4100 speakers, is currently working on a new venture. Otoscan 1 is the first product, a loudspeaker of relatively compact size designed to give a wide frequency response. The bass system of Otoscan 1 is particularly interesting. It consists of two 200 mm drive units of differing resonance, operating in what can only be described as an 'active transmission line' or active line for short. It is similar to the system used in the IMF ALS40.

Basically, rather than use a tube as an absorber, the active line system depends on the controlling effect of each diaphragm on the other, linked acoustically as they are by a common loading chamber.

The active line regime gives most of the audible benefits of a far larger transmission line system without the normal size penalty (and here I simply can't agree with "The Audio Critic" that a correctly aligned reflex system, even one of Neville Thiele's, can quite equal the firm, controlled sound of a properly executed TL system).



Third-order networks are used in the crossover system employed in the Otoscan 1 speakers.

It should actually be possible to produce very small active line systems the main barrier at present presumably being lack of suitable drivers.

But back to Otoscan; allied with the 200 mm drivers is an old favourite, KEF's B110, used in conjunction with a Peerless dome tweeter, a new version of the long-standing Peerless design which has gained such a reputation over the years.

Colin has drawn heavily on the KEF research into the B110's behaviour, with the result that a smooth and detailed midrange performance has been achieved using third-order filters and correction circuitry in the crossovers.

With plenty of power handling and (marginally) above-average efficiency, the Otoscans deliver enough output level for just about any home listening situation, although a very powerful amplifier is an asset in big rooms.

A second model, Otoscan 2, using reflex-loaded KEF B139 and the same midrange/treble system as Otoscan 1, is currently under development and should be in full production by the time this appears. ▶

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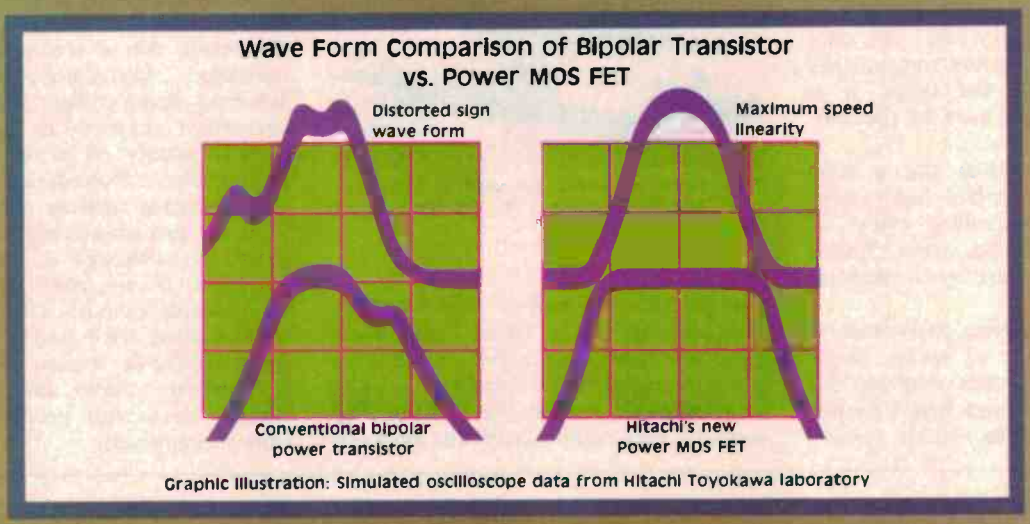

Hitachi Power MOS FET

HA-7700

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HITACHI

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Finally, another speaker, this time the Linn Isobarik. Available in two versions, the passive DMS and the tri-amped PMS, Isobariks have been designed to minimise problems of resonance in speaker systems. The design is founded on a bass configuration used often in the past when a low fundamental resonance is needed from a small sealed enclosure. The system is a straight-forward sealed box, fitted with a KEF B139, but from here things become less conventional. Within the sealed box is a full-size baffle, creating a box-within-a-box, and a second B139 is fitted to this. As reported by Adrian Hope in *Hi-Fi News*, October 1978, Ivor Tiefenbrun's British patent protecting the principle describes it as a means of making the outward-radiating drive unit, i.e: the one that puts sound into the room, behave as though it were in free air. The internal drive unit relieves pressure on the rear surface of the outward facing drive unit because both operate in the same phase.

Superficially, this all seems very plausible, although from memory the Griffin 85 which has used a variation of the same regime for some twelve years now, was never claimed to provide free-air conditions for its outward-facing B139, but merely to provide greater control of this driver's diaphragm.

As it happens, some simple mathematics will show that the free-air condition is not achieved with the Linn system; a correspondent to the Positive Feedback column of *Hi-Fi News* in December 1978 has already shot the whole business down in flames.

Perhaps the simplest way of looking at the system from a design viewpoint was Colin Wait's; he described it as having much the same effect as putting just one B139 in a sealed box of twice the volume of the existing two chambers!

While on the subject of boxes-within-boxes, AWA came up with a very nice little speaker usuing a principle not unlike the practical realisation of the Isobarik a few years ago; it was heard at the 2nd Sydney Consumer Electronics show, and caused quite a sensation.

I've heard both passive and tri-amped versions, the latter at last year's Melbourne Audio show where they failed to impress me. The passive DMS's sounded far better to me in a private home, the speakers being used at the end of their recommended ancillaries, Linn/Grace/Supex turntable, and Naim 32/250 amplifier. The most immediately noticeable feature was dynamic performance, together with a quite unprecedented definition.

Regardless of the correctness or otherwise of Ivor Tiefenbrun's theories on the bass system, low frequency sound seemed extremely controlled to the extent of being quite unobtrusive — possibly too unobtrusive.

The upper frequency system consists of two arrays, one forward-facing and one upward facing, each using the KEF B110 and a Scan-speak dome tweeter similar to the super-tweeter in the AMW four-way 4100.

The reason for the two arrays is to cancel resonances produced by a single array, this also justifies the positioning of the upward-facing array.

However, the penalty, in terms of stereo imaging resulting from use of the upward facing array, is lack of precision. This probably contributes to the sense fatigue the Isobariks generate; the other main contribution to this deficiency seems to be heavy colouration; the Linns don't sound at all neutral and one can't help thinking that a pair of Quad ELSs, suitably set up in a reasonable acoustic, could provide a better overall compromise performance.

I tackled Julian Vereker, of Naim Audio, on these matters during his recent visit to Australia. His reply was that Isobariks were the lowest (harmonic?) distortion speakers so far produced. Maybe so, but for the passive Isobarik's cost of around three grand, I feel it would be more rewarding to try alternatives such as LS3/5A's bi-amped with complementary bass bins, providing far less colouration, little more distortion, excellent image depth and perspective and first class dynamics. ●

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There are dozens of different speaker manufacturers and as many different ways to design speakers.

Fortunately everyone strives for the same end result.

Natural sound.

Some are more successful at achieving this than others. Because it takes patience, experience and a lot of research.

All three ingredients have been lavished on Sanyo's new JSX series of speakers.

The clarity and presence inherent in the design is remarkable. Especially considering their compact size. Some multi-way speaker systems are troubled by distortion from phase differences between input and output signals.

The JSX Series speaker system has a phase equalizer circuit built into its network. This cancels phase differences.

It also makes the overall frequency response of the speaker network as flat as possible.

The phase equalizer network and the carefully chosen three-dimensional speaker layout give the JSX a sparkling natural sound.

What it all means is more bop and less boom for your money.

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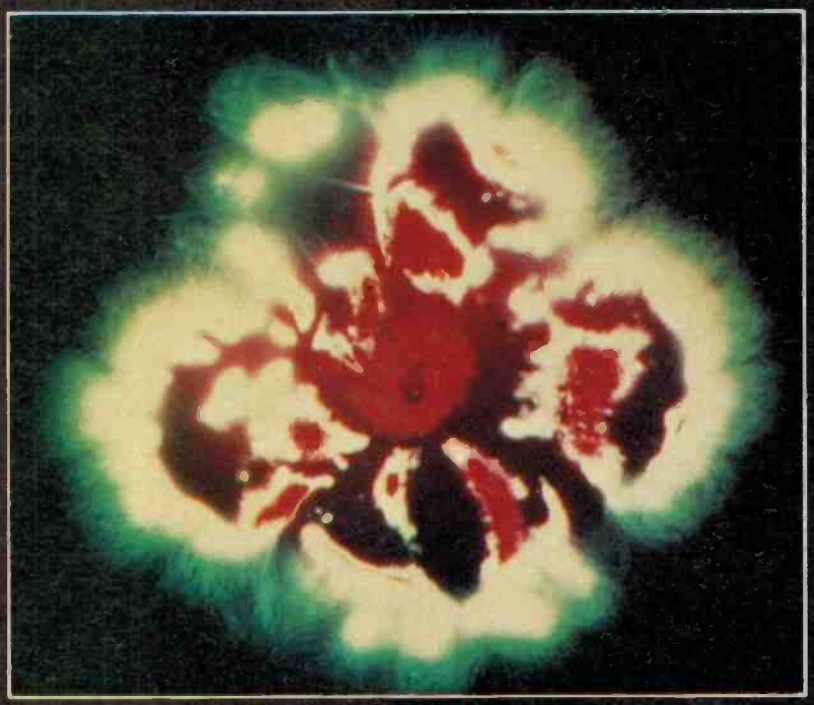
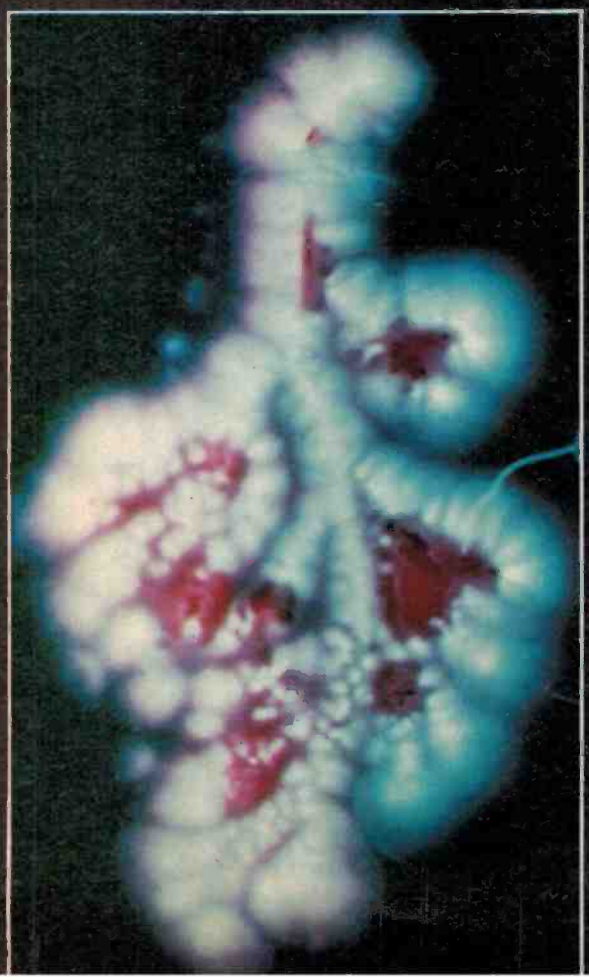
SAN3245/G

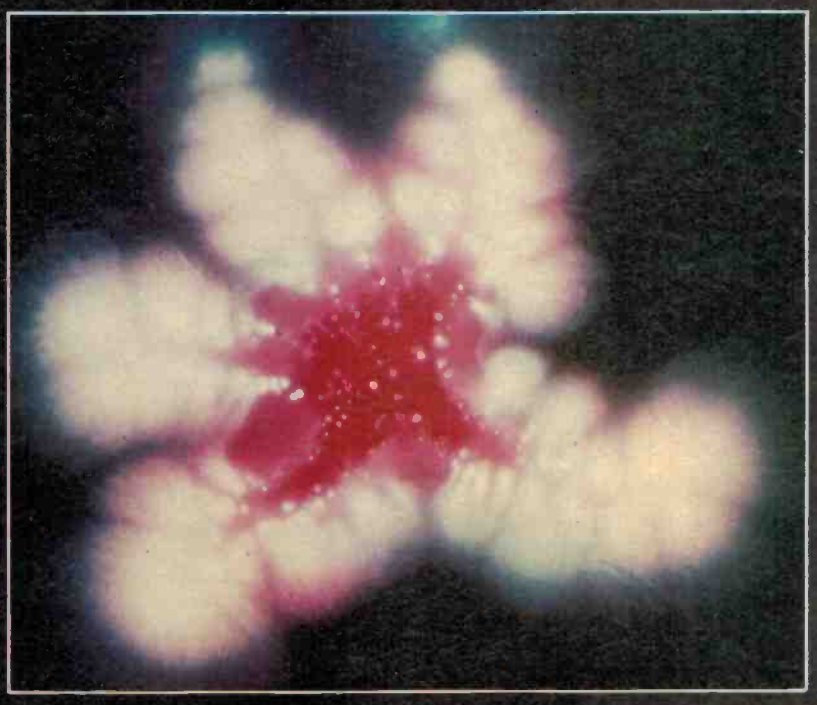

TAITO



Kirlian photograph of an oleander flower. The flesh of the flower in contact with the photograph film is indicated by the dark portions.

Above: the Kirlian aura of a live scorpion. The dark parts in the centre of the outline are portions of the arachnid's abdomen in contact with the photographic plate.





'Radiation field' of a 'Jewel of the Ocean' starfish. Fine structure of the field is evident at the extremities of the creature.

At left: the Kirlian 'aura' of a seafern.

Radiation field photography —

The Kirlian effect

Is it a real phenomena, or a contrivance? The various 'explanations' range from the mystic to the pragmatic. In this article, Dr Peter Sydenham, writing exclusively for ETI, explores the history and phenomenon of radiation field photography — which may yet become a branch of the biophysical sciences.

IN THE 1850's James Clerk-Maxwell became interested in the "lines of force" (demonstrated by sprinkling iron-filings on magnets) concept established previously by Faraday.

In 1855, when Clerk-Maxwell was twenty-four, he read the first of two papers at Cambridge reporting how he had applied mathematical expressions to Faraday's ideas. This apparently surprised Faraday who wrote, "I was at first almost frightened when I saw such mathematical force made to bear upon the subject, and then wondered to see that the subject stood it so well". At that time this must have seemed just another case of an esoteric mathematician apparently taking things beyond reason. But that was only the beginning of a most significant train of events.

From 1868 onward Clerk-Maxwell again became interested in electricity and magnetism. He sought mental models to explain how action could take place between two separated bodies, as had been stated much earlier by Newton. He developed ideas of a system of whirling vortices that helped him, mentally and pictorially, to visualise the action in magnetic fields.

Knowing, from the work of such people as Cavendish, Oersted and Faraday, that electricity was related to magnetism he tried out his ideas of vortices for electric fields. After some necessary modification he came up with a combined theory relating electricity and magnetism. His abstract visualisations including molecular vortices, whirling wheels, idle wheels and their interaction. He translated his images into drawings. (Figure 1)

From these mechanical models came his celebrated theory of electromagnetism, published in 1873. Although based on a visual model it was expressed in mathematical form – the Maxwell equations.

The most surprising result of Maxwell's work was that his visual models suggested that under certain conditions there would be created a wave motion, electro-magnetic in nature, that could be radiated through the electro-magnetic medium of space. He had discovered electro-magnetic radiation – at least, in theory.

Although he predicted that electromagnetic radiation was feasible he was unable to prove this by experiment. And though he wished to verify his theory, it is doubtful he realized the importance of his findings.

Many people then took up the hunt for a practical method to generate and detect the elusive electro-magnetic waves. Over the years 1886 to 1889 Heinrich Hertz, in Germany, was the first to succeed in assembling apparatus (Figure 2) that transmitted the radiation, received and detected it. In the event, his apparatus turned out to be extremely simple. Hertz is said to have declared that, whilst interesting, this knowledge had no real value!

The world had then, for the first time, practical knowledge of an energy regime that was, as such, unknown to man beforehand. Within a decade Marconi had radio systems working and electro-magnetic radiation became an accepted phenomenon of great value.

Previous to the Hertz demonstration, many people had observed unaccountable effects that may well have been naturally generated electro-magnetic radiation – light, of course, is one. The circumstances of these 'strange' observations were varied and no explanation could be placed on them.

Bearing in mind that today, man has collected many well-documented experiences of other inexplicable happenings it seems reasonable to assume that there may well be other energy fields, or like concepts, yet to be discovered and formalised. Because we cannot sense (that is, detect) a given phenomenon with our natural sense organs, even when aided by sophisticated measuring technology, does not constitute positive proof that it does not exist. Perhaps much of the recorded data of psychical phenomena will one day be explained by the discovery of new physical principles. Certainly the wealth of documented evidence suggests there are many such principles. The 'closed-mind' approach will not make the phenomena go away. ▶

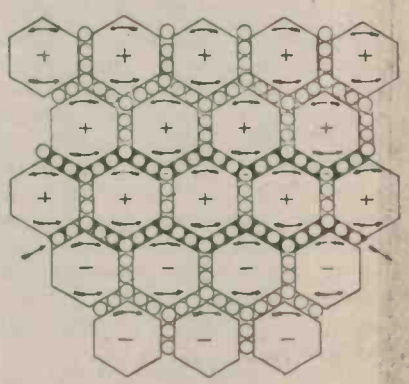


Figure. 1. Maxwell used this sketch of whirling wheels and vortices to aid his thinking about the theory of electromagnetism.

The front cover pictures and those at left are all courtesy of Camera Press, London by Cutten/Szumski.

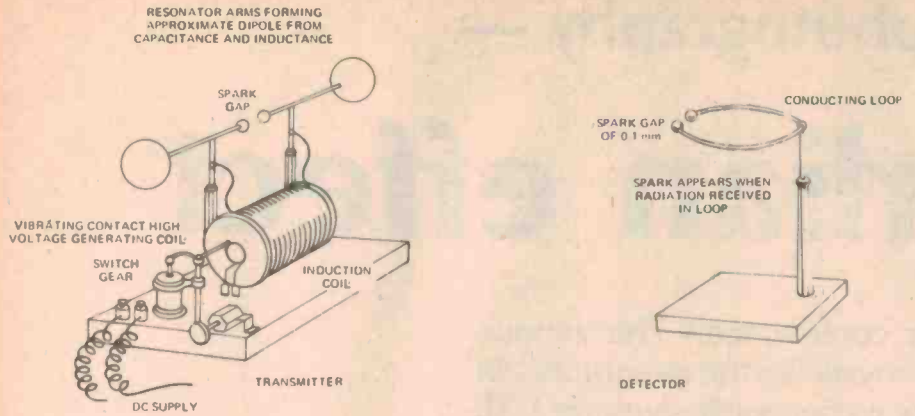


Figure 2. **The apparatus used by Hertz to generate and detect electromagnetic radiation was quite simple. The 'classic' illustration is shown here.**

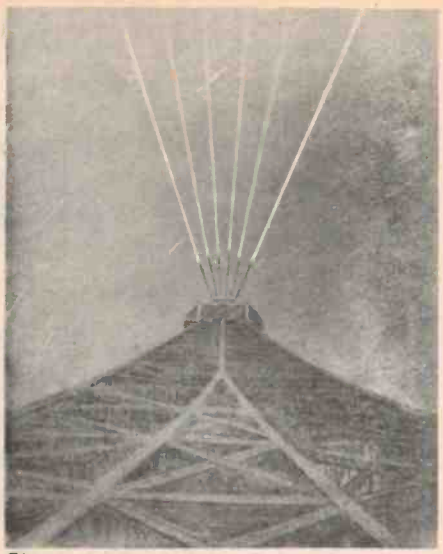


Figure. 4. **Ultra-violet radiation photography looking up to the top of the Eiffel Tower – see text for explanation.**

Electro-photography – the Kirlian effect

Two groups of phenomena that have become closer to explanation than most are first the observations and photographic records of mysterious lights and radiations around people and objects – called variously, radiation field photography, electrophotography, Kirlian effect, Human aura, St. Elmo's fire plus other names – and second acupuncture.

The Kirlian effect and acupuncture would seem as related as monkeys to stones but, as will be shown, they do seem to be complementary concepts. First the Kirlian effect.

Belief in the existence of the human aura is very ancient. Mediaeval people distinguished four kinds of aura: 'Nimbus' and 'Halo' that stream from the head, 'Aureola' that issues from the whole body and 'Glory' which is both kinds combined. These were often featured in paintings; Figure 3 is an example. Others divide the aura into health, vital, Kharmic, aura of character and aura of spiritual nature.

Some people (clairvoyants particularly) claim to be able to see these effects without aids, the colours of the aura indicate the person's emotional and physical state.

The Old Testament bible relates how Moses was involved with a burning bush. Similar flames appeared as the "tongues of fire" that came upon the twelve apostles on the day of Pentecost.

Sharp ends of extended objects – ships masts, yard-arms, church steeples, airplane wingtips – in free air often exhibit this mysterious fire. This became known at St. Elmo's Fire after the martyred Italian bishop who became patron saint of sailors. Other names used include Castor and Pollux, Dioscuri, Corpusant and Fermie's Fire.

Recently this is said to be static electric discharge – corona discharge. A bluish glow was photographed around Pete Conrad the astronaut, when he landed on the Moon from Apollo 12 in 1970.

We all have, no doubt, experienced being charged-up on dry days. There are recorded instances of people who have the ability to deliver powerful electric charges who also have electro-magnetic properties enabling them to suspend

PSYCHIC PHENOMENA – a group of unexplained experiences

Psychic science takes in phenomena such as apparitions (manifestation in image and presence form of the living and dead), apports, (solid objects unaccountably brought into closed-rooms), clairvoyance (supernormal mode of perception, resulting in a visual image in the mind), levitation (people and objects floating, in defiance of gravity), materializations (phantoms built-up from an unknown substance in sensitive persons), predictions (of future events), telekinesis (movement of objects without apparent contact), telepathy (thought transference) plus many more.

These experiences go under such names as psychical phenomena and spiritualism which include mediumship, extra-sensory perception (ESP) and parapsychology. They include such specific events as automatic writing of messages, spirit photographs and the appearance of poltergeists.

In early times these experiences were accepted as part of life and, presumably to help peoples' peace of mind, they were interwoven into their environment, usually as part of the religion. Witches were those with these paranormal powers.

In the 19th century a general trend was to denigrate these experiences because the highly-developing physical science of these times could not explain them. Rather than undermine the scientific method it was easier to dismiss this area of human experience.

In the late 19th century there began to appear many organised and creditable societies for the furthering of knowledge in this fringe-science area.

Serious collecting of case-histories began. Several established scientists joined those interested, examples being Lodge, Crookes and Huxley. Many renowned physical scientists and engineers have developed interests in psychic events in their mature working years.

In this century the universities (in the Western World, that is) have become involved. A laboratory for parapsychology was established at Duke University, North Carolina in 1937. The University of Urecht in the Netherlands had a Chair inaugurated in 1953. The Russians have had an active interest for many years.

But there still is lacking a "plausible theoretical framework" that can be used to explain the observed events.

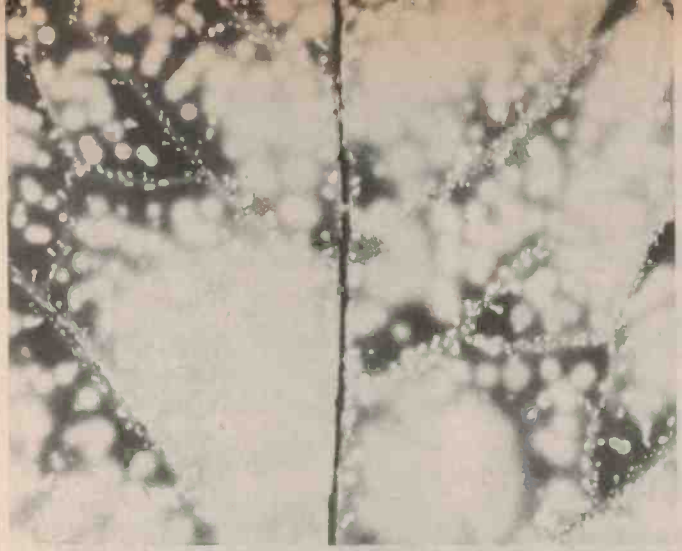


Figure 5. Kendall Johnson's first radiation field photograph was of this leaf. He made it in 1971 using surplus electrical parts in his apparatus.

Figure 3. Right: haloes are one of four forms of human aura. In early times these were shown in many paintings. Shown here is a work called "The Transfiguration" by Fra Angelico (1387 – 1455).

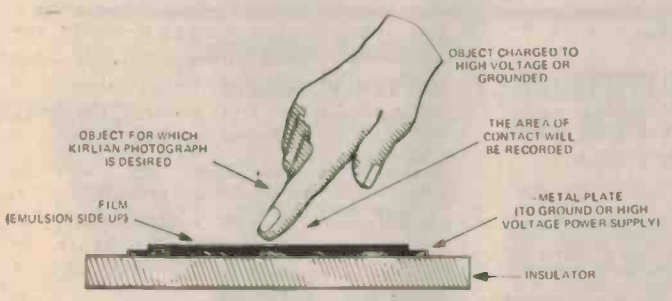


Figure 6. Simple method for making Kirlian photographs of fingertips using static charge built up on the body.

magnetic materials.

Electrical storms have been known to produce images, (a rainbow in one case and pictures of people in others) semi-permanently formed in glass window panes. This is called lightning photography.

In psychic photography, photographs of people – sometimes of people long-departed have appeared on plates. It is suggested that there exists another energy form to electro-magnetic radiation. It is usually called bio-energy, the name coined by Czechoslovakian para-psychologists.

Electro-photography

Electro-photography is as old as the availability of photographic emulsions that could record the existence of radiations. A case dated 1842 is the oldest – see "The probability of the impossible", by T. Moss published by T.P. Tarcher, 1974.

Yakov Narkevich – Todko showed photographs taken using electrical discharges in 1898.

Figure 4 from a 1926 book by C. Hall "Triumphs of invention", carries the caption "A photograph of the Eiffel Tower taken during the dispatch of wireless time-signals. The ultra-violet radiations, although invisible to the naked eye, appear luminous on the photographic plate".

This kind of detection has become known as Kirlian photography after release of the work, in 1958, of the Russians Semyon and Valentina Kirlian. At first, interest in the Western World was minimal but it gained followers especially from 1970 onward.

In the West one man responsible for assisting this interest to flourish is Kendall Johnson, who it seems, was the dominant person in the US to obtain Kirlian pictures, (Figure 5), of objects. ("The Living Aura" by K. Johnson, Hawthorn Books, New York, 1975, is a *must* to read.) There were some earlier accounts of success in the US – one was published in 1938.

Having accepted that there is little mysterious in Kirlian photographs, researchers are now concentrating on trying to resolve whether or not the pictures have recorded more than mere electro-magnetic radiation effects. Do they contain evidence of bio-energy? Does some new form of energy exist to be explained?

The practice of Kirlian photography

In the simplest form of electrophotography an unexposed photographic film is placed on top of an electrode plate with the emulsion uppermost. Onto this is placed the subject to be photographed – a coin, leaf or person's finger or hand. High voltage is applied to the top of the object and discharged through the object and photo-emulsion to the other plate – Figure 6. Clearly the high voltage source must not be of lethal extent if used directly on the body.

Body-part photographs can be made using the static charge built up on a person who shuffles around on a synthetic carpet in a dry room. The use of any other active voltage source for body-part pictures can be a most dangerous practice. It is strongly advised that you experiment with objects such as leaves, coins, flowers, metal shapes and liquid drops, unless you know about the safe use of electrical sensing equipment in electro-medical applications.

Photographs can be obtained using DC charge, a burst of audio frequency high voltage or a single short pulse. Just about every combination appears to have been tried.

Finding the right combination of film type and speed and source characteristics apparently can be time-consuming as each object will need different settings. Results have been obtained using Tesla coils without and with spark-gaps (in which case RF is generated), Van de Graaf generators, charged capacitors and the charge of a person.

Wei, in a paper in the Journal of Applied Physics, Volume 47, p. 4437-4441 reported using a proprietry electric photography set made by Edmund Scientific. This provides voltages up to a maximum of 20 W in the frequency range 3-50 kHz. The set allows the user to vary voltage, frequency, pulse width, pulse repetition frequency and time. He also found that a spring-release piezo-electric generator, which supplies a 10 μsec pulse of 18 kV, was suitable as a source for his work with metal grids. It is likely that the larger style piezo-electric gas lighters might suffice. Wei used ASA 3000 film (Polaroid 87) in his work.

Boyers and Tiller (J.Appl.Phys., Volume 44, 3102-3112, 1973) typically used 100 μsec pulses of bipolar 1 MHz signal having amplitudes varying from 20 to 100 kV. They derived this by driving an Oudin resonator coil (details given in their book) from a modified radio transmitter. They found that each pulse produced different streamer configurations, these tending to expose the film uniformly when a string of pulses was used as excitation. They also established that the surface composition, smoothness, topography, inter-electrode spacing and parallelism of electrodes were each important factors having bearing on the results obtained. They also experimented with colour films, effects produced depending very much on the method of use and the type of film used.

A description of how to build a simple set of equipment is given in Johnson's book "The Living Aura", mentioned above. Another work "High-voltage photography" by H.S. Dakin, published by Edmund Scientific Company, Barrington, New Jersey, USA in 1975 provides circuitry details.

Many different arrangements of film and object position have been used. Figure 7 shows a few variations. The film speed number – the ASA or DIN rating – is of little value as the energy exposing the emulsion is quite different from that for which the film-speed rating is assessed. Different films produce different results.

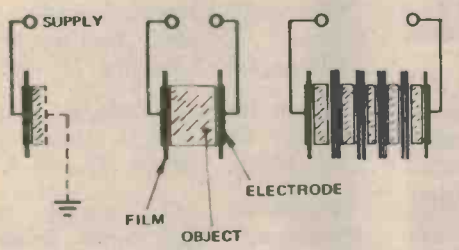
Defined effects

Many variables exist to alter the characteristics of a Kirlian effect photograph. Even so certain effects appear to have been established giving electro-photography an intriguing nature.

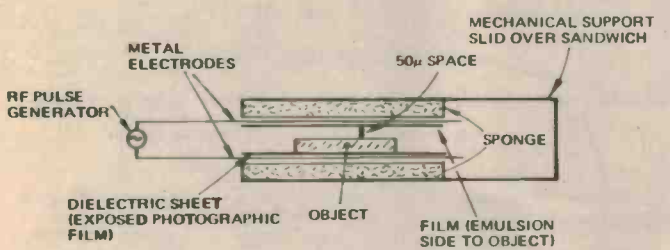
It is said that live leaves and small animals produce a much clearer image, of higher contrast, than when they are dead – the energy image is said to reduce as the leaf looses its life.

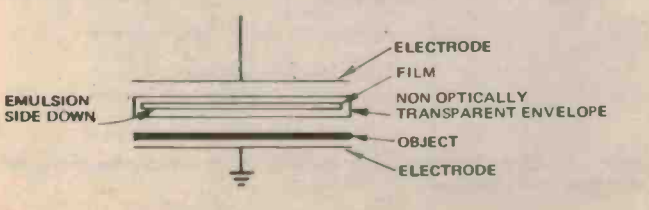
Another claim is that a piece torn from a leaf still shows as present in a photograph of the remainder. This is termed the phantom or cut-leaf effect. (This is not to be lightly dismissed, for in the image storage method of holo-

Figure 7. Various arrangements used in radiation field photography.

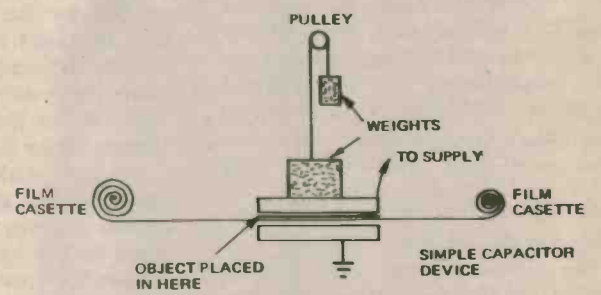


Various techniques used by the Kirlians in Russia.

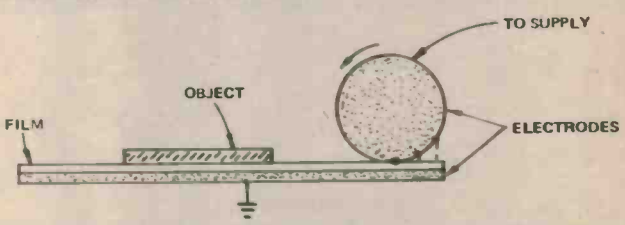




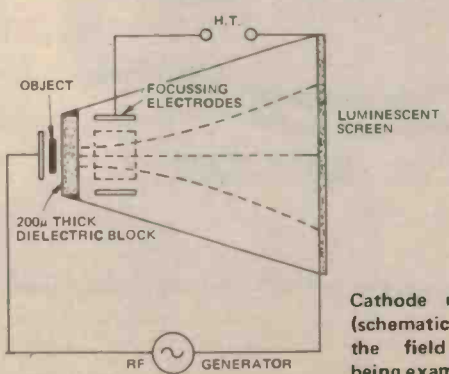
The two diagrams above show various ways of devising an envelope for the production of Kirlian photographs in a lighted room.



Use of roll film to record a Kirlian image. This method requires complete darkness to make the exposure.



A method for producing Kirlian photographs using a rolling electrode.



Cathode ray tube arrangement (schematic only) for picturing the field around the object being examined.

graphy the hologram plate can be broken and any piece from any position will still produce the same 3-D image).

It is also said that psychic healers' finger pads produce a more brilliant image when healing is in process compared with when it is not. As Johnson states: "Do the images show an energy transfer between healer and subject? Is there some informational exchange going on, resulting in the different energy representation of the finger pads".

This also is quite plausible for we accept that information can only be transferred in a physical system when an energy (or mass) carrier exists to convey the data.

Evidence, in the form of Kirlian photographs, has been obtained implying that people with "green-thumbs" have properties that assist repairing damaged plant tissue.

Electro-photographs are certainly artistic and often pleasing to behold. Perhaps they do demonstrate some form of energy unknown to man.

Kirlian photography and acupuncture

What in the world have electro-photography and acupuncture in common? Why stage an international conference on this joint theme? The first Western Hemisphere Conference on "Kirlian Photography, Acupuncture and the Human Aura" was held in New York City in 1972. Papers were read by authors from the Soviet Union, Canada, France, Japan, United Kingdom, Eire and the United States. Letters were received from Czechoslovakia and other countries.

Kirlian photography is concerned with the properties of objects to modify and transmit energy fields – which are certainly of electro-magnetic kind – but may also be of some other, yet unexplained, information-linking nature.

Acupuncture is a Chinese art of healing, using needles inserted into the body at certain places called acupuncture points. It is a very ancient art and has been continuously practised, with effect, in the Asian regions.

The Western attitude to medicine and healing has, until recently, been skeptical towards acupuncture because it cannot be adequately explained by Western science. Considerable evidence now proves that there is much about the body that can be controlled. Yogis are able to perform quite amazing variations of bodily function. Somehow the insertion of needles, in various numbers, places and depths can cure many ailments.

Bio-feedback is an apparently 'understandable' technology – a feature was run on this in Electronics Today International in September 1976. Brendan O'Regan, of the Design Science Institute, Washington DC., wrote in 1973:

"Presumably, we in the West believe our senses only as their impressions are verified by the machines we create". It is in this light that Kirlian photography relates to acupuncture as well as to many other subjects – see Figure 8 for a chart of how the Russians have organised their work on psycho-energetics.

Several workers have reported that Kirlian effects are especially intense over known acupuncture points. Furthermore some people have built probes – called tobiscopes – that indicate their position.

It is claimed that acupuncture can be established by moving electrodes over the body and observing the signal processed by an electro-physiological high-gain amplifier. The extent of the reading is said to also indicate the energy level of that particular acupuncture energy circuit. A 1971 Russian tobiscope, by Adamenko, detects skin resistance changes that are claimed to drop from around the normal 1M down to 50-100 kilohm at an acupuncture point.

Perhaps this article has set you thinking! Equipment to produce radiation field photographs is presently being developed in ETI's laboratory and we hope to publish a project in a forthcoming issue.

Related reading

Additional to the books and papers already mentioned, the following provide accounts concerned with electro-photography and photography of electrical phenomena.

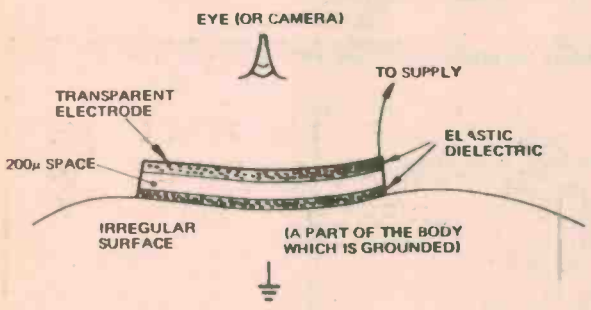
"Psychic discoveries behind the Iron Curtain" S. Ostrander and L. Schroeder, Prentice Hall, 1971.

"Galaxies of life – the Human Aura in Acupuncture and Kirlian photography" S. Krippner, Interface, New York, 1973.

"Photography records electrical phenomenon". Electrical Construction and Maintenance " Volume 75, 86, 1976.

"Instant imaging of electric, radio and acoustic fields" W.G. Hyzer, Optical Engineering, Volume 17, SR-3, 1978.

"Handbook of Unusual Natural Phenomena" W.R. Corliss, Sourcebook Project, Glen Arm, USA, 1977.



Direct viewing of the state of the 'aura' of a living object using a transparent electrode.

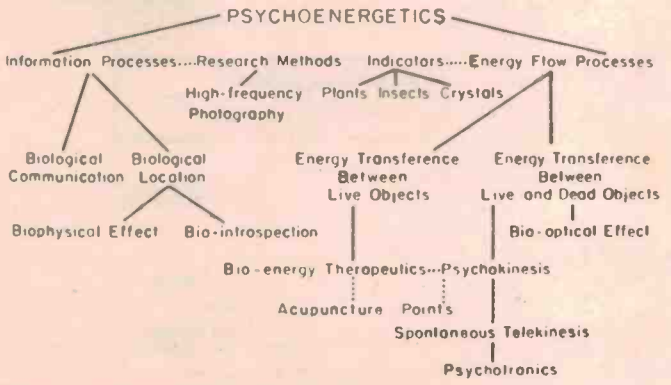


Figure 8. Chart showing how Russian work on psycho-energetics is classified and organised.

All you ever wanted to know about ETI . . . but were afraid to ask

Collyn Rivers

HE'S THE PERSON who started it all.

Collyn's background is odd – even by ETI staff standards! His parents, on one side, were half English half French, on the other, half Arab half Greek. Collyn grew up in North Africa then went to school in England. He left school at 13½ and spent the years between then and National Service 'weaving baskets, building bicycles, digging holes'.

The Royal Air Force sent him to learn about ground radar systems following which he felt 'I ought to get some education'. Spent two and a half years doing economics, but found mechanical engineering more interesting so studied that at the same time. He subsequently did electronics 'but not by choice'.

Joined GM Research Division in 1954 working on vehicle suspension systems, equipment design and development etc. In 1959 was appointed Chief Engineer of a motor industry sponsored survey organisation formed to study and measure road surface conditions throughout Africa. This involved driving an eight tonne mobile laboratory the length and breadth of Africa – including two Saharan crossings.

Following this spent a few years in North Africa installing a microwave telephone system – then migrated to Australia.

Here Collyn worked for a division of Watson Victor designing everything 'from microscope lamp controllers to 500 tonne presses'. From there Collyn went to Natronics (who didn't!) as Applications Engineering Manager.

He left Natronics in 1970 – to found ETI.

Star sign: Leo "what else?".

Likes: Proper cars, things made and done properly, Siamese cats, elegant mechanisms, (most) other Leos.

Dislikes: Things not done properly, journalists, most printers, birds, rug rats, (most) non-Leos, electronics, radio amateurs.

Quote: "If we can only find a way of giving string compressive strength there'd be no need for most of your damn electronics".

Roger Harrison

BORN IN Newcastle (as in Newcastle-on-Hunter, not Newcastle-on-Tyne) in 1946, Roger commenced his career in electronics toying with crystal sets about ten years later. Those first successful projects were built from crumpled, grubby 'build yourself' sheets swapped for a bunch of marbles and a lump of obsidian in the North Parramatta Primary School (Sydney) playground.

At 14 he heard 'hams' on a mate's war surplus R1155 shortwave receiver . . . and has never recovered.

Moving to Melbourne in 1963, Roger attended Swinburne Technical College for the year, passing (brilliantly . . . of course!) 1st Year Electrical Engineering and his amateur radio license examinations. This led to a course in Communications Engineering at The Royal Melbourne Institute of Technology (aahh . . . the old narnal college . . .) which he staggered through (not so brilliantly!) until 1969 when the powers that be decided to change 'the system' and Roger decided it was no longer for him and a tour of Antarctica looked like more fun anyway.

With 92% of his Communications Engineering Diploma tucked away, Roger switched to geophysics and spent 1970 helping to run a survey of the Phillip Law Ice Dome out of Casey base in Antarctica.

Returning in 1971, he concluded in his report: "The ambient temperature of the local Antarctic environment is of such an order of magnitude that it would tend to emasculate at least one copper-zinc alloy anthropoloidal biped".

Having got that ambition off his chest, back and sides, he joined Electronics Today for some of its early issues in 1971, thence to a position with the Ionospheric Prediction Service late that year.

There he stayed, secure in the bosom of the Public Service, (the longest job he *ever* held) until that fateful day in 1977 he resigned to become (shock, horror, probe . . . !) – a freelance technical writer and editor of CB Australia!

An *amateur* – editing a *CB* magazine?! *Nobody* knew what to think.

But . . . that's getting a little ahead.

Roger had been writing technical articles for magazines since about 1964 ("It was exciting work . . ."). In 1973, he and his wife Val (married 1969; two children, 9 and 5.5) started a magazine for radio amateurs called '6UP' (and we won't go into how *that* happened . . .). The following year, this intrepid pair published "The What, Where, Who, Hassles and How Much Book", a buyers guide for electronics and communications hobbyists. It is now a legend amongst the cogniscenti. (The world needs another . . . Ed.)

Along the way Roger has tried his hand at most aspects of electronics and communications – even being a kit and component supplier for a time.

In March 1979 he grasped the reign of ETI firmly in both hands, and still doesn't know whether he's astride a Shetland pony or Brahma bull!

Star sign: non-Leo.

Likes: things that work properly, real live music, beer, Guiness, The Goons, the thrill of VHF DX, cunning circuits, upper atmosphere physics, physics, rug rats, amateur radio and writing.

Dislikes: mechanical things, working for a living, silly technology, cold soldering irons, school, changing clothes in telephone booths and leaping tall buildings in a single bound.

Quotes: "The learning process, unlike the teaching process, is largely random and consists of an infinite series . . .". ●

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

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4581	3.00
4582	1.00
4584	.75
40014	.60
40097	.90
40098	.90
74C02	.35
74C04	.40
74C08	.40
74C10	.40
74C14	1.60
74C20	.45
74C48	2.40
74C73	1.10
74C76	1.15
74C90	1.50
74C93	1.50
74C175	1.75
74C192	1.85
74C193	1.85

• TTL

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

• VOLT. REG

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

• DIODES

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

• BRIDGES

W02	.90
VM48dll	1.25
MDA201	.95
MDA3501	3.40

• ZENERS

½W	.19
1W	.30
2½W	.65

same price, all voltages

• SCR's/TRIAC

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

• LINEAR IC's

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

• MICRO etc

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

• OPTO

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

• RESISTORS

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

• TANTALUMS

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

• CERAMICS

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

• TRIMMER CAP.

5pf to 65pf	.30

• SUPP. CAP.

NS5, 0.5uf	.60
NNS30, 3uf	2.00

• ELECTRO. CAPS. PC TYPE

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

• ELECTRO. CAPS. CAN TYPE

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

• POLYESTER GREENCAPS

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

• WIRE & CABLE

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

• FUSEHOLDERS 3AG —;

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

• FUSES, 3AG —

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

• RELAYS

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

Other lines in stock include: Battery chargers & adaptors, instrument cases & boxes, audio & TV leads-plugs-sockets, DMM's, potentiometers, switches, stylii, transformers, Philips speakers & system kits, vast range of records & cassettes. We are dealers for Aiwa quality hi-fi products.

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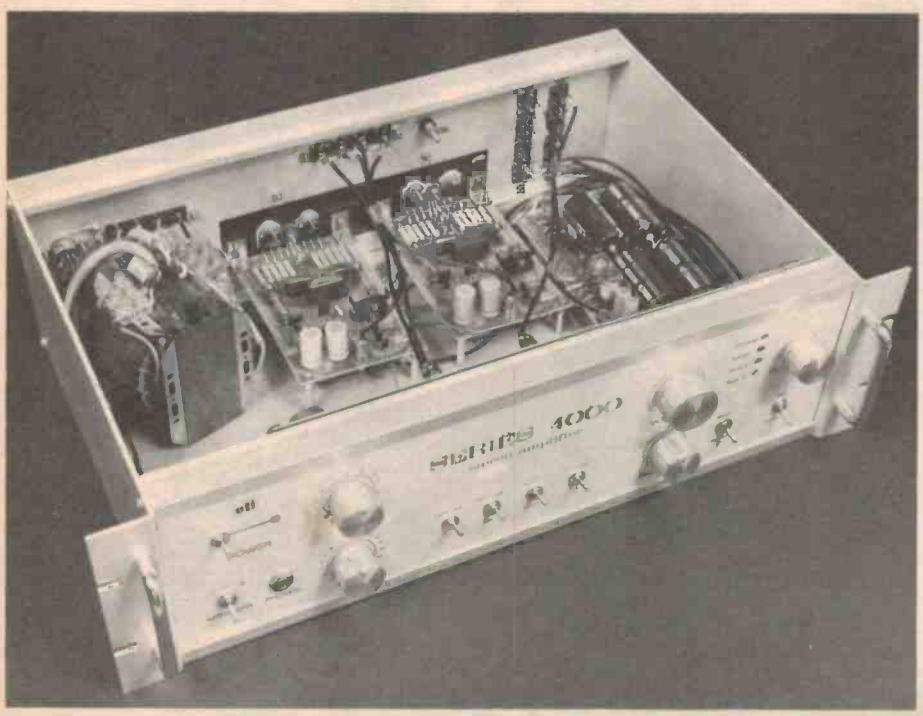
The "Series 4000" stereo amplifier

Here's how to assemble a high-performance 60 watts per channel stereo amplifier using our ETI-470 modules and the ETI-471 preamp control unit.

Circuit design
Trevor Marshall / Phil Wait

Mechanical design/layouts
Phil Wait

Front panel art
Bill Crump



The completed stereo amplifier is shown here mounted in a handsome rack-mounting case. This particular style of case is also available with wooden end cheeks if that is what you prefer.

WE HAVE ALREADY described the ETI 470 60 watt module (May 79) and the ETI 471 preamplifier (June 79) which have proved very popular as individual designs. This article presents the complete Series 4000 amplifier, made from these modules.

We chose to build the amplifier into a single box, being the most economical method as only one box and power supply is used for the preamp and both power amplifiers. However, this method has several drawbacks. Firstly, since the preamp and power amp share the same power supply, the regulation for the preamp must be very good, otherwise low frequency instability can occur, caused by the drop in supply line voltage when the outputs draw high current getting back into the preamplifier.

Hence we have chosen IC regulators for the preamplifier supply lines.

Secondly, the magnetic field from the large transformer and associated AC wiring required to supply the power amplifier modules is quite large and almost impossible to keep out of the sensitive preamp stages. Therefore you will notice that the specification for hum in the completed amplifier is lower than that of the individual units. We took this measurement using a standard EI lamination transformer (Ferguson PF 3577) after rotating it for minimum hum to the position shown in the wiring diagram.

The hum induced by the transformer can be further reduced by using a C-core

ETI 4000 SERIES STEREO AMPLIFIER

Power output	60 watts @ 0.1% THD one channel driven 55 watts @ 0.1% THD both channels driven
Distortion	0.05% THD @ 30 V p-p output across 8 ohm load, both channels driven.
Hum	–70 dB on full output using standard transformer
Noise	–80 dB on full output
Damping factor	57 (measured at 100 Hz, 1 kHz and 10 kHz).
Frequency Response	Phono: Within 0.5 dB of RIAA from 20 Hz to 20 kHz (Follows new IEC curve).

Specifications of prototype

Other inputs:	20 Hz to 20 kHz ± 0.5 dB Subsonic rolloff: 6 dB/octave below 20 Hz
Tape output	150 mV RMS
Sensitivity	For 500 mV RMS output phono: 3 mV RMS other: 150 mV RMS (Phono overload level is 400 mV p-p).
Tone controls	Bass: ± 13 dB at 50 Hz Treble: ± 11 dB at 10 kHz
Filters	High: 6 dB/octave, –3 dB at 5 kHz Low: 6 dB/octave, –3 dB at 100 Hz
Loudness	8 dB boost at 150 Hz and 10 kHz.
Mute switch	20 dB attenuation

type, or better still a toroidal transformer, which have a contained field, but these are often hard to get and expensive to the hobbyist.

We feel that the specifications of the amplifier are very good, however the purist (with plenty of money) may like to do it this way:

The two power amplifier modules, together with individual power supplies using say, 30 000 uF capacitors, could be mounted in a separate box to the preamplifier, which could then be powered from the ETI 581 (June 77) regulated supply.

This would no doubt improve the power output and transient performance of the amplifier but the cost would be much greater.

Construction

Construction details for the preamplifier and power amplifiers have been described previously, all that remains is to house them together, with the power supply, in a suitable box. As we said before, many variations are possible – here is how we did it.

Assemble the power supply board first, taking care to correctly orientate the semiconductors, IC regulators and capacitors. To simplify construction we used pc pins for all terminations to the boards.

The photo of the rear panel shows the position of the input and output connections. Slots are cut in the panel for the connector blocks and a large cut running across the back panel is used to inset the power amplifier modules from the rear. Holes then must be drilled for the earth terminal, external power socket, power cord, mounting screws for the terminal blocks and holding screws for each power amplifier – which pass through the top of each heatsink fastening it to the panel.

The case measures 420 mm x 135 mm x 285 mm and is made from aluminium extrusion with easily removable panels. Available with either metal rack mounting or wooden sides, it can be purchased from suppliers listed at the end of this article.

One thing to watch though is that anodised aluminium does not conduct electricity and, after assembling the box, the various metal parts will probably not be connected to each other, causing a multitude of problems. To overcome this, strap the rear and side panels to the common earth point at the headphone jack on the front panel. (Yes, we found this out the hard way).

After the preamplifier/front panel, power amplifiers and power supply have been mounted in the box and the input/output sockets mounted onto the rear panel the unit can be wired as shown in the wiring diagram.

Common to all amplifier designs, the earth wiring is very critical. Most instability and hum problems can be traced to earth "loops" or incorrect wiring.

The common lead from each channel speaker is returned directly to the OV point on the power supply. A wire is then taken from this point and fed to one power module, to the other, and then to the preamplifier. To avoid an earth loop the braid of the shielded cables from the preamplifier to the power amplifier is not carried through the connector block on the rear panel. OV leads for the LEDs and external power are also returned to the power supply common. The common is then earthed to the chassis at the headphone socket together with the transformer shield and mains earth. This is the ONLY earth point onto the chassis.

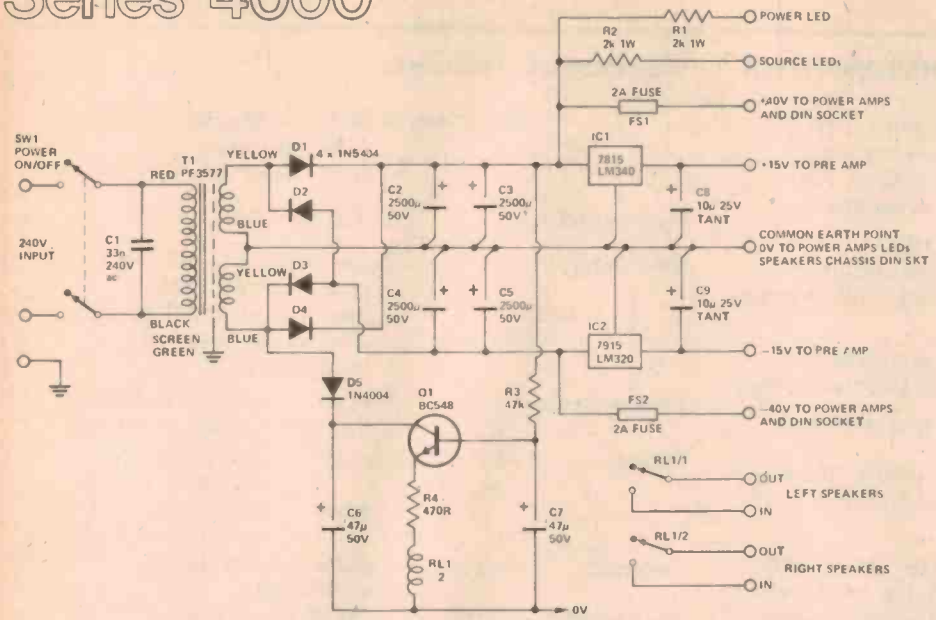
All the ac and speaker wiring is fed along the back and down the left side of the case as shown, well away from the sensitive parts of the amplifier. The dc wiring from the power supply to the preamplifier is carried along the front.

Lengths of shielded cable with RCA plugs on one end are used to connect the input sockets to the preamplifier. These can be made by cutting RCA patch cords to the appropriate length, one cord making two leads. The shields of these cables should not be connected together or to the case at the input sockets.

All that remains is to solder the 330 ohm resistors from the speaker switch to the plugs on the headphone socket.

Check that all wiring is correct and there are no frayed ends. The procedure for setting the bias current for the output transistors is given in the May issue. As soon as this is done insert the 2 A fuses and the amplifier can be switched on.

If you have the older 50 watt ETI 480 modules these could probably be used in place of the ETI 470 module, though we haven't tried it. ▶



Power supply

The power supply for this amplifier uses a 28V-0-28V transformer rated at 2 A to provide +/- 40 Vdc rails for the power amplifiers. Two regulators, IC1 and IC2, supply very stable +/- 15 V rails for the preamplifier.

Current limit resistors are mounted on the pc board to power the front panel LEDs. This permits some flexibility to allow us to think up other things to do with the LEDs later.

Fuses are also provided on the board to protect the power supply from a short circuit in the dc output lines. If the dc output facility on the rear panel is not used the fuses can be short circuited, as each power module is protected by its own fuses.

When an amplifier is first switched on, the two supply lines rarely come up to full voltage simultaneously. This causes a loud 'thump' in the speakers which may damage them. ▶

PARTS LIST - ETI 472

Resistors
- R1, R2 . . . . . 2k 1W 5%
- R3 . . . . . 47k ¼W 5%
- R4 . . . . . 470R 1W 5%

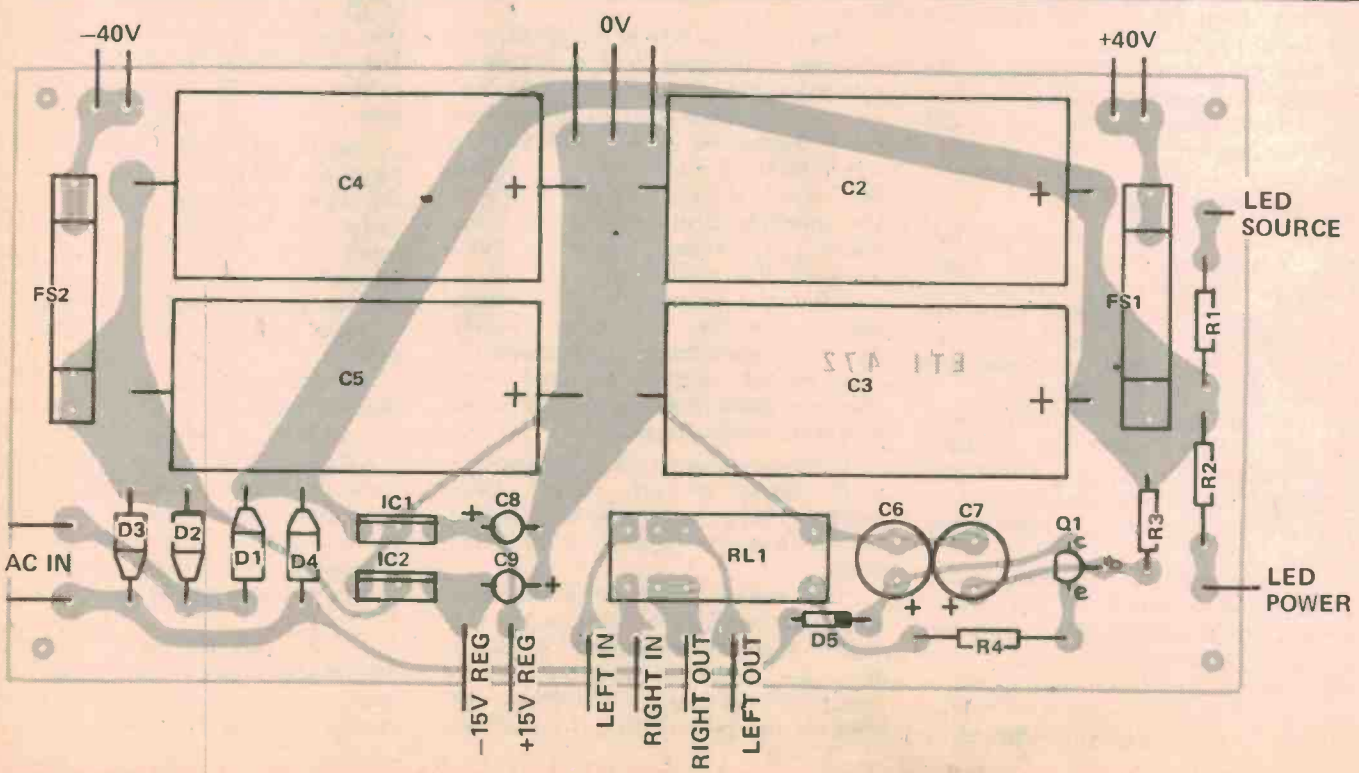
Capacitors
- C1. . . . . 33n 240V ac metalized paper
- C2–C5 . . . . . 2500µ 50V electro
- C6, C7 . . . . . 47µ 50V electro
- C8, C9 . . . . . 10µ 25V tantalum

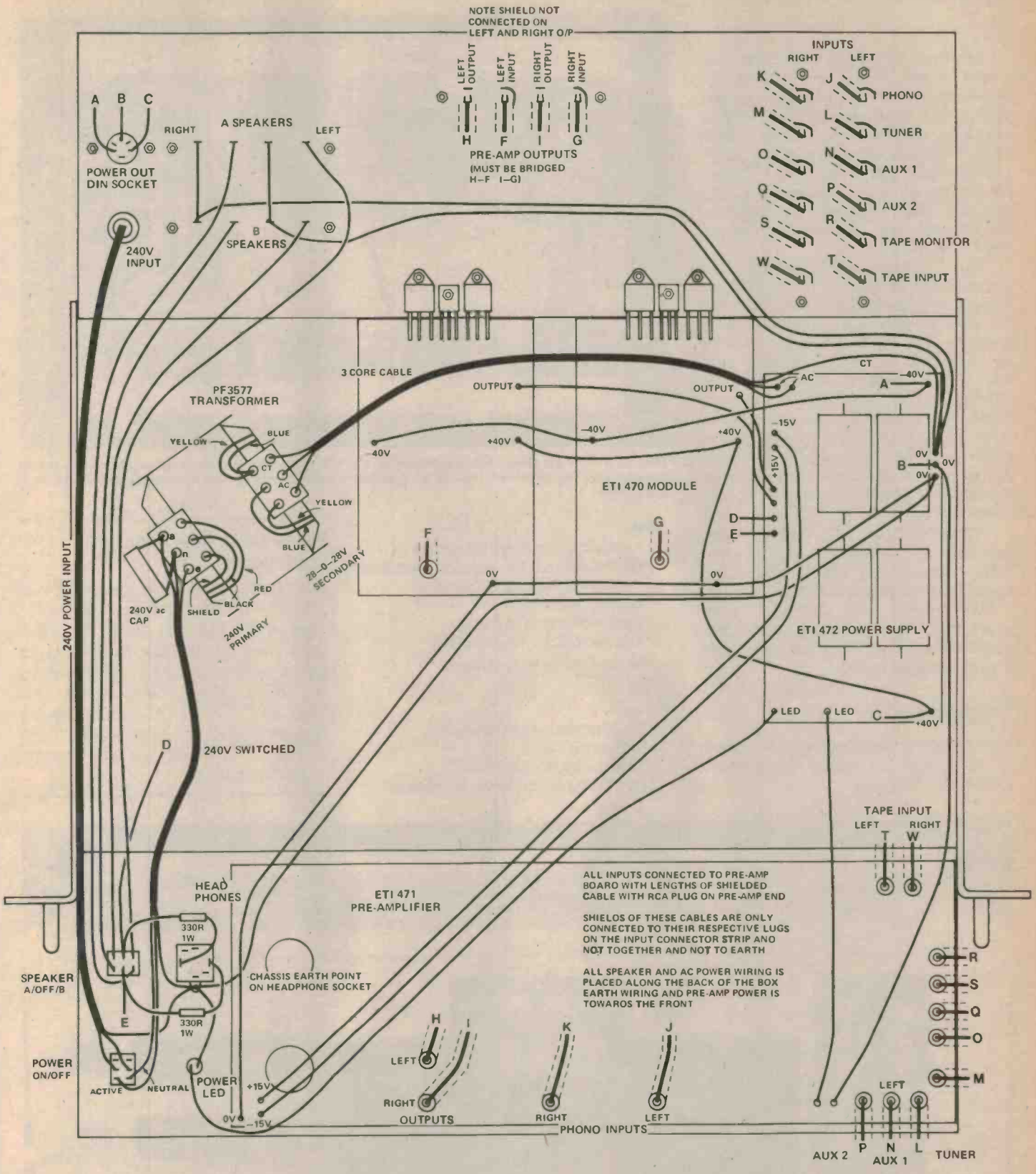
Semiconductors
- D1–D4. . . . . IN5404 or sim
- D5 . . . . . IN4004, A14A or sim
- Q1 . . . . . BC548, BC108, DS548
- IC1 . . . . . 7815, LM340-15, 15V regulator
- IC2 . . . . . 7915, LM320-15, -15V regulator

Miscellaneous
- T1. . . . . PF3577 or similar (Ferguson)
- FS1, FS2. . . . 2 amp fuses (if used)
- RL1. . . . . pcb mounting, 2 pole changeover relay, 12V coil, Pye 265/12/G2V, DS cat S7130 or sim
- SW1. . . . . 2 pole 240 VAC miniature toggle switch.

CHASSIS PARTS LIST

Headphone socket . . . 6.5 mm jack skt.
Speaker switch . . two pole, two position, centre off min. toggle switch
16 RCA plugs or eight patch leads cut in half, two short RCA patch leads, power lead and clamp.
Two, 330R, 1W resistors
Two, 3-way plastic mains terminal strips
Two, 4-way speaker terminals
Two, 6-way RCA panel sockets
One, 4-way RCA panel socket
One, 5-pin DIN socket





Internal wiring and interconnection diagram of the stereo amplifier.

To avoid this an "anti-thump" circuit connects the speakers several seconds after the amplifier is turned on.

It works this way; as the power rails come up to voltage a capacitor, C7, charges via R3. Transistor Q1 conducts pulling in the relay, RL1, and connectiong the speakers after the power rails have had enough time to stabilise. ▶

At first we tried mounting the power supply board in front of the transformer near the preamplifier, but found the proximity of the speaker wiring to the tone control stage caused high frequency instability if the treble control was advanced. The power supply board is now mounted at the opposite side of the case to the transformer and the ac secondary wiring run across the back.

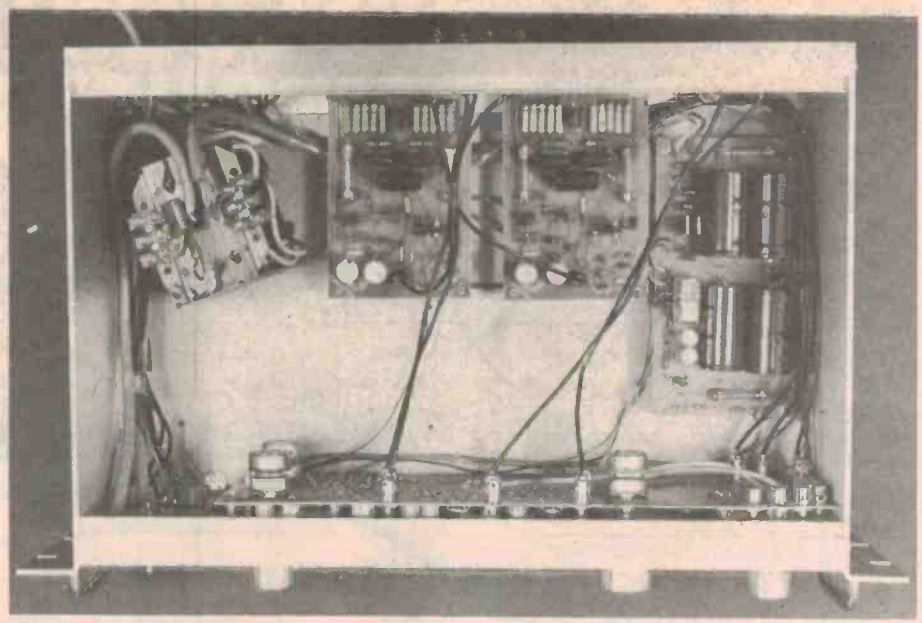
Two three-terminal connector strips are mounted on top of the transformer, using the holes in the mounting plates, to take primary and secondary connections. The shield (green wire) makes up the third wire on the primary side and is run together with the 240 V wiring to the front panel. We used three-core mains flex for connections from the transformer to the power switch and the power supply pc board. A suppression capacitor (C1) is mounted across the transformer primary on the connector block.

Make sure that the power switch you have is rated for 240 Vac, as some being sold are only 125 Vac rated and sometimes fail catastrophically.

Short patch leads will have to be made up to connect each of the preamplifier outputs to their respective power amplifier inputs.

Suppliers

The following suppliers have informed us they have all special components used in this project.



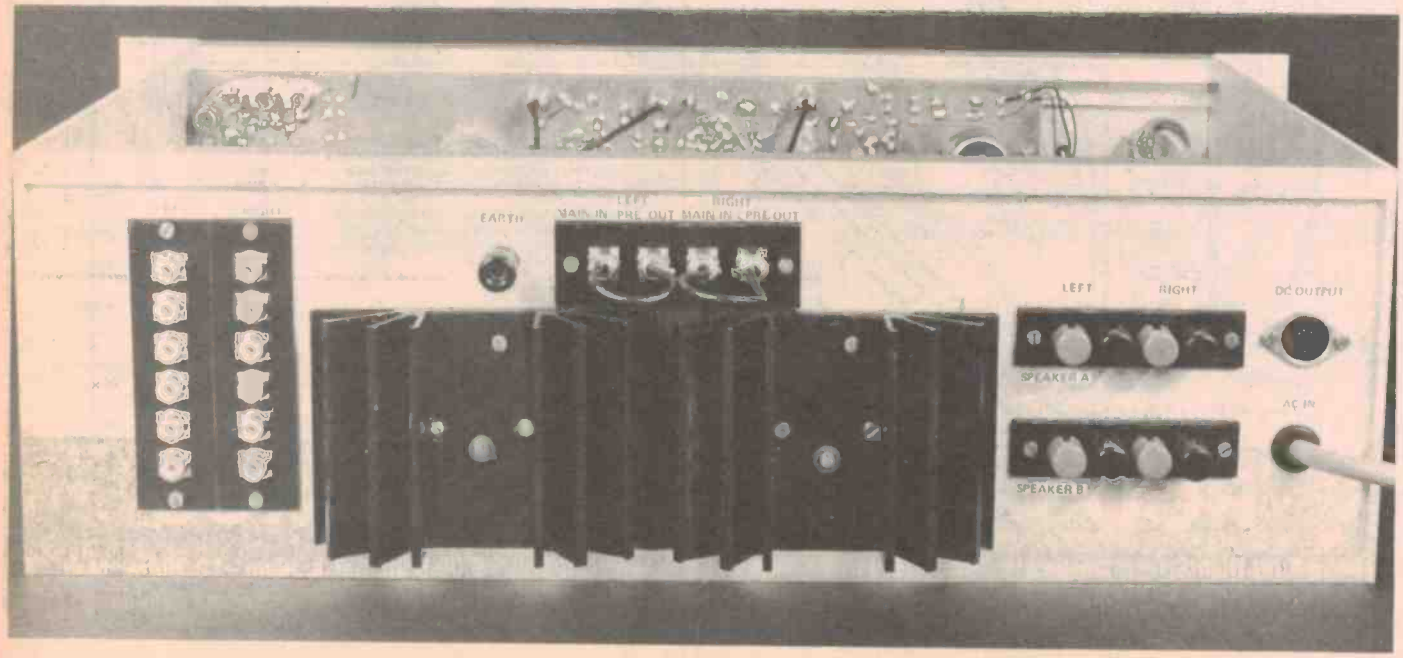
This internal view shows the placement of the main modules and the orientation of the power transformer. The latter will have to be oriented individually to reduce hum levels to the minimum obtainable.

NSW:
- Applied Technology, Hornsby
- DR Hi-Fi and Electronics, Dee Why
- Electronic Agencies, Concord
- Jaycar, Sydney
- Radio Despatch, Sydney
- Silicon Valley, St. Leonards
- Mode Electronics, Botany

Victoria:
- All Electronic Components, Melbourne
- Ellistronics, Melbourne
- Rod Irving Electronics, Northcote

Power Darlington Transistor Equivalents

Owing to the large demand for the Philips Darlington transistors used in the 60 watt power modules they may be temporarily hard to get as new orders take a few weeks to arrive. Texas Darlingtons TIP 142 and TIP 147 appear to be the same and we have tested them in the circuit without any change in performance.



DISCOUNT COMPONENTS

10 RED LEDS $1.50	100 RED LEDS $13.00	10 74LS00 ..... $2.00
7805 ..... 90c	10 4016 ..... $4.50	10 uA301 ..... $3.30
7812 ..... 90c	6 LUG TAG STRIPS 5c	4N28 ..... $1.00
LM317K $2.90	309K $1.50	4N29 ..... $1.10
TIL209 ..... 18c	10 GREEN LEDS $2.90	10 7490 ..... $3.00
10 BC547 ..... $1.20	10 YELLOW LEDS $2.90	10 74123 ..... $5.00
IN4003 ..... 7c	10 4011 ..... $2.00	10 741 ..... $2.90
IN4002 ..... 7c		LED CLIPS 2c
		10 723 ..... $4.50

ULTRASONIC TRANSDUCERS

as used in ETI 585R/T ultrasonic switch

40T	$5.95
40R	$5.95
As a pair	$11.00

ZENERS

400mW E24 Values 3.3v to 33v	0.20
1 Watt Zeners 3.3v to 33v	0.33

TRIACS

SC141D	$1.30
SC151D	$2.10

DIACS

ST2	0.35
ST4	0.80

CLOCK MODULES

MA1002B	$11.50
MA1003	$21.50

MICRO'S

2708 EPROM	$15.00
2114	$14.00
2102 450nS	$2.10
2650	$26.00
8080A	$13.00
9305	$3.30
9317	$3.75
9334	$3.75
9350	$1.80
9368	$1.80

PCB'S PRECISION DRILLED FIBREGLASS

ETI 043	$1.40
ETI 044	$1.30
ETI 047	$1.50
ETI 061	$1.40
ETI 062	$1.80
ETI 063	$1.70
ETI 064	$1.70
ETI 065	$1.70
ETI 067	$1.80
ETI 068	$1.40
ETI 071	$1.40
ETI 072	$1.80
ETI 083	$1.80
ETI 084	$1.70
ETI 085	$1.30
ETI 130	$1.90
ETI 134	$1.90
ETI 135	$1.90
ETI 245	$1.60
ETI 417	$1.80
ETI 445	$1.50
ETI 446	$1.90
ETI 449	$1.50
ETI 450A	$1.90
ETI 450B	$1.90
ETI 480	$2.20
ETI 480PS	$2.20
ETI 481M	$2.00
ETI 481PS	$2.50
ETI 483	$2.20
ETI 484	$3.90
ETI 485	$2.90
ETI 486	$2.90
ETI 528	$2.20
ETI 541	$2.20
ETI 581	$2.20
ETI 583	$2.20
ETI 585R	$1.60
ETI 585T	$1.40
ETI 586	$2.30
ETI 603	$2.50
ETI 604	$1.60
ETI 635	$2.90
ETI 708	$1.90
ETI 713	$3.90
ETI 714	$1.90

RESISTORS

	1-99	100-999
½ watt Metal Glaze	3c	2.5c
1 ohm to 1M (E12 values)	5c	4c
1.2m — 10m (carbon)		
1 watt carbon		
1 ohm to 1M	8c	7c
5 watt		
1 ohm to 100 ohm	.40	.35

TANTALUMS Resin Dipped

	1-9	10-99
.1, .15, .22, .33, .47, .68uF (all 35V)	.25	.20
1uF 35V	.25	.20
2.2uF 25V	.23	.20
2.2uF 35V	.25	.20
3.3uF 25V	.25	.20
4.7uF 35V	.25	.22
6.8uF 35V	.30	.25
10uF 16V	.25	.23
10uF 35V	.30	.28
15uF 16V	.30	.25
15uF 35V	.50	.45
22uF 16V	.38	.35
47uF 16V	.65	.60
68uF 16V	1.20	1.10
100uF 6.3V	.70	.65

MINIATURE TRIMPOTS

	1-9	10 up
0.1 watt, .1" spacing		
100, 250, 500, 1K, 2K, 5K, 10K,	.20	.17
25K, 50K, 100K, 250K, 500K, 1M	.20	.17

I C SOCKETS

	1-9	10 up
8 Pin DIL	.25	.23
14 Pin DIL	.33	.30
16 Pin DIL	.35	.30
18 Pin DIL	.55	.50
24 Pin DIL	.70	.65
40 Pin DIL	1.40	1.20
28 Pin DIL	1.20	1.10

POTENTIOMETERS

.25 watt rotary carbon single gang, Log or Lin.	
1K, 5K, 10K, 25K, 50K	.50
100K, 250K, 500K, 1M, 3M (Lin)	.50

CERAMICS

10pF to 680pF	.05c
820pF to .0015uF E12 Values	.06c

Include 30c postage for free catalogue.

ELECTROLYTICS

			1-9	10 up
4.7 uF	25v	PCB	0.08	0.07
10 uF	25v	PCB	0.09	0.08
10 uF	50v	PCB	0.10	0.09
22 uF	16v	PCB	0.08	0.07
22 uF	35v	PCB	0.10	0.09
33 uF	16v	PCB	0.09	0.08
33 uF	50v	PCB	0.11	0.10
47 uF	16v	PCB	0.10	0.09
47 uF	35v	PCB	0.12	0.11
100 uF	10v	PCB	0.11	0.10
100 uF	16v	PCB	0.12	0.11
220 uF	25v	PCB	0.15	0.14
470 uF	16v	PCB	0.17	0.16
1000 uF	25v	PCB	0.38	0.36
2500 uF	50v	Axial	1.95	1.85
2200 uF	25v	PCB	0.55	0.90
6800 uF	50v	LUG	4.75	
5600 uF	40v	PCB	2.90	
4700 uF	35v	Axial	2.10	

KITS

ETI 480 100W Module Kit	
Includes Heat Sink Bracket	$19.75
ETI 480 50W Module Kit	
Includes Heat Sink Bracket	$16.00
12 volt Electronic Siren Kits	
1. "Whip"	$8.00
2. "Wail"	$8.00
3. "Flying Saucer"	$8.00
Horn Speaker to suit	$8.50

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55,000 Cars will be stolen this year . . .
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For window and door protection in conjunction with main alarm module. Full details given in book below.

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$99.00

Cat L -5108

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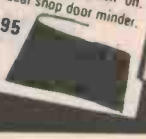

Cat L-5270

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$6.90 Cat C-2705

ELECTRONIC SIREN DRIVER:

Turns horn speaker into ear-shattering siren. Ideal for alarms with switched output only.

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Dual purpose: alarm unit as well as visitor doorbell. A secret three digit code (you program it yourself) allows legitimate entry when switched to 'guard'; or a pleasant 'ding dong' chime greets visitors in alternative mode. Fastens to door, is activated by magnet attached to post or lintel. Once triggered it will not respond to alternative switch position (so intruder can't defeat it). Novel, but effective.

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Copies are available for only $1.50 from any Dick Smith Store or re-seller

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DICK SMITH ELECTRONICS

SEE OUR OTHER ADS IN THIS ISSUE FOR LIST OF DICK SMITH STORES & RESELLERS OF OUR PRODUCTS

Microwave ovens sure have lots of zip, but don't get zapped! Build our —

Microwave oven leak detector

While microwave ovens are generally well-designed and safe to use, the human factor (even Murphy's Law) can thwart the manufacturer's efforts and possible unsafe levels of microwave energy may be radiated without warning. Simple and inexpensive to build, this project will indicate if your oven is safe . . . or not.

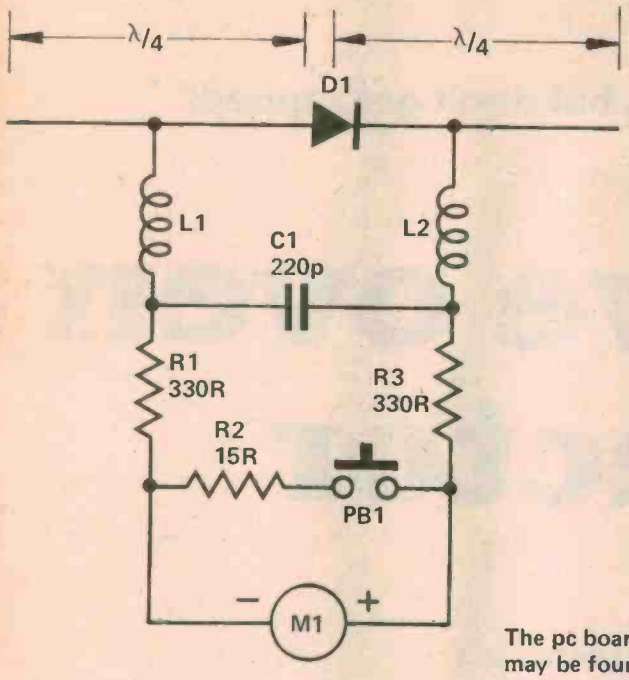
Jonathan Scott

THE MICROWAVE oven is one of the most recent examples of advanced technology finding application in the home. Many thousand such devices are sold for domestic use in Australia alone each year, while commercial units have long been found in restaurants and snack-bars.

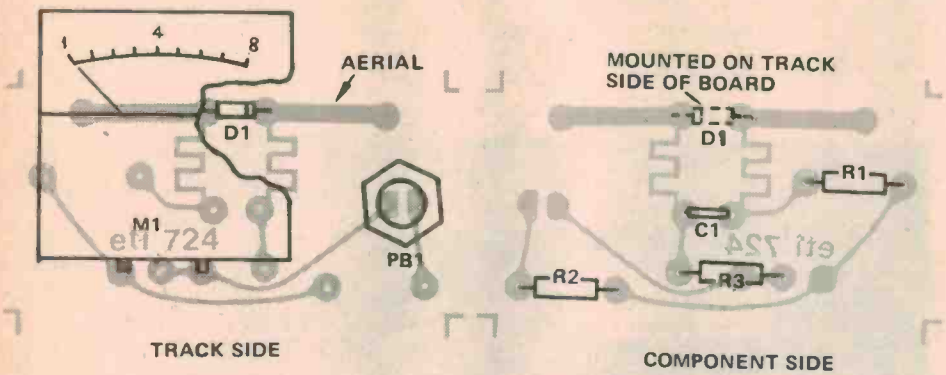
The microwave cooking method, while unlikely to usurp conventional cooking methods, has distinct advantages. It is usually quicker; two to five times quicker in fact. Because it heats the foods directly, but does not heat the bowl or container, the food can be left enclosed. The process is often cleaner and less utensil-consuming as a result. Because the energy penetrates below the surface of a lump of food and does not rely so completely on conduction, it can be used for rapid defrosting of foods. (See "How a microwave oven works").

Unfortunately, the microwave energy is quite dangerous. It must be carefully contained within the cooking chamber. The window is usually sealed to the radiation by a fine metal grille similar to heavy duty fly-screen. The door fits flush and firm, and the instructions warn against allowing any distortion of

The device is housed in a 'zippy' box, everything being attached to the front panel, held in place by the four screws. Our prototypes were calibrated through the kind assistance of the Electrical Engineering Department of Sydney University.



The pc board artwork for this project may be found on page 148



Component overlays of both sides of the pc board. Note that the diode is mounted on the COPPER SIDE of the board. It is strongly recommended that the device is constructed using the pc board design shown so that results are consistent with the calibrated prototype.

PARTS LIST - ETI 724

Resistors
- R1 . . . . . 330R
- R2 . . . . . 15R
- R3 . . . . . 330R

Capacitor
- C1. . . . . 220p ceramic

Semiconductor
- D1 . . . . . HP 5082–2800 Shottky Hot Carrier Diode

Miscellaneous
- PB1. . . . . momentary push button
- M1 . . . . . 250μa FSD Signal Strength meter
- L1, L2 . . . . . Etched on pcb

ETI 724 pcb (includes L1, L2 and antenna).

Plastic jiffy box (25 mm x 50 mm x 90 mm).

HOW IT WORKS – ETI 724

Operation is very simple. The device is completely passive and requires no batteries. It uses the radiated energy from the oven to deflect a meter directly.

The pc board dipole, when exposed to microwave radiation of about 2.5 GHz, develops an ac voltage across D1. When the diode is positively biased the diode conducts, shorting the dipole. When reverse biased it isolates, thus leaving a net voltage on the diode. This DC component is filtered by L1, L2 and C1.

The amplitude of the dc component varies somewhat with the type of radiation from the oven – CW or pulsed, depending upon the supply rectification and filtering used with the magnetron. It will also vary with distance, of course. The Australian safety limit is 5 mW/cm^2 at a distance of 5 cm from the oven. R1, R2 and R3 define the sensitivity, the values chosen being suitable to produce FSD for 5 mW/cm^2 CW at the pc board plane with PB1 closed.

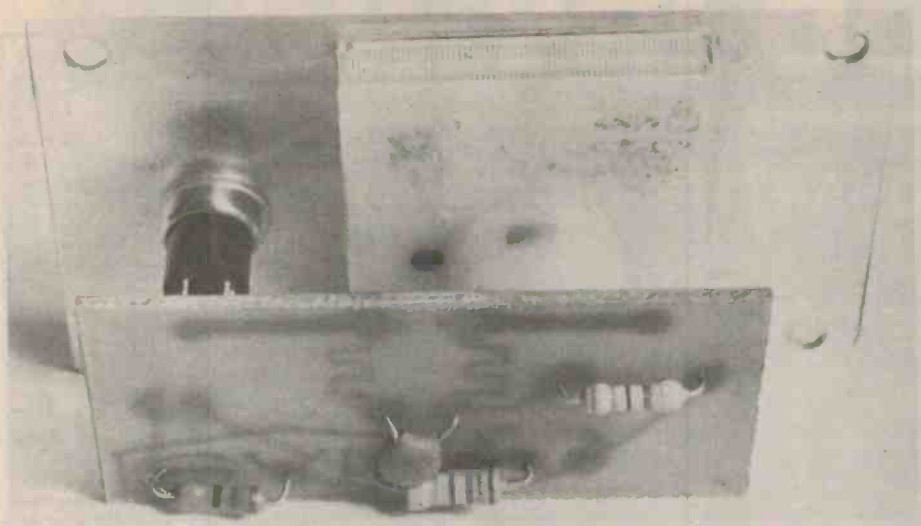
Some variation should be expected from unit to unit. This should not normally be of any concern, however, as a healthy oven will emit at least one order of magnitude less than the 5 mW level, and so the readout is unambiguous even when the unit is not the exact 5 cm from the oven surface.

the door. All ovens have safety circuits preventing the power being applied with the door open. Some ovens have as many as five interlocks against accidental activation without correct door closure. They do not, unfortunately, incorporate an alarm which warns if a leak occurs. This can happen if the door is slightly bent by being closed on a lump of stray food or if damaged during a domestic fracas.

In view of these things it seems wise to have some additional method of checking for leakage.

Leak detectors

There are some commercial leak detectors available. The most common one is made by the CSIRO. This consists of some circuitry, including a LED, encapsulated in a clear plastic tube. Entirely passive in operation, it illuminates the LED if the integral 62 mm long dipole is exposed to radiation of approximately the safe recommended limit. The CSIRO device is the cheapest available and sells for around $15. In operation it is satisfactory, but has two drawbacks. Firstly, were the hot carrier diode to be destroyed, as could happen for any number of reasons, including being exposed to cook strength signal, a 'safe'



Internal view of the microwave oven leak detector shows the simplicity of construction.

report would always be given. In other words, the device cannot easily be checked. Secondly, the output is go/no-go. No indication of gradual increase in leakage is available.

So, if leakage from your oven has been gradually getting worse, you won't know until it reaches the level that trips the sensor (admittedly this may still be well below the harmful level).

Our design does not suffer from these drawbacks. The output is an analogue meter. This is set to read full-scale deflection (FSD) for a signal of approximately 5 mw/cm^2 in the 'test' mode. Hence, as little as 10% of the danger level can be read.

When the test button is released, the sensitivity increases by about an order of magnitude. In this condition the unit acts like a signal strength meter, and should show some deflection with the normal residual leakage of an oven. This confirms that it is working. We estimate that it should cost $10-$12, pc board included, as a kit. If you have upwards of $300 worth of oven, ten dollars is not a bad investment to insure the family jewels . . .

Construction

Unless you are very experienced with high frequency work already it is important to use the pc board. The antenna is printed onto the board and so, is inherently tuned sufficiently closely when the correct board is used. It is also convenient as the meter and button are soldered directly on the copper side and the whole assembly is self-contained.

No box at all is actually necessary, but if you choose to use one, ensure that it is not metallic except for the front panel. There are no flying leads, etc, so if need be, one could leave the whole circuit just as is, with no box.

We used a 25mm x 50 mm x 90 mm jiffy box which was just big enough inside.

Ensure that the diode and meter are soldered in the right way round. Also try to solder the diode neatly, as shown in the overlay. It should be soldered onto the copper side directly, flat against the pc board in the centre of the dipole. Use of the board and close adherence to our design will ensure that your unit is close to prototype sensitivity and will thus read true.

Using it

The meter is moved around the door rim with the oven operating, meter facing away, button depressed, the back parallel to the door and spaced approximately 40 mm from the surface.

When testing, it should be moved over the oven in each polarisation, just to be sure. To check if it is working, simply repeat the procedure without depressing the test button. Some erratic flicker of the needle should be evident, indicating correct operation. It can be left on top of the oven when not specifically being used, so that some drastic leak will cause deflection should that occur.

How a microwave oven works

There are several separate sections to a microwave oven. Firstly, there is a Magnetron, which is the heart of the system. This is a thermionic device incorporating a resonant cavity. It is an oscillator and will deliver power at super high frequencies (microwave ovens operate on 2.45 GHz). The oven has a power supply incorporating a number of safety interlocks preventing activation in unsafe circumstances.

There is a cooling system for the electronics, usually a fan. The cooking chamber has metal walls and some system of ventilation to remove steam, etc. The one fan is often used to cool the electronics as well as ventilate the cooking chamber. A duct (waveguide) transfers the microwave energy to the chamber from the magnetron. Some form of disperser spreads the energy and prevents standing waves within the chamber. This is either a rotating platform moving the food or a set of vanes in the chamber ceiling reflecting the beam about. (This is often driven by the fan motor or even the stream of cooling-ventilating air).

Finally, a control panel allows varying degrees of automatic control of the RF power. This always includes a timer and a door interlock.

Water is the primary microwave absorbing agent in food. Dry food and glass or plastic containers are substantially unheated by the radiation. The energy can penetrate to a depth of about 20 mm effectively, though this varies markedly with the food.

Domestic ovens consume about 1200 watts altogether, of which about half appears as microwave power in the food chamber. This, considering the mode of absorption, is considerably more efficient than an ordinary oven which is why the cooking speed is so rapid. ●

Project 148

Versatile logic test probe

If you work or experiment with logic circuitry this project should be invaluable for debugging circuits. Inexpensive to build, it may be used both with TTL and CMOS circuitry, and indicates HI or LO conditions as well as pulse trains above 1 MHz. It will also detect short, isolated pulses having widths down to 500 ns.

Dr P.M. Kelly

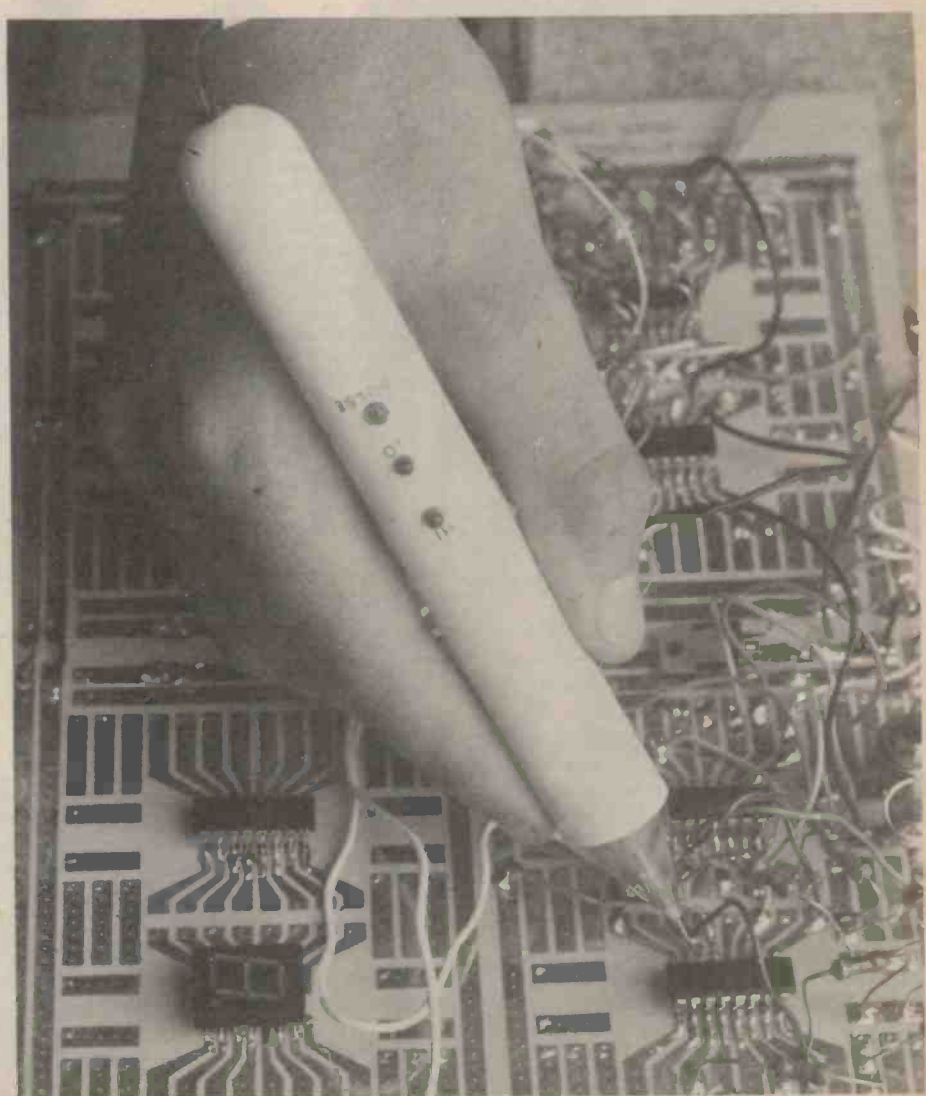
INTEREST in digital electronics has grown rapidly in the past few years with the advent of microprocessors and large scale integration. The most essential test instrument for experimenting with digital circuitry is a logic probe.

In its most basic form this should provide an indication of the logic level at any point in a circuit without overloading the section being tested. Other desirable features are the ability to follow high frequency pulse trains (preferably over 1 MHz) and to detect isolated, narrow pulses less than 1 μsec in width. Finally, the instrument should be compatible with both TTL and CMOS ICs and be able to operate from a wide range of supply voltages (say five to 15 volts).

Commercial logic probes that satisfy all these requirements are available, but they invariably cost over $30. The probe design described here offers comparable performance for less than $5, combined with an excuse to enjoy a good cigar – a cigar tube is used for the case!.

Indication is by means of three LEDs. Two red LEDs indicate either a HIGH or a LOW condition on the point under test, a green LED is used to indicate that a pulse train is occurring.

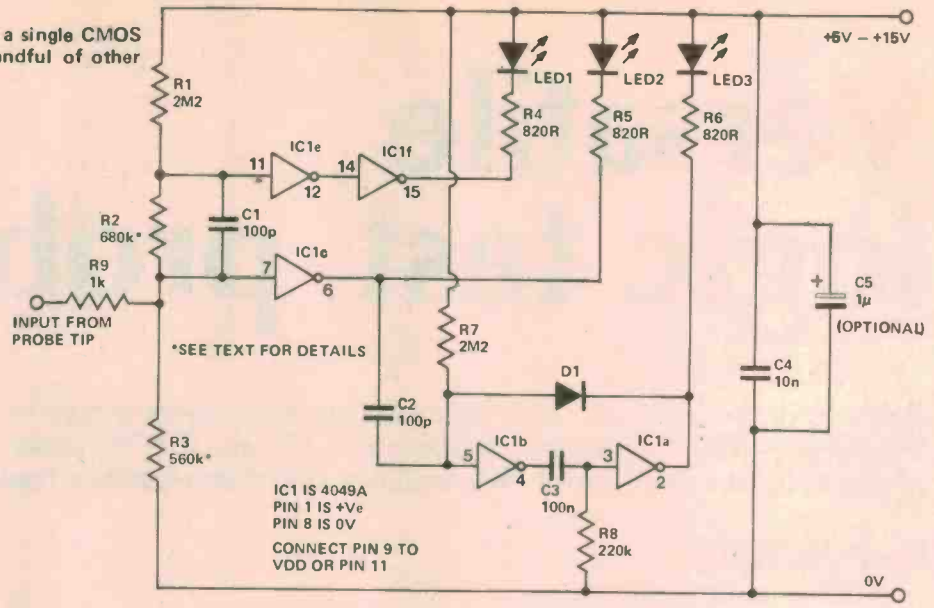
The circuit uses a single CMOS IC and a handful of resistors and capacitors. The components are mounted on a small pc board and housed in a tubular case such as an aluminium cigar tube or a length of plastic conduit. The power is supplied from the actual circuit under test and the performance characteristics of the prototype are described in the specification listed here. ▶



A logic probe is an invaluable aid for debugging or servicing digital circuitry. This project is inexpensive and easy to build.

Project 148

The circuit is simple, involves a single CMOS IC, three LEDs and a handful of other components.



SPECIFICATION ETI-148

- TTL or CMOS compatible
- Supply voltage: 5 to 15 volts
- Input impedance: over 400k
- Indicates HIGH (1), LOW (0) or floating states
- Follows high frequency pulse trains – over 1.5 MHz
- Detects single pulses down to 500 nsec in width, and stretches these to 15 msec.
- Relative brightness of HIGH/LOW LEDs indicates duty cycle of pulse trains.

HOW IT WORKS ETI 148

Three of the six inverter/buffers in IC1 are used in the high/low detection circuit. IC1c is connected to the probe tip via R9. When the input goes HIGH (logic 1), IC1c output goes low and illuminates LED 2 through R5. Similarly when the input goes LOW (logic 0), the series pair IC1e and f illuminate LED 1 through R4. The resistor network R1, R2 and R3 ensure that the outputs of both IC1c and IC1f remain high when the input is 'floating'. C1 is connected across R2 as a 'speed-up capacitor' to maintain a sharp pulse shape into IC1e and so improve the ability to follow high frequency pulse trains (over 1MHz)

The two inverters IC1a and b form a monostable circuit that stretches short pulses (less than 500 nsec) out to 15 msec (0.7RC) using C3 and R8. The input of the monostable comes from the output of IC1c and is isolated from the DC level of this output by C2. The combination of R7 and D1 normally holds IC1b input high. When a negative going pulse is fed into IC1b through C2, the output goes high, forcing IC1a to go low and illuminate LED 3. Diode D1 ensures that the input to IC1b is kept low (0.7V above zero) so long as the output of IC1a remains low. This prevents subsequent pulses from re-triggering IC1b until the monostable itself retriggers via discharge of C3 to earth through R8, and allows IC1a output to go high, switching off LED3.

Capacitors C4 and C5 (optional) confer immunity to spikes or pulses in the supply lines, which are taken from the circuit being tested.

Construction

A printed circuit board is recommended for this project to provide consistent performance characteristics.

Before attempting to mount the components on the printed circuit board check to see that it fits easily into the case. The board must be a loose enough fit to allow it to be moved up and down within the case over a range of at least 5 mm. (Refer to the diagram).

If this is not possible, the width of the board can be reduced slightly with a file or coarse sandpaper, taking care not to remove too much or to damage the copper portions of the board.

The other alternative is to use a larger case – buy a bigger cigar! This movement within the case is necessary so that the LEDs can be juggled into position in the holes in the casing (see later).

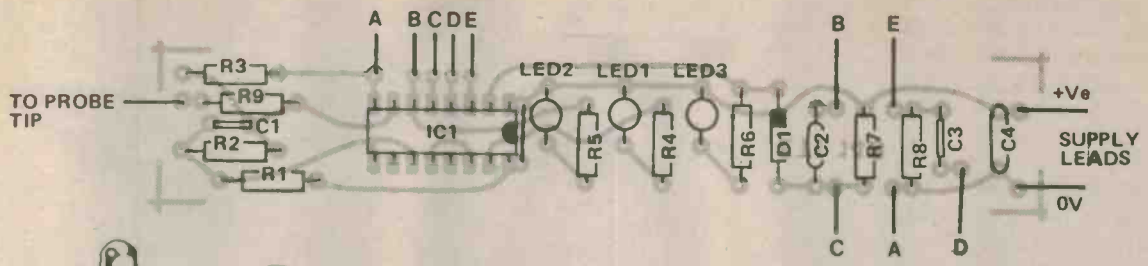
Mount the wire links, the resistors and the capacitors on the pc board, keeping all components as close to the board as possible. Note that C3 is mounted on the underside of the board. Next, install the three LEDs. The height of the LEDs above the pc board must be such that the assembly will slide into the case with the board pushed down against the bottom of the case (see diagram). For a 20 mm diameter case this height should be about 12 mm. If the LEDs are not high enough, then it will not be possible to push the assembled board up into a position where the LEDs project through the holes in the case.

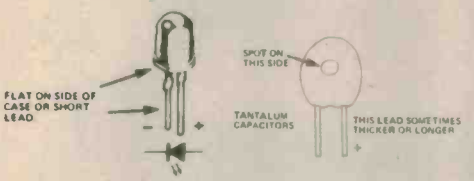
Next, add the power leads (without clips or E-Z hooks at this stage) and the 10 cm wire to the probe tip. Last of all solder IC1 into position, observing all the usual precautions – shorted pins, heat sink, earthed soldering iron, pins 8 and 16 soldered first.

The probe tip housing on my prototype was turned from perspex and a 2 mm hole drilled through the centre. The probe tip wire is soldered to the end of a darning needle which is cemented into the housing with epoxy, allowing the needle to project about 15 mm beyond the end of the housing. It is not necessary to use a perspex cone, turned up as I have it. A flat-faced plug of a suitable material will suffice equally well.

Drill the 3mm holes for the LEDs at 10 mm intervals, starting 75 mm from the front of the case. The hole for the supply leads is drilled in the back of the case and fitted with a small rubber grommet (or plastic LED housing) to prevent the case rubbing through the insulation on the leads.

Before mounting the assembled pc board in the case check the circuit for dry joints, solder bridges, incorrectly mounted components, etc. Then test the device as follows. Connect to a five volt supply and observe the three LEDs. None should light with the probe tip isolated. If the LOW LED (LED 2) comes on or flashes, then R2 is too small and must be replaced by a slightly larger resistor (say 820k). Touching the probe tip with the fingers may cause LED 2 to light, but this should go off when the tip is isolated. Touching the probe tip to either supply rail should light the appropriate LED, with the

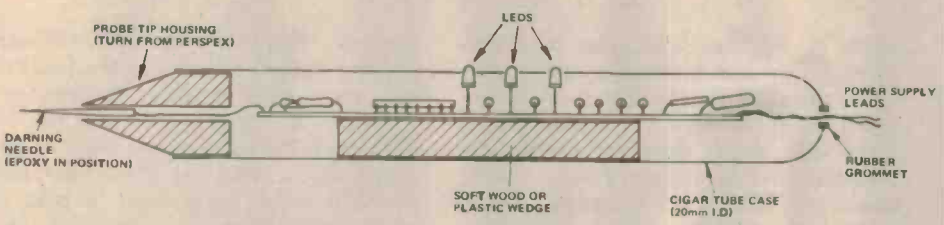


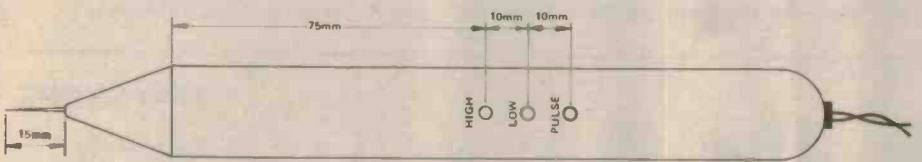


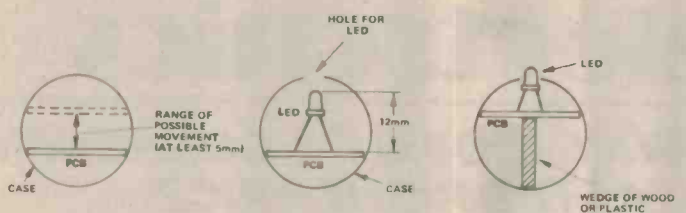
NOTE
C5 IF USED IS MOUNTED ACROSS C4 (OBSERVE POLARITY)

CONNECT RESPECTIVE LETTERS TOGETHER
A TO A B TO B etc.

Component overlay for the pc board. Refer to the construction diagrams below for correct assembling of the LEDs.







PARTS LIST – ETI 148

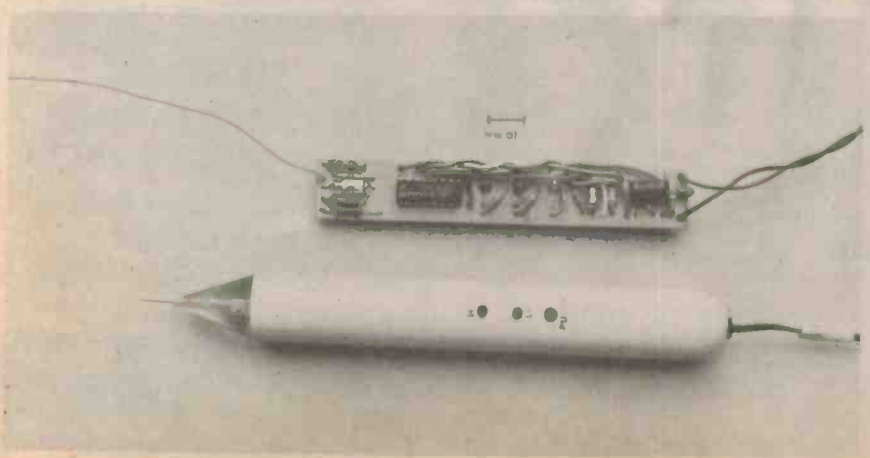
Resistors all ¼W, 5%
- R1,7 . . . 2M2
- R2 . . . . 680k*
- R3 . . . . 560k*
- R4,5,6 820R
- R8 . . . . 220k
- R9 . . . . 1k

Capacitors
- C1,2 . . . 100p Ceramic
- C3. . . . . 100n Greencap
- C4. . . . . 10n Greencap
- C5. . . . . 1μ Tantalum (Optional)

Semiconductors
- IC1 . . . . 4049A
- LED 1,2 . 3mm red
- LED 3 . . 3mm green
- D1 . . . . 1N4148 (or equivalent)

Miscellaneous
pcb; red and black leads with alligator clips or E-Z hooks;
cigar case (or equivalent) – minimum dimensions 20mm ID, 140mm long;
perspex rod for probe tip housing;
darning needle.

** Resistors R2 and R3 may have to be altered slightly (in the range 470k to 820k) to suit the transfer characteristics of IC1 – see text.*



The printed circuit board is reproduced on page 148 or 149.

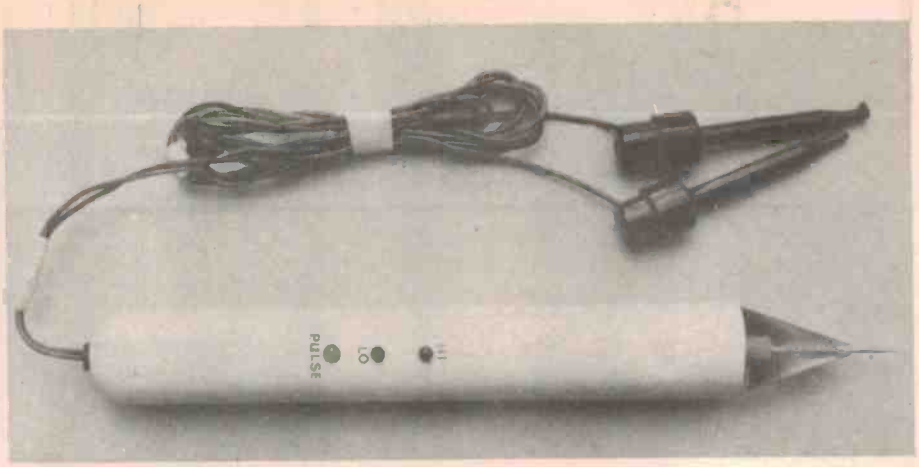
These diagrams above, and the picture left show the general construction of the probe and the drilling of the cigar tube or whatever case is used.

PULSE LED flashing when the tip first touches the positive rail. If the LOW LED does not light when the probe is connected to 0V, then R2 is too large. Change R2 to 560k and repeat the sequence above.

Now try a 15 volt supply. Again, all LEDs should be extinguished when the probe tip is isolated. The HIGH LED (LED 1) may glow very faintly. If this glow is too strong, reduce the value of R3 to say 470k. However, if R3 has to be altered it will be necessary to recheck the circuit at 5V to see that the low voltage performance is still satisfactory. At 15 volts repeat the process of touching the probe tip to the two supply rails. The results should be the same as in the case of the 5 volt supply, but the LEDs will be considerably brighter.

When satisfied that the circuit works correctly mount it in the case. First, cover the edges of the pc board with strips of tape to insulate it from the case and apply a thin smear of epoxy cement around the base of each LED. Feed the power supply leads through the back of the case, followed by the assembled board. Jockey the board into a position where the LEDs are directly under the holes in the case and then push the assembly up into a position so that the LEDs protrude through the holes in the case. The epoxy around the base of the LEDs will anchor them in position. In addition to this means of holding the board in place, a small wedge of soft wood, plastic or similar insulating material can be inserted into the space between the bottom of the board and the case. The probe tip and its plastic housing is then inserted in the front of the case and epoxied in position.

When the epoxy has set, fit the clips or E-Z hooks to the ends of the supply leads, label the three LEDs and give the whole instrument a coat of protective lacquer. The completed logic probe is now ready for use — but don't forget to smoke the cigar! ●



The completed logic probe.

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S3 ETI 482A. Preamp Board
S4 ETI 482B. Tone Control Board
S5 ETI 485. Graphic Equalizer
S6 ETI 480. 50 watt Amplifier less H/s
S7 ETI 480. 100 watt Amplifier less H/s
S8 ETI 480. Power Supply for above
S9 ETI 443. Expander Compressor
S10 ETI 444. Five Watt Stereo
S11 ETI 422B. Booster Amplifier Incl. metalwork
S12 ETI 438. Audio Level Meter
S13 ETI 440. 25 watt Stereo Amp. Incl. metalwork
S14 ETI 420. Four channel Amplifier
S16 ETI 423. Add-on Decoder Amplifier
S17 ETI 422. 50 watt per channel Amplifier
S18 ETI 426. Rumble Filter
S19 ETI 429. Simple Stereo Amplifier
S21 ETI 417. Over led Distortion Monitor
S22 ETI 410. Stereo Width Control
S24 ETI 427. Graphic Equalizer
S25 E.A. Playmaster 10 plus 10
S26 E.A. Playmaster 128 40 watt
S27 E.A. Playmaster 132 40 watt
S28 E.A. Playmaster 136 13 watt
S29 E.A. Playmaster 137 3 watt
S30 E.A. Playmaster 143 12.5 watt
S31 E.A. Playmaster Twin 25 watt
S32 E.A. Musicolour II 1000 w/ch
S33 E.A. Musicolour III 1000 w/ch
S34 E.A. Stereo Dynamic Noise Filter
S35 ETI. 60 watt Audio Amp. Module

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

TEST EQUIPMENT
TE1 ETI 134. True PMS 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.F. Attenuator
TE8 ETI 122. Logic Tester
TE9 ETI 124. Tone Burst Generator
TE10 ETI 123. C Mos Tester
TE11 ETI 116. Impedance 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
TE24 ETI 109. Digital Frequency Meter
TE25 E.A. SWR Reflectometer
TE26 E.A. R.F. Impedance 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 Gen.
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 Pre-setable Counter
TE44 ETI 550. Digital Dial (less case) Includes ETI 591

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. Infra Red Intruder Alarm
WS11 ETI 305. Automatic Car Alarm System
WS12 ETI 582. House Alarm
WS13 E.A. Electronic Siren
WS14 E.A. 1976 Car Alarm
WS15 E.A. 10 Ghz Radar Alarm

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. Sync-A-Slide
PH13 E.A. Auto Trigger for Time Lapse Movies
PH17 ETI 558. Mast Head Strobe
PH15 ETI 553. Tape Slide Synchronizer
PH17 E.A. Digital Photo Timer
PH17 ETI 594. Development Timer

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

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
A9 ETI 302. Tacho and Dwell Meter
A10 ETI 303. Brake Light Indicator
A11 ETI 309. Battery Charger
A12 E.A. 1970 C.D.I.
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 & Tacho
A18 E.A. Strobe Adaptor for Above
A19 E.A. 1975 C.D.I.
A20 E.A. Mains P.S. for Car Cass
A21 E.A. Automatic H.D. Batt. Charger
A22 ETI 318. Digital Car Tacho. (less metalwork)
A23 ETI 319A. Variwiper Mk. 2 (No dynamic braking)
A24 ETI 319B. Variwiper Mk. 2 (For dynamic braking)
A25 ETI 320. Battery Condition Indicator

GUITAR UNITS
G1 ETI 447. Audio Phaser
G2 ETI 413. 2 x 200 watt Bridge Amplifier
G3 ETI 424. Spring Reverb Mixer
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

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P2 ETI 449. Balance Mic Pre-amplifier
P5 ETI 414. Master Mixer 8 channel
P6 ETI 419. Mixer Pre-amplifier — 4 ch; Mixer Pre-amplifier — 2 ch
P7 ETI 401. F.E.T. 4 Input Mixer
P8 E.A. Playmaster 127 Control Unit
P9 E.A. Simple Mixer for Pick up & Mic
P10 E.A. Playmaster 145 Mixer
P11 ETI 446. Audio Limiter
P12 ETI 471 Pre Amp

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T2 ETI 740. F.M. Tuner
T4 E.A. Playmaster 146 AM-FM Tuner

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V5 E.A. Stage (etc.) Auto Dimmer 4 K.W. & 6 K.W. add on for above
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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 20-2 0-30V at 2A or 0-60V at 2A or Dual Pos and Neg 30V at 2A
PS11 E.A. C.B. Power Supply
PS12 ETI 142. Power Supply 0-30V 0-15A (fully protected)
PS13 D.R.E.A.M. 6800

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R2 ETI 711R. Remote Control Receiver
R3 ETI 711D. Remote Control Decoder
R4 ETI 711B. Single Control
R5 ETI 711C. Double Control
R6 ETI 711P. Power Supply
R7 ETI 707A. 144 MhZ Converter
R8 ETI 707B. 52 MhZ Converter
R9 ETI 708. Active Antenna
R10 ETI 710. R.F. Power Amplifier
R11 ETI 780. Novice Transmitter
R12 ETI 703. Antenna Matching Unit
R14 E.A. 240 Communications Receiver
R15 E.A. 110 Communications Receiver
R16 E.A. 160 Communications Receiver
R17 E.A. 130 Communications Receiver
R18 E.A. All Wave I/C2
R19 E.A. Deltahet S/S Mk. 2 Comm R/X
R20 E.A. Fremodyne 4 Complete Kit
R21 E.A. Fremodyne 4 RF Section
R22 E.A. PM 138 Tuner Receiver
R23 E.A. Mos Fet 52 Mhz Converter
R24 E.A. 2-6 Mhz Converter
R25 E.A. 6-19 Mhz Converter
R28 E.A. V.H.F. Power Match
R29 E.A. Short Wave Converter for 27 Mhz
R30 E.A. Simple S.W.R. Meter
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C5 ETI 632B. Part 2 Control Logic V.D.U.
C6 ETI 632C. Part 2 Character Generator V.D.U.
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C8 ETI 632. U.A.R.T. Board
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C16 D.R.E.A.M. 6800 less keypad & cover

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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
M14 ETI 701. Masthead Amplifier
M15 E.A. I/C Volume Compressor
M17 E.A. Electronic Anemometer
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 Operated Relay
M27 E.A. Gas Detector Car; Boat
M28 E.A. Led Chaser
M29 E.A. Sound Effects Generator
M30 ETI 551. Light Chaser 3 channel 1000 watt/ ch.
M31 E.A. Electronic Machine
M32 E.A. Remote TV Headphone
M34 ETI 650 STAC Timer
M35 ETI 557. Reaction Timer
M36 ETI 249. Combination Lock (less lock)

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Project 451

A hum filter for hi-fi systems

There are few things more annoying in life than attempting to track down and remove all sources of hum from a hi-fi set up only to be partially successful, no matter how hard you try. This project should remove the last vestige of that 50 Hz pest from your system. Go 'notch' that nasty!

David Tilbrook

SO YOU'VE just spent most of your spare money, unpacked everything from the boxes, connected it up and turned it on. What on earth is that awful noise?

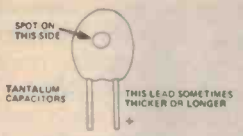
Maybe this is a bit of an exaggeration, but it does illustrate the problems some of us have with mains induced hum. Often it's necessary to position the various components of a hi-fi system close together and this can cause problems.

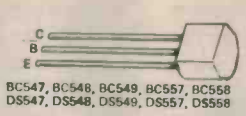
The magnetic field around the transformer in the power amplifier can couple to the preamp or tape deck. Also, the location of nearby 240V mains wiring can cause problems that can be very difficult to overcome. In theory, if the equipment and leads have been properly shielded and earthed this problem shouldn't exist. In practice it's a very different story.

This project aims at overcoming some of the problems of mains induced hum by using a notch filter at the hum frequency of 50 Hz. At this frequency any signal present will be attenuated. At frequencies either side of the notch the response should return to the unattenuated input level.

The 'Q', or Quality Factor, of a tuned circuit – which the RC network in this circuit forms, determines the bandwidth, or narrowness, of the amplitude response of the circuit (see the diagram). As this circuit forms a notch filter, the Q of the circuit determines the narrowness of the notch.

With a high-Q notch the frequency response of the circuit will dip suddenly around the notch frequency. Frequencies ▶

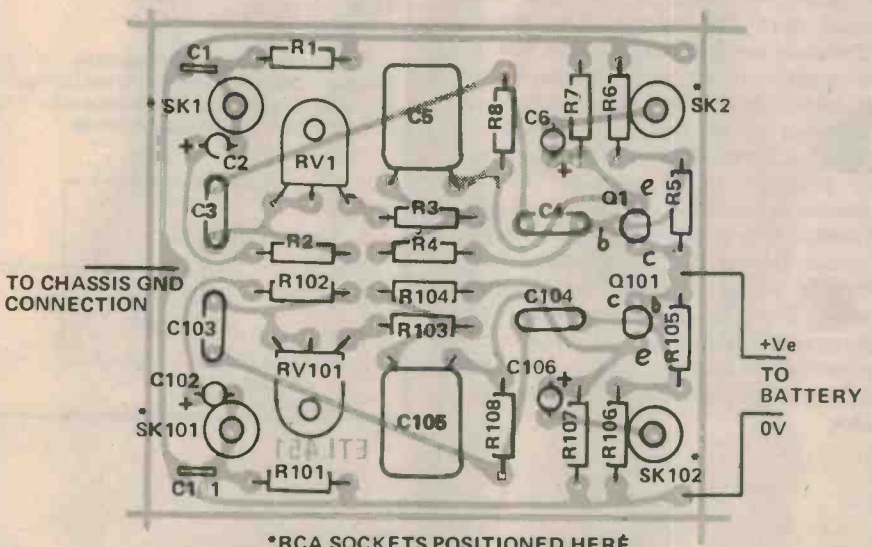




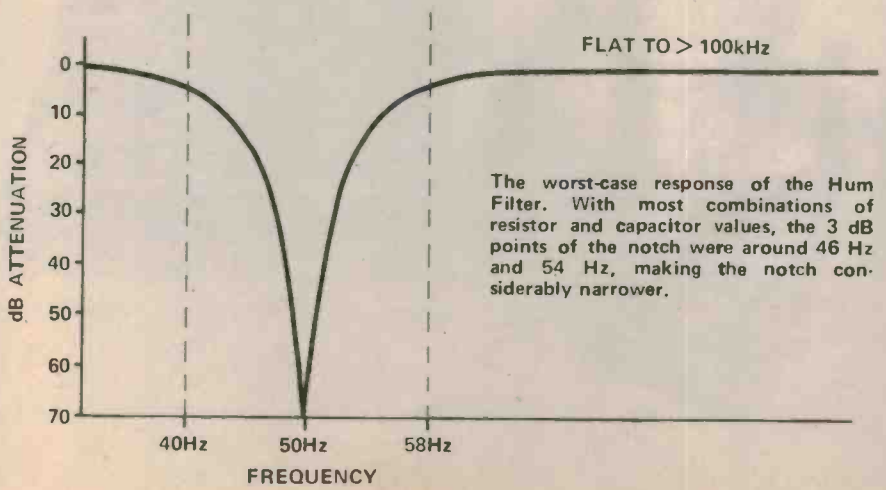
BC547, BC548, BC549, BC557, BC558
DS547, DS548, DS549, DS557, DS558

NOTE
ONLY ONE CHANNEL HAS BEEN SHOWN FOR CLARITY. THE COMPONENT NUMBERING OF THE OTHER CHANNEL BEGINS at 101 i.e. R101 R102 etc.

The printed circuit board is reproduced on page 148 or 149.



*RCA SOCKETS POSITIONED HERE ON FRONT PANEL OF CHASSIS



The worst-case response of the Hum Filter. With most combinations of resistor and capacitor values, the 3 dB points of the notch were around 46 Hz and 54 Hz, making the notch considerably narrower.

PARTS LIST - ETI 451

Resistors all ¼ W, 5%
- R1, R101 . . . 68k
- R2, R102 . . . 27k
- R3, R103 . . . 22k
- R4, R104 . . . 47k
- R5, R6, R105, R106 . . . . . 470k
- R7, R107 . . . 33k
- R8, R108 . . . 22k

Capacitors
- C1, C101 . . . . 10pf ceramic
- C2, C102 . . . . 1µ tant
- C3, C4, C103, C104 . . . . . 68n greencap
- C5, C105 . . . . 150n greencap
- C6, C106 . . . . 1µ tant

Potentiometers
- RV1, RV101 . 50k min preset

Semiconductors
- Q1, Q101 . . . BC549, BC109, DS549, etc.

Miscellaneous
ETI 451 pcb, box to suit, 4 panel mounting, RCA sockets.

Components for 100 Hz operation
- R4, R104 . . . 22k
- R8, R108 . . . 10k

Replace R3 with wire link.

a little either side of the notch centre frequency will be little affected. If the Q is low, frequencies some way either side of the notch frequency will be attenuated. The actual attenuation at the notch frequency is greater with a high-Q circuit than with a low-Q circuit.

High-Q circuits have the disadvantage that slight changes in component values, due to temperature changes etc, will affect the centre frequency. Tuning of the circuit to frequency is also quite critical. Lower-Q circuits do not suffer so much from this disadvantage..

The design Q chosen for this project was a compromise between the constraints of critical tuning and drift effect and good attenuation at the notch with little affect on nearby frequencies. Peak attenuation at the notch centre frequency of 50 Hz is around 80 dB while attenuation of only 3 dB is obtained at 40 Hz and 58 Hz. There is some audible effect on the bass response of a system, but this is minimal.

Construction

Mount the resistors and capacitors on the board first. Be sure the orientation of the tantalum capacitors is correct. These are polarized and can only be installed one way round. Next, install the preset pot. If you elect to use the same case we did, the preset must lie flat on the board. This is best done by bending the pins 90° first and then soldering onto the printed circuit board. Finally, solder the transistor in place.

The input and output connections are best made by mounting the four RCA sockets directly above the input and output pads on the pc board. Strong wires can be soldered onto the RCA sockets and the entire board slid onto the four wires. This serves the purpose of holding the board in place as well as forming the input-output connections. A short insulated wire should be connected to the gound point provided on the pc board (see overlay diagram) and to the chassis. The RCA sockets are grounded by their mounting nuts, so be sure to use a metal case.

The circuit is run from a single No. 216 nine volt battery. The current consumption of the prototype was 200μA so the battery life should be good for several months. If it is found that battery life is not long enough a power switch could be fitted.

The filter can be used almost anywhere in the amplification chain since its overload margin is very high (typically 8 V p-p). It should obviously be placed after the point where the hum is being picked up. If the hum is in the turntable it can even be placed between the turntable and the magnetic phono input of the amplifier since the input impedance is 47 k shunted by 10 pF, which should suit most magnetic cartridges.

Once the filter is in place, the presets are adjusted so that the hum is brought to a minimum by adjusting each channel independently.

Installation

Before connecting the battery, check the pc board thoroughly. Check the orientations of the tantalum capacitors and the transistor. If all is right, plug in the battery and seal the base.

In the unit we built, holes were drilled in the chassis immediately above the preset pots. This allows the filter to be fine-tuned after it has been connected into the circuit. The presets themselves are connected to the base of the transistors via some resistance, so the transistor bias voltage is present on the preset. If the pot is to be adjusted through a hole in the chassis this voltage will probably be shorted out by the screwdriver touching the earthed chassis. Although this won't damage the circuit, it could damage the loudspeakers if the filter is being used in the magnetic phono line. It certainly makes the adjustment meaningless, so either use a non-metal adjustment tool or use LED mounting grommets to insulate the holes.

If the hum problem you are experiencing is 100 Hz instead of 50 Hz the filter is easily adapted. Simply replace resistor R3 (22 k) in each channel with a wire link. Remove R4 (47 k) and replace with a 22 k resistor. Remove R8 (22 k) and replace with a 10 k resistor. ●

HOW IT WORKS

The circuit consists of a "Twin-T" notch filter formed by capacitors C3, C4 and C5 and resistors R3, R4, R8 and preset PR1.

The operation of the Twin-T requires that $C_3 = C_4 = \frac{C_5}{2}$

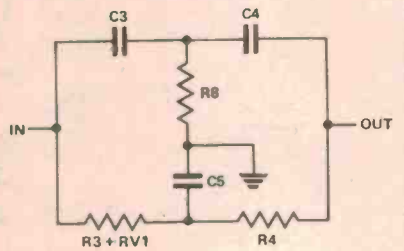
and $R_3 + PR1 = R_4 = 2R_8$

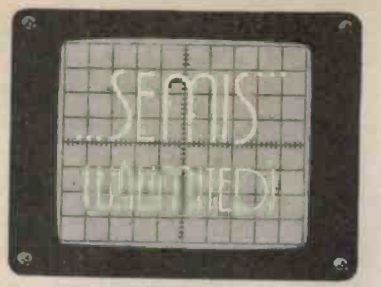
These conditions must be met with reasonable accuracy if a good, deep notch is to be obtained. The preset corrects to a certain extent for errors due to component mis-match and assumes that the notch can be adjusted to the exact frequency of the hum to be rejected.

The frequency of the notch is then given by

$$f = \frac{1}{2\pi R_4 C_4}$$

The transistor is operating as an emitter follower, giving zero voltage gain, but providing feedback into the notch to increase the Q to acceptable limits.





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LM311	.55
LM318	2.25
LM324N	.65
LM334Z	1.10
UA339PC	.50
LM349N	1.45
LF356	.90
LF357N	.90
LM358N	.60
LM370N	2.50
LM373N	3.30
LM380	.85
LM381N	1.50
LM382N	1.30
LM386N	.90
LM387N	1.10
LM391N	1.40
LM393AN	.70
555	.25
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LM565CN	1.10
LM567CN	1.20
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LM723CH	.54
LM733CN	.75
741	.20
UA747PC	.85
LM748CN	.45
LM1458N	.50
LM2902N	1.20
LM3039H	.78
CA3065	.50
CA3130	1.05
CA3140T	1.05
UA3401	.60
LM3900N	.65
LM3909N	.85
LF13741N	.50
LF13741H	.50

TRANSISTORS

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

TTL 7400 SERIES

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

CMOS

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

TTL 74LS SERIES

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

S.C.R.

C106Y	.30
BT100A300R	.50
C106D1	.50

DIODES

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

ZENER DIODES

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

VOLTAGE REGULATORS

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

OPTO

FND 507	1.40
FND 357	1.00
FND 500	1.00

STANDARD LEDS

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

MICROS

2102	1.20
2114	5.50
2708	10.00

All prices plus sales tax if applicable. CMOS, TTL, MICROS and LEDS are plus 15 percent, all others plus 27½ percent.

TERMS: Minimum Order $10 Aust.
Bankcard accepted

Send 30c stamp for free price list

• We specialise in fast, prompt service with total customer satisfaction. • All items are guaranteed 30 days from date of shipment — user damage excepted. • Postage and handling: Add $1.50, orders over $50 add $3. All orders sent certified mail. • Prices valid 2 months from date of issue. • School and government orders accepted.

IS SERVICING YOUR GAME?

If you're a service technician, or even a hobbyist who likes to tinker, Dick has a range of products just for you. Products such as the aerosol service aids below: they'll make your job easier and quicker!

'CANNED COLD'

Ideal for seeking out troublesome intermittents, this spray cools on contact down to -50° C. Also shrinks shafts, bushes, pins, etc. Complete with long reach tube. (350g can).

$3.00

Cat N-1056

FREON SPRAY

This is a very handy product to have around: it cleans, degreases, andremoves moisture, is non-toxic, non-explosive and inflammable. It won't harm components of surfaces (inc. rubber & plastic) and leaves no residue. Complete with long reach nozzle. 250g can.

$3.00

Cat N-1051

CRC-2 26 SPRAY

The motorist's friend — and just as handy in the service tool box. This is a moisture removing cleaning spray which drives moisture out and leaves a thin film of silicone. Ideal for pots, switches and contacts, great for car ignition systems in wet weather. Huge 454g can.

$4.95

Cat N-1060

ELECTROLUBE 2x LUBE PEN

So convenient for the serviceman! A pen-shaped pack which fits into the pocket, containing a state-of-the-art electro-mechanical lubricant. Non-drying, ideal for all circuit moving parts, mechanical & auto components, etc.

$2.40

Cat N-1047

PCB LACQUER

This is a spray-on lacquer for protecting printed circuit boards from tarnishing. Furthermore, you can solder through this (unlike many other circuit lacquers). 397g can.

$5.80

Cat N-1045

ELECTROLUBE PRECLENE

Another quality Electrolube product: a highly efficient high pressure solvent. Ideal for tuners, switches,relays, plugs & sockets, commutators, pots, etc etc etc.Non corrosive, low toxicity and inflammable. Complete with long tube. 340g

$4.50

Cat N-1040

CLEAR ACRYLIC SPRAY

Fine, colourless spray ideal for protecting panels, etc, or for covering screen printed or 'Letraset' lettering

Also useful for moisture proofing or weatherproofing outside components (TV antennas, terminals, etc).

$2.25

Cat N-1011

MATTE BLACK SPRAY PAINT

Quick drying, matte finish spray. Ideal for touch-up work, great for painting heatsinks for increased efficiency. (Used a lot by car enthusiasts for special panel painting, etc.)

$2.20

Cat N-1070

SAVE ON CLARION!

Yes! AWA Clarion car sound gear is now reduced — save a bundle by buying now!

PU828 AUTO REVERSE CAR CASSETTE PLAYER

Save almost $20.00! Superb Clarion auto reverse player has a reputation second to none. 6 watts per channel output, fast forward and rewind. A real bargain at this price.

Cat A-6551 ..... was $188.50 NOW **$169.50**

PU686 AM/FM STEREO AUTO REVERSE

SAVE AN INCREDIBLE $86.00!!! One of the top car cassette units you'll find, with AM & FM stereo receiver as well. Full features include fast forward as well as rewind,plus loudness control. 5.5W/channel output. A great replacement for the garbage that most car manufacturers put in!

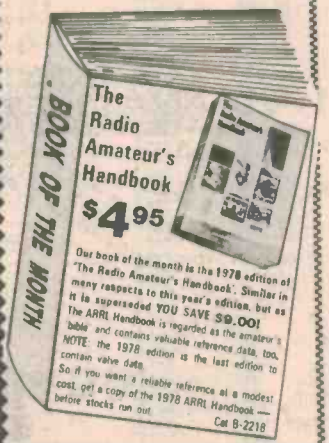
Cat A-6557 ..... Was $345.00 NOW **$279.00**

CTD 2006 HIGH POWER CAR SPEAKERS

Twin cone air suspension speakers will really make your in-car sound come alive. They handle 20W max. have a massive 280g magnet (133mm cones). Really top performers.

Cat A-7040 ..... was $46.75 pr NOW **$39.95 pr**

The winner of the Exidy Sorcerer Computer from the Sydney Home Computer Show is **Kevin Reville, of Frenchs Forest**



Our book of the month is the 1978 edition of 'The Radio Amateur's Handbook'. Similar in many respects to this year's edition, but as it is superseded **YOU SAVE $9.00!** The ARRL Handbook is regarded as the amateur's bible and contains valuable reference data, too. NOTE: the 1978 edition is the last edition to contain valve data.

So if you want a reliable reference at a modest cost, get a copy of the 1978 ARRL Handbook — before stocks run out.

Cat B-2218

WATCH THIS SPACE

AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! N.B. Specials are strictly while store stocks last.

Don't miss out!

LAST MONTH:

'BIG BRUISER' TORCH

Was $5.50 — now $2.88

SAVING $2.62

AT LAST . . .

A complete audio system you can build yourself and SAVE!

PLAYMASTER AM/FM STEREO TUNER & CLOCK

Another outstanding kit from Electronics Australia. Features spre-built and aligned AM/FM tuner module (most of the hard work is done already!) with a digital readout dial which doubles as an accurate digital clock. Simple to construct.

Cat. K-3494 ..... **$129.50** (Reduced from $159.50)

PLAYMASTER STEREO AMPLIFIER (2 models)

Our most popular kit. And you can decide which power output you want: 25 watts per channel or a massive 40 watts per channel. Thousands of these have been built, some by complete novices! Imagine telling your friends that you built it yourself!

Twin 25: Cat K-3410 ..... **$105.00**

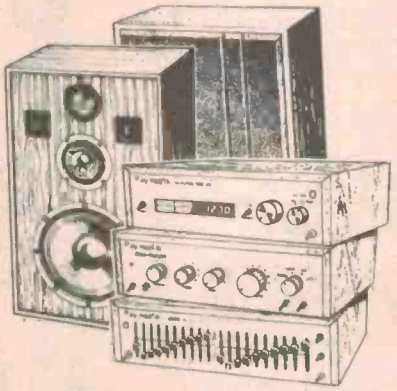
Forty/Forty deluxe Cat K-3411 ..... **$129.50**

PLAYMASTER GRAPHIC EQUALISER

Our newest Playmaster kit, and it looks like being one of our most popular! This remarkable device allows you to tailor the frequency response of your system to suit your surroundings. Sound EXACTLY the way you like it.

NOTE: Stocks of this kit may be limited at some stores due to incredible demand.

Cat K-3500 ..... **$99.50**



PLAYMASTER SPEAKER KITS:

3 types to choose from. 75 litre (300mm) 3-way; 53 litre (250mm) 3-way; and 26 litre (200mm) 3-way networks. Any of these systems can be completed by virtually any constructor in less than 2 hours total work. Full instructions are provided (no soldering required.) Largest system features mid-range & tweeter controls.

NOTE: Enclosure (box) kits and speaker kits available separately if required.

3-75L 300mm 3-way Speaker System: (as shown)

Speaker kit: Cat C-2042 .... $160.00 pr Box kit: Cat C-2622 .... $124.00 pr

TOTAL SYSTEM PRICE (per pair): **$284.00**

3-53L 200mm 3-way Speaker System

Speaker Kit: Cat C-2044 .... $125.00 pr. Box Kit: Cat C-2624 .... $99.00 pr

TOTAL SYSTEM PRICE (per pair): **$224.00**

3-26L 200mm 3-way Speaker System

Speaker kit: Cat C-2046 ..... $70.00 pr. Box Kit: Cat C-2626 ..... $79.50

TOTAL SYSTEM PRICE (per pair) **$149.50**

FULLY INTEGRATED RELIABLE CAR PROTECTION

L-5090

● 12V DC negative earth cars ● Senses current drops to sound alarm ● Siren horn with alarm module built onto the back ● Install the alrm in your boot or engine compartment ● Very simple installation ● Special connection for protection of CB or stereo units ● Recommended quality product from Dick

$49.50

AMATEURS: Don't delay getting that new Yaesu any longer! The war could finish at any time — and you may miss out. See page 157 for latest news from the front!

ONLY $49.95

A-8660

BOOST CAR STEREO SOUND

● 30 watts maximum power to each channel ● Easily connected to your car stereo ● Huge heatsinks for heat dissipation ● Works on any 12V DC negative earth car ● Small size 118(W)x40(H)x165(D)mm ● Contains 4 IC's - all solid state.

SHEER LUXURY!

Imagine! That first cold seat of a winter's morning could be the most delightfully warm seat you'll have all day. The Dick Smith warmed toilet seat. Perfectly safe, perfect luxury!

$32.50

X-2000

TRANSISTOR SPECIAL

5 YEAR WARRANTY ON TRANSISTORS!!!

Yes, thats right. We have arranged for a large US owned manufacturer to produce high quality transistors with LOWER NOISE figures than the original European specs. Standard TO-92 case PLUS lead terminations clearly marked.

PLUS - PLUS A FIVE YEAR WARRANTY (if used within specs.)

DS547	Z-1300	~~25c~~	14c
DS548	Z-1308	~~25c~~	14c
DS549	Z-1319	~~27c~~	14c
DS557	Z-1340	~~39c~~	17c
DS558	Z-1348	~~39c~~	17c

NOTE: THESE ARE OUR ONE OFF PRICES! YOU DON'T HAVE TO BUY A PACK OF 10...

SOMETHING TO DO DURING THE LONG WINTER NIGHTS?

BUILD YOURSELF A COMPUTERISED DOORBELL . . .

Amaze your friends and visitors with this incredible achievement in dedicated microcomputers. A doorbell that actually plays 24 different tunes. You can easily build this kit — full instructions are provided — in a few hours. Cat K-2020

WAS $49.50 NOW 39.50

DON'T FORGET OUR TWO NEW STORES:

Yes! Dick has opened two new stores recently for the benefit of our interstate customers:

CANBERRA: 96-Gladstone St Fyshwick Phone 80 4944

PERTH: 414 William Street, City. Phone 328 6944

PUSH BUTTON PHONE DIALLER

WITH MEMORY

$49.95

Cat X-1175

Converts rotary dial phones to push button type. Ideal for hobby use or private phone systems. Remembers last number dialled (push button for instant recall up to 16 digits).

ATTENTION: Although these fit perfectly into standard Aust. phones (no soldering required) current regulations do not permit them to be used for this purpose.

SOON OPEN IN WOLLONGONG

Norman Gunston, eat your heart out!

The Electronic Dick is coming to Wollongong . . .

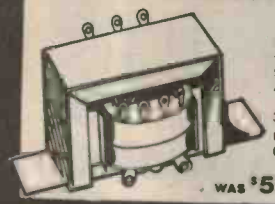
The old town will never be the same again after Dick arrives — watch for the new store located at

263 KEIRA ST WOLLONGONG

WATCH YOUR LOCAL PAPER FOR THE GRAND OPENING: IT WON'T BE LONG!

Our transformers solve your voltage problems . . .

You probably imagined our multi-tap transformers only gave the voltages shown on them . . . WRONG! Our transformers give a huge range of voltage combinations. It's just a matter of picking certain taps to get the voltages you need. So even if your requirements seem a little 'strange' you can probably get the voltage you need from a quality Dick Smith multi-tap power transformer.



M-2155: nominally 15V @ 1A with taps at 6.3V, 7.5V, 8.5V, 9.5V, 12.6V & 15V.
Also gives the following: 1.0V, 1.2V, 2.0V, 2.2V, 2.4V, 3.1V, 3.2V, 3.5V, 4.1V, 5.1V, 5.5V, plus 2.0V CT, 12.6VCT, & 15.0V CT – a total of 21 combinations!

WAS $5.60 SPECIAL AT... **$3.95**

M-6672 nominally 30V @ 1A with taps at a 15V, 17.5V, 20V, 24V, 27.5V & 30V.
Also gives the following: 2.5V, 3.5V, 4.0V, 5.0V, 6.0V, 7.5V, 9.0V, 10.0V, 12.5V plus 5.0V CT & 30V CT — a total of 18 combinations!

ONLY **$6.75**

NEW!

MULTI-VOLTAGE POWER PACK
3, 6, 9 & 12V @ 1A

If it's a DC power pack you need, go no further than the new A&R multi-voltage power pack. Ideal for all those heavier current devices e.g. burglar alarms, projects, as a bench power supply, etc etc etc. Fully approved supply in a neat flat package – screw on terminals.
Cat. M-9530

$22.50

PARTS FOR NEW KITS

PLAYMASTER STEREO EQUALIZER (See EA May)
Complete kit including instructions ..... Cat. K-3500 $99.50
UA4136 Quad Op Amp ..... Cat. Z-6105 $1.95
PC Boards (set of 3 high quality boards) ..... Cat. H-8360 $12.95

INTERSIL LCD EVALUATION KIT (See Feb EA)
As used in the EA digital voltmeter ..... Cat. K-3450 $39.50

WHISTLE FILTER (See Feb EA)
Complete kit, including instructions ..... Cat. K-3496 $19.75

WHAT'S NEW

LCD CLOCK MODULE

Scoop purchase! Time & date modules, ideal for phone timers. Liquid xtal disp... buy direct from the importer and save. Battery included! Incredible value.

$12.50 X-1039

SCOOP PURCHASE

11 Way Edge Connector

Uses the standard 2.54mm (0.1) spacing, has 11 pins in 12 possible positions. With keyway that can be moved if required. Place in series for up to 110 way. Gold plated connecting pins.
WORTH OVER $1.50 EACH! OUR PRICE: P-2812

PACK OF 4 - $1.00

WHAT'S NEW

HIGH DENSITY EGG INSULATORS

Ceramic has finally given way to modern nylon. No more problems with cracked porcelain, or worries about dropping them!
Very high density and highly insulative, these modern-day egg insulators are ideal for all places you used to use ceramic. And look at the saving in price!
Ceramic equivalent: 80c each
60¢ ea Cat D-5300

REAP THE BENEFIT of Dick's incredible bulk purchasing power. Here are just a couple of extraordinary bargains for YOU!

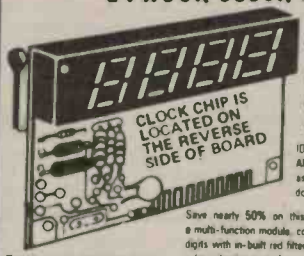
2200uF/50V electros
How much would you expect to pay? $2.00, even more? You can buy these from Dick from 80c each. They're ideal for power supplies, etc. Famous 'Rubycon' brand. R-4575
$1.00 ea; 10 up 80c ea

SPST MICROSWITCHES:
Normally $2.00 or more each — now from only 50c each. Use in burglar alarms, as limit switches, etc etc. 240V rating. Buy now and save with this scoop purchase. Cat S-1018
60c each 10 up 50c ea

SUPER SPECIAL: 2114 Memory IC's at almost half price. 4k static RAMs – ideal for the experimenter – were $14.50 **NOW $7.90** Cat Z-9306
Be quick for this bargain

NEW LOWER PRICE

24 HOUR CLOCK MODULE



4 DIGIT **$6.90** WAS $13.50

IDEAL BEGINNER'S PROJECT! All the hard work is done, pre-assembled PCB module, all you do is add 6 function switches.
Save nearly 50% on this incredible clock bargain. It's a multi-function module, complete with data sheet. 12mm digits with in-built red filter. You reap the benefit of Dick's volume buying power!
Cat X-1048

Transformer to suit: M-2822 $4.25
Suitable switches: Push button: Cat S-1102 35c each. Toggle type: Cat S-1173 $1.20 each

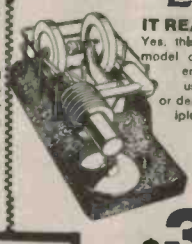
NEW!

$17.50
VALUE!

'VIDEO BRAIN' COMPUTER KEYBOARD
Full function computer style keyboard with 37 keys, silver plated double sided board, double sided edge connector (0.1" spacing) and high quality computer-grade push buttons with interchangeable key tops.
The manufacturer of this quality keyboard went broke and we bought the lot. You reap the benefit! This keyboard must have cost twice as much to manufacture as the price we're asking for it!
All keys can be individually accessed by cutting PCB tracks.
Come on all you experimenters: you've been asking for this — so here it is!
Cat X-1182

WHAT'S NEW

HEAT EXCHANGE ENGINE



IT REALLY WORKS!
Yes, this is an actual scale model of a 'Stirling Cycle' engine which you can use to power models, or demonstrate the principles of external combustion. Comes with a beautifully presented book describing Stirling Cycle theory & operation.

$39.95 X-1500

WHAT'S NEW

IN ONE WORD . . . BRILLIANT!

MINI HI-FI SPEAKERS

They might be mini size, but they're huge in performance. And they compare favourably with speakers costing three times as much! 2-way sealed enclosure in smart aluminium (so they're robust) with a 100mm woofer, 25mm tweeter, enclosure measuring 120 x 120 x 190mm. Ideal for cars, caravans, boats, flats, etc etc etc.
Cat X-1175

99.50 pr

(Compare close equivalents at up to $350.00!!
Cat A-2375

DICK'S OWN "GOLDEN ROD" TV ANTENNA

EXCLUSIVE TO DICK SMITH!

$29.50
Cat L-4022

If you live in the metropolitain area or even a fringe area, then this is the antenna for you. It will give excellent results. Maximum gain on channels 0,2,7,9 & 10, with GOLD ANODISED elements for extra long life. 300 ohms impedance; complete with mounting bracket.

UPGRADE YOUR TRS-80, APPLE OR SORCER TO 16k RAM

(or your 16k Apple/Sorcerer to 32k!)

Cat X-1185

WHY PAY MORE?

149.50

You can install this expansion kit yourself and save $250.00! Others charge $430 and more to fit this simple kit. . .
All our ICs are guaranteed brand new, prime spec devices. Don't be conned into paying a fortune! Kit as supplied suits Sorcerer and Apple. To upgrade TRS-80 you will need 2 DIP switches, Cat S-1608 @ $2.57 each.
FULL INSTRUCTIONS PROVIDED

SIMILARLY OPTIONED COMPUTERS SELL FOR THESE FIGURES:*

SORCERER:	$1,434.50
TANDY TRS-80:	$1,828.00
APPLE II:	$2,887.00

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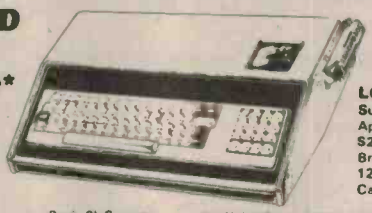

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Here is the first truly beginner's guide to microprocessors. It is based around a single microprocessor system that also includes basic theory that must be understood before learning any microprocessor system.

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A CONSUMER'S GUIDE TO PERSONAL COMPUTING AND MICROCOMPUTERS By Stephen Freiberger and Paul Chew.

Here are two valuable books in one: an introduction to the principles of microcomputers that assumes no previous knowledge on the reader's part, and a review of 64 microcomputer products from over 50 manufacturers. Other features of this consumer's guide are: extensive illustrations to reinforce the discussions; a selection and sources section to assist you in reviewing, selecting, and purchasing microcomputer products; summary charts of major microcomputer products offering a quick summary of specifications for a given product; and comment sections covering the advantages, disadvantages, and best-buy tips for each microcomputer product.

THE 6800 MICROPROCESSOR: A Self-Study Course with Applications By Lance A. Leventhal.

This simple introduction to the 6800 microprocessor includes 15 laboratory exercises that emphasize the use of the microcomputer as a controller which responds to inputs and prepares suitable outputs. Although the coverage is confined to simple control applications of microcomputers, it also points out how microprocessors can be used in communications, data acquisition, business data processing, interfacing and many other applications.

BASIC BASIC: An Introduction to Computer Programming in Basic Language, Second Edition By James S. Coan.

"... an excellent introduction to the use of BASIC through remote terminals and time-sharing." **Computing Reviews.** "It is a well-written book ... there are many good examples, complete with results." **Computer World.** "Coan's book offers considerable insight into problem solving in BASIC and would make a fine addition to your personal computing library." **Killobaud.**

These are three of the many fine reviews on the first edition of this populat introductory book. This second edition continues to offer you an excellent introduction to the essential statements of BASIC, with an added feature of a new chapter on strings and files. Over 100 sample programs are used to present the language and to integrate programming with mathematics.

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Here is the computer chess program that won first place in the first chess tournament at the 1978 West Coast Computer Faire. It is written in Z-80 assembly language, using the TDL macro assembler. It comes complete with block diagram and sample printouts.

THE FIRST BOOK OF MICROCOMPUTERS: The Home Computer Owner's Best Friend By Robert Moody.

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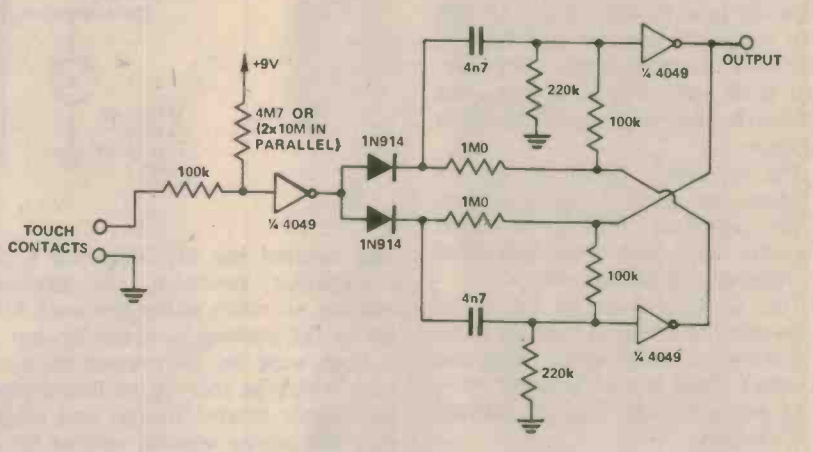
Ideas for Experimenters

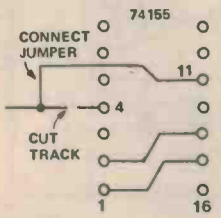
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we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

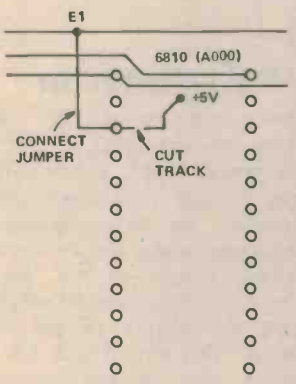
Touch Switch

A nice simple little circuit from Paul Tannard of Brighton – a touch switch and flip-flop built from one CMOS IC.

The advantage of having a flip-flop on the output of a touch switch is that it then becomes touch-on, touch-off. A further gain is that, if you're inputting single pulses to some sort of counting circuit, it makes a very positive debounce circuit. Remember that if you are using it for this purpose and you wish to hang a LED off the end to show you what's happening at the output, you can drive the LED by using one of the unused gates in the package as a buffer and connecting it to the other output of the flip-flop. That is, unless you want to build two of the switches from one package!







D2 Kit Modification

When using the Motorola D2 kit with external RAM located at 0000, the 512 bytes of RAM supplied with the kit is 'overlayed' by the external chips. This means that the user has 'lost' his 512 bytes.

Allen Bruce of Millfield thought that this was a bit of waste (excuse the pun – Ed) and decided to do something about it. He has effectively moved the on-board RAM so that is starts at A000, allowing the use of all the RAM in the system.

The modifications are as follows:

Cut the track from the MC74155 at pin 4. This is the 'not RAM' signal going to the four RAM sockets. Connect a piece of wire between pin 11 of the 74155 and the track going away to the four RAM sockets.

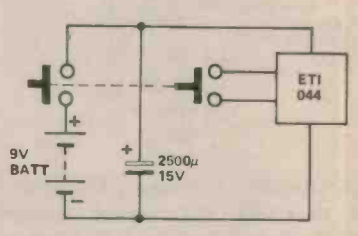
Pin 10 of A000 RAM is connected to +5V. Cut this track and take pin 10 to address line 9. The best place to connect this is at the place where "E1" is marked on the top side of the board.

Doorbell Current Saver

Graeme Scott of Surrey Hills, Victoria developed this little trick when he was teaching Electronics in schools. It's an elementary way of saving current in a doorbell circuit. (Why didn't we think of it? – Ed)

The circuit uses two components – a two-pole momentary action switch and a very large capacitor. Operation is self-evident.

Although it is shown in conjunction with the ETI 044 electronic doorbell, the technique will probably be useful in many other applications.



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

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

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

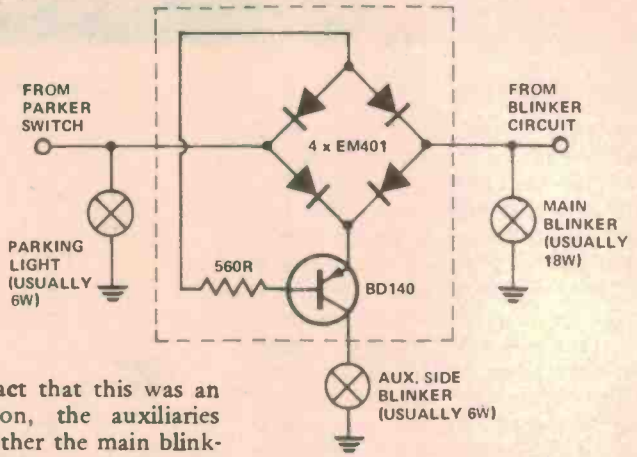
Ideas for Experimenters

Blinker Controller

Having fitted a set of auxiliary blinker lights to his car, Kris McLean VK2ZKL of Granville Tech. was faced with the problem of how to turn them on and off. No problem, you say, put them in parallel with the main blinker circuitry.

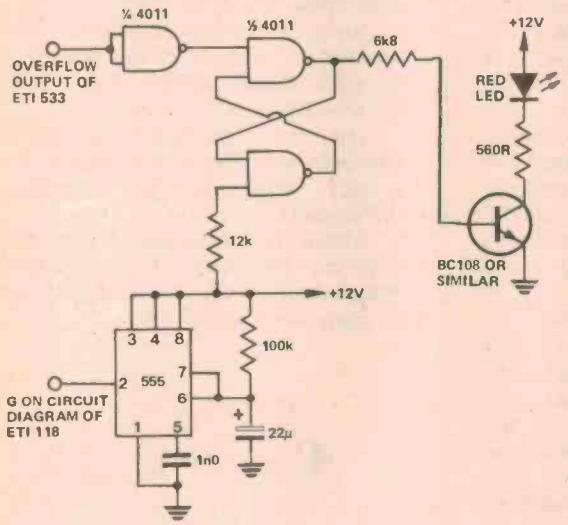
That is all very well if all you want tham to do is blink on and off, but what if you want:

1) The auxiliary lamps to go on when the parking lights are on.
2) The auxiliary blinkers to light at the same time as the main ones when the parkers are off.
3) The auxiliaries to go on in an inverted cycle (ie to light up when the main blinkers go out and vice versa) when the parkers are on — presumably for 'hazard flasher' operation.



Kris spotted the fact that this was an exclusive-or function, the auxiliaries coming on when either the main blinkers or the parking light was lit, but not if both were lit. He devised the circuit here which he then fitted into a plastic pill bottle (useful things) and inserted into the wiring at each side of his car.

Frequency Meter Overflow Indicator

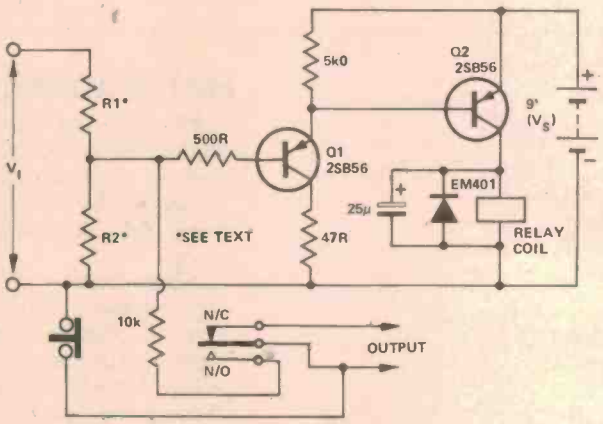


After Gregory Freeman of Nairne had built the ETI 118 digital frequency meter, he found that the lack of an overflow indication was rather disconcerting. As a result, he built this little circuit, which latches the overflow output from the ETI 533 digital display module and resets it after a pre-determined period.

Although the circuit was originally intended for the ETI 118, it should be fairly easy to add it to any of the projects which use the 533 module.

Operation is fairly straightforward. When the overflow output of the 533 pulses high, it sets the latch formed by the 4011. This lights the LED via the transistor which will remain on until the 555 resets it.

The 555 is operating in the monostable mode, being triggered about every three seconds by the timebase output of the DFM (which is pin G on the board).



Relay PSU Protector

This circuit may prove very useful when trying out a project for the first time. Any power supply shorts will pull the supply voltage (Vi) down, turning the transistors on and tripping the relay. This then causes the 10 k resistor to latch the circuit in the 'tripped' mode. The relay is connected so that it disconnects the supply to the circuit being tested. The circuit can be reset by pressing the momentary-contact switch shown.

R1 is selected so that Vi/R1 is greater than Vs/R2. R2 must be greater than R1 and Vs/R2 must be large enough to turn the first transistor on.

The circuit (which was sent in by Scott Field of Taree) work with Vi ranging from 3 to 18 volts.

OFFER ..... SPECIAL READER

SYM-1 Special Reader Offer

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

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

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

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

*

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

OFFER ..... SPECIAL READER

Lab Notes

An occasional series in which we discuss interesting circuit techniques, circuits we have tried in our own laboratory but not developed as a project, practical notes on projects, measurement techniques for hobbyists etc.

Getting the best from the ETI-140 1GHz DFM

SINCE IT WAS described in the March and April 1978 issues, this project has been very popular, reportedly many hundreds have been built.

The design has proved very sound, although some constructors have reported minor problems. This is gratifying considering the complexity of the project.

Here are a number of hints and tips to help you get the best from your instrument.

Minor errata

We should get this out of the way first.

In the table on page 87 of the March 1978 issue, the connections for IC42 should show pins 4 and 5 connected to the +5V rail, while pin 12 goes to OV (zero volts).

On the circuit diagram, p. 90 of the March 1978 issue, the reset output of IC37 (pin 5) is incorrectly labelled "Reset Button". This button actually connects to IC41 (a debounce circuit). The overlay is correct.

Crystal oscillator

The oscillator stability is the main limitation on ultimate performance, as would be expected. Experience indicates that, despite the crystal oven (which works quite well), temperature changes affecting the 74LS00 oscillator/driver affect the frequency of oscillation, limiting the accuracy to a few parts per million.

This is quite satisfactory for many purposes, but, where greater accuracy is required, particularly where the full display facilities are to be used to best advantage, then an 'add-on' high stability oscillator is recommended (see following notes).

It may be found that some crystals will not 'behave' in the circuit as published. The solution lies in tailoring some of the oscillator components to suit the crystal used.

For starters, R58 and R59 may be adjusted to give the correct drive level to the crystal. Reliable starting and improved stability result from a little 'juggling' of these resistors. Not all crystals have the same characteristics.

Too high or too low a drive level may cause unreliable starting and possible harmonic or sub-harmonic oscillation. (e.g. rather than the oscillator operating on 4 MHz as intended, it may produce 8 MHz or 2 MHz). In addition, too low a drive level increases frequency drift. The correct level is best found experimentally if you experience trouble in this department.

Note that capacitor C3 is a bypass intended to suppress harmonic operation of the oscillator. However, with some crystals it may bring about sub-harmonic oscillation!

From experience, some crystals require R58 and R59 to be 470 ohms and C3 to be left out for best operation of the oscillator/driver. Still others need these resistors to be at least 1k, C3 being retained in this case.

Additionally, it has been noted that the value of C4 may need to be increased to achieve correct operation on frequency and period modes. A value of 330 pF is suggested as a starting point.

Longer gate times

The standard gating time of one second (1.6 S on prescale) is a good compromise between accuracy and reading delay, chosen to suit the majority of applications envisaged for this instrument. Longer gating times of 10 seconds, or even 100 seconds, can be provided by adding extra stages to the divider chain. This is desirable at lower frequencies where resolution is the important factor.

If the extra stages are connected at the output of IC31 (pin 9), the range of the time and period functions will be increased, but, at the same time the resolution will be reduced. Low power Shottky devices — 74LS90s — are recommended. Note that CMOS 4518s require buffering to drive the 74S10, and are therefore impractical.

Sensitivity control

If you find it disconcerting that the sensitivity control operates opposite to the convention; i.e. maximum sensitivity is obtained when the control is wound fully anti-clockwise, this can be reversed as follows:

On the pc board cut the track connecting the centre pin of RV1 and connect the centre pin of the pot to the opposite pin instead.

For many applications, a linear pot will provide a more 'controlled' rate of attenuation.

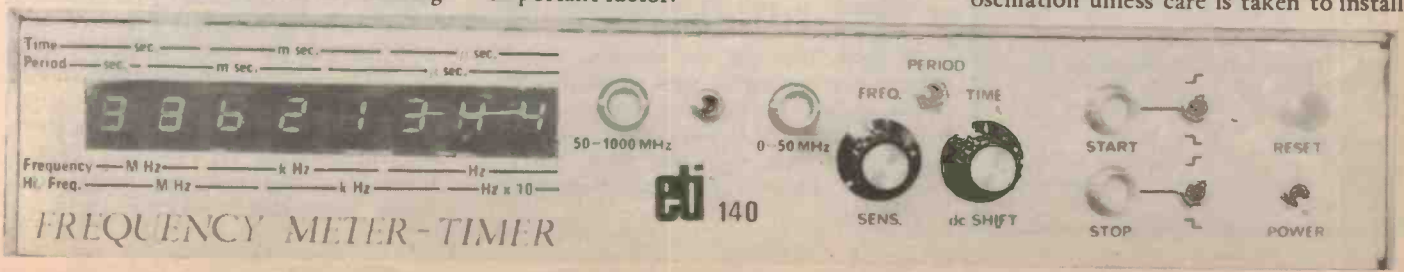
Note that the DC shift control is 'off' when it is centred.

Prescaler pointers

Constructers should follow stringent RF construction practices in order to avoid problems with the prescaler — particularly around the OM335.

Earth paths are critical at UHF. All components should be soldered both above and below the board where indicated, especially the earth leads of the OM335. This IC should mount right down on the pc board. Some ceramic material may need to be *carefully* scraped away from the pins at the component's body to enable successful soldering to the pins on the top side of the pc board.

As the OM335 provides a lot of gain in a small space the stage will tend to be unstable at best, breaking into oscillation unless care is taken to install ▶



Lab Notes

it correctly. If you experience instability problems, check the above points first. Then, adding an extension to the tin-plate shield running alongside the OM335 (refer to the photographs in the original article). These measures should be completely effective.

The 'Maximum input' of 200 mVac specified for the ETI 140 refers to the input impedance of 75 ohms. Above this level the input protection diodes reduce the impedance. Specified maximum input to the OM335 itself is about 2.5 V. The diodes will protect it from most overloads, but to retain system impedance during measurements and to give the maximum overload safety margin, input level should be kept well below the specified maximum.

Fortunately, the sensitivity is so high, at least 20 mV at 50 MHz and improving with increasing frequency, that for most applications direct connection to a circuit is not necessary and a small pickup loop on the end of a coax lead is all that is required to obtain an adequate measurement.

Displays

The DL707 display specified is an industry standard and can be obtained under a variety of part numbers. Some of these, for example, are:
MAN72A
745-0017
TIL312
5082-7610
5082-7650

Some constructors who used the XAN3062 display, substituted for the DL707, found them unreliable. If DL707s are unavailable, any of the above may be substituted.

Power supply

Do not be bothered (. . . my little chicken — as the fairy story goes) that the transformer specified (Ferguson PL18/20VA) gets quite hot. This is not because it is overloaded, rather it is designed to run at a relatively high temperature. It conducts a fair amount of heat through the chassis, which, naturally enough, gets quite warm. The internal temperature remains within tolerable limits. If you're worried about it, either run the unit with the lid slightly raised or put ventilation holes in the lid.

General tips

When attaching the external wiring to the pc board, a little extra length will allow the board to be pivoted forward to allow access to the underside for service. Not shown in Figure 8 (April 78 issue, p.79) is an extra connection from point 'E' to the main board. The type 8168 pushbutton switch specified for PB1 has not been available for some time, due to production problems we are told. Type 8121 may be substituted. The connections are different but, referring to figures 8 and 16 in the April 1978 issue and the markings on the switch, correct wiring is readily ascertained.

When troubleshooting

The apparent complexity of the instrument may make the task of servicing or debugging seem daunting. However, if the unit is treated in its separate sections it becomes fairly straightforward.

Firstly, it is essential that the unit not be switched on without the earth lead from the chassis to the pc board earth pattern or the 9582 (IC42) will be damaged. If a prescaler is fitted the earth should go from a lug under the prescaler input socket to the earth pattern of the prescaler board — use a short, heavy lead.

A divider probe must be used when checking operation of the ECL devices with a CRO, otherwise oscillation may result. A 'x10' probe is recommended, but should not be used on the ECL/TTL translator.

Note that it is normal of ICs 42 to 45 and 47 to 49 to run hot.

Exercise care when removing ICs from the board to avoid damage. The safest way in the absence of special equipment is to use a solder sucker or 'solder wick' to remove solder.

Add-on crystal oscillator

Improved short-term and long-term stability can be obtained by constructing a separate oscillator and buffer and incorporating the whole assembly with the oven components suggested in the article on ETI 140.

A suitable oscillator circuit is given here. Capacitors C1 and C2 should be either silver mica or polystyrene types. Exact value is not critical and one

value either side of those specified may be used. The two 10n (0.01 uF) bypass capacitors should be ceramic types. The output capacitor from the collector is best chosen by experiment, depending on the buffer used. More on this later.

The 2k2 resistor marked 'Rf' determines the level of feedback, and to a certain extent, affects the ultimate stability as it isolates the crystal from the active device and the load. It should be chosen such that reliable starting is obtained, with the highest tolerable value. One standard value lower than that determined by experiment for reliable oscillator starting is the best bet. Note that it may take some seconds for the oscillator output to appear and rise to maximum level following switch on with this circuit.

The 5-60 pF trimmer is used to set the frequency exactly. A miniature Philips film trimmer or (if you have the space) a mica compression trimmer should be used.

A CMOS Schmitt trigger, to provide logic level output, is recommended as a buffer. The coupling capacitor from the oscillator collector should be chosen to be as small a value as possible, consistent with reliable operation of the Schmitt trigger. A value of 100 pF is a good place to start.

All these measures isolate the crystal from the cruel vicissitudes of the 'outside world'.

The crystal, oscillator components, buffer and oven components should all be mounted in a thermally-insulated container – polystyrene foam blocks are ideal, as mentioned previously. The crystal should be mechanically (and thus thermally) connected to the oven components as detailed in the original article. Having some thermal linkage to the other components is also a good idea, however, this is left to the individual constructor's ingenuity.

Output from the buffer can be taken direct to the divider chain.

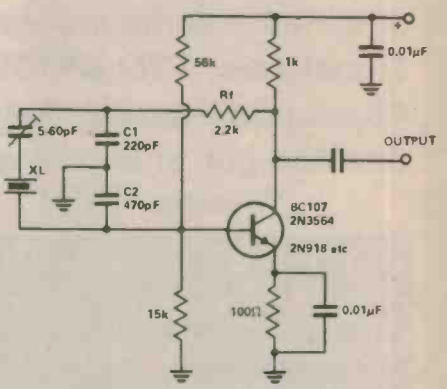
Only common and +5 V supply are the other connections necessary.

Crystal specifications

No specifications were given in the original article for the crystal. Not all crystals are the same. The following set of specifications is recommended.

Frequency:
4.0000 MHz
Manufacturing tolerance:
+/- 20 ppm
Temperature tolerance:
+/- 20 ppm,
-10 to +55°C
(or 0 to +60°C)
Load capacitance:
32 pF (or 30 pF)

The crystal can be obtained in either the HC6/U (13 mm pin spacing) or the smaller HC18/U package – the latter is preferred for space reasons. Either pins or flying leads may be ordered for the crystal connections. ●



The assistance and cooperation of John Rileagh, of JR Components, in preparing these notes on the ETI 140 DFM is greatly appreciated.

SAVE A FORTUNE

YES! Dick has torn the bottom out of semiconductor prices.
Our incredible buying power has let us drop the prices on 60% of our wide range of semis – some are up to 70% off our '79 catalogue price!
Transistors, TTL, CMOS, LEDs – all reduced to the lowest prices ever!
All are prime spec & factory fresh. Combine that with these incredible prices, and this has got to be the greatest semiconductor sale ever. Our bulk buying power means *YOU REAP THE BENEFIT!*

TRY THESE FOR STARTERS:

DS547/8/9 small signal transistors	14¢ea	Large red LEDs	16¢ea
Motorola 2N3055 power transistor	93¢ea	4001 CMOS ICs	24¢ea
741 Op Amps	34¢ea	1N914/1N4148 signal diodes	5¢ea

LINEAR ICS

		WAS	NOW
Z-6020	CA3028A	3.75	1.82
Z-6025	CA3130T	2.50	1.80
Z-6040	LM301	1.05	.33
Z-6045	LM308	2.75	.88
Z-6055	LM339	3.57	.73
Z-6080	LM380	2.00	1.48
Z-6081	LM381	3.52	1.93
Z-6082	LM382	2.80	1.90
Z-6090	LM1808		1.00
Z-6100	LM3900	1.75	.93
Z-6105	uA4136	1.95	1.88
Z-6109	LM3909	1.50	1.08
Z-6130	MM5837		1.50
Z-6132	MN3001	13.50	13.50
Z-6145	NE555	.40	.34
Z-6146	NE556	2.75	.84
Z-6180	OM321	15.00	14.80
Z-6190	OM802	2.50	1.20
Z-6230	SAK140	3.10	2.28
Z-6250	SL440		9.84
Z-6270	TCA220		2.90
Z-6290	UAA170	3.80	3.75
Z-6292	UAA180	3.80	3.75
Z-6352	uA709	1.00	.78
Z-6360	uA723 TO-5	1.20	1.14
Z-6362	uA723 DIL	1.00	.49
Z-6370	uA739	2.75	2.43
Z-6380	uA741 TO-5		.15
Z-6382	uA741 DIL	.60	.34
Z-6510	1310		1.50
Z-6520	ZN414		3.95

VOLTAGE REGULATORS

		WAS	NOW
Z-6542	LM317	4.50	2.90
Z-6543	LM341P5 5V ½A	1.15	.93
Z-6545	7805 5V 1A	1.25	1.05
Z-6552	7812 12V 1A	1.25	1.05
Z-6554	7815 15V 1A	1.25	1.05
Z-6555	7905 5V 1A NEG	1.75	1.68
Z-6556	7912 12V 1A NEG	1.75	1.68
Z-6557	7915 15V 1A NEG	1.75	1.68

ZENERS

400mW all values 16¢ ea
1W all values 29¢ ea
10W all values $1.75 ea.

TRANSISTORS

		WAS	NOW
Z-1054	AC126		.55
Z-1060	AC132		.70
Z-1062	AC127		.80
Z-1064	AC128		.80
Z-1080	AC187		.80
Z-1082	AC188	.95	.82
Z-1110	AD161	1.75	1.65
Z-1112	AD162		1.75
Z-1134	AF116		1.20
Z-1138	AF118		1.50
Z-1160	ASZ15 OC28		4.75
Z-1168	ASZ18 OC36		4.75
Z-1241	BCY71		.95
Z-1242	BCY72		.75
Z-1300	DS547/BC547	.25	.14
Z-1308	DS548/BC548	.25	.14
Z-1319	DS549/BC549	.27	.14
Z-1329	BC109C/BC549C	.49	.34
Z-1340	DS557/BC557	.33	.17
Z-1348	DS558/BC558	.33	.17
Z-1359	BC159/8C179	.30	.17
Z-1370	BC186		.77
Z-1380	BC635	.82	.44
Z-1382	BC636	.85	.44
Z-1388	BC639	.75	.34
Z-1389	BC640	.75	.19
Z-1443	BD139	.95	.32
Z-1444	BD140	.95	.32
Z-1460	BD262	1.92	1.26
Z-1462	BD263	1.92	1.26
Z-1470	BD266A		1.50
Z-1500	BFW11	1.75	1.49
Z-1560	BF115	.90	.64
Z-1590	BF173/BF199	1.00	.89
Z-1596	BF177/BF336	1.50	.87
Z-1598	BF178/BF336	1.50	.94
Z-1599	BF179/BF337		1.60
Z-1602	BF180	1.20	.73
Z-1604	BF184		1.00
Z-1608	BF185		.85
Z-1630	BF200		1.25
Z-1750	CL33		1.00
Z-1752	CL34		.90
Z-1780	D13T1/2N6027	1.54	.49
Z-1786	DS2646/2N2646	1.20	.93
Z-1800	MJ2955 TO3	1.15	.93
Z-1804	MJ3055/2N3055	1.15	.93
Z-1832	MPF102 FET	.80	.59
Z-1833	2N4342 P-Ch. FET	1.50	1.18
Z-1834	MPF103/2N5457	.85	.73
Z-1836	MPF104/2N5458	1.10	.49
Z-1838	MPF105/2N5459	.65	.58
Z-1840	MPF106/2N5485	.70	.58
Z-1848	MPF31/MPF121		1.50
Z-1874	MU9660		.50
Z-1920	OCP71 PHOTO		.90
Z-1930	OC26/AD149	2.50	2.15
Z-1932	OC44		.95
Z-1936	OC45		.50
Z-1941	OC71		.75
Z-1942	OC72		.75
Z-1944	OC74		.75
Z-1945	OC75		.50
Z-1950	FPT100 PHOTO	2.00	1.38
Z-1952	MEL12 PHOTO		2.50
Z-2005	TIP2955 TO220	1.53	.93
Z-2008	TIP3055 TO220	1.50	1.18
Z-2020	TIP31	.95	.79
Z-2024	TIP32	1.00	.79
Z-2064	2N4030/TT800		1.00

		WAS	NOV
Z-2068	2N3019/TT801		1.00
Z-2126	2N301	3.00	2.30
Z-2130	2N3053/BFY50	.80	.53
Z-2140	2N3054/40250	1.70	.88
Z-2145	2N3055	.95	.83
Z-2180	PN3563/2N4292	.80	.30
Z-2182	2N3564	.60	.29
Z-2184	2N3566	.70	.29
Z-2186	2N3567	.70	.29
Z-2190	PN3569/BC337	.71	.23
Z-2242	BC328/2N3905	.60	.17
Z-2246	2N3640	.60	.28
Z-2250	PN3642/BC337	.49	.19
Z-2252	PN3643/BC338	.60	.17
Z-2254	2N3644/BC327	.55	.19
Z-2256	PN3645	.60	.25
Z-2320	PN4250	.80	.35
Z-2326	PN4258	.60	.32
Z-2340	2N5484	2.75	.58
Z-2390	2N5590 RF 15W	8.50	8.48
Z-2391	2N5591 RF 30W	11.50	11.48
Z-2394	2N6084 RF 45W	19.75	16.20
Z-2420	2N706A		.50
Z-2480	2SB337		1.00
Z-2484	2SB367		1.00
Z-2500	2SC1096		1.50
Z-2501	2SC1306		4.50
Z-2502	2SC1307		6.50
Z-2503	TA7205P		4.50
Z-2504	TA7214P		7.00
Z-2560	40327		1.98
Z-2580	40408		2.75
Z-2582	40409		3.30
Z-2584	40410		3.30

THESE PRICES APPLICABLE UNTIL 31st AUGUST 1979

ON SEMIS!

DS548 — 14c!

ALL PREVIOUS PRICES ARE AS LISTED IN OUR 1979 JUMBO CATALOGUE.

DIODES

		WAS	NOW
Z-3030	OA90	.30	.09
Z-3040	OA91	.25	.18
Z-3050	OA95	.30	.18
Z-3060	BA100	.35	.34
Z-3070	BA102 VARICAP	.65	.43
Z-3090	OA200	.35	.34
Z-3100	OA202	.35	.34
Z-3120	1N914/1N4148	.12	.05
Z-3202	1N4002/EM401	.15	.06
Z-3204	1N4004/EM404	.15	.08
Z-3207	1N4007/EM410	.30	.14
Z-3222	1N5404	.45	.38
Z-3228	1N5408	.65	.43
Z-3230	HP5082-2800	2.90	2.88
Z-3232	OA47	.45	.38
Z-3240	MR110		.90
Z-3244	MR410		1.20
Z-3260	BYX21L/200	2.20	1.90
Z-3262	BYX21L/200R	2.20	1.90
Z-3300	WO2 BRIDGE	1.00	.58
Z-3304	WO4 BRIDGE	1.00	.68
Z-3326	PA60 BRIDGE		4.75
Z-3334	PB40 BRIDGE	4.75	3.48

LEDS & DISPLAYS

		WAS	NOW
Z-4010	LEO Small red	.22	.20
Z-4020	LED Small green	.60	.28
Z-4030	LED Large red	.22	.16
Z-4032	LEO Large green	.55	.28
Z-4034	LED Large yellow	.55	.34
Z-4036	LED Large orange		.55
Z-4038	LEO Large clear/red		.55
Z-4040	LED Rect. red		.65
Z-4042	LEO Rect. green		.65
Z-4103	LT303 display CC		1.50
Z-4110	DL704 display CC	3.25	2.30
Z-4117	LT302 display CA		1.50
Z-4127	OL747 display	3.50	3.48
Z-4147	FND70 display		1.75
Z-4150	FNO500 display	2.95	1.35
Z-4160	HP-5082-7663 display		4.50
Z-4163	MAN3 display		.50
Z-4165	4 digit display FCS824		4.95
Z-4170	8 digit LCO		3.75

CLOCK CHIPS & MISC

Z-6814	MM5314	5.90	5.80
Z-6821	CT7001		6.50
Z-6830	TMS3834		8.90
Z-6832	AY-3-8112		17.50
Z-6848	AY-3-8500		3.75
Z-6852	AY-3-8600		15.00
Z-6854	AY-3-8760		19.50
Z-6856	AY-3-8710		17.50

MICROPROCESSOR

		WAS	NOW
Z-9201	2650 CPU	25.00	20.00
Z-9202	MM5740AAF	21.50	15.98
Z-9204	S1883 UART	5.90	5.25
Z-9206	2513 CHAR. GEN.	12.50	12.48
Z-9302	2102 RAM	2.70	1.30
Z-9304	2112 RAM	4.90	2.25
Z-9306	2114 RAM	7.90	7.30
Z-9308	MM5204 EPROM	19.75	12.60
Z-9309	PIPBUG ROM		19.75
Z-9310	4116 RAM	24.50	17.00

SCRS & TRIACS

		WAS	NOW
Z-4310	C103B SCR	1.95	1.38
Z-4315	C106Y1 SCR	1.00	.48
Z-4320	C106D1 SCR	1.50	.73
Z-4330	C122D equiv. SCR	1.95	1.28
Z-4332	C122E SCR	2.70	1.58
Z-4354	C164D SCR		3.25
Z-4358	C168D SCR		4.95
Z-4510	SC141D TRIAC	2.00	1.28
Z-4520	SC151D TRIAC		2.75
Z-4710	BR100 DIAC		1.00
Z-4740	ST4 TRIGGER	1.10	.50
Z-4760	V413 DIAC		1.65

OPTO

		WAS	NOW
Z-4800	ORP12 LOR		1.45
Z-4802	DSE12 OOUBLE LOR		.75
Z-4804	4N28 OPTO COUPLER	1.50	1.08

CMOS

		WAS	NOW
Z-5600	4000	.39	.27
Z-5601	4001	.39	.24
Z-5602	4002	.39	.24
Z-5606	4006	2.00	1.36
Z-5607	4007	.39	.24
Z-5609	4009	.89	.47
Z-5611	4011	.39	.24
Z-5612	4012	.46	.24
Z-5613	4013	1.00	.53
Z-5614	4014	1.75	1.20
Z-5616	4016	1.00	.49
Z-5617	4017	1.75	.92
Z-5618	4018	1.75	1.32
Z-5620	4020	1.85	1.48
Z-5621	4021	1.75	1.15
Z-5622	4022	1.65	1.48
Z-5623	4023	.39	.24
Z-5624	4024	1.35	.73
Z-5625	4025	.39	.28
Z-5627	4027	1.00	.60
Z-5628	4028	1.50	1.20
Z-5629	4029	1.35	1.28
Z-5630	4030	.70	.38
Z-5649	4049	1.00	.38
Z-5650	4050	1.00	.43
Z-5651	4051	1.35	.82
Z-5668	4068	.55	.33
Z-5671	4071	.39	.24
Z-5681	4081	.39	.27
Z-5710	4416	.80	.74
Z-5715	4426	2.50	2.48
Z-5720	4449	.55	.43
Z-5730	4511	1.75	1.05
Z-5740	4518	1.95	1.05
Z-5742	4520	1.95	1.05
Z-5748	4528	2.00	1.28
Z-5781	5369AA	2.50	2.48
Z-5782	MC14553	11.55	6.50
Z-5784	S50242		14.00
Z-5410	74C00	.50	.34
Z-5412	74C02	.30	.34
Z-5413	MC14584/74C14	1.60	.50
Z-5414	74C926	6.50	4.50
Z-5415	MC10116L		1.95
Z-5416	ICM7217		16.00
Z-5417	CA3140E DIL	2.50	1.48
Z-5418	0S8629N		6.50

TTL

		WAS	NOW
Z-4900	74LS00	.42	.23
Z-4901	74LS01	.42	.28
Z-4902	74LS02	.42	.23
Z-4904	74LS04	.45	.28
Z-4908	74LS08	.42	.28
Z-4910	74LS10	.42	.23
Z-4920	74LS20	.42	.28
Z-4930	74LS30	.42	.28
Z-4973	74LS73		.65
Z-4974	74LS74		.36
Z-4976	74LS76	.72	.42
Z-4985	74LS85		1.35
Z-4990	74LS90		.50
Z-4992	74LS92	1.00	.96
Z-4993	74LS93	1.00	.94
Z-4995	74LS95	1.40	1.28
Z-4997	73LS123		.82
Z-5010	7400	.45	.23
Z-5011	7401	.45	.23
Z-5012	7402	.45	.23
Z-5013	7403	.45	.25
Z-5014	7404	.45	.26
Z-5015	7405	.45	.28
Z-5018	7408	.45	.28
Z-5019	7409	.45	.28
Z-5020	7410	.45	.23
Z-5023	7413		.45
Z-5024	7414	2.20	.84
Z-5030	7420	.45	.24
Z-5035	7430	.45	.28
Z-5040	7437	.88	.44
Z-5042	7440	.49	.28
Z-5043	7441AN	1.65	1.36
Z-5044	7442	1.32	.66
Z-5047	7447	1.80	.93
Z-5050	7450	.49	.33
Z-5051	7451	.49	.33
Z-5053	7453	.49	.33
Z-5054	7454	.45	.28
Z-5060	7460	.45	.33
Z-5070	7470	.70	.62
Z-5073	7473	1.10	.58
Z-5074	7474	1.10	.34
Z-5075	7475	1.32	.48
Z-5076	7476	1.10	.42
Z-5083	7483		1.76
Z-5085	7485	2.20	1.10
Z-5086	7486	.88	.38
Z-5090	7490	1.00	.48
Z-5091	7491	1.54	.73
Z-5092	7492	1.10	.62
Z-5093	7493	1.10	.56
Z-5095	7495	2.42	.73
Z-5096	7496	2.00	.90
Z-5250	74107	1.10	.46
Z-5260	74121	.80	.48
Z-5263	74123	1.90	.74
Z-5265	74141	3.20	1.20
Z-5269	74191	3.50	1.36
Z-5270	74192	2.50	.90
Z-5280	74193	1.75	.83
Z-5282	74LS14	2.20	.88
Z-5284	74LS138	2.90	1.12
Z-5350	9001		2.20
Z-5354	9368		3.52
Z-5360	95H90		12.50
Z-5364	11C90		9.85

SEE OUR OTHER ADS FOR STORE ADDRESSES AND MAIL ORDER DETAILS

NOTE: THESE ARE ONE-OFF PRICES – NOT BULK PRICES. DONT BUY "DISCOUNT" PACKS YOU DON'T NEED

'THE S100 BUS STOP' TM

HARDWARE

CPU BOARD

Z80 at 4MHz with power on jump, wait states on all cycles, Z80 or 8080 I/O addressing mode, provision for on board 2708 eprom, DMA grant tri-states all signals from board.

RAM BOARD

16K, 2114's, low power, 450nS that will work at 4MHz with no wait states, 4K addressing with write protect.

PROM BOARD

16K, 2708, wait states, 8K or 16K boundary addressing.

I/O PORT BOARD

9 parallel and 1 serial, link select for TTY, CRT or TTL outputs, Xtal controlled baud rate generator, 9600 to 75 baud, patch area to flat cable connectors.

FLOPPY DISK CONTROLLER BOARD

Can control up to 4 8" or 4 mini drives single or double sided, IBM 3740 soft sectored, 34 & 50 way edge connector on top of board for direct interface to full or mini drives, suits Shugart, Persci, MFE & CDC drives plus others.

CARD CAGE

11 slot mother board, 15 amp power supply, cooling fan 90 CFM, key switch for power on, bench mount and rack mount (illus), all anodised aluminium.

SME MICROCOMPUTER SYSTEMS *UNDER $1,000*

DEALER: The Byte Shop, 29 Colbee Crt, Phillip, ACT. 81-5011.

SOFTWARE AND FIRMWARE

Monitor Prom 2708 Z80 16 functions, **Disk Bios Prom** for CP/M boot up; **Disk Test Prom** with random read/write, format, read & write to sectors etc; **ETI 640 Driver Prom** (Z80). All proms supplied with listings and instructions, Std. versions $25 ea. Customised versions $30 ea.

DISK SOFTWARE

Customised CP/M disk operating system, E-Basic, Microsoft 16K Basic, Fortran, Cobol, CP/M users group, text editor, assemblers, symbolic instruction debugger, disassemblers, general ledger, disk copy, ram test.

PRICE

Of typical system with 16K Ram, Prom Board, Port Board, Z80 CPU, Card Cage, Assembled & Tested $1250.00, Kit Price $993.00.

Disk System: with 2 x 8" drives and controller $1319. With 1 x 8" drive and controller $739.

NOTE: Card Cage is available in 6800 version with 10 amp reg. supply.

SPECIAL

90 CFM 240V Muffin Fan 4½" square $24.00. Power Transformer 8V at 15 amp 2 x 16V at 1 amp $24.00.

ETI 642 S100 16K STATIC RAM

16K, 2114 Low Power chips 1.2 Amps typ. for 16K, 300 or 450 nS, 4K addressing, 4K Write Protect switches, Bank Select, Wait states, plated thru holes, solder mask, see Feb. ETI project for details. **KIT $299. P&P $5. ASSEMBLED & TESTED $366 plus $5 P&P Reg. mail.**

S100/6800 CHASSIS

Now with 15 amp power supply!

11 slot backplane, fully card guided, 15 Amp power supply, fan, key switch, bench mount, rack mount, anodised alum. Sent FOB IPEC Transport. **BASIC BENCH MOUNT $189. BASIC RACK MOUNT $166. ACCESSORIES KIT $46. S100 POWER SUPPLY $79. 6800 REGULATED POWER SUPPLY $104.**

S100 I/O PORT BOARD

9 Parallel ports (programable), 1 SERIAL PORT — TTY — RS232 — or TTL. BAUD rate generator 9600 to 75. Fully address decoded, Low Power buffers, Plated thru holes, solder mask. **KIT $164, A&T $189. P&P $3.**

- S100 Cassette Board available soon.
- S100 16K Eprom board kit..$90 plus $3 P&P
- S100 Z80 CPU board kit...$149 plus $3 P&P
- S100 FLOPPY DISK CONT. kit $159. P&P $3
- S100 ACTIVE TERMINATION BOARD.....$33
- S100 11 slot Backplane.....$36
- S100 100 way connecter.....$8.00
- S100 WIRE WRAP board.....$28.50
- S100 Extender board kit.....$28.50
- NUMBER CRUNCHER KIT.....$49.50
- PAPER TAPE READER KIT.....$69.50
- FRONT PANEL DISPLAY KIT.....$87.50
- 8080 SINGLE STEP CONTROL.....$21.65
- Muffin Fans 240V — Special.....$24.00

UV EPROM ERASERS

New product range, Model LEE/T 15W tube, 20 min. timer, up to 40 EPROMS, will erase in 10/15 mins. Model MEE/T 8W tube, 20 min. timer, up to 10 EPROMS will erase in 20/30 mins. Model MEE is the same as MEE/T but with no timer. All erasers are fully assembled and have a safety switch. **LEE/T $105, MEE/T $93.50 MEE $76.00**

- **DISK DRIVES**
  - SHUGART SA400.....$375 P&P $5
  - SHUGART SA800.....$608 P&P $5
- **6800 PRODUCTS**
  - 6800 Active Termination Board.....$33.00
  - 6800 Extender Board.....$28.50
  - 6800 11 slot backplane.....$36.00
  - 6800 11 slot chassis (basic).....$166.00
- **EPROMS & RAM CHIPS**
  - 2708 450 nS GUARANTEED.....$12.00
  - 2716 450 nS single supply.....$47.50
  - Hitachi 2114 Low Power 450 nS "Super-Rams", 4MHz.....$8.50

Send 60c in stamps for COMPUTER PRINTOUT CATALOGUE for more details.

ALL PRODUCTS AUSTRALIAN MADE AND EX STOCK (ALMOST). DEALER ENQUIRIES WELCOME

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BUILT & TESTED POA. ALL PRICES ADD 15 PERCENT S/T IF APPLICABLE.

Print-out

Sydney Home Computer Show

May 24th-27th saw lots of hectic (if not frantic) activity at Lower Sydney Town Hall as the Sydney Home Computer Show came to town. Twenty-six companies exhibited the latest goodies, both locally designed and manufactured, and fully imported. An estimated 15000 people passed through the Show during the four days it was on. All seemed to have a great time pressing buttons, having their handwriting analysed by computers or portraits computer-printed on paper or T-shirts!

Here's a brief rundown on the companies that attended and the equipment exhibited:

Anderson Digital Equipment; Australian agents for the Compucolor II models 4 and 5 computers. These machines offer up to 32 Kbytes of user workspace with Extended BASIC in ROM, available with either single or dual floppy disks. Full colour graphics is possible with up to eight foreground and eight background colours. ADE also handle the Houston Instrument HI PLOT low cost personal computing plotter.

TCG Systems Automation Pty Ltd showed the Ohio Scientific range of computers, ranging from the Challenger 1P to the C3. The latter is expandable to a disk-based multi-user system. Many of these systems utilise BASIC in ROM, and are ideal low cost systems for the beginner and allow later expansion.

Automation Statham are Australian importers of Processor Technology Sol computers, as well as the Morrow/Thinker Toys range of boards. On their stand they demonstrated the Sol computer with Helios II disk drive running the Word Wizard text editor package, a remarkable piece of software.

Tandy took up four stands with a very comprehensive display centred around the TRS-80. Tandy have backed up this system very well indeed, their technical manual for the TRS-80 being a good example of well prepared material.

B & S Micro Applications presented the first public showing of their MAP 2S computer system. Based on the 2650, this unit runs a fast (compiled) BASIC, similar to Microsoft BASIC, and is supplied with 10 K of RAM and 10 K of ROM as standard. The MAP 2S includes a keyboard and VDU, as well as a cassette interface.

Hard at it on the Tandy stand

Futuretronics Australia put on their usual impressive (and loud) display of electronic games, including the Chess Challenger 7 which took the honours in the first Australian Computer Chess Championship. The Atari Video Computer System, also on display, offers enough variety to keep any kid (of any age) amused for hours, if not days.

The Strand Electric Division of Rank, distributors of Motorola microcomputer products, displayed a comprehensive range of hardware, including the EXORciser II development system and the EXORterm VDU. Motorola data books and information were also available at their stand.

The main attraction of **Warburton Franki's** stand was the Heath(kit) H8 and H11 computer systems, which were running with their optional disk drives. Also on display were the ET-3400 microprocessor trainer and the Paratronics range of logic state analysers.

The Sord range of computers are available in Australia from **Mitsui and Co**. These Z-80 based micros are S-100 compatible, particularly suited to small business applications. The Sord M-100 is specifically designed for hobbyist use, however, and includes such novel features as a loudspeaker for music generation.

Pickwell & Co. displayed a range of products for graph and chart-type planning. These are particularly useful in project management, such as large software projects.

Programmable Calculator Systems and Sales are primarily concerned with small business applications of microcomputers, including the Canon AX-1, an integrated desk-top computer system which meets the needs of many small businesses. Also on this stand were **Calculator Imports (Aust.) Pty Ltd** who demonstrated the Vector MZ computer with a Computalker speech synthesizer and high resolution graphics.

Computerland are the distributors for the well-known Apple II desk-top computer. They had some amazing demonstrations of the high resolution graphics capabilities of this machine, as well as a system connected to a Summagraphics Bit Pad to digitize handwriting and provide a character analysis on that basis, work out your biorhythms, etc.

Hanimex, of camera fame, have got a couple of interesting new products: the Commodore PET and the Lexicon Electronic Language Translator. The PET is a very well known home computer, and has previously been reviewed in these pages. The Lexicon is designed to turn a holiday abroad into a transport of delight by electronically translating such useful phrases as 'Waiter, please deliver a bottle of champagne and my card to that delightful young lady in the pink dress at the next table'. ▶

Can You Assist?

Although the Sydney Home Computer Show was generally considered to be a great success, it wasn't so good for the Microcomputer Enthusiasts' Group. Sometime during Thursday night or Friday morning (24th & 25th May), while the Show was closed to the public, two Sanyo VM9T video monitors were stolen from MEG's stand on the stage. These are 230 mm (nine-inch) monitors, finished in creamy grey, without handles, and the serial numbers are 13801112 and 13801135.

The monitors are worth around $200 each, and are the property of one of the club members, who would obviously like them back. If you have any information, or someone tries to sell them to you, contact Sydney Central Police Station.

SYSTEM B

$5,895 + $587 sales tax

The VECTOR **MZ** is a compact, attractive, yet powerful microcomputer storing 49,152 bytes of usable memory. For mass storage, Micropolis double density floppy disk drives are used each holding 315,000 bytes. If more capacity is required the VECTOR **MICRO STOR** may be adapted to give a total disk capacity of 1,260,000 bytes on line. The **MZ** comes standard with Micropolis disk **BASIC** using 23K, although many software options are available. eg. CP/M — C BASIC 2, COBOL and FORTRAN.

The VECTOR **MT** video terminal receives its power from the MZ, driven by the VECTOR **FLASHWRITER** video board and two special PROMS on the 12K PROM/RAM. The MT has a typewriter keyboard, 10-key numeric pad and video screen which is available in 16 line by 64 display or 24 x 80. Many features include U/L case, reverse video, paging & scrolling, cursor motion, block and line graphics, etc.

The MZ and MT are designed to interface directly to give the VECTOR GRAPHIC **DEVELOPMENT SYSTEM**, which has enough capacity for interactive programming adaptable to nearly all applications.

The VECTOR **MEMORITE** word processing system is an automated typing and editing system. Text is typed at the MT keyboard and immediately displayed on the screen. At the same time it is memorized by the machine. The text may then be modified without retyping it. It can be stored on magnetic diskette and later retrieved for further changes. At any time, drafts of the text can be printed on the **QUME** bi-directional 55ch/sec. daisy wheel, letter quality printer. The document can be modified and reprinted as many times as desired. As a general purpose office machine, the MZ hardware is also used for all standard business Data Processing.

VECTOR GRAPHIC from A.J.&J.W. Dicker Pty.Ltd.

24 Woodfield Blvde., Caringbah. 02 525 5639

AJF Systems and Components demonstrated the Sol computer system, as well as Texas Instruments' wide range of calculators and related products, such as the 'Speak and Spell'. AJF are also agents for Intel, and showed the SDK-86 System Design Kit, based on the 8086 microprocessor.

The Altos Sun series of computers are cost-effective small business computers based on the Z-80 microprocessor. **The Dindima Group,** who represent them in Australia, are able to offer software to suit Australian conditions for business applications, as well as word processing and text formating programs.

AJ & JW Dicker offered the Vector MZ microcomputer, together with accounting and word processing software. The Memorite word processor is particularly powerful, with its on-screen editing features.

Informative Systems, a Melbourne-based supplier of Cromemco computer systems showed a Z-80 based system that can support up to eight terminals simultaneously, is able to address up to 512 Kbytes of memory, and is backed up with comprehensive software, including FORTRAN and COBOL.

Semcon Microcomputers have designed a range of EXORciser-compatible boards, including a multiprocessor CPU board and an extremely versatile VDU board. A particularly impressive demonstration at the show featured a new debugging monitor which displays the CPU register contents, movements of the program counter through program memory, and the contents of the stack. A very neat system indeed.

Economic Digital Control have just released a line of 'Teach Yourself' computers specifically intended for the beginner. They have also a complete office data system including software for $7700. EDC also import the Jade range of computer boards, including a nice floppy disk controller.

Transdata Pty Ltd, from Gloucester NSW, displayed their ViewData and Data 650 systems, based on the 6502 processor. The first system is basically a super-smart terminal with 4K of RAM and BASIC in ROM, while the second is based either on cassette bulk storage or Micropolis disk drives.

Dick Smith was there, of course, showing the Exidy Sorcerer. This home computer is extremely powerful, utilising plug-in ROM packs to virtually reshape the machine, and even offers programmable graphics characters. Interestingly, Dick is now selling memory upgrade kits for the TRS-80 — look out Tandy!

ASP Microcomputers supply a complete system for business use, but did a roaring trade in computer portraits and T-shirts on their stand. Also on the ASP stand — a Selectric typewriter conversion kit, and the Malibu Design Group 160 cps bidirectional dot matrix printer.

Micropro Design showed their MicroCon programmable controller which is based on a 6500 series microprocessor. A simple interpretive language permits easy programming of the device for control applications. Micropro also displayed their 1610EM printer interface for Diablo printers and a 2758/2716 EPROM programmer.

Microprocessor Applications were mentioned in Printout last month as the Australian representatives for the Versatile 4 microcomputer system. This small business system integrates a VDU, keyboard, processor and dual disk drives into one package, and is available with a complete software package.

The Australian Computer Society had a stand in order to answer questions about membership and distribute pamphlets and booklets on careers in the computer industry.

ETI was there of course. We demonstrated a Z-80 system which will be appearing soon as an ETI project. We also had the binary-hex trainer as well as the ETI 641 printer, and our logic state analyser. We particularly enjoyed meeting those readers who stopped for a chat and only apologise that we were getting rather hoarse towards the end of most days!

Overall, the show was considered a great success. The **Sydney Microprocessor Enthusiasts' Group,** who had a display on the stage, signed up 27 new members on the spot. We are unable to comment on the success of the lecture streams, as we were rather tied to the stand and weren't able to attend.

A great success — we must do it again sometime!

Australian Computer Society forms MICSIG

A Microcomputer Special Interest Group has been formed by the Australian Computer Society — or, for those who revel in acronyms, ACS MICSIG.

The group will meet on the second Tuesday of each month at 7.30 pm in the Seminar Room, Oliphant Building, ANU (Canberra). All enquiries should be addressed to **The Registrar, MICSIG, c/o PO Box 446, Canberra City, ACT 2601.** Members will receive copies of the Microcomputer Journal.

ANNOUNCING THE SORD

PERSONAL BUSINESS COMPUTER M100 SERIES FROM JAPAN

NEW

FOR THE BUDGET CONSCIOUS

M180 — $2700
- INCLUDES ALL features of M170B and:
- Floppy disk controller for 3 disk drives
- One drive double density 143KB (up to 3 drives)
- Total of 48KB of memory
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M190 — $3100
- Includes all features of M180 and:
- Color Graphics controller for color use

- **With business Software at slightly extra cost**
  - — Debtors
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M110A MODEL $985.00
- CPU Z80
- Memory: 4K ROM (Max 8K) 16K RAM (max 32K)
- Full ASCII Keyboard & 20 BASIC command keys
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- S100 bus signal edge connector

M110B model $1281.00
- Same as above plus an additional 16K of RAM

M170A $1525.00
- Includes all of M110A model
- Green colour TV monitor (24 lines x 64 characters)
- one cassette unit
- power supply box

M170B $1825.00
Same as M170A model plus an additional 16K of RAM

OPTIONS
- **See M180 & M190 models**

SOROC

SOROC IQ120
- Cursor Control Keys
- Numeric Key Pad
- Line and page erase.
- Addressable Cursor
- Switch selectable Transmission from 75 to 19,200 bps
- Communication mode: **HDX/FDX/Block**
- Interfaces: Printer Interface/RS232 Extension
- RS232C Interface
- Non-glare read out screen
- Protect mode
- Tab

$1245

SOROC IQ140
- A price/performance breakthrough in professional terminals. All the capabilities of the IQ120, plus a score of user oriented features. Screen edit, status-mode conversion, wrap around insert/delete, reverse video are just a few. Controllable from 16 function keys on the detachable keyboard. Limited availability! SO **ORDER NOW!**
- **Status-mode indicator line on screen**
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- **Switch-selectable band rates 110-19 200**
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- **Polling capability optional**

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Computers for primary school kids

Canberra primary school children will soon be able to gain computing experience using two TRS-80 machines donated by the Canberra branch of the Australian Computer Society.

The computers will be used at the Campbell Mathematics Centre to teach computing to children in classes 4 to 8. Children will be taught an elementary programming language and given simple problems to solve on the computers.

Campbell Mathematics Centre was chosen for this purpose as it offers facilities to all schools, public and private, in the Canberra district.

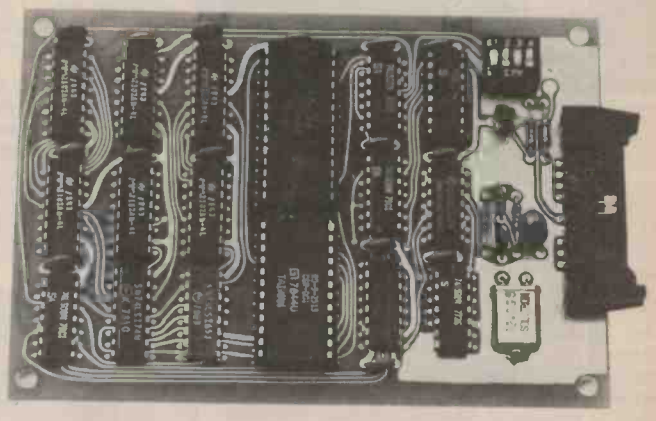
Other projects which the Canberra ACS hope to use the machines for include: demonstrations at school careers presentations and P and C meetings; loans to school classes for longer periods for further study and 'mentor' schemes where computing professionals assist individual teachers or students in computer studies or career advice.

Schools wishing to borrow the machines should write to the Branch Secretary, PO Box 446, Canberra City, ACT 2601.

Computerland software contest judging

A number of delays have prevented us from completing the judging of this contest in earlier issues, and, at press time judging was still in progress.

However, we entreat you enthusiastic souls to be patient a little longer as we hope to announce the winners in the August issue. Hang in there!



Cheap VDU

If you're in the market for a cheap VDU, check out the VIB-1000 now available from Embryonic Systems.

Based on the Thomson-CSF SFF96364 CRT controller chip, the VIB-1000 offers a 64 character 7 x 5 ASCII character set, and responds to erase page & cursor home, cursor home, erase to end of line & cursor return, cursor return, cursor left, cursor right, cursor up and cursor down commands. Automatic scrolling is provided, as well as a roll screen command.

The 16 line by 64 character display is accessed through an eight bit parallel interface, and the device produces standard composite video output with selectable positive/negative video and synch. The circuitry runs off a single 5V supply and is compact enough to fit into your keyboard enclosure.

Also available are the VIB-2000 and VIB-3000. The first adds foreground and background video modes, screen protect and ready-busy handshake. The latter has all the features of the VIB-2000 plus screen read capability.

SA Micro Group

Up to date information on the South Australian Microprocessor Group, Inc.

Meetings are held at Thebarton High School, Ashley St., Thebarton, and further details are available from: The Secretary, SA Microprocessor Group, Inc, PO Box 113, Plympton, SA 5038. Their club newsletter is a good example of how these things should be done and certainly shows the club to be active.

BUILD A COMPUTER KIT AND SAVE

KB05 FULLY ENCODED KEYBOARD

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

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

EA2650 STARTERS KIT

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

EA2650 starters kit $65.00

EA LOW COST VDU SELLOUT!

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

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

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

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

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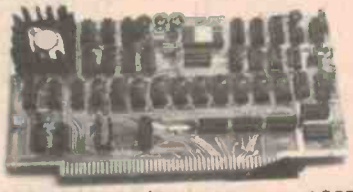
(9 to 5 Mon. to Sat.)

DG640 VDU ON S-100 BUS

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

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

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



DG640 kit $149.50 (PCB with manual $35.00)

EUROCARD 2650 SINGLE BOARD EXPANDABLE 2650 COMPUTER

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

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

DB1008 8K STATIC 2114 RAM

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

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

EPS100 ECONOMY POWER SUPPLY

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

EPS100 power supply kit $60.00

ET1632 UART/BAUD RATE GENERATOR

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

632U with full instructions $18.50

ETI 630 HEX ENCODER/DISPLAY

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

ET1630 HEX DISPLAY $14.50

SECI CASSETTE INTERFACE

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

SECI Cassette interface kit $24.50

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

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

DB1048 ROM Board/Cassette interface $130.00

Microprocessor-based universal controller

Phil Cohen reviews the Microcon, a 'teach yourself' microcomputer designed both as a learning system and a practical programmable controller having many applications.

WHAT DO YOU WANT to do with your computer? If all you need is a few digital inputs and outputs and a lot of timing and sequencing which is easy to program, then perhaps this might interest you.

The MicroCon, designed and produced by MicroPro Design P/L, was originally intended as a programmable controller for industrial applications. However, it was soon realised that it had great potential as a learning aid, home appliance controller and a host of other things.

The basic idea behind it is that most people don't need to use the full power of a fast MPU. For most control applications, the controller has seconds — sometimes minutes — to 'think' in. It's only when the microcomputer is configured with an operating system that speed differences become noticeable

Similarly, the full, awesome instruction set of something like a Z-80 is far too much to have to learn and understand just to turn a light on and off or control an air-conditioning system.

Finally, the thought of all those boards and wires running in various directions, carrying handshakes and other mysteries is enough to make even the hardened engineer think twice.

The solution:

A single printed circuit board, holding all the hardware necessary to form a versatile and fairly powerful controller, along with a fair amount of digital input and output and the means for entering programs in a simple language.

Hardware

The MicroCon measures 115 x 230 x 25 mm and needs -12 V @ 100 mA, + 12 V @ 100 mA and 5 V @ 1 A. The front panel consists of a keypad and a four-digit seven segment display. The I/O consists of eight TTL inputs and eight TTL outputs, all fully decoded on the board.

Fine, you connect all the inputs and outputs of the system you want to control to the TTL at the back, then program and debug using the front panel. After you have produced a working program, you can have it blown into a PROM and insert the PROM IC into the socket which is provided on the board.

You will then have a completely de-bugged system which is 'dedicated' to control the system you were working on. That could be anything from a chemical plant to your hi-fi — the TTL inputs could easily be connected to push-buttons on a front panel somewhere, allowing you to give commands to the machine.

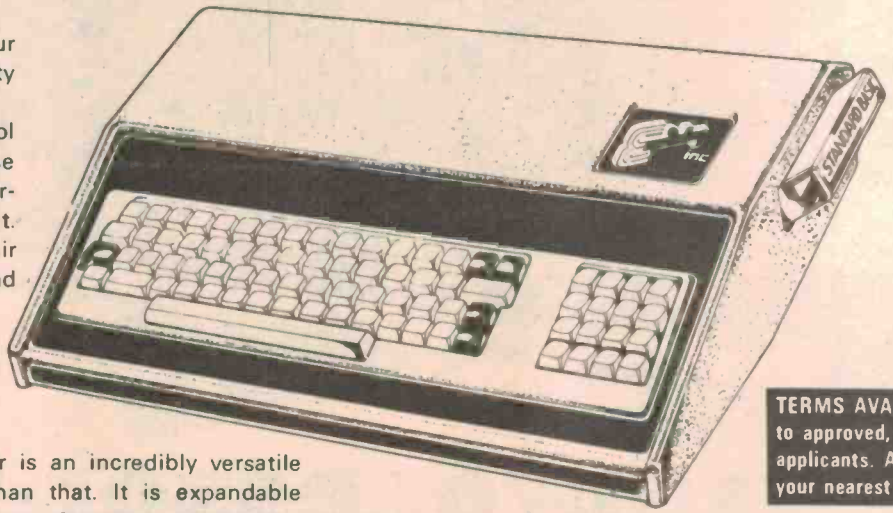
What does it cost? — around $250. ▶

WE'VE GOT A PROBLEM!

There is virtually NOTHING we can say that can really convey the experience of owning and using your OWN Exidy Sorcerer Computer.

YOU HAVE TO TRY IT FOR YOURSELF...

We use an Exidy Sorcerer in our importing, servicing and quality control departments.
You can use it for stock control and accounts. Your wife can use it for housekeeping, recipe storage, balancing the bank account. Your children can use it in their schoolwork, to play exciting and challenging games.
If you don't watch out, your friends will want it to develop a betting system!



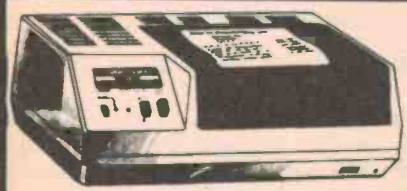
As you can see, the Sorcerer is an incredibly versatile instrument. But it is more than that. It is expandable (using a huge range of various manufacturers peripherals – no more 'single source' components) and it is highly cost effective (and isn't that important?)
Can you afford to buy any other system – a system which could be as much use as a box of TRASH in a few months?

TERMS AVAILABLE to approved, personal applicants. Ask at your nearest store.

Basic 8k Sorcerer: Cat X-1190 ..... $1095.00
Sorcerer with 16k RAM: Cat X-1192 ..... $1250.00

Have you seen our latest computer mailer? Ask for your FREE copy now from your nearest Dick Smith store or re-seller.

NOW! BUY YOUR PERIPHERALS FOR ALL BRANDS OF COMPUTERS FROM DICK SMITH AND SAVE



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Brand new and prime spec printer at an incredible bargain price. The entire stock of an Australian importer of these units was bought be Dick so you REAP THE BENEFIT! Normally selling for $699.00, Dick is giving them away at the unbelievable price of just $495.00!
This units suits TRS-80, Apple, Sorcerer, etc, and features 3 sizes of print, 150 lines per minute, no ribbon required and is very quiet in operation. NOW is your chance to save over $200.00 – but be quick! Stocks won't last long at this price!

Cat. X-3250 **$495.00**

TV MONITOR

Compare the price of other monitors! Ours suits virtually any microcomputer, without the normal price tag! Made by a major manufacturer, gives jitter-free picture and option of AC or DC power.
WHY PAY MORE?

Cat. X-1196 **$149.50**

C-10 COMPUTER CASSETTES

Cat. X-3500

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	656 Bridge Road,	RICHMOND.	Phone 428 1614
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RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.

Microcon

The MicroCon's 'architecture' consists of a 6505 processor – closely related to the 6502, which is used in the PET, the KIM and other hobby machines – 1K of PROM, 1K or RAM [of which ½K is available to the user, although there are sockets for two 2114 RAMs which are also user-accessable, bringing the user RAM up to 1.5K] and enough decoding to provide the TTL I/O, the keyboard and the display, along with an expansion socket on the back of the board.

Software

Most MPU instruction sets are fairly complex and mysterious things to a beginner. Even a programmer who has only worked with one system finds changing to another processor a bit of a bind.

What MicroPro have done is to sit down and design a processor instruction set which is easy to learn and useful for control applications. They then designed the front panel and display to suit and programmed a ROM for the 6505 so that it became a complete monitor system and peripheral driver.

What exactly does the instruction set allow you to do? There are sixteen general-purpose registers and one accumulator, all eight-bit. There are the usual array of arithmetic, logical and jump instructions (see inset), along with subroutine jumps and even FOR-loop structures. In addition, single instructions allow the user to input or output to the ports on the back of the board, and the display and keyboard can both be accessed via the user's software.

The instruction set is highly logical in its organisation and consists of about two dozen mnemonics, most of which have a register as one of their parameters.

INSTRUCTION SET SUMMARY AND PROGRAM EXAMPLE

INSTRUCTION SET SUMMARY

MNEMONIC	BYTES	DESCRIPTION
ADD(X)	1	Adds the contents of register X to the accumulator
AND(X)	1	Logical ANDs the contents of register X with the accumulator
ASSM	1	Sets the processor into its 'assembly' mode – the next codes it comes across will be treated as straight 6505 codes. This is effectively an exit from the operating system.
DISP(X)	1	Sets the individual segments of display digit X on or off using the code stored in the accumulator holds 7F, the display digit X would show an 8.
HLT	1	Halts the processor and sends control back to the monitor routine.
IN(X,Y)	2	Inputs data from one of the peripherals which can be connected to the extension backplane (see text).
INC(X)	1	Increments the contents of register X.
JMP(X)	3	Unconditional jump.
JPC(X)	3	Jump if flag clear.*
JPS(X)	3	Jump if flag set.*
*Note. Flag is set and cleared according to the results of arithmetic and logical operations.		
KEYB	1	Loads a code into the accumulator which tells the machine which key has been pressed. Result is FF if no key pressed.
LOAD(X)	2	Load accumulator with value X.
LOOP(X)	1	Start loop using value stored in register X. This is the same as a FOR statement in BASIC or a DO statement in FORTRAN.
NEXT	1	Has exactly the same effect as a NEXT statement in BASIC – it sends control back to the last LOOP instruction encountered. LOOP structures can be nested to a depth of 30.
OFF(X)	1	Turns bit X of the TTL output off.
ON(X)	1	Turns bit X of the TTL output on.
OR(X)	1	Logical ORs the contents of register X with the accumulator.
OUT(X,Y)	2	Outputs data to a peripheral on the expansion backplace (see text).
RETN	1	Terminates an interrupt subroutine, which has been started by a TIME instruction.
TAR(X)	1	Transfer contents of accumulator to register X.
TEST(X)	1	Sets the flag (see JPS and JPC) to the value of the TTL input, bit X.
TIME1(X)	2	Initiates timer 1 with a time interval of X (hex) hundredths of a second. When the timing period is up, control of the processor will be interrupted and sent to the location which is specified in the RAM locations 0 and 1.
TIME2(X)	2	Same as TIME1, but for timer number 2.
TRA(X)	1	Transfers the contents of register X to the accumulator.
XOR(X)	1	Exclusive-ORs the contents of register X with the accumulator.

PROGRAM EXAMPLE

The following program example, taken from the MicroCon instruction manual, waits for a key to be pressed, stores the code of the key in register 1 and then continues.

ADDRESS	CODE	MNEMONICS	COMMENTS
10	20	KEYB	Get code from keyboard scanning routine. This will load the key code into the accumulator. If no key has been pressed, it will load it with FF.
11	01	TAR(1)	Save the contents of the accumulator in register 1.
12	30 FF	LOAD(FF)	Load the accumulator with the value FF.
14	A1	XOR(1)	Exclusive-OR the contents of register 1 with the accumulator (which now holds FF). This will clear the flag if the value in the register is FF (which indicates that no key has been pressed yet).
15	58 00 10	JPC(0010)	If flag is clear, jump back to address 10.

There are also two 'timers'. These are initialised in the user software, with the number of 1/100ths of a second specified as a parameter to the initialisation instruction. When the period of one of the timers is up, it will force the processor into an interrupt routine, the address of which is specified in RAM. The timer can of course be re-initialised in the interrupt routine.

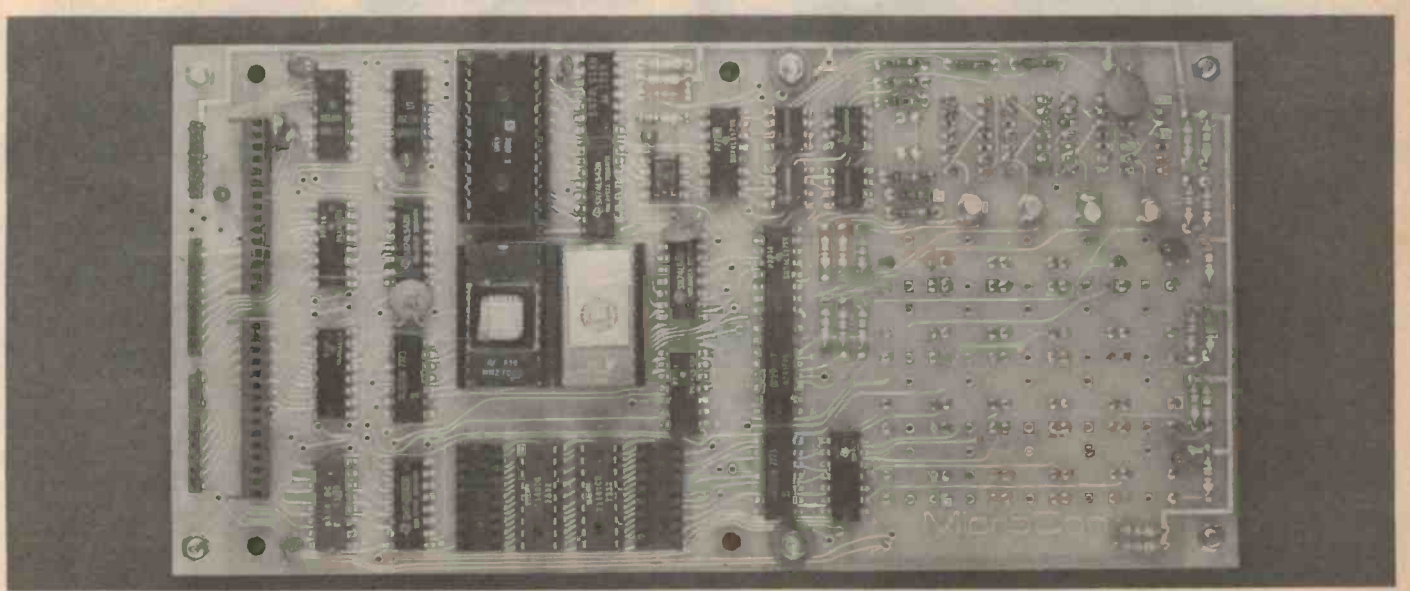
This means that if the processor is required to look at a particular input once every second, the timer is initialised with a decimal 100 value and the rest of the program is continued. After one second, the processor will jump to the specified location, at which the timer will again be set to one second, the input which has to be serviced can be looked at and a return instruction then sends the machine back to what it was doing when the timer interrupted it.

Another nice feature which isn't (usually) found on micros is a loop structure. This is initialised by putting the number of times a particular piece of code is to be repeated into one of the registers. The LOOP(X) instruction then marks the start of the loop using that particular register. When the processor encounters a NEXT instruction, it will jump back to the last LOOP instruction it passed, decrement the register and go through the next bit of code again. LOOPs can be 'nested' to a maximum depth of 30.

Monitor

The system also contains a small but useful monitor, which allows the ▶

A view behind the front panel of the MicroCon. The keyboard section is on the right, the displays being driven by the four transistors. All of the inputs and outputs appear at the left of the panel.



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ETI have arranged with MicroPro for ETI readers to buy the MicroCon at a reduced price — see ad on page 223 of this issue. This is what you will get for your money — a MicroCon board and front panel and a full instruction manual. All you need is the power supply (which is also available from MicroPro).

memory and registers to be looked at and altered manually. This is done using dedicated control keys on the front panel.

The registers can be examined, for example, simply by pressing the 'shift' key at the same time as the hex key associated with that register (there are sixteen registers, remember). Memory can be stepped through, either for checking or for entering blocks of code.

What's nice about the monitor is that it's been designed to work with the system it's in — the keys are in sensible places and the whole thing is simple to operate — there are none of the problems which can sometimes occur with small monitors when they are used with seven segment displays alone. The error messages come up as 'ERR 1', no ambiguous and cryptic characters appear. The MicroCon is so simple to operate that, after familiarising yourself with the system, all you really need in the way of documentation is the page in the manual which tells you the instruction set in short form.

The fact that the controller is simple to operate doesn't mean that it's not powerful. It can execute (typically) 10 000 instructions per second. This is quite fast enough for many process control applications.

Expansion

In order to allow the MicroCon to be connected to other devices, such as tape recorders, ROM blowers, discs and what have you, an expansion backplane can be plugged into the main board. This carries the following signals to any peripheral boards plugged into the backplace:

DO to D7 — bi-directional data bus
FO, F1 — I/O transfer function select
R/W — transfer direction select
ADDRX — device enable
INTX — device interupt enable
+5, 0, +12 and -12 volt supply lines.

The backplane bus is accessed by the controller by means of the IN(,) and OUT(,) instructions.

Peripherals which MicroPro are offering for the system include a board which will decode eight analogue inputs, one which will give eight analogue outputs and a real time clock board.

The manual for the MicroCon leaves nothing to the imagination. It gives all of the facts of the system's operation — even to the point of giving complete circuit diagrams. There is also a reasonably large section at the start of the book which deals with elementary computer concepts and leads the user into the operation of the unit in a clear and unambiguous way. No attempt has been made to 'wow' the prospective buyer into thinking that this machine is the greatest thing since sliced bread. The text is clear, concise and sensible.

Summary

Although originally intended as an industrial controller, the MicroCon is probably the best of the 'teach yourself' systems on the market. Operating the machine, you get the impression that it holds no secrets — it's easy to get a 'feel' for its operation. It's a sensible way to get into machine code programming. It's also fairly cheap.

The only disadvantage that it has is that the machine code instruction set that it uses doesn't actually apply to any actual processor. This is not as bad as it seems. After you've tackled this instruction set, you can use the ASSM instruction to program the device in 6505 machine code. It is also possible to access the display and keyboard and the peripherals using routines already in ROM and jumping to them from 6505 code.

If what you want is to control your house/factory, or if you just want to get into micros in a cheap and easy way, then we would suggest that you think very carefully about using this machine.

For further information, contact MicroPro Design P/L, PO Box 153, North Sydney 2060. Tel: (02) 438 1220. ●

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	1N4005	600v	1A	.08
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	1N4148	75v	10mA	.05
	1N4733	5.1v	1 W Zenner	.25
	1N4749	24v	1W	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25
	1N5349	12v	3W	.25

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	14-pin	pcb	.20	ww	.40
	16-pin	pcb	.25	ww	.45
	18-pin	pcb	.30	ww	.95
	20-pin	pcb	.35	ww	1.05
	22-pin	pcb	.40	ww	1.15
	24-pin	pcb	.45	ww	1.25
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	2N2222A		.19
	2N2907A	PNP	.19
	2N3906	PNP (Plastic)	.19
	2N3904	NPN (Plastic)	.19
	2N3054	NPN	.55
	2N3055	NPN 15A 60v	.60
	T1P125	PNP Darlington	1.95
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4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
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7400	.20	7492	.45	74H20	.25	74LS76	.70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.80	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	1.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.95
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.35	74LS51	.75		
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CLIP Cellular Logic Image Processing

At University College, London, there is a research group working on a method of image processing which could prove to be the link between the human eye and the TV camera. Phil Cohen talked to Dr. Michael Duff about Cellular Logic Image Processing.

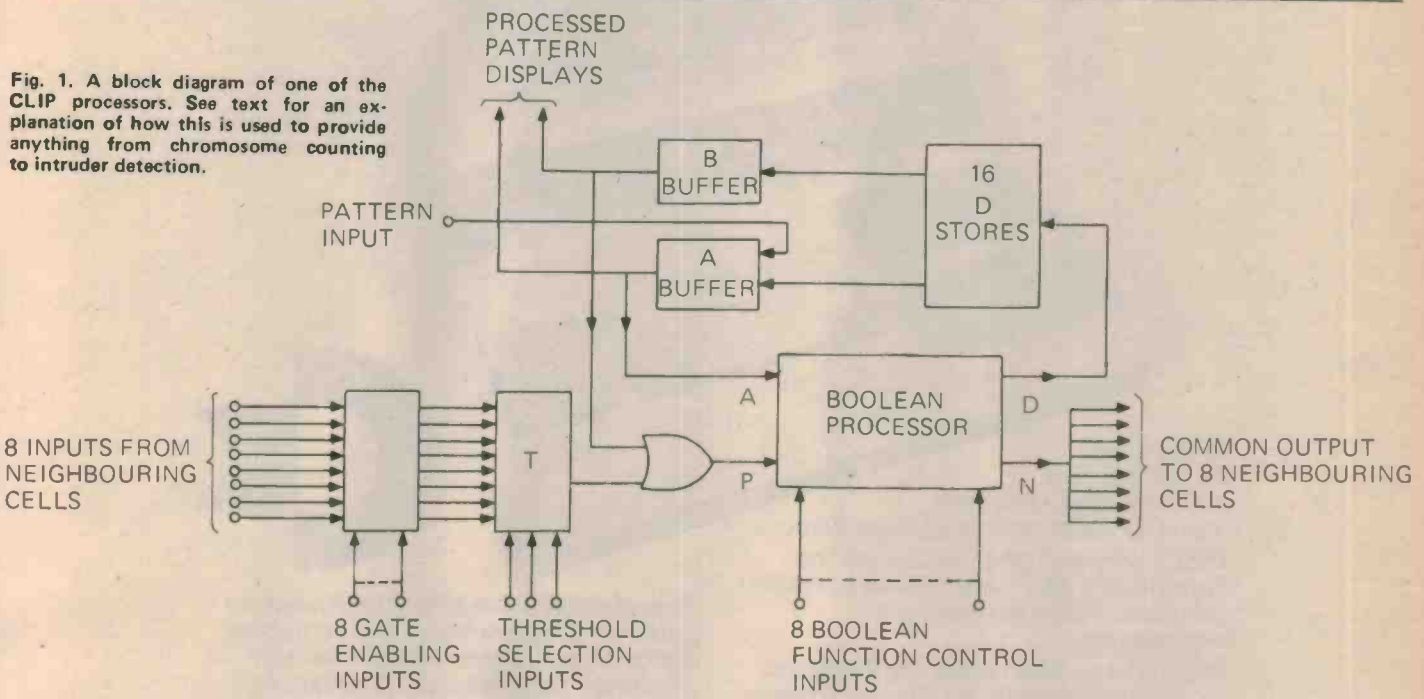

Fig. 1. A block diagram of one of the CLIP processors. See text for an explanation of how this is used to provide anything from chromosome counting to intruder detection.

CELLULAR Logic Image Processing was first proposed in 1958 by S. Ungar in the States. It was suggested that the cells of the human eye do a lot of the processing *before* what we see is fed up the optic nerve to the brain.

What exactly do we mean by image processing?

Generally, it means processes like perimeter-finding – producing the outline of an object, or skeletonising – finding a set of lines which are unbroken and follow the object's shape.

This sort of process can be used in such diverse applications as fingerprinting, character recognition (OCR) or even intruder detection (spotting movement on a TV picture) but perhaps the two most useful areas will be biomedical scanning – chromosome counting or looking for abnormalities on X-ray plates – and production line quality control.

Parallel Processing

The model of the human eye previous to 1958 was of a simple camera – the point-by-point information was fed to the brain, which did all the clever processing.

However, it was pointed out that for processes such as edge-finding it was much more efficient to use a parallel processing system.

The essential difference between serial and parallel processing schemes is that in a serial scheme the data is processed bit by bit in a central unit (CPU) and the intermediate results are stored in memory.

In parallel processing the data is fed in as an array and the processing takes place all at the same time – *there is one processor for each data element.* The intermediate results are passed from processor to processor as the calculations continue.

In the human eye, then, the question is: could a number of cells just behind the light-detecting ones be the parallel processors, responding to commands from the brain to find the edges of objects, or detect movement? Certainly it is known that the edges of the field of vision are extraordinarily good at spotting movement; could this be because the structure of the eye is different there?

The Processors

Going back to the CLIP machine, in this sort of application the type of processor we are talking about is in no▶

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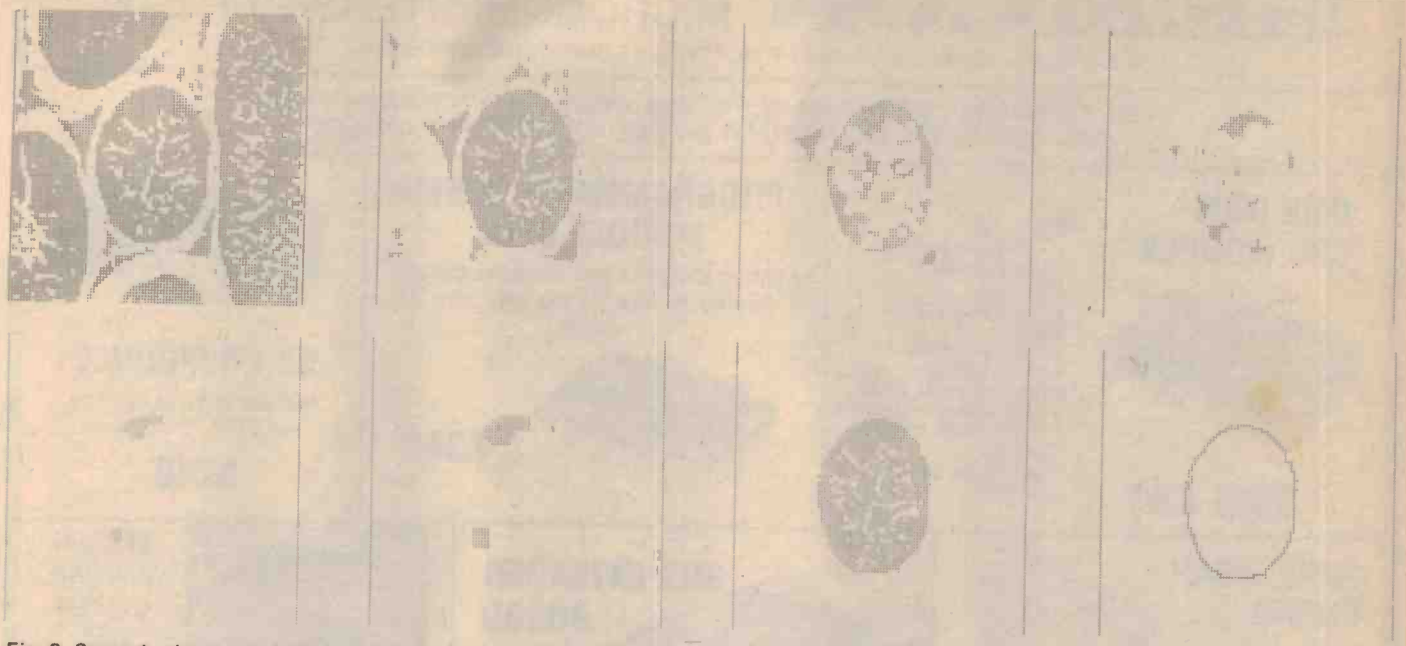


Fig. 2. Stages in the processing of a microscope photo of part of a rat. The processor is trying to find the outline of the large central feature.

way as complex as a modern MPU. The sort of data it receives are single-bit inputs from the image sensor associated with it and one bit each from the eight nearest processors' outputs.

Why eight? Well, this provides an optimum "connectivity" – too few and the processing becomes slow, too many and the cost of connecting the processors together becomes enormous.

The sort of operation the processor would have to perform would be to give an output if any of its neighbours gave an output *and* the image bit fed to it was a "0".

The program example (in PET BASIC) given shows the usefulness of this sort of process. Of course, we cannot perform parallel processing directly in BASIC – the program has to scan the image bit by bit, simulating the action of each processor in turn.

The important thing about using this sort of scheme for image processing is that the outputs of the units will change in "waves", travelling at speeds dependant on the propogation delay of the devices involved. This means that, by having four "edge registers" which are not connected to the image input we can do things like finding the outer edge of an object by starting a signal from the edge registers and programming the processors to stop propagating it at the edge of the object. The program example carries out this sort of process.

Structure

In the CLIP machine, the processors each have the structure shown in Fig. 1. Each is connected to its eight neighbours and its output fans out to the same neighbours. There is also a "pattern input" for connection to the picture signal (which is derived from a TV camera and multiplexed to provide each processor with a 1-bit signal from one point of the camera's image).

The gate enabling threshold selection and function control inputs are from a programming bus common to all processors.

The gate enabling inputs allow instructions like "If the output from the processor to the left is '1' . . . ". The threshold selection inputs allow "If more than three inputs are '1' . . ."

Combining the two allows very comprehensive processing of the inputs – "If any two of the processors to the left give an output . . . ", for example.

There are also various buffers for more complex instruction types.

The boolean processor itself can be programmed via the function controls to "look" like any combination of memory-less logic gates.

Implementation

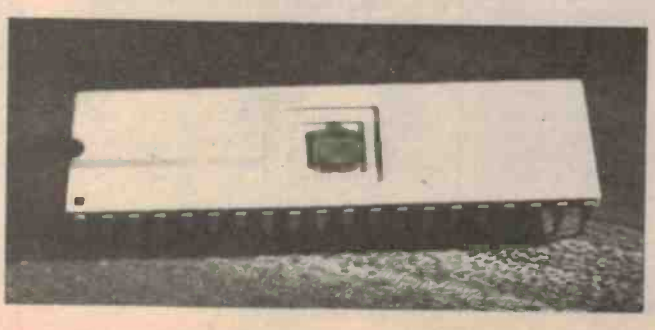
The processors come in custom-built ICs, each chip containing eight units. The CLIP 4 machine contains an array of 96 x 96 processors.

CLIP 4 is the product of ten years of research at University College. It's a commercially viable product – it fits into one 7-foot instrument rack, including power supplies and controller. The cost? Around $50 – 70 thousand.

The processors themselves are based on NMOS technology and the control circuitry (the part that acts as a "conductor" – in the musical sense – directing all of the processors) is implemented in hardware – an MPU would be too slow!

The input signal is from a TV camera (only part of the picture is used – 96 lines x 96 points). This is encoded either as a black and white picture with no grey or as a grey-scale image. CLIP can handle grey-scale pictures, performing processes such as smoothing.

The output from the system would be to a video monitor or, in some applications, just a few bits of data to another peripheral, such as a warning indicator in the case of intruder detection. ▶



This custom-made chip holds eight of the CLIP processors.

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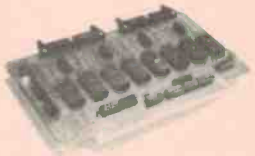

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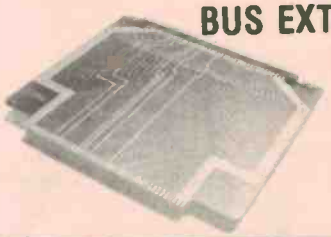

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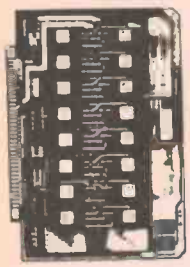

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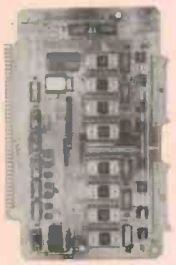

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Software

The software for the system consists of a series of inputs for the function-definition bus of the processors and a loop structure which is linked to the processor outputs.

Looking at Fig. 2, the machine is trying to find the outline of the largest isolated mass of black in the input pattern.

The original input is shown in the top left. The first instruction propagates white from the edge registers through all connected black. This leaves the pattern second from the left on the top line. The program then "erodes" the image by removing all black dots not surrounded by black and then removing their neighbour black dots as well.

It repeats this erosion until one more stop would cause all black to vanish completely. This leaves the image as it is at the end of the top line.

The program then surrounds each black by eight blacks. It then recalls from the original input pattern the part which is "connected" to the current pattern. The last step finds its outline.

Naturally, this sort of software cannot be written in a conventional language — the group have developed what is effectively an assembler for the system and all the groups working on image processing worldwide are due to meet this year to discuss a suitable high-level language.

Applications

One very interesting application mentioned earlier is production line control. CLIP can tell the difference between an object which has been correctly punched out of metal and one with the wrong surface area or the wrong number of holes, etc.

The amazing thing is that it can do this fifty times a second! In fact, the machine can perform 1500 parallel processes per TV frame period.

The machine could be fitted to the "reject" solenoid on a production line so that badly produced pieces could be pushed off the line.

Another area in which the machine could be useful is in microscopic counting. There are systems available already which will count the number of items in a picture, or even the number between certain size limits, but the inherent flexibility of CLIP make it invaluable for complex tasks such as red blood cell deformity checking and other applications where previously a human operator was the only alternative.

One slightly more frightening possibility is the use of such a system in facial recognition — enabling authorities to keep track of every individual automatically.

When the system was first proposed about ten years ago, the device which was envisaged was a pair of super-binoculars, with photo-diodes at one end and LEDs at the other, modifying images so that only moving objects, or even more selectively, only enemy tanks would be seen! This is some way from the present state of the art but in a few years . . . who knows?

We would like to thank Dr Michael Duff and University College in general for their help. ●

CLIP Simulation Program

The following program, written in PET BASIC, simulates the action of the CLIP machine by 'pretending' to be each processor in turn in a 10 x 10 array. It's very slow to run (several minutes) and this shows the advantage which a parallel processing scheme has over a serial one.

```
10 S = 10
```

S is the dimension of the 2-dimensional square processing array. S is defined here so that the program can be altered to run with a larger array.

```
20 DIM A(S,S), B(S,S)
```

A is the image input to the system. B represents the processor outputs.
Load the image into the system:

```
30 FOR I = 2 TO S-1
40 FOR J = 2 TO S-1
50 READ A(S,S)
60 NEXT J
70 NEXT I
```

The outer layer of processors represent the edge register, in which we can initialise processing 'ripples' (see text).

```
80 DATA 0,0,0,0,0,0,0,0
90 DATA 0,1,1,1,1,1,1,0
100 DATA 0,1,0,0,1,0,0,0
110 DATA 0,1,1,0,1,1,0,0
120 DATA 0,1,1,0,1,1,1,0
130 DATA 0,1,1,1,1,1,0,0
140 DATA 0,0,0,0,0,0,0,0
150 DATA 0,0,0,0,0,0,0,0
```

Now for the 'seed' which will propagate during processing. Note that it's in the edge register:

```
1010 B(S,S) = 1
```

Now print the results so far

```
1014 GOSUB 2000 : REM PRINT
RESULTS
1015 F = 0
```

F is set to 1 if any changes are made

```
1020 FOR I = 2 TO S-1
1030 FOR J = 2 TO S-1
```

. . For each processor. . .

```
1040 FOR K = -1 TO 1
1050 FOR L = -1 TO 1
```

. . For each of the eight 'connected' processors . . .

```
1055 IF L = 0 AND K = 0 THEN 1090
```

. . except the one we're simulating . . .

```
1060 IF B(I+K, J+L) <> 1 OR A(I,J) <> 0 THEN 1090
```

skips the next bit unless the image is zero at this point and one of the neighbour's outputs is one

```
1070 IF B(I,J) = 0 THEN F = 1
```

B(I,J) is going to be set to 1. F is set to 1 if this represents a change

```
1080 B(I,J) = 1
1090 NEXT:NEXT:NEXT:NEXT
1130 IF F = 1 THEN 1014
1140 STOP
```

repeats the process until the output is stable (i.e. there were no changes during this pass)
The following subroutine prints the results:

```
2000 REM PRINT RESULTS
2010 PRINT " ": REM CLEAR SCREEN CHARACTER
2020 FOR I = 1 TO S
2030 FOR J = 1 TO S
2040 IF A(I,J) = 1 THEN PRINT "A"; : GOTO 2060
2050 PRINT " ";
2060 NEXT J
2070 PRINT " ";
2080 FOR J = 1 TO S
2090 IF B(I,J) = 1 THEN PRINT "B"; : GOTO 2110
2100 PRINT " ";
2110 NEXT J
2120 PRINT
2130 NEXT I
2140 RETURN
```

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3.9	1N748A	1N4730A	1N5335B	—
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4.7	1N750A	1N4732A	1N5337B	1N3995A
5.1	1N751A	1N4733A	1N5338B	—
5.6	1N752A	1N4734A	1N5339B	1N3997A
6.2	1N753A	1N4735A	1N5341B	1N3998A
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10	1N758A	1N4740A	1N5347B	—
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2N3739	Sil NPN PWR T066 300V 1A	1	2.20	0.42
2N3740	Sil PNP PWR T066 60V 4A	1	1.40	0.27
2N3766	Sil NPN PWR T066 60V 4A	1	1.60	0.31
2N3772	Sil NPN PWR T03 60V 20A	1	3.20	0.62
2N3773	Sil NPN PWR T03 140V 16A	1	3.50	0.68
2N3789	Sil PNP PWR T03 60V 10A	1	2.20	0.43
2N3904	Sil NPN Sig T092 40V 200MA	3	0.90	0.18
2N3906	Sil PNP Sig T092 40V 200MA	2	1.04	0.20
2N3924	Sil NPN PWR T039 18V 500MA (FAE 250MHZ)	1	3.20	0.62
2N4034	Sil PNP Sig T018 40V 100MA (FAB 400MHZ)	2	1.00	0.20
2N4121	Sil NPN Sig T0106 40V 100MA (FAB 400MHZ)	3	0.90	0.18
2N4141	Sil NPN Sig T0106 30V 200MA	2	1.10	0.22
2N4220A	Sil FET N TO72	1	0.90	0.18
2N4236	Sil PNP PWR T05 80V 1A	1	1.73	0.34
2N4249	Sil PNP Sig T0126 60V 100MA	3	0.90	0.18
2N4250	Sil PNP Sig T0126 40V 100MA	3	0.90	0.18
MPS4258	Sil PNP GP AMP T039 12V 50MA 700MHZ	2	0.96	0.19
2N4351	Sil N Channel MOS FET	1	2.85	0.55
2N4352	Sil P Channel MOS FET	1	2.70	0.52
2N4355	Sil PNP Sig T0126 60V 500MA	3	0.90	0.18
2N4356	Sil PNP Sig T0126 80V 500MA	3	0.90	0.18
2N4360	Sil P Channel J FET	2	1.08	0.21
2N4401	Sil NPN Sig T092 40V 600MA	1	0.75	0.15
2N4403	Sil PNP Sig T092 40V 600MA	1	0.75	0.15
2N4427	Sil NPN RF PWR T039 1W OUT	1	1.24	0.24
2N4919	Sil PNP PWR T0126 60V 1A	1	0.99	0.19
2N4922	Sil NPN PWR T0126 60V 1A	1	0.85	0.17
2N5038	Sil NPN PWR T03 90V 20A (FAE 60 MHZ)	1	4.20	0.81
2N5086	Sil PNP Sig T092 50V 50MA (LoNoise)	3	0.90	0.18
2N5087	Sil PNP Sig T092 (LoNoise Higain)	3	0.90	0.18
2N5088	Sil NPN T092 30V 50MA (LoNoise)	3	0.90	0.18
2N5089	Sil NPN Sig T092 25V 50MA (LoNoise)	3	0.90	0.18
2N5190	Sil NPN PWR T0126 40V 4A	1	0.81	0.16
2N5191	Sil NPN PWR T0126 60V 4A	1	0.98	0.19
2N5193	Sil PNP PWR T0126 40V 4A	1	0.91	0.18
2N5194	Sil PNP PWR T0126 60V 4A	1	1.08	0.21
2N5210	Sil NPN Sig T092 50V 55MA (LoNoise)	1	0.75	0.15
2N5458	Sil FET N Channel T092 J FET	2	0.90	0.18
2N5459	Sil J FET N Channel T092	2	1.00	0.20
2N5461	Sil J FET P Channel T092	2	1.34	0.26
2N5484	Sil J FET N Channel T092	2	1.00	0.20
2N5485	Sil J FET N Channel T092	2	1.02	0.20
2N5486	Sil J FET N Channel T092	2	1.00	0.20
2N5656	Sil NPN PWR T0126 300V 500MA	1	0.88	0.17
2N6049	Sil PNP PWR T066 55V 4A	1	2.05	0.40
2N6274	Sil NPN PWR T03 100V 50A	1	1.60	0.31
2N6378	Sil PNP PWR T03 100V 50A	1	13.50	2.60
2N6425	Sil PNP PWR T066 300V 250MA	1	1.80	0.35
MPS6530	Sil NPN Sig T092 40V 600MA	2	0.88	0.17
MPS6565	Sil NPN Sig T092 40V 30MA (LoLevel)	2	0.94	0.18
MPS6586	Sil NPN Sig T092 45V 30MA (LoLevel/HiGn)	2	1.00	0.20
2N6577	Sil NPN PWR DARL T03 100V 15A 120W	1	1.92	0.29
2N6578	Sil NPN PWR DARL T03 120V 15A 120W	1	1.70	0.33
2N6609	Sil PNP T03 140V 16V 150W	1	3.50	0.68
3N140	Sil N Channel FET TO72	1	1.45	0.28
3N210	Sil N Channel FET U120	1	1.45	0.28
AC126	Use AC188			
AC128	Germ PNP Sig T01 32V 10MA	1	0.75	0.15
AC187	Germ NPN Deflection T01 5MHz	1	0.75	0.15
AC188	Germ PNP Deflection T01 1.5MHz	1	0.75	0.15
A0149	Germ PNP PWR T03 50V 3.5A	1	1.79	0.35
A0161	Germ NPN PWR T066 32V 1A	1	1.44	0.28
A0162	Germ PNP PWR T066 20V 3A	1	1.50	0.29
AF126	Germ PNP Sig T072 20V 11MA	1	0.75	0.15
AF127	Germ PNP Sig T072 20V 11MA	1	0.75	0.15
BC102	Sil NPN Sig T018 45V 100MA	3	1.05	0.21
BC108	Sil NPN Sig T018 30V 100MA	3	1.05	0.21
BC109	Sil NPN Sig T018 20V 100MA (LoNoise)	3	1.05	0.21
BC177	Sil PNP Sig T018 45V 100MA	3	1.05	0.21
BC178	Sil PNP Sig T018 20V 100MA	3	1.05	0.21
BC179	Sil PNP Sig T018 20V 100MA (LoNoise)	3	1.05	0.21
BC327	Sil PNP Sig T092 45V 500MA	3	0.90	0.18
BC328	Sil PNP Sig T092 25V 500MA	3	0.90	0.18
BC328	Sil PNP Sig T092 25V 500MA	3	0.90	0.18
BC337	Sil NPN Sig T092 45V 500MA	3	0.90	0.18
BC338	Sil NPN Sig T092 25V 500MA	3	0.90	0.18
BC547	Sil NPN Sig T092 45V 100MA	3	0.90	0.18
BC548	Sil NPN Sig T092 30V 100MA	3	0.90	0.18
BC549	Sil NPN Sig T092 30V 100MA (LoNoise)	3	0.90	0.18
BC557	Sil PNP Sig T092 45V 100MA	3	0.90	0.18
BC558	Sil PNP Sig T092 30V 100MA	3	0.90	0.18
BC559	Sil NPN Sig T092 30V 100MA (LoNoise)	3	0.90	0.18
BC635	Sil NPN Sig T092 45V 1A	2	0.80	0.16
BC636	Sil PNP Sig T092 45V 1A	2	0.80	0.16
BC637	Sil NPN Sig T092 60V 1A	2	0.84	0.17
BC638	Sil PNP Sig T092 60V 1A	2	0.84	0.17
BC639	Sil NPN Sig T092 80V 1A	2	0.86	0.17
BC640	Sil PNP Sig T092 80V 1A	2	0.86	0.17
BD135	Sil NPN PWR T0126 45V 5A	2	1.10	0.21
BD136	Sil PNP PWR T0126 45V 5A	2	1.10	0.21
BD137	Sil NPN PWR T0126 60V 5A	2	1.30	0.25
BD138	Sil PNP PWR T0126 60V 5A	2	1.30	0.25
BD139	Sil NPN PWR T0126 80V 5A	2	1.30	0.25
BD140	Sil PNP PWR T0126 80V 5A	2	1.40	0.27
BD235	Sil NPN PWR T0126 60V 2A	1	0.75	0.15
BD236	Sil PNP PWR T0126 60V 2A	1	0.75	0.15
BD238	Sil PWR PNP T0126 100V 2A 25W	1	0.65	0.13
BD262	Sil PNP Darl PWR T0126 60V 4A	1	1.10	0.21
BD263	Sil NPN Darl PWR T0126 80V 4A	1	1.15	0.22
BD437	Sil NPN PWR T0126 45V 4A	1	1.20	0.23

Type	Description	Bag Qty	Price	+ Tax
B0438	Sil PNP PWR T0126 45V 4A	1	1.20	0.23
B0647	Sil NPN Darl T0220 80V 8A 60W	1	1.60	0.31
B0648	Sil PNP Darl T0220 80V 8A 60W	1	1.60	0.31
B0677	Sil PWR NPN T0126 60V 4A 40W	1	0.95	0.18
BDV64B	Sil PWR NPN SOT93 100V 10A 125W	1	2.79	0.54
BDV658	Sil PWR NPN SOT93 100V 10A 125W	1	2.79	0.54
BF115	Sil NPN Sig T072 30V 30MA	2	1.26	0.25
BF180	Sil HF NPN T072 20V 20MA	1	0.85	0.16
BF182	Sil HF NPN T072 20V 30MA	1	0.85	0.16
BF185	Sil NPN Sig T072 20V 30MA	2	1.22	0.24
BF198	Sil HF NPN T092 30V 25MA	2	0.60	0.12
BF199	Sil HF NPN T092 25V 25MA	2	0.60	0.12
BF200	Sil HF NPN T072 20V 20MA	1	0.85	0.18
BF245A	FET NPN T092 30V 300MW	2	0.70	0.14
BF338	Sil NF NPN T039 180V 100MA	1	0.79	0.15
BF337	Sil NPN PWR T039 200V 100MA	1	0.90	0.18
BF458	Sil HF NPN T0126 100V 100MA	1	0.79	0.15
BF494	Sil HF NPN T092 20V 30MA	3	0.90	0.18
BF495	Sil HF NPN T092 20V 30MA	3	0.90	0.18
BFR91	Sil NPN Sig X 124 Microwave 5.0 GHZ	1	2.84	0.55
BFY50	Sil HF NPN T039 35V 1A	1	0.75	0.15
BFY51	Sil HF NPN T039 30V 1A	1	0.75	0.15
BFY90	Wide Band NPN T072 200/800 MHZ 10V 14MA	1	1.35	0.26
BU126	Wide Band NPN PWR T03 300V 3A 30W	1	3.40	0.66
BU205	Sil NPN PWR T03 700V 2.5A	1	3.86	0.75
BU208A	Wide Band NPN PWR T03 700V 5A 12.5W	1	5.25	1.01
BU326A	Wide Band NPN PWR T03 400V 6A 60W	1	3.75	0.72
BUX81	Wide Band NPN PWR T03 450V 10A 100W	1	10.70	2.06
BUX86	Wide Band NPN PWR T0126 400V 500MA 20W	1	2.45	0.47
EB203	Sil PNP PWR T03 200V 20A 200W	1	6.20	1.20
EB204	Sil PNP PWR T03 200V 20A 200W	1	7.20	1.39
EO203	Sil NPN PWR T03 200V 200W	1	4.90	0.94
EO204	Sil NPN PWR T03 300V 20A 200W	1	8.20	1.20
MFE131	Sil N Channel Dual Gate Mos Fet	1	1.00	0.20
MJ413	Sil NPN PWR T03 400V 10A 125W HFE20	1	2.84	0.55
MJ423	Sil NPN PWR T03 400V 10A 125W HFE30	1	4.66	0.90
MJ802	Sil NPN PWR T03 90V 30A 200W	1	3.04	0.59
MJ900	Sil PNP PWR Darl T03 60V 8A 90W	1	1.71	0.33
MJ901	Sil PNP PWR Darl T03 80V 8A 90W	1	1.98	0.36
MJ1000	Sil NPN PWR Darl T03 60V 8A 90W	1	1.52	0.30
MJ1001	Sil NPN PWR Darl T03 80V 8A 90W	1	1.72	0.33
MJ2501	Sil PNP PWR Darl T03 80V 10A 150W	1	3.81	0.73
MJ2955	Sil PNP PWR T03 60V 15A 150W	1	1.25	0.24
MJ3001	Sil NPN PWR Darl T03 80V 10A 150W	1	3.27	0.63
MJ4032	Sil PNP PWR Darl T03 100V 16A 150W	1	6.62	1.28
MJ4035	Sil NPN PWR Darl T03 100V 16A 150W	1	5.74	1.10
MJ4502	Sil PNP PWR T03 90V 30A 200W	1	3.04	0.59
MJ10000	Switchmode NPN Power Darl 20A 350V	1	1.70	1.39
MJ10002	Switchmode NPN Power Darl 10A 350V	1	4.50	0.87
MJ10005	Switchmode NPN Power Darl 20A 400V - BE Speedup 0100C	1	10.80	2.08
MJ15003	Sil NPN PWR T03 140V 20A 250W	1	4.30	0.83
MJ15004	Sil PNP PWR T03 140V 20A 250W	1	4.30	0.83
MJE243	Sil NPN PWR T0126 100V 4A	1	1.22	0.24
MJE253	Sil PNP PWR T0126 100V 4A	1	1.34	0.26
MJE340	Sil NPN PWR T0126 300V 5A 20W	1	0.95	0.18
MJE350	Sil PNP PWR T0126 300V 5A 20W	1	1.40	0.27
MJE371	Sil PNP PWR T0126 40V 4A 40W	1	1.10	0.21
MJE521	Sil NPN PWR T0126 40V 4A 40W	1	1.10	0.21
MJE700	Sil PNP PWR Darl T0126 60V 4A 40W	1	1.25	0.24
MJE800	Sil NPN PWR Darl T0126 60V 4A 40W	1	1.10	0.21
MJE1091	Sil PNP PWR Darl T0127 60V 5A 70W	1	2.85	0.55
MJE1101	Sil NPN PWR Darl T0127 60V 5A 70W	1	2.25	0.44
MJE2801	Sil NPN PWR T0127 60V 10A 90W	1	2.25	0.44
MJE2901	Sil PNP PWR T0127 60V 10A 90W	1	2.50	0.48
MJE2955	Sil PNP PWR T0127 60V 10A 90W	1	0.80	0.16
MJE2955T	Sil PNP PWR T0220 60V 10A 75W	1	0.80	0.16
MJE3055	Sil NPN PWR T0127 60V 10A 90W	1	0.80	0.16
MJE3055T	Sil NPN PWR T0220 60V 10A 75W	1	0.80	0.16
MJE15030	Comp. Power NPN 8A 150V 50W	1	2.25	0.43
MJE15031	Comp. Power PNP 8A 150V 50W	1	2.25	0.43
MPF131	Use MFE131			
MP06842	MPU Clock Buffer	1	3.60	0.70
MPSA05	Sil NPN Sig T092 60V 500MA	2	0.96	0.19
MPSA06	Sil NPN Sig T092 80V 500MA	2	0.98	0.19
MPSA12	Sil NPN Darl Sig T092 20V 1.5A HFE 20K	2	1.16	0.23
MPSA14	Sil NPN Darl Sig T092 20V 1.5A HFE 10K	2	0.96	0.19
MPSA42	Sil NPN Sig T092 300V 500MA	2	1.06	0.21
MPSA43	Sil NPN Sig T092 200V 500MA	2	1.00	0.20
MPSA55	Sil PNP Sig T092 60V 500MA	2	1.04	0.20
MPSA63	Sil PNP Darl Sig To92	2	0.96	0.19
MPSA92	Sil PNP Sig T092 300V 500MA	2	1.16	0.23
MPSA93	Sil PNP Sig T092 200V 500MA	2	1.10	0.20
MPSU02	Sil NPN PWR X81 40V 8A 1W	2	1.16	0.23
MPSU05	Sil NPN PWR Flat Pak 60V 1A	2	1.20	0.23
MPSU52	Sil PNP PWR X81 40V 8A 1W	2	1.22	0.24
MPSU55	Sil PNP PWR Flat Pak 60V 1A	2	1.20	0.23
TIP31A	Sil NPN PWR T0126 60V 3A	1	0.75	0.15
TIP31B	Sil NPN PWR T0126 80V 3A	1	0.79	0.16
TIP31C	Sil NPN PWR T0126 100V 3A	1	0.83	0.16
TIP32A	Sil PNP PWR T0126 60V 3A	1	0.77	0.15
TIP32B	Sil PNP PWR T0126 80V 3A	1	0.82	0.16
TIP32C	Sil PNP PWR T0126 100V 3A	1	0.90	0.18
TIP33A	Sil NPN PWR T0220 60V 10A	1	0.97	0.19
TIP33C	Sil NPN T0220 100V 10A	1	1.25	0.24
TIP34A	Sil PNP PWR T0220 60V 10A	1	1.13	0.22
TIP34C	Sil PNP T0220 100V 10A	1	1.35	0.26
TIP41A	Sil NPN PWR T0220 60V 6A	1	0.87	0.17
TIP41C	Sil NPN PWR T0220 100V 6A	1	1.09	0.21
TIP42A	Sil PNP PWR T0220 60V 6A	1	0.94	0.18
TIP42C	Sil PNP PWR T0220 100V 6A	1	1.20	0.23
TIP49	Sil NPN PWR T0220 350V 1A 40W	1	1.10	0.21
TIP50	Sil NPN PWR T0220 400V 1A 40W	1	1.35	0.26
TIP112	Sil NPN Darl T0220 100V 2A 50W	1	0.96	0.19
TIP117	Sil PNP Darl T0220 100V 2A 50W	1	0.99	0.19
TIP120	Sil NPN Darl T0220 60V 5A	1	0.85	0.17
TIP122	Sil NPN Darl T0220 100V 5A 65W	1	1.49	0.29
TIP125	Sil PNP Darl T0220 60V 5A 65W	1	0.95	0.19
TIP127	Sil PNP Darl T0220 100V 5A 65W	1	1.52	0.30
TIP2955	Sil PNP PWR T03 Plastic 70V 15A 90W	1	1.35	0.26
TIP3055	Sil NPN PWR T03 Plastic 70V 15A 90W	1	0.85	0.17

DON'T FORGET OUR FAST EFFICIENT MAIL ORDER DIVISION

R.F. TRANSISTORS

Type	Description	Bag Qty	Price	+ Tax
2N3866	Sil NPN VHF/UHF PWR T039 28V 1A	1	1.09	0.21
2N4427	Sil NPN 2W T039	1	1.24	0.24
2N5589	Sil NPN PWR MT71 VHF	1	5.20	1.00
2N5590	Sil NPN PWR MT72 VHF	1	7.20	1.39
2N5591	Sil NPN PWR MT72 VHF	1	11.80	2.27
2N5944	Sil NPN PWR MT70 UHF 2W	1	9.30	1.79
2N5945	Sil NPN PWR MT90 UHF 4W	1	13.60	2.62
2N5946	Sil NPN PWR MT90 UHF 10W	1	16.60	3.20
2N6080	Sil NPN PWR MT72 VHF 4W	1	5.45	1.05
2N6083	Sil NPN PWR MT72 VHF 30W	1	12.95	2.50
2N6084	Sil NPN PWR MT72 VHF 40W	1	13.75	2.65
MRF237	Sil NPN 4W T039 VHF 12V	1	2.28	0.24
MRF238	Sil NPN 30W Stud VHF 12V	1	10.64	1.12
MRF243	Sil NPN 80W Flange VHF 12V	1	32.78	3.45
MRF245	Sil NPN 80W Flange VHF 12V	1	38.50	4.05
MRF454A	Sil NPN 80W Stud HF 12V	1	24.86	2.63
MRF475	Sil NPN 12W T0220 CB 12V	1	3.60	0.35
MRF603	Sil NPN 10W Stud 175.300 MHZ	1	8.54	0.90
MRF641	Sil NPN 15W Flange UHF 12V	1	18.52	1.95
MRF646	Sil NPN 45V Flange UHF 12V	1	25.64	2.70
MRF901	Sil NPN Low Noise/GHZ plus Micro-T	1	1.78	0.19
MPSU31	Sil NPN 3.5W Plastic CB/AM 12V	1	0.85	0.09

R.F. MODULES

MHW593	10.400MHZ Amp 350/8 Gain 12V	1	40.25	5.25
MHW602	146.174MHZ VHF FM 20W 12V	1	42.00	5.48
MHW710.1	400.440MHZ FM 13W 12V	1	42.50	5.55
MHW1221	CATV Amp 340/B Gain	1	33.55	4.35
MHW1341	40.300MHZ CATV Amp 340/B Gain	1	37.95	4.95
OM335	3 Stage W.B. AMP	1	10.15	1.07

MAIL ORDER DIVISION

ALL ORDERS PROCESSED WITHIN 24 HOURS

THYRISTORS

2N2646	UJT T018	1	0.82	0.16
2N2647	UJT T018	1	1.28	0.25
2N4441	SCR T0220 50V 8A	1	1.40	0.27
2N4443	SCR T0220 400V 8A	1	2.20	0.42
2N4444	SCR T022U 600V 8A	1	3.50	0.67
2N4870	UJT T092	1	0.75	0.15
2N4871	UJT T092	2	1.36	0.26
2N5061	USE C103YY			
2N6027	PUT T092	2	0.75	0.15
2N6969B	Triac T0220 50V 4A Ult Sens Gate	1	1.20	0.23
2N6070	Triac T0220 100V 4A	1	0.80	0.16
2N6073A	Triac T0220 400V 4A Sens Gate	1	1.32	0.26
2N6073B	Triac T0220 400V 4A Ult Sens Gate	1	1.70	0.33
2N6116	PUT T018	1	1.35	0.26
2N6155	Triac T0220 400V 10A	1	2.50	0.48
2N6237	SCR T0220 50V 4A	1	0.90	0.17
2N6240	SCR T0220 400V 4A	1	1.50	0.29
C103Y	SCR T092 30V 8A	2	1.10	0.21
C103YY	SCR T092 60V 8A	2	1.20	0.23
C106B	SCR T0220 200V 4A Sens Gate	2	1.10	0.21
C106D	SCR T0220 400V 4A Sens Gate	2	1.28	0.25
C122D	SCR T0220 400V 8A Sens Gate	1	1.12	0.22
C122E	SCR T0220 500V 8A Sens Gate	1	1.32	0.26
C228D	SCR Stud 400V 35A	1	3.60	0.35
C228E	SCR Isolated Stud 500V 35A	1	4.20	0.81
MU10	UJT T092	2	0.80	0.16
MBS4991	BiDirectional Switch T092 8V	2	1.36	0.26
P13T1	PUT T092	1	1.10	0.21
P13T2	PUT T092	1	1.20	0.23
SC141D	Triac T0220 400V 6A	1	1.39	0.27
SC141E	Triac T0220 500V 6A	1	1.99	0.39
SC146D	Triac T0220 400V 10A	1	1.84	0.36
SC146E	Triac T0220 500V 10A	1	2.64	0.51
SC2500	Triac Stud 400V 15A	1	3.85	0.75
SC250E	Triac Stud 500V 15A	1	4.64	0.90
SC260E	Triac Isolated Stud 500V 25A	1	6.29	1.21
TIC45	SCR T092 60V .6A	2	1.04	0.20
TIC46	SCR T092 100V .6A	2	1.18	0.23

LINEAR

Type	Description	Bag Qty	Price	+ Tax
301A-8	Low Noise OP Amp	2	0.80	0.09
301A-CAN	Low Noise OP Amp	1	0.97	0.10
301A-14	Low Noise OP Amp	2	1.04	0.11
306-8	Comparator	1	1.78	0.19
307-8	Comp OP Amp	1	0.66	0.07
307-CAN	Comp OP Amp	1	0.99	0.11
307-14	Comp OP Amp	1	0.87	0.09
308-8	Prec OP Amp	1	1.20	0.13
308-CAN	Prec OP Amp	1	1.77	0.19
308-14	Prec OP Amp	1	1.61	0.17
310-8	OP Amp volt Follower	1	2.80	0.30
311-8	Prec Comparator	1	1.12	0.12
311-CAN	Prec Comparator	1	2.74	0.29
311-14	Prec Comparator	1	1.61	0.17
324-14	Quad OP Amp	1	1.24	0.13
339-14	Quad Comparator	1	0.98	0.11
339A-14	Precision Quad Comparator	1	3.00	0.32
358-8	Single Supply of AMP 100dB	1	0.75	0.15
380-14	Audio Pwr Amp	1	1.45	0.28
381-14	Dual Low-Noise Pre Amp	1	2.25	0.44
381A-14	Low Noise Dual Pre Amp	1	3.04	0.59
382-14	Dual Low-Noise Pre Amp	1	1.75	0.34
5534-8	Low Noise of Amp	1	2.35	0.46
540-CAN	Power Driver	1	3.45	0.67
555-8	Timer	1	0.35	0.04
556-14	Dual Timer	1	1.30	0.14
561-16	Plase Locked Loop	1	3.80	0.73
565-14	PLL	1	1.90	0.20
566-8	Function Generator	1	3.20	0.34
567-14	PLL Tone Decoder	1	2.80	0.30
709-8	Op Amp	1	0.69	0.08
709-CAN	Op Amp	1	0.90	0.10
709-14	Op Amp	1	0.75	0.08
710-14	Diff Comparator	1	0.75	0.08
711-14	Dual Diff Comparator	1	0.78	0.08
725-8	Precision Inst Op Amp	1	4.10	0.43
725-CAN	Precision Inst Op Amp	1	6.00	0.63
733-CAN	Diff Video Amp	1	1.95	0.38
733-14	Diff Video Amp	1	1.45	0.28
741-8	Op Amp	1	0.35	0.04
741-CAN	Op Amp	1	0.75	0.08
741S-8	High Slew Rate Op Amp	1	3.15	0.33
747-14	Dual 741	1	1.12	0.12
748-8	GP Op Amp	1	0.75	0.08
748-14	GP Op Amp	1	0.90	0.10
758-14	FM Stereo Mux Decoder	1	3.00	0.58
776-CAN	Programmable Op Amp	1	3.75	0.40
777-14	Precision Op Amp	1	1.50	0.16
1310-14	Codless FM Mux	1	4.29	0.83
1316-14	Audio Amp	1	2.80	0.54
1327-14	Pal Chroma Demod	1	1.95	0.38
1330-14	Lo Level Vid Det	1	1.50	0.29
1331-14	Lo Level Vid Det	1	1.82	0.35
1350-14	Video IF Amp	1	0.98	0.19
1352-14	Video IF Amp and AGC	1	1.37	0.27
1358-14	Sound IF Amp	1	1.30	0.25
1403-8	2.5V Prec Ref	1	2.60	0.28
1405-14	A/D Sub system	1	8.95	0.94
1406-14	8-Bit D/A Conv	1	5.90	0.62
1408L8-14	8-Bit D/A Conv	1	4.50	0.48
1413-16	ULN2003A Darl Array	1	1.45	0.28
1458-CAN	Op Amp	1	2.85	0.30
1458-8	Dual Op Amp	1	0.82	0.09
1458-CAN	Dual Op Amp	1	0.98	0.11
1458-14	Dual Op Amp	1	1.55	0.17
1488	See Interface			
1489	See Interface			
1494-16	4 Quadrant Multiplier	1	6.00	0.63
1495-14	4 Quadrant Multiplier	1	5.25	0.55
1496-CAN	Mod/Demod	1	2.23	0.24
1496-14	Mod/Demod	1	2.68	0.28
1496-8	Mod/Demod	1	1.68	0.18
1550-CAN	RF/IF Amp	1	1.70	0.33
3301-14	Quad Op Amp	1	1.15	0.12
3302-14	Quad Comparator	1	1.10	0.12
3340-8	Electronic Attenuator	1	1.41	0.27
3360-8	¼ Watt Amp	1	1.11	0.21
3401-14	Quad Op Amp	1	0.95	0.10
3403-14	Quad True Diff Op Amp	1	1.50	0.16
3420-14	Switch Reg Control Chip	1	6.75	0.71
3459-14	Quad Address Driver	1	3.50	0.37
3900-14	Quad Op Amp	1	0.90	0.10
3909-8	LED Flasher	1	1.25	0.24
4558-8	Wide Band Op Amp	1	0.98	0.11
4741-14	Quad 741	1	1.60	0.17
HA4741-14	Quad 741 Low Noise Cer	1	3.80	0.40
CA3046-14	Transistor Array	1	2.20	0.43
CA3086-14	Transistor Array	1	1.60	0.31
CA3130-CAN	Fet Input Op Amp	1	2.50	0.27
CA3140-CAN	Fet Input Op Amp	1	1.90	0.20
OAC08CQ	D/A Converter	1	5.20	0.55
OAC100CC03	D/A Converter	1	25.00	2.63
OP01CJ	Hi-Speed OP Amp T05	1	2.90	0.31
OP02EY	Hi Performance OP Amp OIL	1	5.40	0.57
OP05CJ	Compensated OP Amp T05	1	10.70	1.13
OP07CJ	Lo Offset Voltage OP Amp T05	1	11.60	1.22
OP07CY	Lo Offset Voltage OP Amp OIL	1	11.60	1.22
OP15GJ	FET Input Op Amp T05	1	4.60	0.49
OP16GJ	FET Input Op Amp T05	1	4.60	0.49
OP17GJ	FET Input Op Amp T05	1	4.60	0.49
REF01CJ	Precision Voltage Reference 10V+	1	5.40	0.57
REF02CJ	Precision Voltage Reference 5V+	1	5.40	0.57
SN76018	Audio Amp	1	2.59	0.27
TL071	Fet Input OP Amp	1	1.20	0.13
TL081	Fet Input Op Amp	1	1.00	0.11
TL083	Fet Input Op Amp	1	0.80	0.09
TL084	Fet Input Op Amp	1	2.40	0.25

REGULATORS

Type	Description	Bag Qty	Price	+ Tax
309K	Pos 5V 1.5 Amp T03	1	2.90	0.31
317KC	Pos Adj 1.5 Amp T0220	1	3.39	0.36
323	Pos 5V 3 Amp T03	1	4.50	0.48
350K	Pos Adj 3 Amp T03	1	8.65	0.91
723-CAN	Pos Adj 100 Mil	1	1.35	0.14
723-14	Pos Adj 100 Mil	1	0.90	0.10
1461	Pos Tracking T066	1	9.00	0.95
1463	Neg Tracking T066	1	5.85	0.62
1466-14	Precision V + A Reg	1	8.60	0.91
1468-14	Dual 15V Tracking	1	4.35	0.46
1469	Pos 500 M Watt Tracking	1	5.00	0.53
7805P	Pos 1A 5V T0220	1	1.20	0.13
7805K	Pos 1.5A 5V T03	1	2.40	0.25
7806P	Pos 1A 6V T0220	1	1.20	0.13
7808P	Pos 1A 8V T0220	1	1.20	0.13
7812P	Pos 1A 12V T0220	1	1.20	0.13
7812K	Pos 1.5A 12V T03	1	2.40	0.25
7815P	Pos 1A 15V T0220	1	1.20	0.13
7815K	Pos 1.5A 15V T03	1	2.40	0.25
7818P	Pos 1A 18V T0220	1	1.20	0.13
7824P	Pos 1A 24V T0220	1	1.20	0.13
7824K	Pos 1.5A 24V T03	1	2.40	0.25
7905P	Neg 1A 5V T0220	1	1.65	0.18
7905K	Neg 1.5A 5V T03	1	3.35	0.35
7906P	Neg 1A 6V T0220	1	1.65	0.18
7908P	Neg 1A 8V T0220	1	1.65	0.18
7912P	Neg 1A 12V T0220	1	1.65	0.18
7912K	Neg 1.5A 12V T03	1	3.35	0.35
7915P	Neg 1A 15V T0220	1	1.65	0.18
7915K	Neg 1.5A 15V T03	1	3.35	0.35
7918P	Neg 1A 18V T0220	1	1.65	0.18
7924P	Neg 1A 24V T0220	1	1.65	0.18
7924K	Neg 1.5A 24V T03	1	3.35	0.35
78H05	Pos 5V 5 Amp T03	1	8.65	0.91
78GC	Pos 1A Adj	1	2.85	0.30
78MGC	Pos 500 MA Adj	1	2.55	0.27
79GC	Neg 1A Adj	1	2.85	0.30
79MGC	Neg 500 MA	1	2.55	0.27
78L05	Pos 100 MA T092 5V	2	1.00	0.11
78L06	Pos 100 MA T092 6V	2	1.00	0.11
78L08	Pos 100 MA T092 8V	2	1.00	0.11
78L12	Pos 100 MA T092 12V	2	1.00	0.11
78L15	Pos 100 MA T092 15V	2	1.00	0.11
78L18	Pos 100 MA T092 18V	2	1.00	0.11
78L24	Pos 100 MA T092 24V	2	1.00	0.11
79L05	Neg 100 MA T092 5V	1	0.75	0.08
79L06	Neg 100 MA T092 6V	1	0.75	0.08
79L08	Neg 100 MA T092 8V	1	0.75	0.08
79L12	Neg 100 MA T092 12V	1	0.75	0.08
79L15	Neg 100 MA T092 15V	1	0.75	0.08
79L18	Neg 100 MA T092 18V	1	0.75	0.08
79L24	Neg 100 MA T092 24V	1	0.75	0.08

INTERFACE

Type	Description	Bag Qty	Price	+ Tax
8T20N	BI-DI Monostable (Diff In)	1	4.07	0.43
8T23N	Dual IBM 360/370 Intf Driver	1	2.29	0.24
8T24N	Triple IBM 360/370 Intf Receiver	1	2.29	0.24
8T26AN	Quad 3-state BUS Driver/Receiver	1	2.75	0.29
8T28N	Quad 3 state BUS Driver/Receiver	1	2.75	0.29
8T38N	Quad BUS Transceiver (OC)	1	2.31	0.25
8T96N	HS HEX Buffer Inverter	1	1.65	0.18
8T97N	HS HEX Buffer Inverter	1	1.65	0.18
8T98N	HS HEx Buffer Inverter	1	1.65	0.18
1488N-14	RS232 Quad Driver 14 Pin Plastic	1	1.40	0.15
1488L-14	RS232 Quad Driver 14 Pin Cer	1	1.75	0.19
1489AN-14	RS232 Quad Receiver 14 Pin Plastic	1	1.40	0.15
1489AL-14	RS232 Quad Receiver 14 Pin Cer	1	1.75	0.19
75107	Dual Line Receiver	1	2.49	0.26
75108	Dual Line Receiver	1	2.49	0.26
75109	Dual Line Driver	1	2.49	0.26
75110	Dual Line Driver	1	2.49	0.26
75112	Dual Line Driver	1	2.99	0.32
75154	Quad Line Receiver	1	3.99	0.42
75188	RS232 Quad Line Driver 14 Pin Plastic	1	1.40	0.15
75189	Quad Line Receiver	1	1.40	0.15
75363	TTL to MOS Driver	1	3.99	0.42
75365	Quad Clock Driver	1	3.69	0.39
75451	Dual Periph Driver	2	1.22	0.13
75452	Dual Periph Driver	2	1.22	0.13
75491	Quad LED Seg Driver	1	1.18	0.13
75492	Hex LED Seg Driver	1	1.29	0.14
HD1-0165-5	16 Key Encoder	1	8.25	0.87
S1757	UART	1	8.50	0.90
S1883P	UART	1	7.75	0.82
S2350	USRT	1	15.00	1.58
TMS6011	UART	1	5.50	0.58

A-D CONVERTERS

Part No.	Description	Bag Qty	Price	+ Tax
MC3410CL	10 Bit D/A Conv	1	7.95	1.53
TL500	A/D Processor	1	9.37	1.80
TL501	A/D Processor	1	5.23	1.00
TL502	Processor for JL500/501	1	7.90	1.52
TL503	Processor for JL500/501	1	6.10	1.17
TL489	5-Step Analog Lever Detector	1	1.15	0.22
TL490	10-Step Linear Scale Indicator (OC)	1	1.87	0.36
TL491	10-Step Linear Scale Indicator (EM Pull Up)	1	1.85	0.36
TL507	A/D Converter	1	1.25	0.24

MPU

2608	PIP Bug	1	21.00	2.52
2650	CPU	1	26.50	3.18
2651	PCI	1	10.50	1.26
2652	MPCC	1	20.00	2.40
6502	CPU	1	14.30	1.72
6522	PIA	1	12.10	1.45
6532	COMP PIA	1	14.95	1.79
6551	Super ACIA with onboard baud rate gen.	1	14.70	1.76
6800L	CPU	1	18.35	2.20
6800P	CPU	1	11.00	1.32
6801LI	CPU + Monitor Rom (LIL Bug)	1	54.45	6.53
6802P	CPU + Clock + Ram	1	15.70	1.88
6803L	CPU + Ram + Uart + Clock	1	41.25	4.95
6808L	CPU + Clock	1	19.80	2.38
6809L	CPU	1	TBA	
6820	Use 6821P	1		
6821P	PIA	1	5.80	0.70
6828P	PIC	1	10.60	1.27
68A30P8	MIK Bug	1	9.20	1.10
6840P	PTM	1	16.50	1.98
6843L	FDC	1	33.00	3.96
6844L	DMA Controller	1	33.00	3.96
6845L	CRT Controller	1	33.00	3.96
6850P	ACIA	1	5.40	0.65
6852P	SSDA	1	5.80	0.70
6854P	ADLC	1	24.20	2.90
6860L	0-600 BPS Modem	1	11.50	1.38
6862L	2400 BPS Modem	1	15.40	1.85
6871A-1	MPU Clock 921-6KHZ	1	27.00	3.24
6871A-2	MPU Clock 1 MHZ	1	27.00	3.24
6875	MPU Clock Generator	1	7.40	0.89
68Min2	Mini Bug 11 Rom	1	33.00	3.96
68Min3	Mini Bug 111 Rom	1	46.00	5.52
68488L	GPIA	1	34.50	4.14
8080A	CPU	1	15.75	1.66
8224	Use 74LS424			
8228	Use 74S428			
Z80-CPU	CPU - 2 meg	1	18.62	2.23
Z80A-CPU	CPU - 4 meg	1	22.27	2.67
Z80-CTU	CTC	1	14.98	1.80
Z80-PIO	PIO	1	14.98	1.80
9900	CPU	1	41.70	5.00
9901	PI and I/O Controller	1	12.75	1.53
9902	ACC	1	11.80	1.42
9903	SCC	1	TBA	
9904	Use 74LS362			
9980	16 BIT Microcomputor	1	37.50	4.50

MEMORY PRODUCTS

2501	64x5x7 Static ASC11	1	10.78	1.14
3258A	64x5x7 Static ASC11	1	4.00	0.42
66710P	128x7x9 ASC11 Shifted w/- Greek	1	11.75	1.24
66740P	128x7x9 ASC11 Shifted w/- Math Symb Pix	1	11.75	1.24
66750P	128x7x9 ASC11 Shifted w/- Alph/num con	1	11.75	1.24
66760P	128x7x9 ASC11 Shifted 2/- Brit Stand Char	1	11.75	1.24

MISCELLANEOUS

S1998A	Direct Drive Alarm Clock Chip	1	8.50	1.28
S8890	Rhythm Generator	1	11.00	1.85
S50242	Top Octave Synthesiser	1	14.20	2.13
SN76477	Complex Sound Generator	1	4.50	0.87

CMOS

Type	Description	Bag Qty	Price	+ Tax
4000	Dual 3-input NOR Gate plus Inv	2	0.70	0.08
4001	Quad 2-input NOR Gate	2	0.70	0.08
4002	Dual 4-input NOR Gate	2	0.70	0.08
4006	18-Bit static shift register	1	1.81	0.19
4007	Dual complementary Pr plus Inv	2	0.70	0.08
4008	4-Bit full adder	1	1.48	0.16
4009	Hex inverting buffer/level shifter	1	0.80	0.09
4010	Hex non inverting buffer/ level shifter	1	0.80	0.09
4011	Quad 2-Input NAND Gate	2	0.70	0.08
4012	Dual 4-input NAND Gate	2	0.70	0.08
4013	Dual D Flip Flop	1	0.87	0.09
4014	8 Bit static shift register	1	1.61	0.17
4015	Dual 4 Bit static shift register	1	1.16	0.12
4016	Quad analog switch	1	0.87	0.09
4017	Decade Counter/Divider	1	1.61	0.17
4018	Presettable Divide-by N counter	1	1.61	0.17
4019	Quad and/or select gate	2	1.28	0.14
4020	14 Bit binary counter	1	1.71	0.18
4021	8 Bit static shift register		1.61	0.17
4022	Octal counter/divider	1	1.51	0.16
4023	Triple 3 input NAND Gate	2	0.70	0.08
4024	Seven stage ripple counter	1	1.20	0.13
4025	Triple 3 input NOR Gate	2	0.70	0.08
4026	Decade counter w/7 segment outputs	1	2.00	0.21
4027	Dual J-K Flip-Flop	1	0.87	0.09
4028	BCD to decimal decoder	1	1.42	0.15
4029	Presettable UP/Down binary/ decade counter	1	1.21	0.13
4030	Quad 2-input exclusive OR Gate	2	1.20	0.13
4032	Triple Serial adder (positive logic)	1	1.91	0.20
4033	Decade counter w/7 segment outputs	1	2.00	0.21
4034	8 Bit Universal 8us register	1	3.52	0.37
4035	4-Bit shift register	1	1.91	0.20
4040	12-Bit binary counter	1	1.61	0.17
4041	Quad true/complement buffer	1	0.94	0.10
4042	Quad latch	1	1.30	0.14
4043	Quad NOR R S latch	1	1.61	0.17
4044	Quad NAND R S latch	1	1.51	0.16
4046	Phase Locked loop	1	2.32	0.25
4049	Hex inverter/buffer	1	0.90	0.10
4050	Hex buffer	1	0.90	0.10
4051	8 Channel Analog Multiplexor	1	1.20	0.13
4052	Dual 4 Channel Analog Multiplexor	1	1.20	0.13
4053	Triple 2 Channel Analog Multiplexer	1	1.20	0.13
4060	14 Stage binary counter & osc.	1	1.31	0.14
4066	Quad analog switch	1	1.01	0.11
4068	8 input NAND Gate	2	0.70	0.08
4069	Hex Inverter	2	0.70	0.08
4070	Quad exclusive OR Gate	2	0.70	0.08
4071	Quad 2 input OR Gate	2	0.70	0.08
4072	Dual 4 input OR Gate	2	0.70	0.08
4073	Triple 3 input AND Gate	2	0.70	0.08
4075	Triple 3 input OR Gate	2	0.70	0.08
4076	quad D-type register	1	1.81	0.19
4077	Quad Exclusive NOR Gate	2	0.70	0.08
4078	8-Input NOT Gate	2	0.70	0.08
4081	Quad 2-Input and Gate	2	0.70	0.08
4082	Dual 4-Input and Gate	2	0.70	0.08
4093	Quad 2-Input and Schmitt Trigger	1	0.70	0.08
4160	Decade Counter (ASY Clear)	1	1.15	0.12
4161	Binary Counter (ASY Clear)	1	1.15	0.12
4163	Binary Counter (SYN Clear)	1	1.15	0.12
4174	HEX D Flip-Flop	1	1.15	0.12
4175	Quad D Flip-Flop	1	1.60	0.17
4194	4 Bit Universal shift register	1	1.81	0.19
4402	Dual 4 input expandable NOR Gate	2	0.70	0.08
4404	8 Stage binary counter	1	0.94	0.10
4408	Binary to phone pulse converter	1	10.06	1.06
4409	Binary to phone pulse converter	1	10.06	1.06
4410	2 of 8 tone encoder	1	9.28	0.98
4411	Bit Rate Generator	1	11.60	1.22
MC14412FP	Universal low speed modem	1	16.54	1.74
SCL4412	Dual 4 input expandable NAND Gate	2	0.84	0.09
4415	Quad Precision Timer/Driver	1	10.15	1.07
4416	Quad analog switch	1	0.70	0.08
4419	2 of 8 Keypad to binary encoder	1	3.26	0.35
4422	Remote control transmitter	1	8.67	0.91
4426	Decade counter w/7 segment driver outputs	1	2.20	0.23
4428	Binary to octal decoder	1	1.50	0.16
MC14433	3½ Digit A/D converter	1	12.78	1.34
SCL4433	Decade counter w/7 segment driver outputs	1	2.11	0.22
4435	3½ digit A/D logic subsystem	1	7.93	0.84
4441	Quad buffer driver	1	1.21	0.13
4445	21 Stage frequency divider and oscillator	1	2.36	0.25
4446	Phase Locked loop	1	3.34	0.35
4449	Hex Inverter	2	0.88	0.09
4450	OSC. 16 Stage divider/buffer flatpack	1	3.62	0.38
4451	Oscillator/divider buffer	1	3.62	0.38
4490FP	Hex Bounce Eliminator 15V	1	3.62	0.38
4490VP	Hex Bounce Eliminator 5V	1	3.12	0.33
4500	1 bit Micro Processor	1	10.92	1.15
4501	Triple gate	2	0.70	0.08
4502	Strobed Hex Inverter/Buffer	1	1.71	0.18
4503	Hex 3-stage buffer	1	1.16	0.12
4506	Dual expandable AOI Gate	1	0.70	0.08
4507	Order 4070	2	0.70	0.08
4508	Dual 4-Bit latch	1	4.28	0.45
4510	BCD UpDown counter	1	1.71	0.18
4511	BCD to7 Segment Latch/ Decoder/Driver	1	1.42	0.15
4512	8 Channel data selector	1	1.42	0.15
4513	BCD/7 Segment latch/decoder/ driver	1	2.36	0.25
4514	4-Bit latch/4-to-16 Line decoder (high)	1	3.34	0.35
4515	4-Bit latch/4-to-16 Line decoder (low)	1	3.34	0.35
4516	Binary Up/Down counter	1	1.71	0.18
4517	Dual 64-Bit static shift register	1	8.66	0.91
4518	Dual BCD Up counter	1	1.71	0.18
4519	4-Bit AND/OR selector	1	0.91	0.10
4520	Dual binary Up counter	1	1.71	0.18
4521	24-Stage frequency divider	1	3.12	0.33
4522	Programmable BCD Divide by-N counter	1	1.71	0.18
4526	Programmable binary Divide-by-N-counter	1	1.71	0.18
4527	BCD Rate multiplier	1	3.12	0.33
4528	Dual Monostable Multivibrator	1	1.81	0.19
4529	Dual 4-Channel analog data selector	1	2.02	0.22
4530	Dual 5-input majority logic gate	1	0.90	0.10
4531	12-Bit parity tree	1	1.45	0.16
4532	8-Bit priority encoder	1	2.52	0.27
4534	Real time 5-decade counter	1	8.30	0.87
4536	Programmable timer	1	6.03	0.64
4538	Dual precision Mono Multivibrator	1	2.22	0.24
4539	Dual 4-Channel data Selector/Multiplexer	1	1.44	0.16
4541	Programmable Osc/Timer	1	2.02	0.22
4543	BCD-to-7 Seg Latch/ Decoder/Driver	1	2.81	0.30
4549	Successive approximation register	1	6.52	0.69
4553	3-Digit BCD counter	1	6.84	0.72
4554	2x2-Bit parallel binary multiplier	1	2.12	0.23
4555	Dual binary to 1-of-4 decoder	1	1.01	0.11
4556	Dual binary to 1-of-4 decoder (inverting)	1	1.01	0.11
4557	1-to-64-Bit variable length shift register	1	6.87	0.72
4558	BCD-to-7 segment decoder	1	2.02	0.22
4559	Successive Approximation register	1	6.52	0.69
4560	NBCD adder	1	3.26	0.35
4561	9's complementer	1	1.13	0.12
4562	128-Bit static shift register	1	8.15	0.86
4566	Industrial time base generator	1	2.68	0.28
4568	Phase comp/prog counter	1	3.78	0.40
4569	Dual prog BCD/binary counter	1	2.34	0.25
4572	Hex gate	2	1.08	0.12
4580	4x4 Multiport register	1	8.88	0.94
4581	4-Bit arithmetic logic unit	1	4.13	0.44
4582	Look-ahead carry block	1	1.61	0.17
4583	Dual Schmitt trigger	1	1.41	0.15
4584	Hex Schmitt trigger	1	0.76	0.08
4585	4-Bit magnitude comparator	1	2.00	0.21
4599	8-Bit latch	1	3.04	0.32
45104	PLL Freq synth	1	6.82	0.72
45106	PLL Freq synth	1	7.38	0.78
45107	PLL Freq synth	1	6.82	0.72
45109	PLL Freq synth	1	6.82	0.72
45112	PLL Freq synth	1	7.38	0.78
5411	Oscillator 16 stage divider	1	3.20	0.34
74C00	Quad 2-input NAND Gate	2	0.70	0.08
74C02	Quad 2-input NOR Gate	2	0.70	0.08
74C04	Hex Inverter	2	0.70	0.08
74C08	Quad 2-input AND Gate	2	0.70	0.08
74C10	Triple 3-input NAND Gate	2	0.70	0.08
74C14	Hex Schmitt Trig	1	1.75	0.19
74C20	Dual 4-input NAND Gate	2	0.70	0.08
74C30	8-input NAND Gate	2	0.70	0.08
74C32	Quad 2-input OR Gate	2	0.80	0.09
74C42	BDC to Decimal Decoder	1	1.42	0.15
74C48	BCD/7 Seg Decoder/Driver	1	2.31	0.35
74C73	Dual J-K Master-Slave F/F	1	1.10	0.12
74C74	Dual D-Type Edge-Trig F/F	1	0.90	0.10
74C76	Dual J-K Master-Slave F/F	1	0.90	0.10
74C83	4-Bit Bin full adder	1	2.20	0.23
74C85	4-Bit Magnitude Comparator	1	2.56	0.27
74C86	Quad 2-input Excl OR Gate	1	0.99	0.11
74C89	64-Bit Tri-State RAM	1	6.75	0.71
74C90	Decade Counter	1	1.32	0.14
74C93	4-Bit Bin Counter	1	1.32	0.14
74C95	4-Bit L/R Shift Reg	1	1.61	0.17
74C107	Dual J-K Master-Slave F/F	1	1.89	0.20
74C151	8 to 1 MUX	1	2.50	0.27
74C154	4 to 16 Decoder/Demux	1	3.84	0.41
74C157	Quad 2-in Data Selector	1	2.36	0.25
74C160	Sync 4-Bit Decade Counter	1	1.96	0.21
74C161	Sync 4-Bit Binary Counter	1	1.96	0.21
74C162	Sync 4-Bit Decade Counter	1	1.96	0.21
74C163	Sync 4-Bit Binary Counter	1	1.96	0.21
74C164	8-Bit P Out Serial S R	1	1.61	0.17
74C165	Parallel-Load 8-Bit S R	1	1.61	0.17
74C173	Tri-State Quad D F/F	1	1.61	0.17
74C174	Hex D F/F with Clear	1	1.75	0.19
74C175	Quad D-Type Edge Trig F/F	1	1.61	0.17
74C192	Sync Decade Up/Down Counter	1	1.75	0.19
74C193	Sync 4-Bit Up/Down Counter	1	1.96	0.21
74C195	4-Bit Parallel Shift Register	1	1.65	0.18
74C221	Dual Monostable Multi	1	2.05	0.22
74C901	Hex Inv TTL Buff	1	0.84	0.09
74C9022	Decade Counter	1	0.95	0.10
74C903	Hex Inv P. Mos Buff	1	0.84	0.09
74C904	Hex Non/Inv P. Mos Buff	1	0.84	0.09
74C906	Open Drain Buff Active P. Down	1	0.84	0.09
74C907	Open Drain Buff Active P Up	1	0.84	0.09
74C914	Hex Schmitt Trig	1	2.18	0.23
74C922	16 Keyboard Encoder	1	5.65	0.60
74C925	4 Dec Counter/Divider	1	7.40	0.78
74C926	4 Digit Counter/Display Driver	1	7.40	0.78
74C927	4 Digit Counter/Mux 7 Seg	1	7.40	0.78
74C926	4 Digit Counter/Mux 7 Seg	1	7.40	0.78
80C97	Hex Buffer Inverter	1	0.94	0.10

TTL (S)

74S00	Quad 2-Input NAND Gate	1	0.75	0.08
74S02	Quad 2-Input NOR Gate	1	0.75	0.08
74S03	Quad 2-Input NAND Gate	1	0.75	0.08
74S04	Hex Inverter	1	0.80	0.09
74S08	Quad 2-Input AND Gate	1	0.75	0.08
74S10	Triple 3-Input NAND Gate	1	0.75	0.08
74S11	Triple 3-Input AND Gate	1	0.75	0.08
74S30	8-Input NAND Gate	1	0.75	0.08
74S32	Quad 2-Input OR Gate	1	0.75	0.08
74S37	Quad 2-Input NAND Buffer	1	1.65	0.18
74S38	Quad 2-Input NAND Buffer (OC)	1	1.65	0.18
74S51	Dual 2-Wide 2-Input AOI	1	0.75	0.08
74S74	Dual D-Type Edge Triggered F/F	1	1.20	0.13
74S86	Quad 2-Input Exclusive OR Gate	1	1.50	0.16
74S112	Dual J-K Neg Edge F/F	1	1.20	0.13
74S113	Dual J-K Pos Edge F/F	1	1.20	0.13
74S135	Quad Exclusive OR/NOR Gate	1	2.10	0.22
74S138	3 to 1 of 8 Decoder/Demux	1	3.00	0.32
74S139	Dual 2 to 10 of 4 Decoder/Demux	1	3.00	0.32
74S151	1 of 8 Mux	1	2.85	0.30
74S157	Quad 2 to 1 Line Mux	1	2.85	0.30
74S158	Quad 2 to 1 Line Mux	1	2.85	0.30
74S174	Hex D-Type F/F with clear	1	4.15	0.44
74S175	Quad D-Type Edge Triggered F/F	1	4.15	0.44
74S181	4-Bit Arithmetic Logic Unit	1	8.25	0.87
74S182	Look Ahead Carry Generator	1	3.15	0.33
74S188	32 x 8 Bipolar Prom (OC)	1	3.87	0.37
74S57	Quad 2 to 1 Selector/Mux	1	3.00	0.32
74S287	256 x 4 Bipolar Prom (3 state)	1	3.00	0.32
74S387	256 x 4 Bipolar Prom(OC)	1	3.00	0.32
74S428	Direct Replacement Intel 822B	1	5.50	0.58

74	Description	Bag Qty	TTL Price	+ Tax	TTL (LS) Price	+ Tax
00	Quad 2in Nand Gate	2	0.56	0.06	0.56	0.06
00*	Quad 2in Nand Gate (5 PK)	5	1.14	0.12	1.14	0.12
01	Quad 2in Nand Gate (OC)	2	0.70	0.08	0.70	0.08
02	Quad 2in Nor Gate	2	0.66	0.07	0.66	0.07
02*	Quad 2in Nor Gate (5 PK)	5	1.14	0.12	1.14	0.12
03	Quad 2in Nand Gate (OC)	2	0.70	0.08	0.70	0.08
04	Hex Inverter	2	0.66	0.07	0.70	0.08
04*	Hex Inverter (5 PK)	5	1.14	0.12	1.14	0.12
05	Hex Inverter (OC)	2	0.80	0.09	0.80	0.09
06	Hex Inverter B/D (OC)	1	0.76	0.08	NA	
07	Hex Buffer/Driver (OC)	1	0.76	0.08	NA	
08	Quad 2in and Gate	2	0.76	0.08	0.76	0.08
09	Quad 2in and Gate (OC)	2	0.76	0.08	0.76	0.08
10	Triple 3in Nand Gate	2	0.66	0.07	0.66	0.07
10*	Triple 3in Nand Gate (5 PK)	5	1.14	0.12	1.14	0.12
11	Triple 3in and Gate	2	0.86	0.09	0.86	0.09
12	Triple 3in Nand Gate (OC)	2	0.80	0.09	0.80	0.09
13	Dual Nand Schmitt Trigger	1	0.76	0.08	0.76	0.08
14	Hex Schmitt Trigger	1	0.86	0.09	0.86	0.09
15	Triple 3in and Gate (OC)	2	0.80	0.09	0.75	0.08
16	Hex INV Buff/Driver (OC)	1	0.76	0.08	NA	
17	Hex Buff Driver (OC)	1	0.76	0.08	NA	
20	Dual 4in Nand Gate	2	0.70	0.08	0.70	0.08
21	Dual 4in and Gate	2	NA		0.70	0.08
22	Dual 4in Nand Gate (OC)	2	0.80	0.09	0.75	0.08
23	EXP Dual 4in Nor W/Strobe	2	0.80	0.09	NA	
25	Dual 4in Nor W/Strobe	2	0.80	0.09	NA	
26	Quade 2in Nand Gate	2	0.80	0.09	NA	
27	Triple 3in NOR Gate	2	0.80	0.09	0.75	0.08
28	Quade 2in Nor Buffer	2	0.80	0.09	0.80	0.09
30	8in Nand Gate	2	0.70	0.08	0.75	0.08
32	Quad 2in or Gate	2	0.66	0.07	0.80	0.09
33	Quad 2in Nor Buffer (OC)	2	0.90	0.10	0.90	0.10
37	Quad 2in Nand Buffer	2	0.80	0.09	0.90	0.10
38	Quad 2in Nand Buffer (OC)	2	0.80	0.09	0.90	0.10
40	Dual 4in Nand Buffer	2	0.70	0.08	0.70	0.08
41	BCD, OEC Decoder/Driver	1	1.43	0.15	NA	
42	BCD, DEC Decoder/Driver	1	0.90	0.10	0.90	0.10
43	EXC 3, OEC Decoder/Driver	1	1.56	0.17	NA	
44	EXC 3/Grey, OEC Decoder	1	1.15	0.12	NA	
45	BCD, OEC Decoder/Driver	1	1.97	0.21	NA	
46	BCD, 7 SEG Decoder/Driver 30Volt put	1	1.26	0.14	NA	
47	BCD, 7 SEG Decoder/Driver 15V put	1	1.26	0.14	1.50	0.16
47*	BCD, 7 SEG Decoder/Driver	2	2.00	0.21	2.35	0.25
48	BCD, 7 SEG Decoder Driver O C	1	1.26	0.14	1.50	0.16
50	Dual 2WD 2in and/or INV Gate	2	0.70	0.08	NA	
51	And/or Invert Gate	2	0.70	0.08	0.75	0.08
53	EXP 4 wide and/or INV Gate	2	0.70	0.08	NA	
54	4 wide and/or INV Gate	2	0.70	0.08	0.80	0.09
55	2 wide and/or INV Gate	2	NA		0.80	0.09
60	Dual 4in expander	2	0.70	0.08	NA	
63	Hex Current-sensing interface Gates		NA		2.50	0.27
70	And Gated J-K Flip-flop with reset and clear	1	0.70	0.08	NA	
72	And Gated J-K Flip-flop with reset and clear	2	1.20	0.13	NA	
73	Dual J-K Flip-Flop with Clear	1	0.70	0.08	NA	
74	Dual D type Flip-flop with preset and clear	2	0.70	0.08	0.85	0.09
75	4 bit bistable latch	2	1.00	0.11	1.00	0.11
76	Dual J-K Flip-flop with preset and clear	1	0.70	0.08	0.70	0.08
78	Dual J-K with preset, com clear and com CLK	1	NA		0.70	0.08
79	Use 7474		NA		NA	
80	Gated full adders	1	1.25	0.13	NA	
81	16 Bit Ram	1	1.50	0.16	NA	
82	2 Bit Binary full adder	1	1.70	0.18	NA	
83	4 bit Binary full adder with fast carry	1	1.70	0.18	1.70	0.18
84	16 bit Ram	1	1.70	0.18	NA	
85	4 bit magnitude comparator	1	1.50	0.16	1.50	0.16
86	Quad 2in EXC or Gate	1	0.70	0.08	0.70	0.08
90	Decade Counter	2	0.90	0.10	1.23	0.13
90*	Decade Counter (5 PK)	5	1.96	0.21	2.87	0.30
91	8 bit Shift Reg	1	0.70	0.08	1.35	0.14
92	Divide by 12 counter	1	0.90	0.10	0.90	0.10
93	4 bit Binary counter	1	0.70	0.08	0.90	0.10
94	4 bit Shift Reg	1	1.20	0.13	NA	
95	4 bit Shift Reg.	1	1.10	0.12	1.25	0.13
96	5 bit Shift Reg.	1	1.32	0.14	1.32	0.14
97	SYNC 6 bit binary rate multiplexer	1	3.18	0.33	NA	
100	8 bit bistable latch	1	2.60	0.27	NA	
107	Dual J-K Flip-flop with clear	1	0.80	0.09	0.65	0.07
109	Dual J-K Flip-flop with clear and preset	1	0.80	0.09	0.65	0.07
110	And/gated J-K Flip-flop with data lockout	1	0.80	0.09	NA	
111	Dual J-K Flip-flop with data lockout.	1	1.00	0.11	NA	
112	Dual J-K Flip-flop with preset and clear	1	NA		0.65	0.07
113	Dual J-K Flip-flop with preset	1	NA		0.65	0.07
114	Dual J-K Flip-flop with com clear com clock and preset	1	NA		0.65	0.07
120	Dual pulse Syncronizer/Driver	1	1.88	0.20	NA	
122	Retrig Mono Multi with clear	1	0.80	0.09	0.80	0.09
123	Dual Retrig Mono Multi with clear	1	1.10	0.12	1.30	0.14
125	Quad Bus Buffer Tri-state	1	1.00	0.11	1.00	0.11
126	Quad Bus Buffer Tri-state	1	1.00	0.11	1.00	0.11
128	50 OHM line driver	1	1.00	0.11	NA	
132	Quad 2in Pos-nand Schmitt Trigger	1	1.37	0.14	0.37	0.14
136	Quad EXC-OR Gate	1	0.90	0.10	0.90	0.10
138	3 to 8 line Decoder/Multiplexer	1	NA		1.25	0.13
139	Dual 2 to 4 line Decoder/Multiplexer	1	NA		1.25	0.13
141	BCD-DEC Decoder/driver	1	1.59	0.17	NA	
142	Counter/latch/decoder/driver	1	4.80	0.50	NA	
143	Counter/latch/decoder/driver	1	5.50	0.58	NA	
144	Counter/latch/decoder/driver	1	5.50	0.58	NA	
145	BCD-DEC Decoder/driver	1	1.67	0.18	2.00	0.21
147	10 line DEC to 4 line BCD priority encoder	1	2.83	0.30	2.83	0.30
148	8 line to 3 line priority encoder	1	2.00	0.21	1.50	0.16
150	1 of 16 selector/multiplexer	1	1.59	0.17	NA	
151	1 of 8 selector/multiplexer	1	1.59	0.17	1.00	0.11
153	Dual 4 line to 1 line selector/multiplexer	1	1.59	0.17	1.00	0.11
154	4 line to 16 line Decoder/Multiplexer	1	2.10	0.22	NA	
155	Decoder/Demultiplexer	1	1.60	0.17	1.90	0.20
156	Decoder Demultiplexer	1	1.40	0.15	1.40	0.15
157	Quad 2 to 1 line Selector/Multiplexer	1	1.40	0.15	1.25	0.13
158	Quad 2 to 1 line Selector/Multiplexer	1	1.40	0.15	1.30	0.14
160	Syncronous 4 bit counter	1	1.80	0.19	1.40	0.15
161	Syncronous 4 bit counter	1	1.80	0.19	1.40	0.15
162	Syncronous 4 bit counter	1	1.80	0.19	1.40	0.15
163	Syncronous 4 bit counter	1	1.80	0.19	1.40	0.15
164	8 bit parallel out serial shift reg.	1	1.80	0.19	1.45	0.15
165	Parallel load 8 bit SR	1	1.80	0.19	2.15	0.23
166	8 bit shift reg.	1	2.00	0.21	3.00	0.32
167	SYNC Decade rate multi	1	4.80	0.50	NA	
170	4 x 4 Register file	1	3.30	0.35	2.70	0.28
172	16 bit Register file	1	11.40	1.20	NA	
173	4 bit D-Type reg	1	2.70	0.28	1.10	0.12
174	Hex D-Type Flip-flop	1	1.80	0.19	1.10	0.12
175	Quad D-Type Flip-flop	1	1.10	0.12	1.10	0.12
176	Presetable counter/latch	1	1.80	0.19	NA	
177	Presetable counter/latch	1	1.80	0.19	NA	
178	4 bit Uni shift reg	1	2.00	0.21	NA	
179	4 bit Uni shift reg	1	2.00	0.21	NA	
180	9 bit odd/even Par Gen/checker	1	1.84	0.19	NA	
181	ALU/function generator	1	3.60	0.38	3.60	0.38
182	Look ahead carry generator	1	1.60	0.17	NA	
183	Dual carry-save full adder	1	NA		5.10	0.54
184	Code coverter	1	3.50	0.37	NA	
185	Code converter	1	3.50	0.37	NA	
186	512 bit prom	1	19.80	2.08	NA	
188	256 bit prom	1	3.30	0.35	NA	
190	SYNC up/down counter	1	2.30	0.24	1.65	0.17
191	SYNC up/down counter	1	2.30	0.24	1.65	0.17
192	SYNC up/down dual clock counter	1	2.30	0.24	1.50	0.16
194	4 bit BI-DIR uni shift reg	1	1.80	0.19	1.30	0.14
195	4 bit par-access shift reg	1	1.30	0.14	1.30	0.14
196	Presentable counter/latch	1	1.65	0.17	1.65	0.17
197	Presetable counter/latch	1	1.65	0.17	1.65	0.17
198	8 bit bidirect unit SR	1	2.50	0.26	NA	
199	8 bit bidirect unit SR	1	2.50	0.26	NA	
221	Dual Mono Multi	1	1.70	0.18	2.00	0.21
240	Octal buffer/driver/recsever	1	NA		2.10	0.22
241	Octal buffer/driver/reciever	1	NA		2.10	0.22
242	Quad bus transceiver	1	NA		2.10	0.22
243	Quad bus transceiver	1	NA		2.10	0.22
244	Octal buffer/driver/receiver	1	NA		2.10	0.22
245	Octal bus transceiver	1	NA		2.70	0.28
247	BCD-7SEG decoder/driver	1	2.30	0.24	2.20	0.23
248	BCD-7 SEG decoder/driver	1	2.30	0.24	2.20	0.23
249	BCD-7 SEG decoder/driver (OC)	1	2.30	0.24	2.20	0.23
251	Data sel/multiplexer	1	1.50	0.16	1.50	0.16
253	Dual Sel/multiplexer	1	NA		1.50	0.16
257	Quad sel/multiplexer	1	NA		1.50	0.16
258	Quad sel/multiplexer	1	NA		1.50	0.16
259	8 bit addressable latch	1	3.30	0.35	2.00	0.21
261	2 x 4 bit PAR Binary multi	1	NA		3.54	0.37
265	Quad comp-out element	1	1.20	0.13	NA	
266	Quad 2in nor gate (OC)	1	NA		0.90	0.10
273	Octal D-Type Flip-flop	1	3.30	0.35	2.30	0.24
275	7 bit slice Wallace tree	1	NA		7.00	0.74
276	Quad J-K Flip-flop	1	2.00	0.21	NA	
278	4 bit cascade prio reg	1	3.75	0.39	NA	
279	Quad S-R latch	1	1.20	0.13	1.20	0.13
280	9 bit odd/even Parity GEN/CHK	1	NA		3.90	0.41
283	4 bit bin full adder	1	2.00	0.21	1.35	0.14
284	4 x 4 PAR bin multi	1	5.60	0.59	NA	
285	4 x 4 PAR bin multi	1	5.60	0.59	NA	
	Decade counter	1	1.30	0.14	1.35	0.14

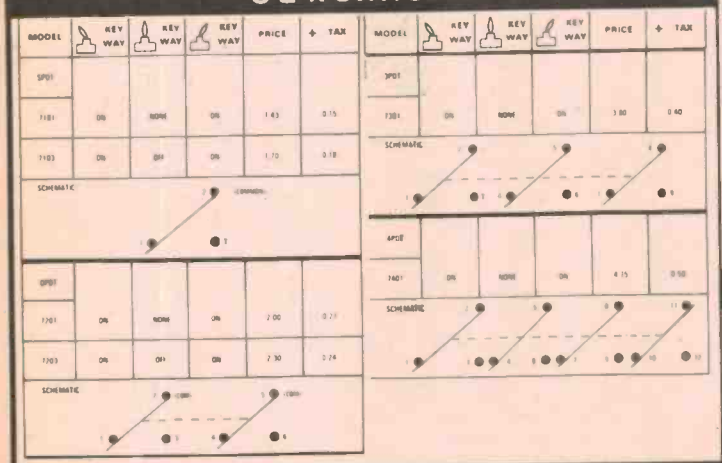
TTL / TTL (LS)

74	Description	Bag Qty	Price	+ Tax	Price	+ Tax
293	4 bit Binary counter	1	1.30	0.14	1.40	0.15
295	4 bit bidirect uni S.R.	1	NA		2.20	0.23
298	Quad 2in multi with storage	1	2.10	0.22	2.20	0.23
323	8 bit bidir uni shift/stor reg.	1	NA		8.25	0.87
324	Voltage Controlled OSC	1	NA		1.65	0.17
325	Dual Voltage Controlled OSC	1	NA		5.20	0.55
326	Dual Voltage Controlled OSC	1	NA		5.20	0.55
327	Dual Voltage Controlled OSC	1	NA		5.20	0.55
351	Dual 8-1 line Sel/Multi	1	3.60	0.38	NA	
352	Dual 4-1 line Sel/Multi	1	NA		2.50	0.26
353	Dual 4-1 line Sel/Multi	1	NA		2.50	0.26
362	4 PH CLK GEN for TMS 9900	1	NA		1.10	0.12
365	HEX Bus Dirver	1	1.10	0.12	1.10	0.12
366	HEX Bus Driver	1	1.10	0.12	1.10	0.12
367	HEX Bus Driver	1	1.10	0.12	1.10	0.12
368	HEX Bus Driver	1	1.10	0.12	1.10	0.12
373	Octal D Type Latch	1	NA		2.55	0.27
374	Octal D Type Flip-flop	1	NA		2.55	0.27
375	4 bit B1 Latch	1	NA		0.90	0.10
377	Octal D Type Flip-flop	1	NA		3.12	0.33
378	HEX D Type Flip-flop	1	NA		1.65	0.17
379	Quad D Type Flip-flop	1	NA		2.25	0.24
386	Quad 2in EXC-OR Gate	1	NA		0.90	0.10
390	Dual Decade Counter	1	2.00	0.21	2.20	0.23
393	Dual 4 Bit Bin Counter	1	2.50	0.26	2.30	0.24
395	4 Bit Uni Shift Reg.	1	NA		2.20	0.23
396	Octal Storage Reg.	1	NA		2.60	0.27
398	Quad 2in Multi with store	1	NA		3.90	0.41
399	Quad 2in Multi with store	1	NA		2.86	0.30
424	Direct replacement Intel 8224	1	NA		5.10	0.54
425	Quad Gate	1	1.00	0.11	NA	
426	Quad Gate	1	1.00	0.11	NA	
445	BCD-7 SEG DEC/DRV 7V	1	NA		2.25	0.24
447	BCD-7 SEG DEC/DRV	1	NA		1.65	0.17
490	Dual Decade Counter	1	3.50	0.37	3.50	0.37
668	SYNC 4 bit up/down Dec Count.9	1	NA		1.45	0.15
669	SYNC 4 bit up/down Dec Count.	1	NA		1.45	0.15
670	4 x 4 REG File Tri-state	1	NA		3.00	0.32
673	16 bit Ser In/Ser out S.R.	1	NA		18.00	1.89
674	16 bit Ser In/Ser out S.R.	1	NA		18.00	1.89

WIRE - WRAP

Part No	Description	Bag Qty	Price
WSU30M	Modified Wire Wrap Tool	1	9.50
WW50R	Wire Wraping Wire Red	50ft	2.60
WW50B	Wire Wraping Wire Blue	50ft	2.60
WW50Y	Wire Wraping Wire Yellow	50ft	2.60
3WW5	Wire Wraping Wire Length 3.5 inches	100	1.63
5WW	Wire Wraping Wire Length 5 inches	100	1.84

C & K SWITCHES



SC270

Precision Minature Sidecutters

Price $6.50

Features

- High Strength
- Less Bulk
- Thinner Profile
- Lower Operator Fatigue
- Low Cost

SCOPE TC60

Soldering Iron

Price $40.60

Replaces any 10W to 60W Iron

- Variable Wattage
- Variable Screw on Tips
- Variable Temp 200° - 400°
- 240 Volts Mains Operated

STS	Safety Stand with sponge	**$8.80**
LL	Replacement Tips	**$1.60**
	Your choice	
	1.6mm Double Flat	
	2.4mm Double Flat	
	4.8mm Single Flat	
AS	**Anti Seize Lube**	**$1.60**

PL475

Precision Minature Needle Nose Pliers

Price $6.00

STATIC RAMS

Part No.	Description	Bag Qty	Price	+ Tax
21L02A-4	1Kx1 450 NS Low Power	1	2.20	0.23
2102A-4	1Kx1 450 NS	1	1.95	0.21
2112-1N	256x4 500 NS	1	3.00	0.32
2112-A	256x4 350 NS	1	4.20	0.44
2114/4045	1Kx4 450 NS	1	7.60	0.80
2114-3	1Kx4 300 NS	1	10.00	1.05
TMS4044	4Kx1 450 NS	1	10.00	1.05
HM3-6501-9	256x4 CMOS Low Power 285 NS	1	9.90	1.04
HM3-65010-5	256x4 CMOS 500 NS	1	6.44	0.68
HM1-6508-9	256X4 CMOS 285 NS	1	8.25	0.87
HM1-65080-5	256X4 CMOS 500 NS	1	5.95	0.63
HM1-6504-9	4Kx1 CMOS 300 NS	1	52.20	5.48
HM1-8514-9	1Kx4 CMOS 300 NS	1	52.20	5.48

DYNAMIC RAMS

Part No.	Description	Bag Qty	Price	+ Tax
TMS4060	4Kx1 22 Pin 300 NS	1	16.73	1.76
MC4096	4Kx1 16 Pin 350 NS	1	7.20	0.76
TMS4116	16Kx1 16 Pin 200 NS	1	18.50	1.94

SHIFT REGISTERS

SYP1404A	1024x1 Dynamic	1	4.45	0.47
SYP2527V	Dual 256 Bit Static	1	5.35	0.57
SYP25328	Quad 80-Bit Static	1	4.78	0.51
SYP25338	1024-Bit Static	1	7.07	0.75
TMS3113NC	Dual 133-Bit Static	1	5.93	0.63
TMS3120NC	Quad 80-Bit Static	1	5.93	0.63

UV PROMS

Part No.	Description	Bag Qty	Price	+ Tax
1702	256x8 1500NS	1	10.00	1.05
2708	1Kx8 450NS	1	13.50	1.42
2716	2Kx8 450NS+5V	1	56.00	5.88
TMS2716	2Kx8 450NS 3 Rail	1	30.00	3.15
TMS2532	4Kx8 450NS+5V	1	77.00	8.09

FUSIBLE LINK PROMS

HPROM10512-5	64x8 55 NS Access	1	12.82	1.35
HPROM11024-5	256x4 50 NS Access	1	5.25	0.55
HM37602-5	32x8 Hi-Speed Prog OC	1	2.67	0.28
HM37603-5	32x8 Hi-Speed Prog TS	1	2.67	0.28
HM37610-5	256x4 Hi-Speed Prog OC	1	3.12	0.33
HM37611-5	256x4 Hi-Speed Prog TS	1	3.12	0.33
HM37620-5	512x4 Hi-Speed Prog OC	1	5.94	0.63
HM37621-5	512x4 Hi-Speed prog TS	1	5.94	0.63
HM37641-5	512x8 Hi-Speed Prog TS	1	11.88	1.25

PLUGS AND SOCKETS
LOW PROFILE SOCKETS

Part No.	Description	Bag Qty	Price	+ Tax
LPS- 08-G	8-Pin Gold	2	0.70	0.08
LPS- 08-T	8-Pin Tin	2	0.65	0.07
LPS- 14-G	14-Pin Gold	2	1.00	0.11
LPS- 14-T	14-Pin Tin	2	0.90	0.10
LPS- 16-G	16-Pin Gold	2	1.10	0.12
LPS- 16-T	16-Pin Tin	2	1.00	0.11
LPS- 18-G	18-Pin Gold	1	0.68	0.07
LPS- 18-T	18-Pin Tin	1	0.63	0.07
LPS- 22-G	22-Pin Gold	1	0.81	0.09
LPS- 22-T	22-Pin Tin	1	0.79	0.09
LPS- 24-G	24-Pin Gold	1	0.85	0.09
LPS- 24-T	24-Pin Tin	1	0.80	0.09
LPS- 28-G	28-Pin Gold	1	1.25	0.13
LPS- 28-T	28-Pin Tin	1	1.10	0.12
LPS- 40-G	40-Pin Gold	1	1.55	0.17
LPS- 40-T	40-Pin Tin	1	1.47	0.16

STANDARD SOCKETS (WIRE WRAP)

CA-08S-WW	8-Pin	2	1.20	0.13
CA-14S-WW	14-Pin	1	0.75	0.08
CA-16S-WW	16-Pin	1	0.80	0.09
CA-18S-WW	18-Pin	1	0.90	0.10
CA-22S-WW	22-Pin	1	1.20	0.13
CA-24S-WW	24-Pin	1	1.30	0.14
CA-28S-WW	28-Pin	1	1.82	0.19
CA-36S-WW	36-Pin	1	2.20	0.23
CA-40S-WW	40-Pin	1	2.38	0.25

DIP PLUGS

DIP-14	14-Pin Dip Plug Without Cover	2	1.12	0.12
DP-16	16-Pin Dip Plug Without Cover	2	1.20	0.13
DP-24	24-Pin Dip Plug Without Cover	1	0.94	0.10
DPC-14	14-Pin Dip Plug With Cover	1	0.70	0.08
DPC-16	16-Pin Dip Plug With Cover	1	0.75	0.08
DPC-24	24-Pin Dip Plug With Cover	1	1.25	0.13

XLP SERIES - CONNECTORS

XLP-3-11C		1	3.62	0.70
XLP-3-12C		1	3.37	0.65
XLP-3-13		1	3.17	0.61
XLP-3-14		1	2.66	0.51
XLP-3-31		1	3.62	0.70
XLP-3-32		1	2.36	0.45
XLR-LNE-11C		1	4.25	0.82
XLR-LNE-12C		1	3.93	0.76
XLR-LNE-31		1	4.25	0.82
XLR-LNE-32		1	3.47	0.67

"D" TYPE CONNECTORS

DB25S	25 Pin Socket	1	7.09	0.74
DB25P	25 Pin Plug	1	4.45	0.47
51212-1	Cover	1	1.58	0.17

EDGE CONNECTORS

H431111-22	135 Pitch 22/44 Way Wirel Wrap		4.45	0.47
H431121-22	125 Pitch 22/44 Way Solderl Tail		4.40	0.46
H431111-50	S-100 Buss Connector Wirel Wrap		9.27	0.97
H431121-50	S-100 Buss Connector Solderl Tail		9.00	0.94
TP4-43	156 Pitch 43/86 Way Wirel Wrap		6.75	0.71
TP3-43	156 Pitch 43/86 Way Solderl Tail		6.75	0.71

Check Page 2 for Dealer Network

CRYSTALS

Part No.	Description	Bag Qty	Price	+ Tax
XTAL-1 MHZ	1 MEG HZ ± 0.005% @ 25°C	1	6.95	0.84
XTAL-1.8 MHZ	1.8 MEG HZ ± 0.005% @ 25°C	1	6.95	0.84
XTAL-2 MHZ	2 MEG HZ ± 0.005% @ 25°C	1	6.95	0.84
XTAL-4 MHZ	4 MEG HZ ± 0.005% @ 25°C	1	5.95	0.72
XTAL-5 MHZ	5 MEG HZ ± 0.005% @ 25°C	1	5.95	0.72
XTAL-6 MHZ	6 MEG HZ ± 0.005% @ 25°C	1	5.95	0.72
XTAL-10 MHZ	10 MEG HZ ± 0.005% @ 25°C	1	5.75	0.69
XTAL-12 MHZ	12 MEG HZ ± 0.005% @ 25°C	1	5.75	0.69

TRANSFORMERS

PL12/5VA	240 Volt Prim 6-0-6 Volt Sec. 5VA P.C. Mount.	1	4.50	1.12
PL30/5VA	240 Volt Prim 15-0-15 Volt Sec. 5VA P.C. Mount.	1	4.50	1.12
PL18/20VA	240 Volt Prim 9-0-9 Volt Sec 20VA	1	6.05	1.50
PL12/40VA	240 Volt Prim 6-0-6 Volt Sec. 40VA	1	7.40	1.83
PL30/40VA	240 Volt Prim 15-0-15 Volt Sec. 40VA	1	7.40	1.83
PL30-9/40VA	240 Volt Prim Has 15-0-15 and 9 Volts Sec. designed for M.P.U Type Application	1	12.50	1.69

ALL OUR STORES OPEN

9am — 5pm MON. - FRI.

9am — 12 MIDDAY SAT.

LIQUID CRYSTAL DISPLAYS

- Threshold Voltage - 90% (TYP) 2.5 Volts
- ½ inch Digits
- Transflective

Part No.	Description	Bag Qty	Price	+ Tax
MLC20101	Single Digit 5 x 7 Dot Matrix Dip	1	$17.20	$1.80
MLC21001	3½ Digit Clock/Inst Display	1	$17.20	$1.80
MLC40301	6 Digit Clock Display not ½ inch	1	$17.20	$1.80

LEDS

GL-56	Green Diagnostic	2	0.80	0.09
HLMP-0301	Red Rectangular 2.5 MCD	1	1.30	0.16
HLMP-0401	Yellow Rectangular 2.5 MCD	1	1.30	0.16
HLMP-0501	Green Rectangular 2.5 MCD	1	1.30	0.16
HLMP-1301	Red TI High Efficiency 2.0 MCD	1	0.76	0.09
HLMP-1401	Yellow TI 2.5 MCD	1	0.76	0.09
HLMP-6600	Red Sub Min 5V Supply 0.6 MCD	1	0.98	0.12
HP5082-4484	Red TI 0.8 MCD	3	0.95	0.12
HP5082-4550A	Yellow Diffused T 1-3/4 2.6 mcd	1	0.84	0.09
HP5082-4655	Red Diffused T1-3/4 3 mcd	1	1.35	0.15
HP5082-4850	Red TI¾ 0.8 MCD	2	0.80	0.10
HP5082-4950	Green TI¾ 1.8 MCD	2	1.30	0.16
HP5082-4955	Green Diffused T 1 3/4 2.2 mcd	1	1.35	0.15
HP5082-4550	Amber TI¾ 1.80 MCD	2	1.30	0.16
HP5082-4732	Voltage Sensing Red	1	1.20	0.15
RL21	Red diffused T1-3/4 1.2 mcd Wide Angle	2	0.80	0.09
RL21-04	Red Water Clear T1-3/4 1.2, mcd Wide Angle	2	0.80	0.09
RL50	Red Water Clear Diagnostic	3	0.90	0.10
RL54	Red Diffused Diagnostic	3	0.75	0.08
RL55	Red Diffused Diagnostic 3 mcd	3	0.90	0.10
RL2000	Red Diffused T1-3/4 3.5 mcd Wide Angle	2	0.90	0.10
RL4403	Red Diffused T1-3/4 1.2 mcd Wide Angle	2	0.90	0.10
RL5054-2	Red Diffused T1-3/4 spot 3 mcd	1	0.68	0.07
RLC200	Red Diffused T1-3/4 4.5 to 12.5V operation	1	0.65	0.07
RLC201	Red Diffused T1-3/4 4.5 to 16V operation	1	0.65	0.07
RLC210	Red Diffused T1 4.5 to 11V operation	1	0.75	0.08
RLC410	Red Diffused T1 Battery Status Off at 2.4V	1	0.90	0.10
YL56	Yellow Diagnostic	2	0.80	0.09
TIL209	Red Diffused T1	3	0.75	0.08
TIL211	Green T1	2	0.75	0.08
TIL220	Red T1-3/4	2	0.60	0.07
TIL222	Green T1-3/4	2	0.80	0.09
TIL224	Amber T1-3/4	2	0.80	0.09
MT1	Mount Clip for T1	10	0.70	0.08
MT1-3/4	Mount Clip for T1-3/4	10	0.70	0.08

Note: T1 Pack dia. 125 in nom
T1-3/4 pack dia. 2 in nom

LED. INFRA RED

IRL60	Infra-Red 500 Mircowatts	1	1.00	0.11
TIL32	T1 1.2 Milliwatts	1	1.32	0.14

PHOTO

MRD148	Photo Darl 12V 8Vceo TO92	1	0.70	0.08
2N5777	Photo Darl 25V 8Vceo TO92	1	0.85	0.09
MRD150	Mirco T Transistor	1	1.50	0.16
MRD450	T1-3/4 Transistor	1	1.50	0.16
LPT100	TO106 Transistor	1	1.00	0.11
LPT110	TO106 with Lens Transistor	1	1.10	0.12
TIL78	T1 Transistor	1	0.80	0.09
TIL138	Source & Sensor (Interrupter)	1	2.58	0.28
TIL146	Source & Sensor (Interrupter)	1	2.58	0.28

DISPLAYS

DL701	.3" 7-Seg + - 1 overflow Common Anode	1	2.40	0.26
DL702	.3" 7-Seg LH Decimal Common Cathode	1	2.40	0.26
DL704	.3" 7-Seg LH Decimal Common Cathode	1	2.40	0.26
DL707	.3" 7-Seg LH Decimal Common Cathode	1	2.40	0.26
DL707R	.3" 7-Seg RH Decimal Common Anode	1	2.40	0.26
DL721	.5" Dual 7-seg 1 & Full Digit Common Anode	1	5.50	0.58
DL722	.5" Dual 7-Seg 1 & Full Digit Common Cathode	1	5.50	0.58
DL727	.5" Dual 7-Seg Common Anode	1	5.50	0.58
DL728	.5" Dual 7-Seg Common Cathode	1	5.50	0.58
DL846	.8" 7-Seg Common Anode O/F1	1	4.20	0.45
DL847	.8" 7-Seg Common Anode	1	4.20	0.45
DL849	.8" 7-Seg Common Cathode O/F1	1	4.20	0.45
DL850	.8" 7-Seg Common Cathode	1	4.20	0.45
DL3531	3½-Digit .5" Common Anode MUX	1	8.50	0.90
DL4120-A	1" 4-Digit Common Cathode Non Mux	1	14.00	1.47
DL4130	1" 4-Digit Common Anode Mux	1	19.80	2.08
DL4500	4-Digit .5" Common Anode MUX Clock display	1	8.50	0.90
DL4520A	4-Digit .5" Clock Display Common Cathode	1	8.50	0.90
DL4530	4-Digit .5" Common Anode MUX	1	8.50	0.90
DL6500	.5" 6-Digit Common Cathode MUX (Red)	1	16.50	1.74
DL6830	.8" 6-Digit Common Anode MUX (Red)	1	22.50	2.37
HP5082-7610	H.E. Red 0.3" C. Anode L.H.D.P.	1	3.10	0.37
HP5082-7613	Red 0.3" C. Cathode L.H.D.P.	1	3.10	0.37
HP5082-7620	Amber 0.3" C. Anode L.H.D.P.	1	3.10	0.37
HP5082-7623	Amber 0.3" C. Cathode L.H.D.P.	1	3.10	0.37
HP5082-7630	Green 0.3" C. Anode L.H.D.P.	1	3.10	0.37
HP5082-7633	Green 0.3" C. Cathode L.H.D.P.	1	3.10	0.37
HP5082-7650	H.E. Red 0.43" C. Anode L.H.D.P.	1	3.50	0.37
HP5082-7653	H.E. Red 0.43" C. Cathode L.H.D.P.	1	3.50	0.37
HP5082-7660	Amber 0.43" C. Anode L.H.D.P.	1	3.50	0.37
HP5082-7663	Amber 0.43" C. Cathode L.H.D.P.	1	3.50	0.37
HP5082-7670	Green 0.43" C. Anode L.H.D.P.	1	3.50	0.37
HP5082-7673	Green 0.43" C. Cathode L.H.D.P.	1	3.50	0.37
TIL305	.3" 5 x 7 Alphanumeric Display	1	3.00	0.32
TIL306	.27" 7-Seg with Logic	1	11.28	1.19
TIL308	.27" 7-Seg with Logic	1	11.28	1.19
TIL311	.3" Hexadecimal with Logic	1	11.66	1.23
TIL312	.3" 7-Seg Common Anode Red	1	1.62	0.17
TIL313	.3" 7-Seg Common Cathode Red	1	1.62	0.17

Part No.	Description	Bag Qty	Price	+ Tax
TIL316	.3" 7-Seg Common Anode Amber	1	3.72	0.40
TIL317	.3" 7-Seg Common Cathode Amber	1	3.72	0.40
TIL321	.5" 7-Seg Common Anode Red	1	1.74	0.19
TIL322	.5" 7-Seg Common Cathode Red	1	1.74	0.19

COUPLERS

IL1	2.5KV Breakdown 35% Transfer Ratio	1	1.40	0.15
IL5	2.5KV Breakdown 70% Transfer Ratio	1	1.60	0.17
IL12	1KV Breakdown 10% Transfer Ratio	1	0.90	0.10
IL74	1.5KV Breakdown 35% Transfer Ratio	1	1.15	0.12
IL100	2.5KV Breakdown Hi-Speed 3-State (5N-Sec)	1	6.30	0.67
ILA30	1.5KV Breakdown Darl 100MA Load Current	1	1.30	0.14
ILA55	1.5KV Breakdown Darl 100MA BVceo 55V	1	1.80	0.17
ILCA30	2.5KV Breakdown Darl 125MA BVceo 30V	1	1.45	0.16
ILA55	2.5KV Breakdown Darl 125MA BVceo 55V	1	1.80	0.19
ILCT6	1.5KV Breakdown Dual 50% CTR Minidip	1	2.50	0.27
ILD74	1.5KV Breakdown Dual 35% CTR Minidip	1	1.95	0.21
ILQ74	1.5KV Breakdown Quad 35% CTR16 Pin DIL	1	4.30	0.46
MOC119	Darlington Coupler	1	1.20	0.13
MOC1005	5KV Breakdown	1	1.60	0.17
MOC1011	Triac Driver	1	2.35	0.25
4N26	1.5KV Breakdown 25% CTR Mini Dip	1	1.00	0.11
4N28	500V Breakdown 25% CTR Mini Dip	1	0.90	0.10
4N33	1.5KV Breakdown Darlington Mini Dip	1	1.80	0.17
TIL111	1.5KV B/down 40% TR	1	1.40	0.15
TIL113	1.5KV B/down Darl	1	1.50	0.18
TIL115	2.5KV B/down 20% TR	1	1.40	0.15
TIL116	2.5KV B/down 40% TR	1	1.60	0.17

MOTOROLA

Part No.	Description	
DL104	MECL Data	5.00
DL105R	CMOS Data - Revised	6.00
DL107	MOS Memories Data	5.00
DL109	Low Power Schottky Data	5.00
DL110	R.F. Power Data	10.00
DL111	Power Transistor Data	10.00
DL112	Microcomputer Data	10.00
HB201	Power Circuits Handbook	3.50
HB202	Silicon Rectifier Handbook	3.50
HB203	Switching Transistor Handbook	3.50
HB204	Zener Diode Handbook	3.50
HB205	MECL System Design	3.50
HB206	Voltage Regulator Handbook	3.50
HB207	Understanding Microprocessors	2.50
HB209	MC14500 Industrial Control Handbook	3.00
HB211	Programme the 6800 Processor	3.50
M68APP	M6800 Application Manual	7.50
M68PM	M6800 Programming Manual	10.00
M68PRM	M6800 Programming Reference Manual	5.00

TEXAS INSTRUMENTS

Part No	Description	Price
LCB1011	Understanding Solid State Electronics - Second Edition or Third Edition	3.95
LCB1891	Software Design for Microprocessors	14.25
LCC4041	Power Data Books	8.50
LCC4112	TTL Data Book (Second Edition)	8.95
LCC4162	TTL Data Book (2nd Edition Supplement)	1.35
LCC4131	Transistor and Diode Data Book	11.80
LCC4200	Semiconductor Memories Data Book	4.50
LCC4230	Optoelectronics Data Book (Fourth Edition)	—
LCC4410	Optoelectronics Data Book (Fifth Edition)	4.95
LCC4241	Linear Control Circuits Data Book	4.25
LCC4440	Bipolar Microcomponent Data Book	4.25
LCC4330	Interface Circuit Data Book	5.25
LCC4340	Elector Optical Components	1.85
LCC4350	Voltage Regulator Handbook	2.95
LCC4420	MOS Memory	2.95
LCC4400	9900 Family Systems Design Book	15.95
LCC4430	TIB0203 Magnetic Bubble Memory	2.95
LCC404C-79	Power (European) Data Book	7.50
	TTL/Bipolar Memory/Interface CCTS	11.10

HEWLETT-PACKARD

HPBK-100	Optoelectronics Applications	22.50

SIGNETICS

Title	Price
Analog Data Manual	$7.00
Bipolar/Mos Memory	$3.50
Bipolar/Mos Microprocessor	$4.00
Mem/Micro Buyer & Eng Guide	$2.00
Low Power Sewottky Pocket Guide	$1.25
2650 Microprocessor Handbook	$2.50

MISCELLANEOUS DATA BOOKS

Title	Price
Harris Linear Acquisitions	$2.75
Litronics Catalogue 1978	$2.00
P.M.I. Data Handbook	$3.50
Sprague	$2.50
Microsystems	$6.00

MAGAZINES

Title	Price
Electronics Today Internation (Latest Issue)	$1.40
Electronics It's Easy Vol 1	$3.00
Electronics It's Easy Vol 2	$3.00
Electronics It's Easy Vol 3	$3.00
Test Gear Projects	$3.00
Top Projects Vol 4	$3.00
Top Projects Vol 5	$3.00
ETI Circuits No 2	$2.95
Project Electronics	$4.75
Interface Age (Latest Issue)	$4.00
BYTE (Latest Issue)	$4.00
Personal Computing (Latest Issue)	$4.00
KiloBaud (latest Issue)	$4.00

PHILIPS

Title	Book No	Price
Rectifier Doides Thyristors Trials	SC1A03-78	$4.00
Diodes	SC1B0S-77	$4.00
Low Frequency and dual Transistors	SC211-77	$4.00
H16H Frequency Switching & Field-Effect Transistors	SC301-78	$4.00
Special Semiconductors	SC4A06-76	$4.00
Oevices lor Optoelectronics	SC4B07-78	$4.00
Professional Analogue I.C.'s	SC5A11-76	$4.00
Consumer I.C.'s	SC5B03-77	$4.00
Digital I.C.'s	SC610-77	$4.00
Resistors	CM2A10-77	$4.00
Capacitors	CM2B02-78	$4.00
General Catalogue 1978	—	$4.00
Integrated Circuits 1978	—	$3.00
Semiconductors 1978	—	$3.00

ALL PRODUCTS ARE SUPPLIED BY THE INDUSTRY LEADERS

CERAMIC CAPACITORS

KCK DISC 500 VOLT, N.P.O. (TUNING)

P.F.	N.P.O.	N750
1	NP01P	—
1.2	NP01P2	—
1.5	NP01P5	—
1.8	NP01P8	—
2.2	NP02P2	N7502P2
2.7	NP02P7	N7502P7
3.3	NP03P3	N7503P3
3.9	NP03P9	N7503P9
4.7	NP04P7	N7504P7
5.6	NP05P6	N7505P6
6.8	NP06P8	N7506P8
8.2	NP08P2	N7508P2
10	NP010P	N75010P
12	NP012P	N75012P
15	NP015P	N75015P
18	NP018P	N75018P
22	NP022P	N75022P
27	NP027P	N75027P
33	NP033P	N75033P
39	NP039P	N75039P
47	NP047P	B75047P
56	NP056P	N75056P
68	NP068P	N75068P
82	NP082P	N75082P
100	NP0100P	N750100P
120	NP0120P	N750120P
150	NP0150P	N750150P
180	NP0180P	N750180P
220	—	N750220P
270	—	N750270P
330	—	N750330P
390	—	N750390P
470	—	N750470P

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

MINIATURE CERAMIC PLATE 100 VOLT 10% (H1.K)

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

100 VOLT (TUNING)

	TP100	TNP0	TN150	TN750
0.68	TP100P68	—	—	—
0.82	TP100P82	—	—	—
1	TP1001P	—	—	—
1.2	TP1001P2	—	—	—
1.5	TP1001P5	—	—	—
1.8	TP1001P8	TNP01P8	—	—
2.2	TP1002P2	TNP02P2	—	—
2.7	TP1002P7	TNP02P7	—	—
3.3	TP1003P3	TNP03P3	—	—
3.9	TP1003P9	TNP03P9	TN1503P9	TN7503P9
4.7	TP1004P7	TNP04P7	TN1504P7	TN7504P7
5.6	TP1005P6	TNP05P6	TN1505P6	TN7505P6
6.8	TP1006P8	TNP06P8	TN1506P8	TN7506P8
8.2	TP1008P2	TNP08P2	TN1508P2	TN7508P2
10	TP10010P	TNP010P	TN15010P	TN75010P
12	TP10012P	TNP012P	TN15012P	TN75012P
15	TP10015P	TNP015P	TN15015P	TN75015P
18	TP10018P	TNP018P	TN15018P	TN75018P
22	TP10022P	TNP022P	TN15022P	TN75022P
27	—	TNP027P	TN15027P	TN75027P
33	—	TNP033P	TN15033P	TN75033P
39	—	TNP039P	TN15039P	TN75039P
47	—	TNP047P	TN15047P	TN75047P
56	—	TNP056P	TN15056P	TN75056P
68	—	TNP068P	TN15068P	TN75068P
82	—	TNP082P	TN15082P	TN75082P
100	—	TNP0100P	TN150100P	TN750100P
120	—	TNP0120P	TN150120P	TN750120P
150	—	—	TN150150P	TN750150P
180	—	—	—	TN750180P
220	—	—	—	TN750220P
270	—	—	—	TN750270P
330	—	—	—	TN750330P

	Value	Bag Qty.	Price	+ Tax
TP100	0.68-10PF	10	0.60	0.12
TP100	12-22PF	10	0.90	0.18
TNP0	1-8-39PF	10	0.60	0.12
TNP0	47-82Pf	10	0.90	0.18
TNP0	100-120PF	10	1.20	0.23
TN150	3.9-47Pf	10	0.60	0.12
TN150	56-100PF	10	0.90	0.18
TN150	120-150PF	10	1.20	0.23
TN750	2.9-4.7Pf	10	0.70	0.13
TN750	56-100PF	10	1.00	0.22
TN750	120-330PF	10	1.30	0.25

ELECTROLYTIC CAPACITORS

6.3 VOLT (SINGLE ENDED)

UF	Part No.	Bag Qty.	Price	+ Tax
22	22RB63	10	0.80	0.16
33	33RB63	10	0.95	0.19
47	47RB63	10	0.95	0.19
100	100RB63	10	1.15	0.22
220	220RB63	5	1.05	0.20
330	330RB63	5	1.05	0.20
470	470RB63	5	1.05	0.20
1000	1000RB63	5	1.10	0.21
2200	2200RB63	2	0.90	0.18

10 VOLT (SINGLE ENDED)

0.47	RB4710	10	0.80	0.16
1	1RB10	10	0.80	0.16
2.2	2RB10	10	0.80	0.16
3.3	3RB10	10	0.80	0.16
4.7	4RB10	10	0.80	0.16
10	10RB10	10	0.80	0.16
22	22RB10	10	0.80	0.16
33	33RB10	10	1.00	0.20
47	47RB10	10	1.10	0.21
100	100RB10	10	1.30	0.25
220	220RB10	5	0.95	0.19
330	330RB10	5	1.00	0.20
470	470RB10	5	1.00	0.20
1000	1000RB10	3	0.95	0.19
2200	2200RB10	2	0.90	0.18

16 VOLT (SINGLE ENDED)

10	10RB16	10	0.80	0.16
22	22RB16	10	0.95	0.19
33	33RB16	10	1.00	0.20
47	47RB16	10	1.15	0.22
100	100RB16	5	0.75	0.15
220	220RB16	5	0.80	0.16
330	330RB16	5	1.00	0.22
470	470RB16	4	1.00	0.22
1000	1000RB16	2	0.90	0.18
2200	2200RB16	1	0.80	0.16

25 VOLT (SINGLE ENDED)

4.7	4RB725	10	0.80	0.16
10	10RB25	10	0.80	0.16
22	22RB25	10	1.00	0.20
33	33RB25	10	1.15	0.22
47	47RB25	5	0.65	0.13
100	100RB25	5	0.85	0.17
220	220RB25	5	1.00	0.20
330	330RB25	5	1.20	0.23
470	470RB25	4	0.90	0.18
1000	1000RB25	2	1.00	0.20

50 VOLT (SINGLE ENDED)

.47	RB4750	10	0.80	0.16
1	1RB50	10	0.80	0.16
2.2	2RB250	10	0.80	0.16
3.3	3RB350	10	0.80	0.16
4.7	4RB750	10	0.80	0.16
10	10RB50	10	1.15	0.22
22	22RB50	5	0.75	0.15
33	33RB50	5	0.75	0.15
47	47RB50	5	0.85	0.17
100	100RB50	4	1.00	0.20
220	220RB50	2	0.90	0.18
330	330RB50	2	1.15	0.22
470	470RB50	1	0.85	0.17

4 VOLT (DOUBLE ENDED)

15	15PT4	4	1.05	0.20
47	47PT4	4	1.05	0.20
100	100PT4	4	1.05	0.20
220	220PT4	3	0.90	0.18
330	330PT4	3	0.90	0.18
1000	1000PT4	1	0.75	0.15
4700	4700PT4	1	1.20	0.23

6.3 VOLT (DOUBLE ENDED)

10	10PT6	4	1.05	0.20
33	33PT6	4	1.00	0.20
68	68PT6	4	1.05	0.20
150	150PT6	4	1.10	0.21
470	470PT6	3	0.90	0.18
680	680PT6	1	0.70	0.14
1500	1500PT6	1	0.85	0.16
2200	2200PT6	1	1.20	0.23
3300	3300PT6	1	1.20	0.23

10 VOLT (DOUBLE ENDED)

6.8	6PT810	4	1.05	0.20
22	22PT10	4	1.00	0.20
47	47PT10	4	1.05	0.20
100	100PT10	3	0.90	0.18
220	220PT10	3	0.90	0.18
330	330PT10	3	0.90	0.18
470	470PT10	1	0.70	0.14
1000	1000PT10	1	0.80	0.16
1500	1500PT10	1	0.95	0.19
2200	2200PT10	1	1.20	0.23

16 VOLT (DOUBLE ENDED)

4.7	4PT716	4	1.05	0.20
15	15PT16	4	1.00	0.20
33	33PT16	4	1.00	0.20
68	68PT16	4	1.05	0.20
150	150PT16	3	0.90	0.18
220	220PT16	3	0.90	0.18
330	330PT16	1	0.70	0.14
680	680PT16	1	0.80	0.16
1000	1000PT16	1	0.85	0.17
1500	1500PT16	1	1.20	0.23

25 VOLT (DOUBLE ENDED)

3.3	3PT325	4	1.05	0.20
10	10PT25	4	1.00	0.20
22	22PT25	4	1.05	0.20
47	47PT25	4	1.05	0.20
100	100PT25	3	0.90	0.18
150	150PT25	3	0.90	0.18
220	220PT25	1	0.70	0.14
470	470PT25	1	0.85	0.16
680	680PT25	1	1.00	0.20
1000	1000PT25	1	1.00	0.20

40 VOLT (DOUBLE ENDED)

2.2	2PT240	4	1.05	0.20
6.8	6PT840	4	1.00	0.20
15	15PT40	4	1.00	0.20
33	33PT40	3	0.90	0.18
47	47PT40	3	0.90	0.18
100	100PT40	3	0.90	0.18
150	150PT40	1	0.70	0.14
220	220PT40	1	0.85	0.16
470	470PT40	1	0.95	0.19
680	680PT40	1	1.20	0.23

63 VOLT (DOUBLE ENDED)

.47	PT4763	4	1.00	.20
1	1PT63	4	1.00	.20
1.5	1PT563	4	1.05	.20
2.2	2PT263	4	1.00	.20
3.3	3PT363	4	1.00	.20
4.7	4PT763	4	1.00	.20
6.8	6PT863	4	1.00	.20
10	10PT63	4	1.00	.20
15	15PT63	3	0.90	18
22	22PT63	3	0.90	18
47	47PT63	3	0.90	18
100	100PT63	1	0.80	16
150	150PT63	1	0.80	16
220	220PT63	1	0.85	17
330	330PT63	1	1.20	23

FILTER CAPACITORS

Part No.	Description	Bag Qty	Price	Tax
4K7EL40	4700 UF 40 Volt	1	9.38	1.80
4K7EL63	4700 UF 63 Volt	1	13.07	2.52
4K7EL100	4700 UF 100 Volt	1	15.50	2.98
10KEL16	10000 UF 16 Volt	1	9.38	1.80
10KEL25	10000 UF 25 Volt	1	10.63	2.05
10KEL100	10000 UF 100 Volt	1	25.33	4.87
22KEL10	22000 UF 10 Volt	1	10.63	2.05
22KEL16	22000 UF 16 Volt	1	13.07	2.52
22KEL25	22000 UF 25 Volt	1	15.50	2.98
33KEL40	33000 UF 40 Volt	1	25.33	4.87
47KEL10	47000 UF 10 Volt	1	15.50	2.98
47KEL25	47000 UF 25 Volt	1	25.33	4.87
68KEL16	68000 UF 16 Volt	1	25.33	4.87
83KEL15	83000 UF 15 Volt	1	28.64	5.51
100KEL10	100000 UF 10 Volt	1	25.33	4.87

Note: All prices include price of hardware

TAG TANTALUM

35TTC1	0.1 mF 35V	4	1.00	0.19
35TTC22	0.22 mF 35V	4	1.00	0.19
35TTC47	0.47 mF 35V	4	1.00	0.19
35TTC	1.0 mF 35V	4	1.00	0.19
35TT2C2	2.2 mF 35V	3	1.00	0.19
35TT4C7	4.7 mF 35V	3	1.00	0.19
25TT10C	10 mF 25V	2	0.75	0.15
16TT22C	22 mF 16V	2	0.90	0.17
16TT47C	47 mF 16V	1	1.00	0.19
6TT100C	100 mF 6.3V	1	1.00	0.19

GREEN CAP POLYESTER

100 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.001	GC0010	5	0.60	.12
.0012	GC0012	5	0.60	.12
.0015	GC0015	5	0.60	.12
.0018	GC0018	5	0.60	.12
.0022	GC0022	5	0.60	.12
.0027	GC0027	5	0.60	.12
.0033	GC0033	5	0.60	.12
.0039	GC0039	5	0.60	.12
.0047	GC0047	5	0.60	.12
.0056	GC0056	5	0.60	.12
.0068	GC0068	5	0.60	.12
.0082	GC0082	5	0.60	.12
.01	GC010	5	0.60	.12
.012	GC012	5	0.60	.12
.015	GC015	5	0.60	.12
.018	GC018	5	0.60	.12
.022	GC022	5	0.60	.12
.027	GC027	5	0.60	.12
.033	GC033	5	0.60	.12
.039	GC039	5	0.60	.12
.047	GC047	5	0.70	.14
.056	GC056	5	0.70	.14
.068	GC068	4	0.70	.14
.082	GC082	4	0.70	.14
.10	GC10	4	0.85	.17
.12	GC12	4	0.85	.17
.15	GC15	4	1.00	.20
.18	GC18	3	0.90	.18
.22	GC22	3	1.00	.20
.27	GC27	3	1.00	.20
.33	GC33	2	0.95	.19
.39	GC39	2	1.00	.20
.47	GC47	1	0.60	.12

METALLISED POLYESTER

250 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.01	250FF01	5	0.75	0.15
.012	250FF012	5	0.75	0.15
.015	250FF015	5	0.75	0.15
.018	250FF018	5	0.75	0.15
.022	250FF022	5	0.75	0.15
.027	250FF027	5	0.75	0.15
.033	250FF033	5	0.75	0.15
.039	250FF039	5	0.75	0.15
.047	250FF047	5	0.75	0.15
.056	250FF056	5	0.75	0.15
.068	250FF068	5	0.75	0.15
.082	250FF082	5	0.90	0.18
.1	250FF1	5	0.90	0.18
.12	250FF12	5	1.10	0.21
.15	250FF15	5	1.15	0.22
.18	250FF18	4	1.00	0.20
.22	250FF22	4	1.05	0.20
.27	250FF27	3	1.00	0.20
.33	350FF33	3	1.05	0.20
.39	250FF39	3	1.05	0.20
.47	250FF47	2	0.80	0.16
.56	250FF56	2	0.90	0.18
.68	250FF68	2	1.00	0.20
.82	250FF82	1	0.70	0.14
1.0	2501FF0	1	0.70	0.14
1.2	2501FF2	1	0.80	0.16
1.5	2501FF5	1	0.90	0.18
1.8	2501FF8	1	1.00	0.20
2.2	2502FF2	1	1.10	0.21

METALLISED POLYCARBONATE

400 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.01	400FF01	4	0.85	0.17
.012	400FF012	4	0.85	0.17
.015	400FF015	4	0.85	0.17
.018	400FF018	4	0.85	0.17
.022	400FF022	4	0.85	0.17
.027	400FF027	4	0.95	0.19
.033	400FF033	4	0.95	0.19
.039	400FF039	4	1.05	0.20
.047	400FF047	4	1.05	0.20
.056	400FF056	3	0.95	0.18
.068	400FF068	3	1.00	0.20
.082	400FF082	2	0.70	0.14
.10	400FF10	2	0.75	0.15
.12	400FF12	2	1.00	0.20
.15	400FF15	2	1.05	0.20
.18	400FF18	2	1.10	0.21
.22	400FF22	2	1.20	0.23
.27	400FF27	1	0.70	0.14
.33	400FF33	1	0.80	0.16
.39	400FF39	1	0.90	0.18
.47	400FF47	1	1.00	0.20
.56	400FF56	1	1.10	0.21
.68	400FF68	1	1.20	0.23
.82	400FF82	1	1.30	0.25
1.0	4001FF0	1	1.45	0.28

NON-METALLISED POLYESTER

100 VOLT

U.F.	Part No.	Bag Qty.	Price	+ Tax
.015	100PPC015	4	0.80	.16
.018	100PPC018	4	0.80	.16
.022	100PPC022	4	0.80	.16
.027	100PPC027	4	0.80	.16
.033	100PPC033	4	0.80	.16
.039	100PPC039	4	0.90	.18
.047	100PPC047	4	0.90	.18
.056	100PPC056	4	1.00	20
.068	100PPC068	4	1.00	.20
.082	100PPC082	3	0.90	.18
.1	100PPC10	3	0.90	.18
.12	100PPC12	3	0.90	.18
.15	100PPC15	3	1.05	.20

250 Volt

.0082	250PPC0082	4	0.80	16
.01	250PPC010	4	0.80	.16
.012	250PPC012	4	0.80	.16

400 Volt

.0047	400PPC0047	4	0.80	.16
.0056	400PPC0056	4	0.80	.16
.0068	400PPC0068	4	0.80	.16

630 Volt

.001	630PPC001	4	0.80	.16
.0012	630PPC0012	4	0.80	.16
.0015	630PPC0015	4	0.80	.16
.0018	630PPC0018	4	0.80	.16
.0022	630PPC0022	4	0.80	.16
.0027	630PPC0027	4	0.80	.16
.0033	630PPC0033	4	0.80	.16
.0039	630PPC0039	4	0.80	.16

RESISTORS

OHMS	¼ W (CAR)	½ W (CAR)	1 W CAR	¼ W (MF)	SW (CAR)
15	—	—	—	—	EH05R15
18	—	—	—	—	EH05R18
22	—	—	—	—	EH05R22
27	—	—	—	—	EH05R27
33	—	—	—	—	EH05R33
39	—	—	—	—	EH05R39
47	—	—	—	—	EH05R47
56	—	—	—	—	EH05R56
68	—	—	—	—	EH05R68
82	—	—	—	—	EH05R82
1	CR251R	CR371R	CR521R	—	EH051R
1.2	CR251R2	CR371R2	CR521R2	—	EH051R2
1.5	CR251R5	CR371R5	CR521R5	—	EH051R5
1.8	CR251R8	CR371R8	CR521R8	—	EH051R8
2.2	CR252R2	CR372R2	CR522R2	—	EH052R2
2.7	CR252R7	CR372R7	CR522R7	—	EH052R7
3.3	CR253R3	CR373R3	CR523R3	—	EH053R3
3.9	CR253R9	CR373R9	CR523R9	—	EH053R9
4.7	CR254R7	CR374R7	CR524R7	—	EH054R7
5.6	CR255R6	CR375R6	CR525R6	MR255R6	EH055R6
6.8	CR256R8	CR376R8	CR526R8	MR256R8	EH056R8
8.2	CR258R2	CR378R2	CR528R2	MR258R2	EH058R2
10	CR2510R	CR3710R	CR5210R	MR2510R	EH0510R
12	CR2512R	CR3712R	CR5212R	MR2512R	EH0512R
15	CR2515R	CR3715R	CR5215R	MR2515R	EH0515R
18	CR2518R	CR3718R	CR5218R	MR2518R	EH0518R
22	CR2522R	CR3722R	CR5222R	MR2522R	EH0522R
27	CR2527R	CR3727R	CR5227R	MR2527R	EH0527R
33	CR2533R	CR3733R	CR5233R	MR2533R	EH0533R
39	CR2539R	CR3739R	CR5239R	MR2539R	EH0539R
47	CR2547R	CR3747R	CR5247R	MR2547R	EH0547R
56	CR2556R	CR3756R	CR5256R	MR2556R	EH0556R
68	CR2568R	CR3768R	CR5268R	MR2568R	EH0568R
82	CR2582R	CR3782R	CR5282R	MR2582R	EH0582R
100	CR25100R	CR37100R	CR52100R	MR25100R	EH05100R

OHMS	¼ W (CAR)	½ W (CAR)	1 W CAR	¼ W (MF)	SW (CAR)
120	CR25120R	CR37120R	CR52120R	MR25120R	EH05120R
150	CR25150R	CR37150R	CR52150R	MR25150R	EH05150R
180	CR25180R	CR37180R	CR52180R	MR25180R	EH05180R
220	CR25220R	CR37220R	CR52220R	MR25220R	EH05220R
270	CR25270R	CR37270R	CR52270R	MR25270R	EH05270R
330	CR25330R	CR37330R	CR52330R	MR25330R	EH05330R
390	CR25390R	CR37390R	CR52390R	MR25390R	EH05390R
470	CR25470R	CR37470R	CR52470R	MR25470R	EH05470R
560	CR25560R	CR37560R	CR52560R	MR25560R	EH05560R
680	CR25680R	CR37680R	CR52680R	MR25680R	EH05680R
820	CR25820R	CR37820R	CR52820R	MR25820R	EH05820R
1K	CR251K	CR371K0	CR521K0	MR251K0	EH051K
1.2K	CR251K2	CR371K2	CR521K2	MR251K2	EH051K2
1.5K	CR251K5	CR371K5	CR521K5	MR251K5	EH051K5
1.8K	CR251K8	CR371K8	CR521K8	MR251K8	EH051K8
2.2K	CR252K2	CR372K2	CR522K2	MR252K2	EH052K2
2.7K	CR252K7	CR372K7	CR522K7	MR252K7	EH052K7
3.3K	CR253K3	CR373K3	CR523K3	MR253K3	EH053K3
3.9K	CR253K9	CR373K9	CR523K9	MR253K9	EH053K9
4.7K	CR254K7	CR374K7	CR524K7	MR254K7	EH054K7
5.6K	CR255K6	CR375K6	CR525K6	MR255K6	—
6.8K	CR256K8	CR376K8	CR526K8	MR256K8	—
8.2K	CR258K2	CR378K2	CR528K2	MR258K2	—
10K	CR2510K	CR3710K	CR5210K	MR2510K	—
12K	CR2512K	CR3712K	CR5212K	MR2512K	—
15K	CR2515K	CR3715K	CR5215K	MR2515K	—
18K	CR2518K	CR3718K	CR5218K	MR2518K	—
22K	CR2522K	CR3722K	CR5222K	MR2522K	—
27K	CR2527K	CR3727K	CR5227K	MR2527K	—
33K	CR2533K	CR3733K	CR5233K	MR2533K	—
39K	CR2539K	CR3739K	CR5239K	MR2539K	—
47K	CR2547K	CR3747K	CR5247K	MR2547K	—
56K	CR2556K	CR3756K	CR5256K	MR2556K	—
68K	CR2568K	CR3768K	CR5268K	MR2568K	—
82K	CR2582K	CR3782K	CR5282K	MR2582K	—
100K	CR25100K	CR37100K	CR52100K	MR25100K	—
120K	CR25120K	CR37120K	CR52120K	MR25120K	—
150K	CR25150K	CR37150K	CR52150K	MR25150K	—
180K	CR25180K	CR37180K	CR52180K	MR25180K	—
220K	CR25220K	CR37220K	CR52220K	MR25220K	—
270K	CR25270K	CR37270K	CR52270K	MR25270K	—
330K	CR25330K	CR37330K	CR52330K	—	—
390K	CR25390K	CR37390K	CR52390K	—	—
470K	CR25470K	CR37470K	CR52470K	—	—
560K	CR25560K	CR37560K	CR52560K	—	—
680K	CR25680K	CR37680K	CR52680K	—	—
820K	CR25820K	CR37820K	CR52820K	—	—
1M	CR251M	CR371M	CR521M	—	—
1.2M	CR251M2	CR371M2	—	—	—
1.5M	CR251M5	CR371M5	—	—	—
1.8M	CR251M8	CR371M8	—	—	—
2.2M	CR252M2	CR372M2	—	—	—
2.7M	CR252M7	CR372M7	—	—	—
3.3M	CR253M3	CR373M3	—	—	—
3.9M	CR253M9	CR373M9	—	—	—
4.7M	CR254M7	CR374M7	—	—	—
5.6M	CR255M6	CR375M6	—	—	—
6.8M	CR256M8	CR376M8	—	—	—
8.2M	CR258M2	CR378M2	—	—	—
10M	CR2510M	CR3710M	—	—	—

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

VERTICAL TRIM POTS

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

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

THIS WINNING TRIFECTA ONLY FROM THE silicon valley STABLES.

SYM-1

A FRONT RUNNING WINNER IN TOP COMPANY

A SURE STARTER SIRED BY KIM

A sure starter in performance. In quality. In availability. OEMs, educators, engineers, hobbyists, students, industrial users: Our Versatile Interface Module, SYM-1, is a fully assembled, true tested and warranted microcomputer board that's a single-board computer, complete with keyboard and display. All you do is provide a +5V power supply and SYM-1 gives you the rest.

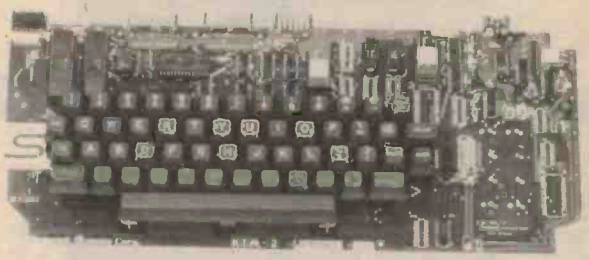
Key features include:

- Hardware compatibility with KIM-1 (MOS Technology) products.
- Standard interfaces include audio cassette with remote control; both 8 bytes/second (KIM) and 185 bytes/second (SYM-1) cassette formats: TTY and RS232; system expansion bus; TV/KB expansion board interface; four 1/0 buffers; and an oscilloscope single-line display.
- 28 double function keypad with audio response.
- 4K byte ROM resident SUPERMON monitor including over 30 standard monitor functions and user expandable.
- Three ROM/EPROM expansion sockets for up to 24K bytes total programme size.
- 1K bytes 2114 static RAM, expandable to 4K bytes on-board and more off-board.
- 501/0 lines expandable to 70.
- Single +5V power requirements.

Price $275 + Tax = $316.25

KTM-2

SURE TO GIVE YOU A GREAT RUN FOR YOUR MONEY



INTERFACE CARD WITH ASCII KEYBOARD AND NUMERIC PAD.
Price $350 + Tax = $386.75

BAS-1

WELL PLACED IN THIS COMPANY

8K ROM BASIC INTERPRETER
Price $150 + Tax = $166.50

MEK6800R2

TV Interface Board Output is Composite Video.
Programmable CRT Video Interface for MEK6800D2 Kit.

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

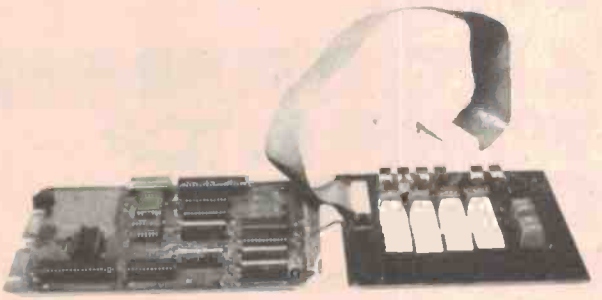
Price $195 + Tax = $221.32

M6800 — Family Evaluation Kit II

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

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

Price $260 + Tax = $295.10



MEK6800AB

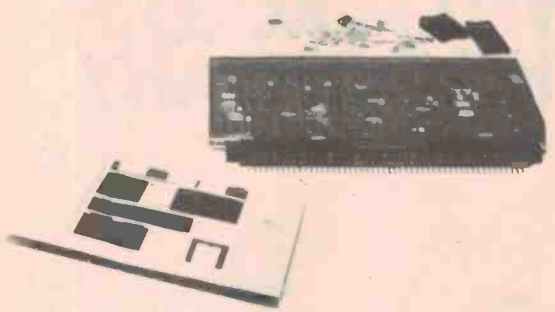
7 Slot Motherboard/Adapter Board for MEK6800D2 Kit

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

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

Price $75 + Tax = $86.25

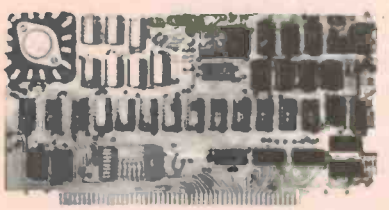
KT 9500



The basic kit consists of a plated-through hole board with component overlay and the mighty 2650 8 Bit Microprocessor, 512 bytes of read/write memory (four 2112 static RAM's), 1K bytes of 2608 ROM with PIPBUG*, two 8T31 1/O ports and buffering on data, address and control lines. A single + 5 volt supply will be required to power the card and communicate with a serial 20mA current loop terminal. Modifications to the basic system can be easily made to allow for various memory configurations and operating modes. Unused plated through holes are provided for the PROM memory chips (82S115's). Other options are jumper selectable.

Price $95 + Tax = $109.25

SV-640



Designed by David Griffiths this superb software controlled V.D.U. kit composes of all components including crystal, IC sockets and top quality plated through hole PCB. Our exclusive 54 page assembly/trouble shooting and software manual is also included. The display format is 16 lines by 64 characters to give upper and lower case letters, reversed video characters (black on white), flashing characters and a graphics resolution of 64 x 128 dot matrix. The unit conforms to the ever increasing popular hobby computer standard S100 bus.

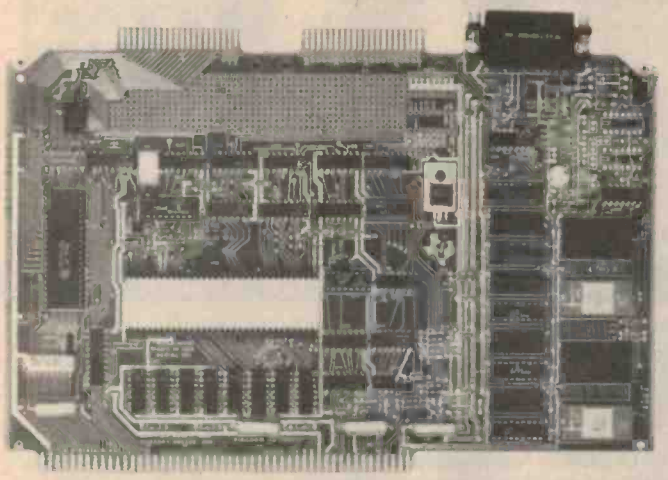
Price $140 + Tax = $149.50

MICROCOMPUTER

TM 990/100M

● TMS 9900 16-bit CPU ● Up to 1K bytes of RAM ● Up to 8K bytes of EPROM ● TMS 9901 programmable system interface ● TMS 9902 asynchronous communications controller; TMS 9903 synchronous communications controller optional plug-in replacement ● EIA or TTY terminal interface option ● Prototyping area for custom applications ● TIBUG operating monitor ● DMA* to off-board memory.

* Requires external control circuitry

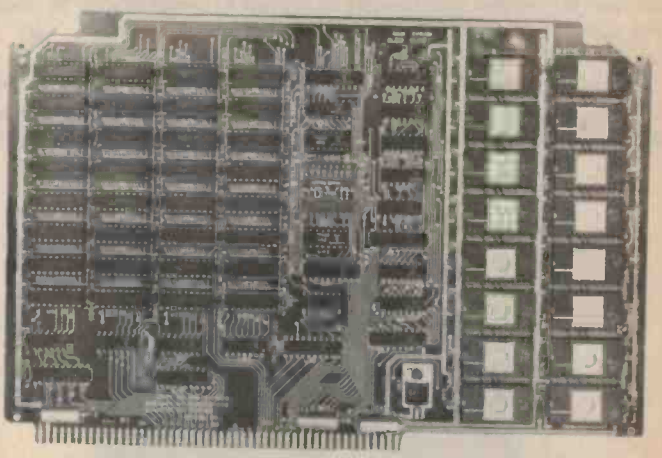


Price $450 + Tax = $507.50

MEMORY EXPANSION MODULE

TM 990/201

● 8K bytes of TMS 2716 EPROM expandable to 32K bytes ● 4K bytes TMS 4045 static RAM expandable to 16K bytes ● Jumper selectable access time ● TTL-compatible interface.

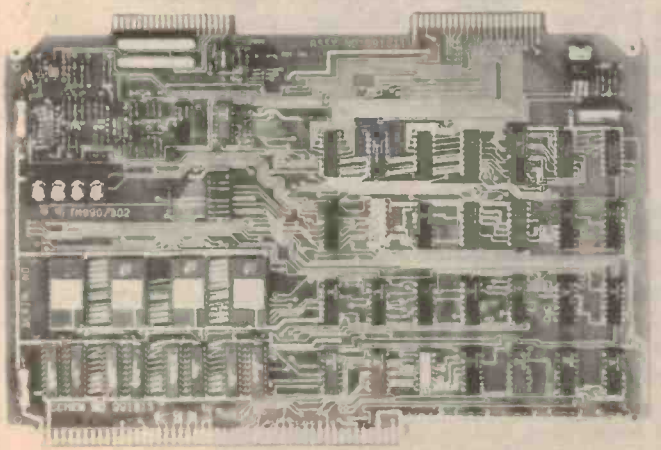


Price $600 + Tax = $676.50

SOFTWARE DEVELOPMENT MODULE

TM 990/302

● An assembled, tested, stand-alone software development system supporting program generation, editing, assembly, debugging and IPROM programming at an extremely attractive cost ● For use with either TM 990/100M or TM 990/101M microcomputer modules ● Provides dual or single audio cassette interface, both static RAM and ROM memory and hardware circuitry for programming EPROMs ● Programming options — TMS 2708, TMS 2716, TMS 2508, TMS 2516, TMS 2532 ● 4K x 16 EPROM or preprogrammed ROM ● 2K x 16 RAM ● Memory expandability for additional performance — TM 990/201, TM 990/206 or TM 990/203 ● EIA communication with other computers ● Bus compatible with other TM 990 family members ● Optional POWER BASIC development software residing in ROM (12K bytes).

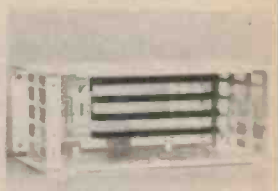


Price $670 + Tax = $755.42

ACCESSORIES

CARD CAGES

TM 990/510 4-slot card cages with 1-inch centres. Back panel contains address bus, data bus, interrupt and control lines to permit memory, I/O and DMA expansion of CPU modules. 10-terminal barrier strip on back panel permits connection of these signals as required: Reset; Restart; 5V; 12V; 15V; GND. 12.7 cm high x 31.75 cm wide x 20.32 cm deep (5 x 12.5 x 8 in). 2.5 cm (1 in) board separation.



Price $190 + Tax = $214.22

TM 990/520 8-slot card cage same as TM 990/510 except 20.96 cm high x 31. 75 cm wide x 20.32 cm deep (8.25 x 12.5 x 8 in). 1.91 cm (0.75 in) board separation.

Price $290 + Tax = $326.97

AUXILIARY MODULES

TM 990/511 Extender board for operating TM 990 modules outside card cage; includes card guide at edges.

Price $140 + Tax = $157.95

TM 990/512 Universal prototyping module allows custom interface to TM 990 bus. Has GND and 5V planes, two power strips for 12V, plus two power strips for user-selectable voltage option.

Price $80 + Tax = $90.20

TM 990/513 Universal prototyping wire wrap module with pins installed to simplify custom interfacing.

Price $310 + Tax = $349.52

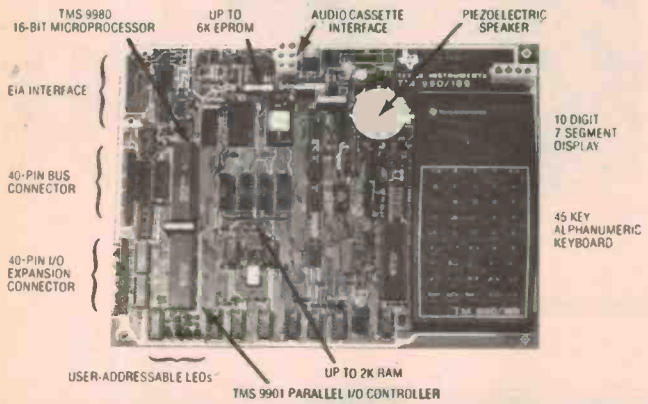
UNIVERSITY MODULE

TM 990/189

The TM 990/189M University Module is a stand-alone educational tool. Easy to use, it gives engineers, students and hobbyists an extremely effective means for acquiring hands-on understanding of microprocessors.

Features of the University Module include the 9980 16-bit microprocessor ● 1K bytes of RAM expandable to 2K on board ● 4K bytes of PROM expandable to 6K on board ● Audio cassette interface ● 16-bit programmable I/O port and interrupt monitor ● 45 key alphanumeric keyboard allows user to program in assembly language ● Ten-digit seven-segment display with 64 character buffer ● Visual and acoustic indicators ● Resident monitor ● Symbolic assembler.

In addition to on-board memory expansion, two other system expansion options are available. You may add either RS232C or 20 mA current loop terminals. Secondly, the bus can be fully expanded by use of the 40-pin bus interface.



A complete 500-page tutorial text accompanies each module. This comprehensive book can be used for self-paced learning or as a text for a university course. Chapter titles include overview of computers, microprocessors and minicomputers ● ALU ● Program development, assembly language ● Memory systems ● I/O concepts ● I/O designs ● Modular programming ● Software engineering ● Product development

A user's guide also accompanies each University Module. The 200-page guide covers the installation and operation of the monitor, symbolic assembler, and instruction set, as well as assembler directives, options and modifications.

Price $299 + Tax = $337.12

DATA ENTRY AND DISPLAY MICROTERMINAL

TM 990/301

● Performs front panel functions of microcomputer systems ● Allows programmer to display and change register and memory information ● 4-digit hexa-decimal display of address and data ● Register, memory, or CRU display and entry keys ● Operates under TIBUG monitor ● Hexadecimal pushbutton keyboard ● Execute, single instruct and convert keys ● Integral cable connects directly to serial EIA port on CPU module.

Price $135 + Tax = $152.21

SOFTWARE

POWER BASIC
HIGH-LEVEL LANGUAGE

TM 990/450 **Price $370 + Tax = $417.17**
TM 990/451 **Price $500 + Tax = $563.75**

POWER BASIC, a versatile extension of the original high-level language, is specifically intended for the industrial real-time I/O environment. It is easy to learn, easy to use, easy to document. And it is one of the fastest BASICs on the market, providing bit manipulation capability as well as the ability to call assembly language subroutines directly.

POWER BASIC language interpreters are available with capabilities ranging from evaluation to EPROM programming.

POWER BASIC features include: 11-digit accuracy ● 24 hour time-of-day clock ● EPROM programming ● Fast ● Can call Assembly Language routines.

FIRMWARE SUPPORT

TIBUG MONITOR

TM 990/40 is a comprehensive, interactive debug monitor included in the basic price of the 990 CPU modules. (Optionally, you may order the board with blank EPROM.) TIBUG includes 13 user commands plus six user accessible utilities and operates with 110, 300,1200 and 2400 baud terminals.

TIBUG FUNCTIONS

- Inspect/change CPU, memory location, program counter, workspace pointer, status registers, workspace elements
- Execute user programs under breakpoint in single/multiple steps
- Dump/load memory to, from paper tape or cassettes
- Find word/byte
- Hexadecimal arithmetic

USER ACCESSIBLE TERMINAL INTERFACE UTILITIES

- Read/write character
- Hexadecimal numeric input/output
- ASCII message output

LINE-BY-LINE ASSEMBLER

TM 990/402 is a line-by-line assembler supplied preprogrammed into a ROM kit for immediate system use. By allowing you to enter instructions in mnemonic form and preforming simple address resolution calculations up to a displacement range of +254/—256 bytes, the assembler is an extremely powerful tool for assembly language input of short programs or easy patching of long programs.

LBLA FEATURES

- Handles all 9900 standard mnemonics
- Accepts binary, octal, hexidecimal and decimal input
- Each line is assembled automatically after input
- Assembly address can be changed through a single command
- Allows comments to be entered after source statement

TI-1750

POCKET PORTABLE . . . WITH MEMORY.

So light. So small. So economical. You'll get up to 2,000 hours of operating time per set of batteries (7 years typical operating time).

You can slip the TI-1750 into your pocket or purse. Ideal for meetings or tests, on business trips or shopping trips.

Pencil thin and smaller than a wallet, the TI-1750 weighs only 2½ ounces. Yet, it performs today's most needed math functions: Add-ons, discounts, square roots, percentages. And it has a four-key memory.

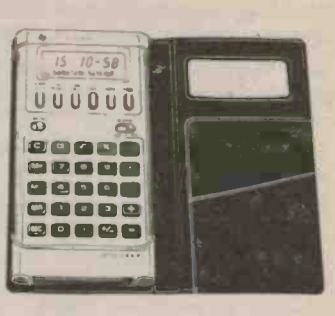
Large easy-to-read liquid crystal display shows 8 digits plus overflow, minus and memory signs.

Comes in brown vinyl wallet folder, complete with note pad and insert pockets for business cards.

DataChron™

A calculator. A clock/alarm. A stopwatch. All three come in the handy, pocket-size DataChron™. Handheld versatility at its best.

POCKET-SIZE ELECTRONIC CALCULATOR/CLOCK . . . WITH STOPWATCH AND ALARM.



A CALCULATOR. Perform the most-needed arithmetic functions. DataChron has four-key memory and can perform add-ons, discounts, interest calculations, square roots and percentages, automatically.

A CLOCK/ALARM. Display shows time, day, date, AM/PM. Alarm reminds you of meetings, of important phone calls, or of any of those many other tasks that always seem to slip your mind. DataChron's 24-hour alarm feature can be set to any hour and minute.

A STOPWATCH. Time speeches, phone calls, athletic events, lab experiments, or even cooking times. Elapsed times can be measured and displayed with one-tenth of a second accuracy. Stopwatch mode displays hours, minutes, seconds and tenths of seconds up to 9-59-59.9.

You'll get over 1-year normal operation on a single set of batteries. Comes in brown vinyl wallet folder with insert pockets for business cards.

The MBA™

A powerful calculator with programmability. Lets you analyze financial situations quickly. Use the MBA calculator and its valuable handbook to make better business decisions involving real estate management, financial analysis and planning, business administration, investment analysis, bonds, and more.

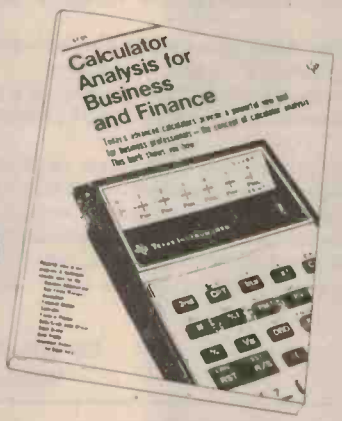
FINANCIAL FUNCTIONS: Computes net present value and internal rate of return for variable cash flows.
Payment, present value, future value, number of periods or periodic interest rates for both ordinary annuities and annuities due.
Also days between dates and direct solution of yield for bonds or mortgages with a balloon.

STATISTICAL FUNCTIONS: Mean, variance, and standard deviation at the touch of a key. Built-in linear regression with correlation coefficient. Also, versatile memory group — 12 in all.

Simple programmability. "Learn" key lets the MBA remember a sequence of up to 32 keystrokes which may include preprogrammed financial functions to provide exceptional power. The sequence may be repeated with the push of a single key.

A BUSINESS/FINANCIAL CALCULATOR WITH PREPROGRAMMED FUNCTIONS AND PROGRAMMABILITY . . .

CALCULATOR ANALYSIS FOR BUSINESS AND FINANCE. Designed to show you how to apply the power of the MBA to your business and financial decision-making. Shows you how to analyze financial situations faster, use statistical methods quickly and easily. Calculator Analysis for Business and Finance includes real-life examples representative of the decision-making situations the business professional works with every day.



Chapters and topics include:

- Basic Financial Calculations
- Review of Statistics
- Accounting
- Personal Finance
- Business Finance
- Real Estate
- Forecasting
- Quantitative Methods
- Statistics
- Bond Analysis

. . . INCLUDED WITH THE MBA, A FACT-FILLED, EASY-TO-USE BOOK FOR BUSINESS AND FINANCIAL DECISIONS.

Slimline TI 25™

An economical and attractive scientific calculator specifically designed for today's professionals and students on the move.

Powerful 52-functions automatically handle a broad range of mathematical problems . . . roots, powers, reciprocals, common and natural logarithms, and trigonometry — in degrees, radians, or grads. Special functions such as π and factorial provide rapid calculations for use in complex problem-solving, and scientific notation lets you work with even the smallest or largest numbers. All at the convenient touch of a key.

Plus built-in statistical capability: mean, variance, and standard deviation. Gives you quick access to the numbers you need to analyze data and to draw conclusions.

An algebraic hierachy system with three levels of parentheses allows you to enter problems as they're usually written, left to right.

Versatile memory will store, recall, or sum data to memory and exchange memory with the display.

Power-saving, easy-to-read liquid crystal display shows eight digits or five-digit mantissa and two-digit exponent. Also indicates memory, angular, and statistical modes.

APD™ AUTOMATIC POWER DOWN. This special "battery-saver" feature prevents accidental power drain by automatically turning the calculator off after about seven minutes of non-use. This, in combination with the power-saving LCD display, provides up to 2 years of normal operation on a single set of batteries.

TI-55

Science. Engineering. Statistics. Social Science. Whatever your field, Texas Instruments TI-55 calculator can help you improve your professional performance by giving you fast, accurate solutions to your problems.

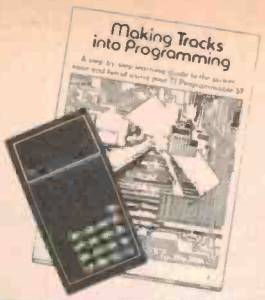
Advanced TI-55 capabilities include simple programming, plus a unique blend of hardware and software support. The versatile TI-55 is packed with the features and functions you need to handle almost any mathematical operation, from logarithms and trigonometry to more advanced statistical problems.

Powerful statistical capability . . . mean, variance, standard deviation, linear regression. Simple keyboard programmability with 32 steps lets you perform repetitive calculations at the touch of a key. Ten user-accessible memories are available to increase the flexibility of calculations.

Easy to understand 140-page Calculator Decision Making Sourcebook shows you how to use the advanced functions of the TI-55 in making better decisions, whatever your field or profession.

SUCCESSOR TO THE SR-51-11 . . . AN ADVANCED SLIDE-RULE CALCULATOR WITH STATISTICAL FUNCTIONS AND SIMPLE PROGRAMMABILITY.

TI Programmable 57



The TI Programmable 57 is a powerful slide rule calculator with statistics and decision making capabilities to help solve repetitive problems. Quickly and accurately.

Eight multi-use memories provide addressable memory locations for you to store and recall data. Powerful program memory stores 50 fully-merged steps for up to 150 keystrokes. Once your program is built, it can be executed repeatedly by supplying new sets of variables. The calculator recalls the program for you and executes on command with each set of variables.

Computer-like programming functions include: Complete editing and error correction capabilities. Six different forms of branching and decision-making capability. Two levels of subroutines. And much more.

The TI Programmable 57 is also a powerful super slide rule calculator which provides many advanced mathematical capabilities to simplify problem solving: Functions of x. Logarithmic functions. Trigonometric functions. Statistical functions. Nine levels of parentheses and the ability to store up to four pending operations let you handle even complex equations quickly and easily.

AOS™ — TI's unique algebraic operation system — makes problem solving easy. You enter problems from left-to-right, exactly as they are stated algebraically.

The TI Programmable 57 comes with a new, illustrated easy-to-follow learning guide — Making Tracks Into Programming. With over 200-pages, this book takes you into the power and fun of programming right away — with step-by-step instructions and examples. Detailed "how-to" discussions cover: Basic programming. Loops and repetitive calculations. Editing and documentation. Decision making. Home management programs. Finance and cash planning. General and advanced math. Scientific applications. Games and recreation. And more. AC adapter/charger and carrying case included.

THE SELF-TEACHING PROGRAMMING SYSTEM FOR STUDENTS AND PROFESSIONALS.

TECHNOLOGY: KEY TO VALUE

The Programmable 57 provides exceptional power at an exceptional price. The key to its value is a remarkable advance in integrated circuit technology — a single MOS/LSI chip with the equivalent capacity of 30,000 transistors. It is the most powerful single-chip calculator ever produced!

TI Programmable 58

Here's a programmable calculator that offers more power, flexibility and capability than any other calculator in its class. Prewritten programs which were once contained on almost 2 dozen magnetic cards have been encapsulated in a tiny plastic module that simply plugs into the calculator. This revolutionary Master Library module is virtually a tool kit for today's professional. It contains 25 different programs available at the touch of a key. Programs include math, statistics, finance.

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3. Label

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PC-100A Operating Characteristics *

Calculator Model	Print	List	Trace	Alpha	Plot	Prompt
SR-52	•	•	•			
SR-56	•	•	•			
TI Programmable 58	•	•	•	•	•	•
TI Programmable 59	•	•	•	•	•	•

* The TI-58/59 will not operate on the older PC-100 printer.

AN ACCESSORY FOR THE TI PROGRAMMABLE 58/59.

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Introducing BASIC

Okay, now you've decided to buy a home computer — how do you go about using it?

by Les Bell

BASIC (Beginner's All-purpose Symbolic Instruction Code) was developed as an instructional language at the Kiewit Computation Centre of Dartmouth College in the USA. It is probably the most used computer language in the world today. Most microcomputers are able to execute programs written in BASIC, and virtually all time-shared systems and mainframe computers in universities and colleges run BASIC.

Like most computer languages, BASIC is not standardised, and so some versions have different commands, statements or functions, or differ in grammatical details from others. We are going to concentrate here on microcomputer versions of BASIC, as most people will have access to a micro.

Nouns and Verbs

When you learnt English at school, one of the things you learnt was grammar. Every language has a grammar, a set of rules which tells you how to string words together to make sentences, and BASIC is no exception.

Rule number one of BASIC grammar: every line begins with a line number. Line numbers can usually be any number between 1 and 32 767, but usually you start at 10 or 100 and increase in 10s. This is so that if you want to insert a line between, say, 20 and 30, you can number it 25. You couldn't put a line between 20 and 21.

The nouns of BASIC, the objects it operates on, are called variables. In 'standard' BASIC (if such a thing can be said to exist), variables usually are numbers, and are named by a letter, or a letter and a number. For example, a program could use three variables called A, A1 and A2, and the BASIC interpreter will distinguish between all three of these.

Some BASIC interpreters are a bit more sophisticated and allow longer variable names such as VALUE, TAX or POWER. This is useful when reading through a program, as you can see what each variable stands for immediately.

In English, every sentence must contain a verb (usually). BASIC is the same; each line is a short sentence telling the computer to do something, and it contains a verb (usually). For example:

```
250 GOTO 50
```

This is what is called, in BASIC, a statement. It starts with a line number, and then follows an instruction, a clear, unambiguous instruction, to the computer — GOTO 50. This instructs the computer (or the BASIC interpreter, actually) to go to line 50. Now you know why every line is numbered.

BASIC statements can use a variety of different verbs. Here are some examples:

LET (as in 10 LET Y=1) The LET statement is optional in some versions of BASIC, which let you type 10 Y=1

= The = symbol is called the "assignment' symbol. This avoids confusion with the equals symbol. For example, BASIC lets you write (or type) 20 LET X=X+1. Now, in mathematics, it is obviously not true to say that X=X+1. In BASIC, it means that variable X is assigned the previous value of X, plus one. In other words, X is incremented (this is a useful function for counting things like runs through a loop of a program). It does not mean that X is equal to X+1.

FOR The FOR instruction is used to set up program loops. For example (excuse the pun):

```
10 FOR I=1 TO 10
20 INPUT A(I)
30 NEXT I
```

This short program section will execute line 20 ten times, inputting A(1), A(2), A(3), and so on up to A(10). The NEXT I statement marks the end of the loop (the I is often optional, but is useful to include).

INPUT The INPUT statement halts the running program, prints a question mark (usually) and waits for the user to type in some data, often the answer to a question. It may also automatically print the question. Like this: 40 INPUT "HOW MANY BANANAS:",A would print up HOW MANY BANANAS: and wait for you to type in the answer, followed by a carriage return, which is the signal for the program to start running again. The number you type in is stored as variable A.

GOSUB This is a very useful and powerful statement. A block of program which is used often in different parts of the main program may be written as a subroutine and then called by the program. A silly example will explain:

```
10 GOSUB 500
.
.
200 GOSUB 500
.
.
340 GOSUB 500
.
.
500 LET Y=X↑2+5↑+3
510 PRINT "Y = ", Y
520 RETURN
```

In this example, the subroutine simply evaluates a quadratic and prints the result each time it is called by the main program. ▶

BASIC

PRINT This statement may include a list of expressions, variables or constants separated by commas or semicolons. For example:

```
35 PRINT "THE VALUE OF X IS ",
```

X would print THE VALUE OF X IS 4.6239242E+09 or something similar. Note that the literal string which is to be printed is enclosed in quotes.

Strings

As well as dealing with numeric variables for calculation, BASIC also allows you to handle words and text. This kind of information is called a string variable, and these are named differently from numeric variables by adding a dollar sign at the end of the name. So, for example, A$ and A1$ are string variables, and are different from A and A1 which are numeric.

Strings can be input, printed, compared, concatenated (strung together), and compared. For example:

```
100 INPUT "HELLO THERE.
    WHAT'S YOUR NAME?", N$
200 PRINT "NICE TO MEET YOU,",
    N$
```

is a good way of letting your computer introduce itself. Or

```
450 IF A$="YES" THEN 480
460 IF A$="NO" THEN 520
470 GOTO 440
```

is a way of letting the user answer yes or no to a question from the computer, with the computer making the appropriate response.

Arrays

As well as variables which consist of a single number, many BASICs allow the creation of variables which are actually tables of values. These are called arrays, and they have a variety of uses. Arrays have to be dimensioned before use; in other words, the user has to tell the computer how many values the table will contain in any direction. Some BASICs limit arrays to two dimension, others allow as many dimensions as you require to the limit of memory.

For example, a program to find the inverse of a 3x3 matrix might start like this:

```
100 DIM A(3,3)
110 FOR I=1 TO 3
120 FOR J=1 TO 3
130 INPUT A(I,J)
140 NEXT J
150 NEXT I
```

This is rather crude, as a well designed program would also print information to prompt the user as he inputs data, but it does illustrate the general principle.

Similarly, one can use arrays in LET statements:

```
40 LET A(I,J)=B(I,J)+C(I,J)
```

would add corresponding elements of two matrices together.

BASIC Arithmetic

Arithmetic in BASIC is fairly straightforward; assignment statements (LET statements) read from left to right following the rules of algebraic hierarchy (sines, cosines, powers, etc are calculated first, followed by multiplication and division, then addition and subtraction, unless this sequence is altered by the inclusion of brackets).

Most BASICs offer a wide range of operators: numeric operators such as +, −, x, /, and ↑, relational operators such as =, <, >, ≥, >=, =>, <=, =<, which give a result of 1 if the expression is true and 0 if it is false, and the Boolean operators AND, OR and NOT which also result in 1 if true and 0 if false.

Some examples may help to make these clear.

```
50 IF X>10E6 THEN END
```

will end a program if too large a value is input.

```
540 IF A(3)>A(2) AND A(2)>A
    (1) THEN PRINT "DECREASING"
```

will check to see that three elements of an array are in decreasing order.

Functions

As well as the standard arithmetic, relational and Boolean operators, BASIC offers a number of built-in functions. For a typical BASIC interpreter, these might be:

ABS(expr) which returns the absolute value of the expression

INT(expr) which returns the integer part of the expression

LEFT$(X$,Y) which returns the leftmost Y character in string X$ (similarly for RIGHT$(X$,Y)

LEN (X$) which returns the length of the specified string

CHR$(expr) which returns the ASCII character corresponding to the value of the expression. For example, CHR$(7) is a bell ring.

STR$(expr) which returns a string with the specified numeric value.

ASC(X$) which returns the ASCII code of the first character in the specified string.

SIN(expr) which returns the sine of the argument.

RND(expr) which returns a random number between 0 and 1.

Example Program

To see how the various statements, functions, operators and commands we have learnt actually operate in practice, it is best to look at an example program. In this case, we shall write a program to do some useful engineering problem-solving – designing an impedance matching pi network.

In the listing of this program, notice that lines 100 to 170 are devoted to a short description of the program to help the user. Lines 180 to 230 actually input the data, and again, these contain prompts which are printed to assist the user. Leaving these out would make the program shorter and quicker to run, but more confusing.

Lines 240 and 250 perform checks for improper conditions on the input data, jumping to sections of program which output appropriate error messages. Again, longer error messages help the user more.

The actual calculations are performed in lines 260 to 330. These are straightforward enough and easy to follow, except for lines 300 and 310 where the calculation of X3 has been split over two lines to make it easier to read. Notice the print statements in lines 120, 170, 200, 230, 330 which space out the output to improve legibility. The colons between PRINT statements allow multiple statements on one line.

```
100 PRINT "PI NETWORK IMPEDANCE MATCHING PROGRAM"
120 PRINT: PRINT
130 PRINT "GIVEN THE VALUES OF R SOURCE AND R LOAD,"
140 PRINT "AND THE CENTRE FREQUENCY AND Q (CENTRE"
150 PRINT "FREQUENCY OVER HALF-POWER BANDWIDTH),"
160 PRINT "THIS PROGRAM CALCULATES C1, C2 AND L1."
170 PRINT: PRINT
180 INPUT "WHAT IS THE RESISTIVE SOURCE IMPEDANCE?",R1
190 INPUT "AND THE LOAD RESISTANCE?",R2
200 PRINT
210 INPUT "CENTRE FREQUENCY?",F
220 INPUT "AND THE Q?",Q
230 PRINT
240 IF R2>R1 THEN 390
250 IF Q<=SQRT(R1/R2-1) THEN 420
260 X1=R1/Q
270 C1=1/(2*3.14159*F*X1)
280 X2=R2/SQRT(R2/R1*(Q↑2+1)-1)
290 C2=1/(2*3.14159*F*X2)
300 X3=Q*R1/(Q↑2+1)
310 X3=X3*(1+R2/(Q*X2))
320 L1=X3/(2*3.14159*F)
330 PRINT: PRINT
340 PRINT "HERE ARE THE VALUES OF YOUR PI NETWORK."
350 PRINT "C1 = ";C1;"F"
360 PRINT "C2 = ";C2;"F"
370 PRINT "L1 = ";L1;"H"
380 END
390 PRINT "LOAD IMPEDANCE IS HIGHER THAN SOURCE –"
400 PRINT "IT CAN'T BE DONE"
410 GOTO 170
420 PRINT "Q IS TOO LOW. TRY AGAIN, WITH SENSIBLE"
430 PRINT "VALUES THIS TIME."
440 GOTO 170
```

A Sample Run (User input is underlined)

```
RUN
GIVEN THE VALUES OF R SOURCE AND R LOAD,
AND THE CENTRE FREQUENCY AND Q (CENTRE
FREQUENCY OVER HALF-POWER BANDWIDTH),
THIS PROGRAM CALCULATES C1, C2 AND L1.

WHAT IS THE RESISTIVE SOURCE IMPEDANCE? 500
AND THE LOAD RESISTANCE? 50

CENTRE FREQUENCY? 3.5E6
AND THE Q? 10

HERE ARE THE VALUES FOR YOUR PI NETWORK.
C1 = 9.09E-10 F
C2 = 2.74E-09 F
L1 = 2.93E-06 H
READY
```

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Voice of America to close two stations

The Voice of America intends going ahead soon with the closure of both the Dixon (California) and the Bethany (Ohio) transmitting stations for their world wide broadcasts.

These closures are deemed to be necessary so that VOA can finance the new permanent satellite programme feeders for all relay stations (excepting Colombo, Sri Lanka).

The Voice of America proposes to conclude programme broadcasts from Dixon on September 2nd this year. In order not to lose coverage of the Far East area from that date, the American Forces Radio and Television Service programmes will be carried for the Far East on two transmitters located at the Delano (California) transmitter site. This will take effect from 1100 on 2nd September.

The Voice of America's programmes for Australia from September will be beamed from the Delano station. This will present some problems for the station, as Delano lacks 247° antennas, although new 302° wideband curtain antennas have recently been erected. This can be slewed plus or minus 30° so that VOA Delano is considering trying it out for the Australian service on 272° which would be centred on Papua New Guinea.

A further consequence of the shutdown of the Dixon and Bethany sites will be increased use of the Philippines relay transmitters for Australian coverage as from September.

The closure of the Bethany relay station is planned for September 1980. The 50 kilowatt independent sideband transmitters at both Dixon and Bethany will be moved to the Greenville (North Carolina) transmitter site, which will continue using independent sideband feeders as a back up to the satellite feeds to the VOA transmitting stations throughout the world. The AM transmitters at Dixon and Bethany will remain in mothballs and will not be moved to other transmitter sites.

Voice of America's relay stations outside the United States are at Kavalla and Rhodes in Greece, Monrovia in Liberia, Tangier (Morocco), Tinang and Poro in the Philippines, and at Colombo (Sri Lanka). Programmes of the VOA are also relayed via the shortwave facilities of the BBC in the United Kingdom and at Ascension Island in the south Atlantic.

The use of satellites for the feeding of programmes to far flung relay stations is becoming a trend among the large international stations. Radio Nederland introduced satellite programme feeds to their relay sites at Bonaire in the Netherlands Antilles and Talata in Madagascar during last year.

Improved technology and the relative cheapness of satellite systems means this move will continue during the 1980's. This has implications for the World Administrative Radio Conference which will be held in Geneva in September and October this year. The conference is likely to recommend reduced spectrum space in the shortwave range 3-30 MHz to be reserved for fixed service and utility operations. The move away from feeder transmitters within this range in favour of satellite facilities has meant that many parts of the 3-30 MHz spectrum space reserved for utility and fixed services are currently under-utilised.

Many international broadcasting stations have made use of the vacant spaces adjoining the broadcast bands in anticipation of World Administrative Radio Conference decisions. This use of out-of-band channels is technically illegal according to the regulations of the International Telecommunications Union, but a clause in current regulations allows out of band channels to be used by broadcasters, so long as such broadcasts don't interfere with fixed service or utility operations.

Saudi Arabia

The Broadcasting Service of the Kingdom of Saudi Arabia, using transmitters at Jeddah, broadcasts English programmes on 11 855 1900-2200, and again from 1000-1300.

Jeddah is another station making use of frequencies outside the designated shortwave broadcast bands. The Holy Koran programme is relayed on 11 685 from 1800-2100 in our local mornings.

Meanwhile, Saudi Arabia's Riyadh station also uses an out of band channel, 15 060, 0500-1500 for Arabic programmes. Also out of band is 5875, used 0300-0730, and 1000-2300 for relays of the Domestic Service programme.

Nigeria

The Voice of Nigeria, Lagos, has announced that three independent programme packages will now be broadcast for their target areas of Central and Southern Africa, West Africa, North Africa and overseas.

Up to now, Voice of Nigeria has broadcast the single programme for all areas. The Central and Southern Africa service would initially be presented in Swahili and English, the West Africa service in English, French and Hausa, and the North Africa and overseas transmissions would be in English, French, and German.

The Director General of Voice of Nigeria has recently stated that the series of 500 kilowatt shortwave transmitters would be installed within the next few months, in order to provide satisfactory reception of Voice of Nigeria's programmes throughout the world.

Voice of Nigeria's current schedule of English programmes is: 0455-0600 on 7255 for West Africa; 0455-0630 on 15 185 and 15 120 for North Africa and overseas; 0800-0900 on 7255 for West Africa; 0830-1000 on 15 185 and 15 120 for North Africa and overseas; 1600-1700 on 7255 for West Africa; 1755-1930 on 11 770 for Central and Southern Africa. 1800-1900 on 15 185 and 15 120 for North Africa and overseas; 1900-2030 on 7255 for West Africa. 2030-2200 on 11 770 for Central and Southern Africa. 2100-2200 for North Africa and overseas on 15 185 and 15 120.

Austria

The Austrian Radio in Vienna has currently scheduled a number of broadcasts on out-of-band channels for use up until September 2nd.

Services for the Americas are carried between 2100 and 0400 each day on 12 015, which is 40 kHz above the official end of the 25 metre broadcast band.

A new out of band channel for Vienna is 15 560, which is used for programmes to the Near East from 1600-1900 every day. ▶

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shortwave loggings

Vienna's programmes for Australia and New Zealand may currently be heard on 21 500 0600-0700; on 21 735 from 0700-0900, and between 0900-1300 on 21 610. You can hear "Report from Austria" in English each night at 1230.

Finland

Radio Finland continues during transmission period J-79 with English to Australia and New Zealand daily from 0930-1000 on 21 495.

The special Sunday programme in English is also heard on 21 495, between 0800 and 0930.

For language students, "Starting Finnish" may be heard each Monday. Interesting news of events in Finland is included in "Out and About" on Saturdays.

Brasilia

Radio Nacional de Brasilia has recently added more programmes in English at convenient times for Australian reception.

The International Service from Brasilia broadcasts 200-2100 on 15 270, on 15 280 from 2110-2210, and between 0200 and 0300 on 15 280 also. The programmes at 0200 and 2110 provide reliable signals in Melbourne. The 0200 service is generally audible, but at a much reduced signal quality. The station is eager to receive reception reports from listeners, and has announced this slightly amended address:

Radiobras, International Service, Box 04-0340, Brasilia 70223, Federal District, Brasil.

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of ARDXC may be obtained from either PO Box 67 Highett VIC 3190, or from PO Box 79 Narrabeen NSW 2101, for a 30c stamp.

Lebanon... Italy...

Radio Lebanon in Beirut has again altered its frequency for programmes to North America between 0100 and 0330 each day.

The service is now heard on the new outlet of 15 285 (replacing 15 440). The English programme is on air 0230-0300 followed by Spanish at 0300. **Radio Television Italiana (RAI) currently beams English to Japan and Australia daily 2200-2225 on 15 315, 11 905 and 9710.**

Italian programmes are beamed to Australia twice a day, at 0830-0930 on 21 690, 17 780, 15 330, 11 810, and 9580, with the second on air in our mornings, 2050-2130 on 15 400, 11 800 and 9575.

New international Caribbean service

Radio Television Dominicana at Santo Domingo in the Dominican Republic, has advised that the station will operate an international programme every day between 2300 and 0200 on 5970 and 9505.

RTV Dominicana hopes to begin the International program in late April or early May, so this should be on the air as we go to press.

There will mainly be Spanish programmes at first, but English will be included soon, and a DX programme is planned. Listeners' reports are welcome, and the station says pennants, QSL cards, badges and stickers will be available to listeners.

The station may be heard on 9505 from 2245 with Spanish programmes to fade-out at approximately 2320 in east Australia at the moment.

The domestic service program broadcasts in our evenings on 5970 from sign-on at 0903. The address for reports is **Radio Television Dominicana, Servicio Internacional, PO Box 969, Santo Domingo, Dominican Republic.** Include International Reply Coupons to receive a reply via airmail.

Latin loggings

Radio Nacional de Chile at Santiago has been noted on the new channel of 6150 with the Home Service in Spanish between 1100 and 1315. Severe interference is present from ABC-Melbourne.

Radio Quillabamba in Peru is a station which plays enjoyable Andean songs, and is currently audible from sign-on at 1100 nightly on 5025.

Radio Progresso at Loja in Ecuador operates on 5060, and is audible between 1100 and 1200 with Spanish programming and local music.

Radio Luz y Vida in Ecuador, is a religious station which also provides pleasant listening with distinctive Latin American tunes. Listen on 4850 between 1100 and 1200. Spanish station identification is usually given on the quarter hour.

Number Two ETI CIRCUITS

Contents

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

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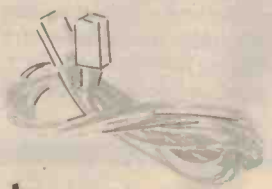

19.95
Regular Retail Price 36.95

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5.0m Extension Cable

Mount your transceiver in the boot. Install plug-in jack on dash, run cable under carpeting to boot. When you leave your car, unplug handset and hide it. For One-Hander only. 21-600

CLEARANCE

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ETI-July '79

Assembling coax plugs

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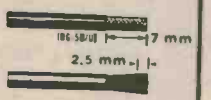
BNC CONNECTORS
Standard Clamp

1. Strip jacket. Fray braid and strip dielectric. Don't nick braid or conductor. Tin conductor.

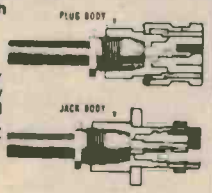


2. Taper braid. Slide nut, washer, gasket and clamp over braid. Clamp inner shoulder should fit squarely against end of jacket.

3. With clamp in place, comb out braid, fold back smooth as shown. Trim 2.5 mm from end.

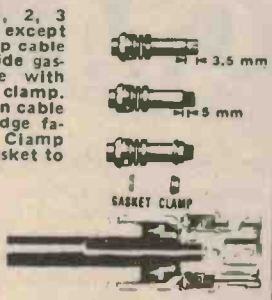
4. Solder contact on conductor through solder hole. Contact should butt against dielectric. Remove excess solder from outside of contact. Avoid excess heat to prevent swollen dielectric which would interfere with connector body.

5. Push assembly into body. Screw nut into body and wrench until tight. Don't rotate body on cable to tighten.

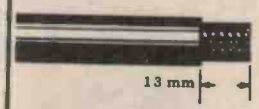


BNC CONNECTORS (IMPROVED CLAMP)

1. Follow 1, 2, 3 and 4 above except as noted. Strip cable as shown. Slide gasket on cable with groove facing clamp. Slide clamp on cable with sharp edge facing gasket. Clamp should cut gasket to seal properly.



N CONNECTORS



1. Remove 13mm of vinyl jacket. When using double shielded cable, remove 14mm.

2. Comb out copper braid as shown. Cut off dielectric 6mm from end. Tin centre conductor.

3. Taper braid as shown. Slide nut, washer and gasket over vinyl jacket. Slide clamp over braid with internal shoulder of clamp flush against end of vinyl jacket. When assembling connectors with gland, be sure the knife edge is toward end of cable and groove is gasket is toward the gland.

4. Slide body into place carefully so that contact enters hole in insulator. Face of dielectric must be flush against insulator. Slide completed assembly into body by pushing nut. When nut is in place, tighten with wrenches. In connectors with gland, knife-edge should cut gasket in half by tightening sufficiently.

Connector assembly information courtesy of Amphenol.

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PREDICTIONS

AUGUST 1979

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time – commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

ETI – Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.

These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

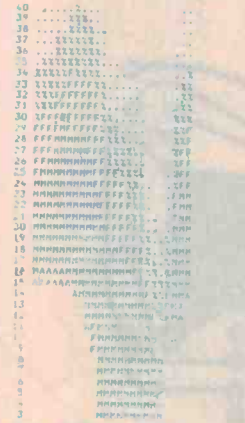
F . . . . . path open at least 90% of days in month.

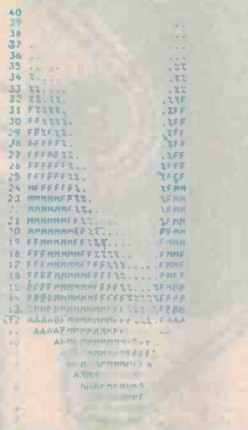
B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

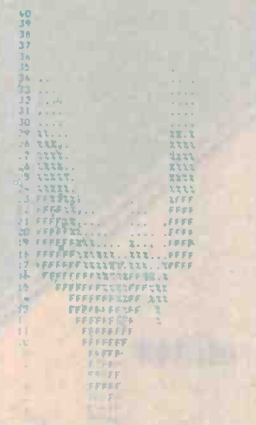
M . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

A . . . . . High absorption indicated. Expect weak signals.


East Coast to Japan
(Also serves N.E. and S.C.)


East Coast to South Pacific


East Coast to North America
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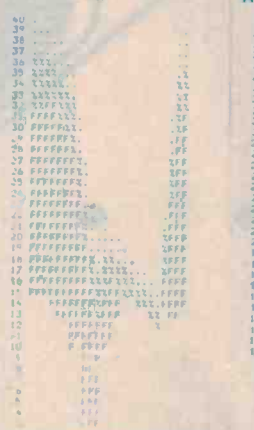
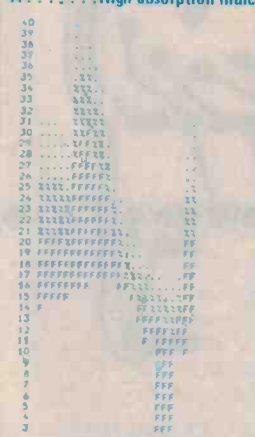
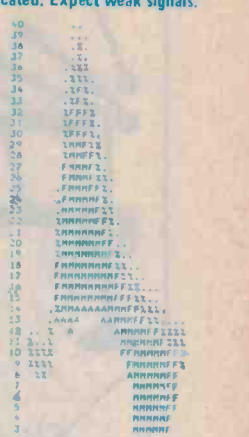
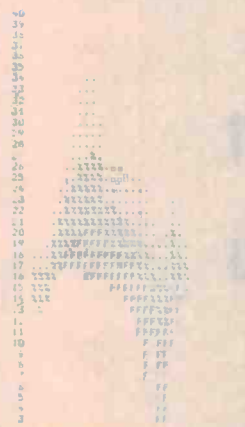
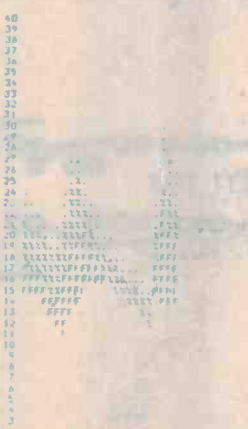

East Coast to South America
(Also serves S.C.)

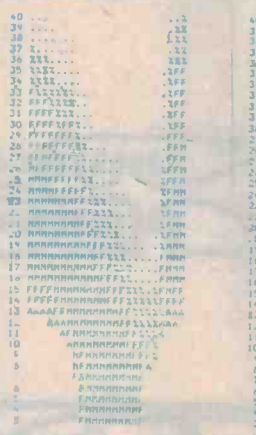

East Coast to North Africa
(Also serves S.C.)

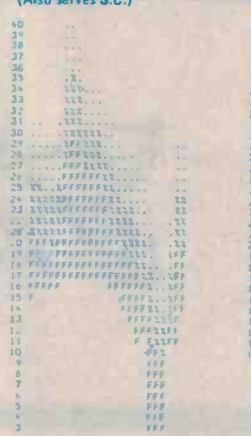

East Coast to South Africa
(Also serves S.C.)

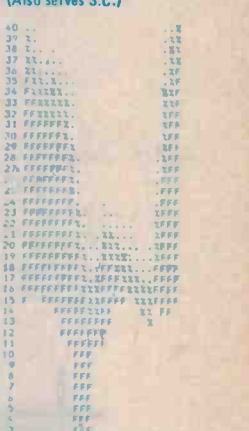

East Coast to Europe
(Short Path)

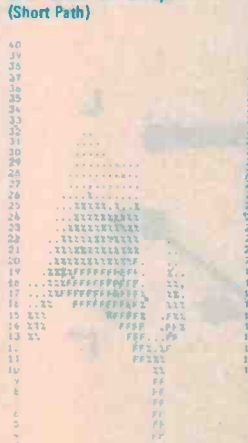

E.C. and S.C. to Europe
(Long Path)


East Coast and S.C. to Persia

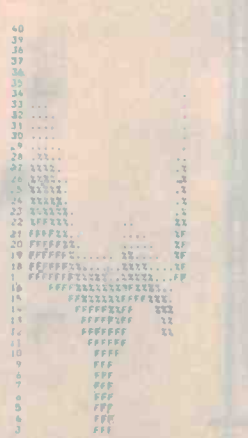

North East to South Pacific
(Also serves S.E.)

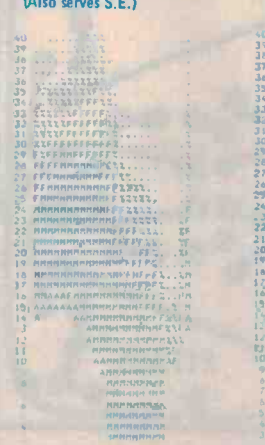

North East to North Africa

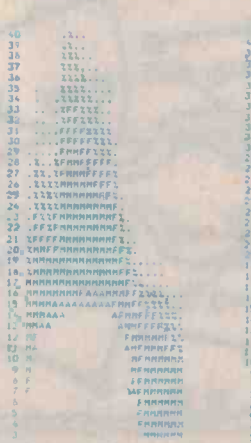

North East to South Africa

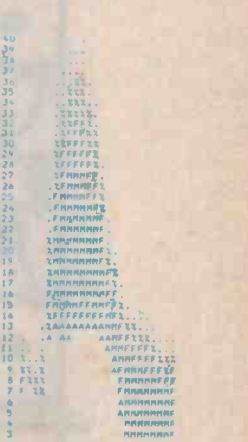

North East to Europe
(Short Path)


S. Central & W.C. to Europe
(Short Path)

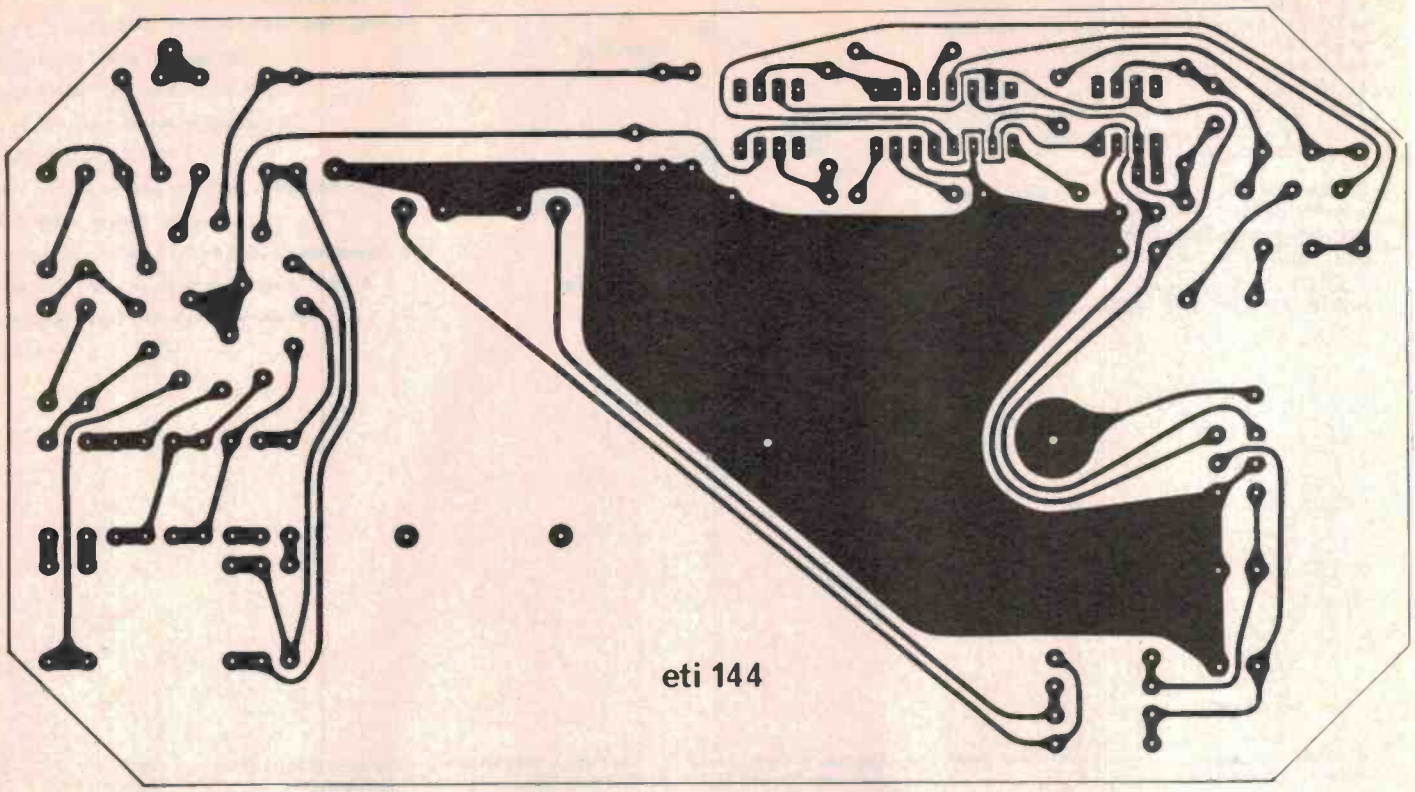

West Coast to North America

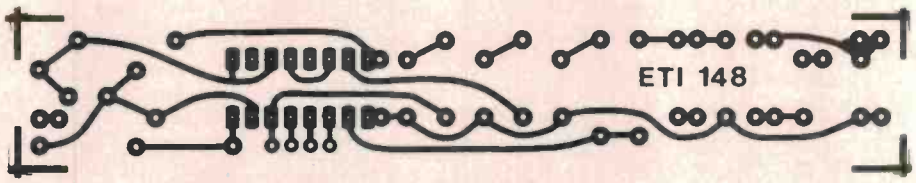

West Coast to Japan

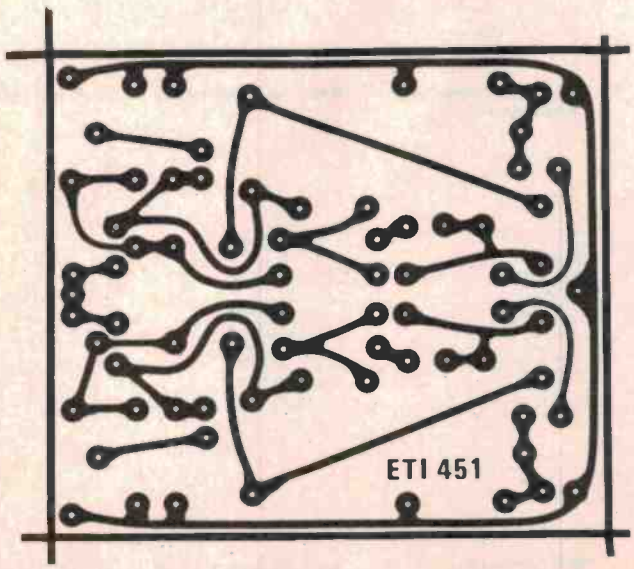

West Coast to North Africa

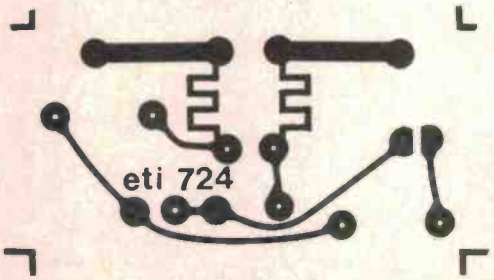

West Coast to South Africa

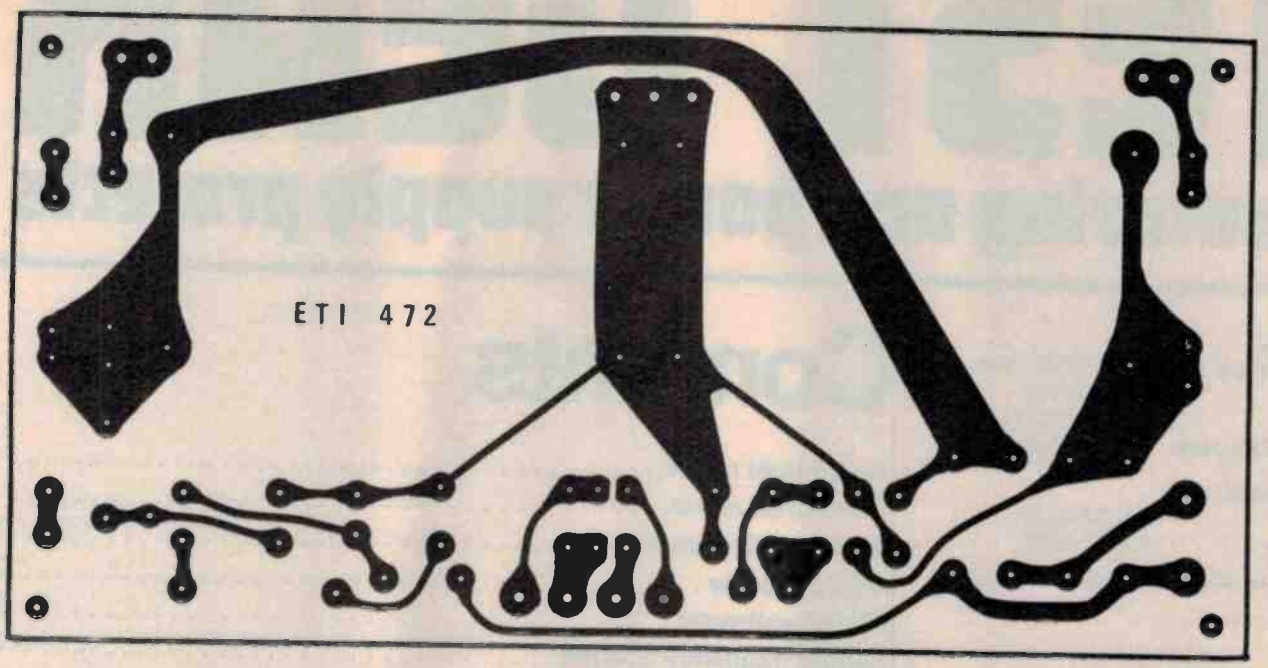
PCB's

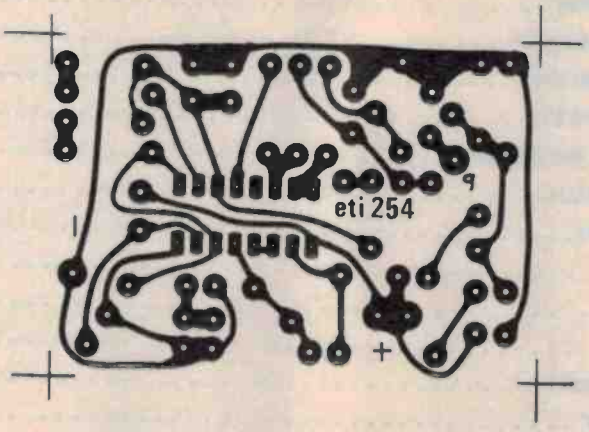






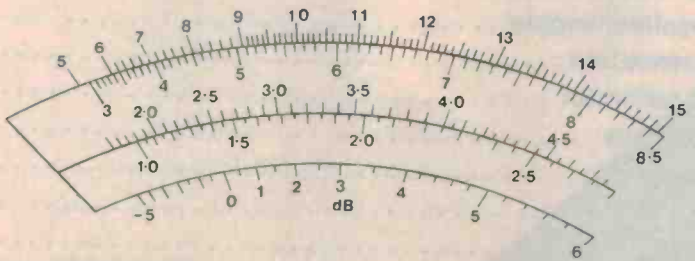






Apologies for the SNAFU last month when the reverse page to the PCBs page was not printed in blue. The Egg Timer and RMS Voltmeter boards, and the meter panel, are reproduced this month to assist. Unfortunately the ETI 471 preamp and the ETI 651 binary-hex converter pc boards are too large to reproduce.

EXPANDED SCALE RMS VOLTMETER



Note
Peak input voltage should not exceed 5 times F.S.D.

1mA F.S.D.

Using ETI PCB Artwork

This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007 which is UV sensitive and can be used under normal subdued light.

Cut a piece of film a little larger than the PC board and expose it to UV light through the magazine page. The non emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner - it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

Further information on Scotchcal and PCB manufacture can be found in the September and December 1977 issues of ETI. Please note also, that occasionally pressure on space may unfortunately prohibit the printing of blue type behind all PCB's, in which case the reader must resort to more conventional photographic techniques for PCB manufacture.

TEST GEAR

-metering and power supply projects

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Project Designs: Barry Wilkinson
Editor: Jan Vernon
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COMMUNICATIONS

British amateur satellite to aid UK spacecraft programme

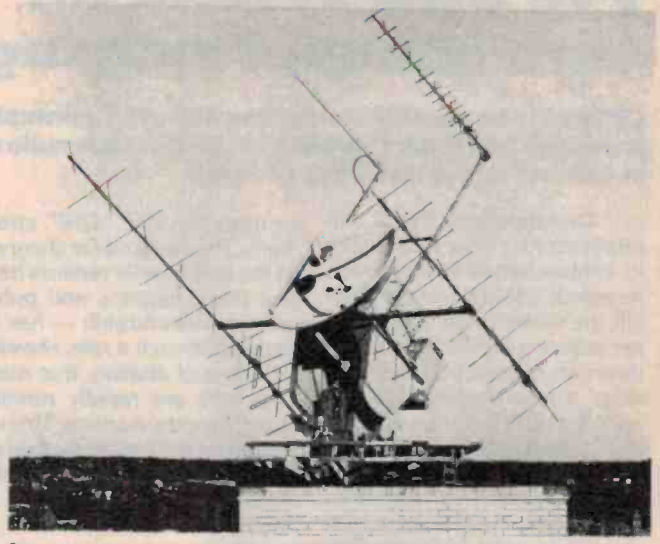
Amateurs at the University of Surrey, UK, will construct the first all-British amateur satellite as part of a programme to develop a spacecraft programme for the UK.

The project will be co-ordinated by the Telecommunications Research Group within the Department of Electronics and Electrical Engineering at the University. One aim is to provide practical experience in developing an inexpensive UK spacecraft programme, a departure from the general aims of the international OSCAR series of amateur satellites.

Proposed features of the satellite include a series of HF band beacons and a number of complex experiments. It is expected VHF/UHF transponders will be carried, as usual.

Collaboration on the project will involve Surrey University's Electronics and Amateur Radio Society (EARS), the Amateur Satellite Corporation (AMSAT), the AMSAT-UK organisation and the Radio Society of Great Britain. British companies are to give active support.

A possible launch opportunity is available in early 1981. The satellite is intended for a polar orbit at an altitude of 900 km.



Surrey University's amateur club OSCAR command station.

Surrey University's Electronics and Amateur Radio Society has operated an OSCAR command station since 1974, constructed entirely by Society members. It sports a steerable antenna complex capable of tracking to an accuracy of half a degree using a modified Bofors anti-aircraft gun mount with sets of crossed yagis on both 145 MHz and 435 MHz plus an ex-Admiralty two metre diameter parabolic dish.

Philips' UHF CB instruments

Philips have recently introduced a range of instruments for checking UHF CB antennas and transmitters.

Made in Australia by Microwave Developments for Philips Service, a field strength meter and two wattmeters comprise the range.

The field strength meter includes a small, detachable quarterwave whip. It is battery operated and has sufficient sensitivity to enable measurements to be made more than 20 metres from an antenna under test or being monitored.

A variable sensitivity control is included.

The field strength meter enables day-to-day checks of radiated power, comparison of different antennas and the plotting of radiation patterns.

The fsm operates over the 477 MHz band and has an input impedance of 50 ohms (it may be connected to a remote antenna). Reference input level is -30 dBm — marked as '0' on the scale — and the scale is calibrated -10 to -1 in dB. With the sensitivity control at min., a further reduction of 10 dB is provided.

It is powered from two standard 9V transistor radio batteries which should last over 150 hours with normal intermittent use.

The other two instruments in the range are reversable wattmeters. They can be used for in-line RF power monitoring or for SWR measurement — reversing the connections provides 'forward' and 'reverse' power readings from which SWR can be calculated. The meters are calibrated to 7.5 watts.

Further information may be obtained from Philips Service at the following locations: **Sydney (736-1233), Newcastle (61-1631), Canberra (95-0321), Melbourne (699-2731), Hobart (28-1021), Brisbane (221-5422), Townsville (79-7422), Adelaide (223-4735) and Perth (322-4653).**

Obituary — Fred Bail

Fred Bail, founder and proprietor of Bail Electronics Service, passed away suddenly on Friday 25 May.

A well-known and respected figure among the amateur fraternity, Fred introduced the Japanese-made Yaesu Musen amateur radio equipment into Australia in the early '60s. Together with his brother Jim, Fred operated the business from his home — or, I should say, shack — in the Melbourne suburb of Box Hill, a now-famous QTH. It was both a shop and an impromptu 'convention' site.

I first met Fred in 1963, prior to gaining my amateur licence. He gave me much encouragement and assistance, for which I will be eternally thankful. Always affable and ready to help up and coming enthusiasts, Fred provided a wealth of encouragement and assistance to many of today's 'established' amateurs, giving them a start in a rewarding hobby and/or career, including the writer.

Fred was an active constructor/experimenter prior to commencing his import business and was active on the air on the HF and VHF bands gaining many of the available awards, though he was modest about his achievements. He was also active in WIA affairs at one time.

Fred's attendance at the many amateur conventions around Australia over the past 15 years made him a well-known identity. His passing, I'm sure, marks the end of an era.

We extend our sympathies to family and friends,

Roger Harrison VK2ZTB
Editor, ETI

COMMUNICATIONS

Pye SSB system for VHF mobile cuts channel spacing, bandwidth

Claimed to be capable of doubling and even quintupling spectrum utilization, Pye's prototype 5 kHz per channel VHF SSB mobile radio underwent its first public trials in London in the last week of April.

Developed by Pye Communications Ltd in Cambridge in conjunction with the Philips Research Laboratories at Redhill, the system uses a pilot carrier at power levels 12 to 20 dB down on speech power. It provides a local frequency reference for reception and an AGC signal needed to overcome the flutter fading experienced by VHF mobiles. Pye engineers claim fading is eliminated, even at speeds over 100 kph. Frequency tolerance is claimed to be plus and minus 150 Hz, which is within the capability of high-stability crystal techniques. A system to generate all the required channel frequencies using a two-chip set has also been developed at the Philips labs. (See ETI, August 1978, p.6.).

The transceiver system is aimed at increasing the number of available channels in the congested VHF/UHF spectrum. The demand for channels in the land mobile services from taxi firms, couriers and public utilities — worldwide — has increased at such a rate, showing little sign of abating, that many countries are rapidly running out of spectrum space. This will be one of the big problems facing the World Administrative Radio Conference in September/October.

The land mobile services in most countries use frequency modulation on VHF and UHF, with some AM services remaining, generally having 25 kHz or 12.5 kHz channel spacing at present in their allocated bands.

A permissible channel separation of 5 kHz would greatly relieve the situation, although single sideband modulation is not compatible with the existing FM system.

SBE enters business radio market

The American communications firm, SBE, has formed a new division to market business radio products in the US.

The firm, located in Watsonville, California, presently markets CB, marine and mobile radio equipment.

The new division will be based in Watsonville and is to be headed by R.A. Baker, an SBE vice-president, according to company president Paul R. Robichaux.

Setting up the new division came about through an increased demand for business radio products such as signalling devices, paging equipment and communications control systems.

"World time" clock

Presented in a substantial, clear acrylic housing, the clock features an electric movement operating from a single 1.5 V D-cell. It has a brushed aluminium dial with prominent hour markings and a secondary 24-hour dial that can be set to show the time in other parts of the world, as well as day and night.

The clock comes with a 12 month guarantee and retails for $75. See **Emona Enterprises, Room 208, 661 George St, Sydney, NSW 2000. Phone (02) 212-4815, 211-3038.**

CB group in US asks for new amateur licence

A new 'hobbyist' class of amateur radio licence has been asked of the FCC by the Washington State CB Radio Association.

They propose a new band for SSB-only transmissions between 27.41 and 28.00 MHz in a petition for rulemaking filed with the FCC in April. The Association argues that the new designation is necessary to overcome overcrowding in the 27 MHz CB band and what they describe as "an alarming increase" in operations on unauthorized frequences — generally in the space between the 27 MHz CB band and the 28 MHz amateur band.

Business and Special Industrial Radio Services presently occupy the area between 27.41 and 27.54 MHz but the Washington group say only a limited number of users are now licensed and these are gradually moving to VHF and UHF bands.

Leo G. Sands, editor of the US 'CB Magazine', filed a petition with the FCC in January this year calling for an SSB-only CB band of 40 channels between either 27.545 and 27.765 MHz or 27.875 and 29.955 MHz. Apparently, this is unused spectrum space in the USA.

FCC Commissioner, Robert E. Lee indicated the Sands petition may go through if other users of this area of the spectrum don't raise objections. A contract has been assigned to study possible harmful interference (intermod) which may occur if the additional channels are allocated.

"Pacific Log" for medium wave DXers

Chris Martin, medium wave editor for the Southern Cross DX Club's journal DX Post, has compiled a list of all broadcast stations in the Pacific region.

Listed by frequency, on every channel from 531 kHz to 1602 kHz, the 'Log' includes data on each station listed. Also included are listings of Hawaiian stations on 10 kHz spacing, call-frequency cross-references of Australian and New Zealand stations as well as Japanese and Phillipines medium wave stations. The 'Log' should prove a valuable guide to the avid medium wave DXer.

For more information, contact **Chris Martin, GPO Box 1150, Sydney NSW 2000, Australia.**

CB exports drop 81 per cent

Figures released by the Japanese Finance Ministry show that exports of CB transceivers, with inputs over 100 mW, for the January to March period this year, were down 81.1 percent in number and 78.1 percent in value compared to the same period last year.

Only 52 723 units were shipped, worth US $3 177 000, in the first quarter this year compared to 279 929 units worth US $14 563 000 for the same quarter last year.

Interestingly, sales volumes of 27 MHz CB radios in Australia have shown a greater slump over the same period, mostly affecting the low to middle priced sector of the market.

Underwater communications equipment

The problem of communicating with divers without the use of wires is a common one. A system offered by Vicom International uses ultrasound to provide diver/diver and diver/surface communication links.

The system uses a frequency modulated carrier at 30 kHz having a range of 500 m. The weight of the base unit (which would normally be carried on a ship) is 4 kg and the diver unit weighs 1.3 g under water (although the inertia offered by it will be higher — the weight of the unit will be greater out of water). Both units will operate for six hours continuously from rechargeable cells — charging units are standard and included in the price (base unit $1400, diver unit $825).

For further information, contact:

Vicom, 68 Eastern Rd, South Melbourne, Vic, 3205. Phone (03) 699-6700.

National UHF CB club

The Victorian UHF Club is interested to hear from any interstate UHF club, whether formed or about to be formed, with a view to an exchange of ideas in general and to discuss the formation of a national UHF body. In the first instance please contact the Secretary, Victorian UHF Club, PO Box 151, Preston Vic. 3072.

The writer will be mobile on UHF from the 22 to 29 August travelling from Melbourne to Adelaide via Bendigo, Swan Hill, Mildura, Renmark, then back via Murray Bridge, Horsham and Ballarat. I will be grateful if Victorian country stations and South Australian stations could give me a shout on channel 11 between 9am and 5pm on any of those days. The rig will be an FM320 into a roof-mounted 4.5 dB Philips whip, and the callsign will be VAR 585 and VCH 051.

Graeme, the VBU 216 out of Rosebud, Victoria, is adamant that he copied an XYL calling CQ Victoria from Adelaide on UHF on Thursday the 17th May last at precisely 2.45pm.

Are there any confirmations of this?

Max
VCH 051

Report from "upstairs"

— on the UHF CB band, with Max Morris

UHF CB will get a shot in the arm with the introduction of the Sawtron 880 mobile due for release this June. The importers, who are based in Victoria, have arranged to import only 100 of these sturdy rigs so I figure it would be an idea to put your order in quick smart. I also understand that the Sawtron Base Station will be on the market next December.

A spot of decent UHF DX was about when a Tassie station worked into Shepparton, Victoria, on the 10th of February last — a distance of nearly 530 km. The copy each way was 5x8 and to attain such good results I'm convinced that you need a fairly high and clean take off spot, such as a cliff close to water, whether it's the open sea or even an inland lake. That's the probable reason why most of our contacts from Victoria are to the Tassie coastal stations at Burnie, Penguin and Devonport.

Another maritime mobile could be on UHF shortly when Ivan, the VBX 157, puts to sea out of San Remo, Vic. with his new steel fishing boat. Ivan has a 240 volt power plant on board plus many other goodies so keep a listen out for signals from Bass Strait.

Aeronautical mobiles are frequently heard around southern Victoria, the latest being Ivan, the VBB 515 with Harry VBV 162 at the controls of a Cessna. Prior to this we heard Harry with Gordon, the VBQ 294 on the 3rd of March in a Cessna 182 en route from Moorabin to Warnambool. The gear used in both these trips was the FM 320 with a Telex noise cancelling mic. — the antenna was a quarter wave mounted down under the aircraft. Signals were S9 for up to 160 km, in short you got a solid copy or nothing.

The Victoria UHF Club has a professional SWR and power meter available to its members on a hire basis at 50 cents a day, for details just ring or call in on Maurie, the Club secretary.

A barometer is probably one of the best UHF aids you can have in any QTH and because the hour is late and my Osrams are fusing, I'll leave the details until next month.

Wideband hybrid amp

The OM360 wideband hybrid amplifier from Philips has a gain of typically 23 dB flat within 0.5 dB over 40 MHz to 860 MHz.

Output voltage at -60 dB intermodulation distortion (DIN 45004, three-tone) is typically 107 dBuV with a noise figure of 7 dB. The OM360 is intended for use in 75 ohm systems as a masthead booster or MATV preamp.

Measuring only 26 x 9 x 3 mm, the OM360 is provided with eight in-line pins along one edge, on a standard spacing of 2.54 mm (0.1 inch) apart. Although designed for use on 12V systems, the device can be employed on 24V systems using a series resistor.

For further information contact, Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW, (02) 427-0888.

'SIT' device is hot stuff at UHF

A newly-developed device, the Static Induction Transistor offers almost five times the power output at UHF than conventional equivalents.

Developed by Prof. J. Nishizawa of Tohoku University's Institute of Electrical Communications, it is claimed the new device promises more miniaturization of equipment using UHF technology ranging from microwave ovens to satellite communications facilities.

Commercial production is anticipated in the not too-distant future.

JAPANESE ICs, TRANSISTORS and DIODES

Suitable for TV's, Car Radios and other Japanese equipment

TRANSISTORS

	$ c
CS9013	.60
2SA489	2.95
2SA495	2.50
2SA496	1.30
2SA545	1.50
2SA561	1.75
2SA562	1.00
2SA564	1.55
2SA628	.76
2SA634	1.95
2SA683	.85
2SA7190	.70
2SA7330	.65
2SA844C	
2SB187	2.15
2SB525	1.15
2SB536	3.60
2SB555	8.35
2SC228	1.70
2SC372	.85
2SC373	.65
2SC380	.75
2SC387A	1.65
2SC388	1.45
2SC403	1.00
2SC458	.55
2SC460	.60
2SC495	2.50
2SC496	1.80
2SC509	1.85
2SC536D	.75
2SC538	2.25
2SC605	2.65
2SC710C	.60
2SC710D	.60
2SC711F	.80
2SC712	1.45
2SC717	1.25
2SC732	1.05
2SC733	.95
2SC735	.95
2SC763D	.65
2SC776	8.65
2SC781	5.85
2SC784	1.35
2SC785	1.20
2SC799	10.70
2SC815	.80
2SC828	.80
2SC829	.80
2SC838	.80
2SC839	.70
2SC900	.60
2SC900F	.65
2SC900U	.65
2SC930	.65
2SC933	1.60
2SC945	.55
2SC1014	1.70
2SC1018	2.95
2SC1047	.60
2SC1061	2.40
2SC1070	3.75
2SC1096	1.40
2SC1107	3.15
2SC1124	2.20
2SC1215	1.15
2SC1226	2.00
2SC1237	7.80
2SC1239	7.45
2SC1306	2.65
2SC1307	6.95
2SC1312	.75
2SC1318R	.60
2SC1327T	.60
2SC1359	.55
2SC1364	.80
2SC13183R	.80
2SC1384	1.20
2SC1398	1.60
2SC1449	2.65
2SC1674	.70
2SC1675	.65
2SC1678	4.45
2SC1685	.65
2SC1687	.75
2SC1760	1.30
2SC1846R	1.15
2SC1957	1.40
2SC1969	3.70
2SC1973	2.00
2SC1974	3.20
2SC2028	2.25
2SC2029	3.50
2SC2074	1.95
2SC2075	3.40
2SC2086	3.95
2SC2166	2.26
2SD180	4.15
2SD187	1.35
2SD235	2.05
2SD261	1.25
2SD288	1.40
2SD313	2.40
2SD325	1.95
2SD359	3.25
2SD525	2.10
2SK19GR	1.30
2SK23A	1.60
2SK30	1.80
2SK33F	1.15
2SK34E	.95
2SK41F	
2SK47	1.95
2SK49	1.45
2SK54B	1.75
2SK55D	1.75
2SK55E	
2SK68L	1.35
2SK355C	
3SK41L	
3SK45B	2.95
3SK48	4.85

INTEGRATED CIRCUITS

	$ c
AN612	2.40
BA521	7.25
HA1322	5.35
HA1339	5.35
HA1342	5.10
HA1366W	
MC1458	2.85
MC4044	6.25
MC14001	
MC14016B	
MC14511	
MC14526B	6.95
MC14568B	12.55
MM5369AA/N	3.40
MM5387AA/N	9.10
MM5799NBR	
MM74C93	
M51202L	3.35
NDC40013	15.70
NIS7261A	9.90
PLL02AG	6.30
SL1626	
SL1640	
SN76115N	3.35
SN76600P	
TA7045M	4.25
TA7060P	2.75
TA7061AP	3.55
TA7062	2.60
TA7063	3.25
TA7069	2.70
TA7205P	4.10
TA7310AN	1.65
TA7310AT	1.75
TC5032P	19.95
TC5080P	8.30
TC5081P	5.50
TC5082P	7.65
UPC566H	2.70
UPC575C2	4.35
UPC577H	3.95
UPC592H2	1.85
UPC1020H	5.95
UPC1156H	5.95
UPC858C	10.95
78L05AV	2.15
78L06	2.15
78L62WV	

DIODES

	$ c
IN34A	.25
1N60AM	.25
1N60FM	.25
1N914	.30
1N4001	.13
1N4004	.30
1N4148	.07
1N5401	.50
1S32	.30
1S188AM	.25
1S953	.40
1S1007	
1S1555	.25
1S1588	.35
1S1885	.30
1S2472	
1S2473	.25
1S2688	
1S2689	2.45
1S9905	
B7 9.1Z	.40
BZ090	
BZ100	
BZ162	.70
GP25G	.75
ITT310	.45
ITT410	.40
M1301	
M8513	.90
MA150	.20
MV201	
MZ205	.45
MZ310	.35
OA90	.17
02Z 5.6A	1.10
RD6A	1.10
RD91E	.40
S3016R	1.45
UO5B	
VO6C	.30
WG713	.25
WZ061	
WZ100	.70

CRYSTALS

3.579545MHz	3.05
9.545	3.60
9.555	3.60
9.565	3.60
9.585	3.60
10.000	3.60
10.010	3.60
10.020	3.60
10.040	3.60
10.0525	5.20
10.240	5.20
10.692	5.20
10.695	5.20
16.965	3.60
17.015	3.60
17.065	3.60
17.115	3.60
17.165	3.60
17.215	3.60
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ETI

Recent research explains night-time transequatorial propagation at VHF.

Roger Harrison
VK2ZTB

The mechanism allowing propagation of VHF signals across the equator during the evenings in equinoxial months (Mar-April, Sept-Oct) has remained a puzzle since discovery of this type of propagation by amateurs in 1947. A flurry of recent research seems to have produced an acceptable basic model, further observations should fill in the details. It is an important advance in ionospheric and radio science, amateur radio played a significant part — and could still.

A BRIEF historical resume of this subject was covered in the March issue, earlier this year (pages 91-92). Recapping, VHF signals propagating across the geomagnetic equator during the evening hours (2000-2300 local mean time), occurring chiefly around the equinoxial months of March-April and September-October, have been investigated since reports from radio amateurs appeared in 1947. Amateurs have been exploiting the mode, now generally called night-time, or Class II TEP since that time. Recently, reports of 144 MHz signals over these paths have stirred a great deal of interest.

Following publication of the research findings of R.F. Woodman and C. LaHoz (Ref. 1), who used a 50 MHz radar to study the equatorial ionosphere above Jicamarca in Peru, a number of researchers have attempted to explain the propagation mechanism supporting this remarkable form of propagation.

Previous models

Prior to 1978, the following four models were proposed:

1. Refraction from the F-layer.
2. Scatter from 'irregularities' (small, dense 'patches' of ionisation) in the F-layer.
3. Double scattering from two patches in the F-layer either side of the geomagnetic equator.
4. Guidance of signals by irregularities aligned with the Earth's magnetic field.

All of these proposed mechanisms suffered from varying drawbacks. The first, refraction from the F-layer, proved to be impossible at the frequencies involved (greater than 50 MHz) from the known characteristics of the equatorial ionosphere.

An ensemble of irregularities in the F-layer cannot return sufficient power to the opposite side of the geomagnetic equator unless shaped so that the signal is focussed, providing coherent addition of the signal over many paths. This was shown to be highly unlikely and certainly did not match up with observations. Scratch model 2.

Double scattering from two patches of irregularities either side of the geomagnetic equator, without an intermediate ground reflection, was eventually considered suspect as it proved difficult to estimate path loss reasonably, although the geometry of the situation fitted the observations. There were a number of other difficulties.

Guidance of signals by field-aligned irregularities received the most attention as it offered the best 'match' to most observations, although some conflicts proved difficult to resolve.

A recent article in QST by Joe Reisert and Gene Pfeffer attempted to explain 144 MHz propagation over transequatorial paths in terms of scattering from field-aligned irregularities (Ref. 2). This theory is an extension of model 2 and suffers from the same limitations, although the observational material is excellent.

An article by Jorgen Rottger (DJ3KR) in the December 1978 issue of Radio Communication (Ref. 3) ascribed 144 MHz TEP to forward scattering from irregularities occurring in connection with high-rising "plasma bubbles" in the equatorial ionosphere. These plasma bubbles were described by Woodman and LaHoz (Ref. 1) and consist of elongated 'tubes' or 'bubbles' of depleted ionisation that rise through the equatorial ionosphere after local sunset and travel from west to east. Small, dense irregularities are associated with the 'walls' of these bubbles.

This theory proved to be on the right track but scattering could not account for the received signal powers observed. Also, the proposed mechanism requires transmitted and received angles of elevation not found in observations (although more observations are necessary). Rottger's theory does explain quite a number of the observed signal characteristics. The periodicity of generation and movement of the bubbles accords quite well with results of long-term fading observations detailed in Rottger's paper.

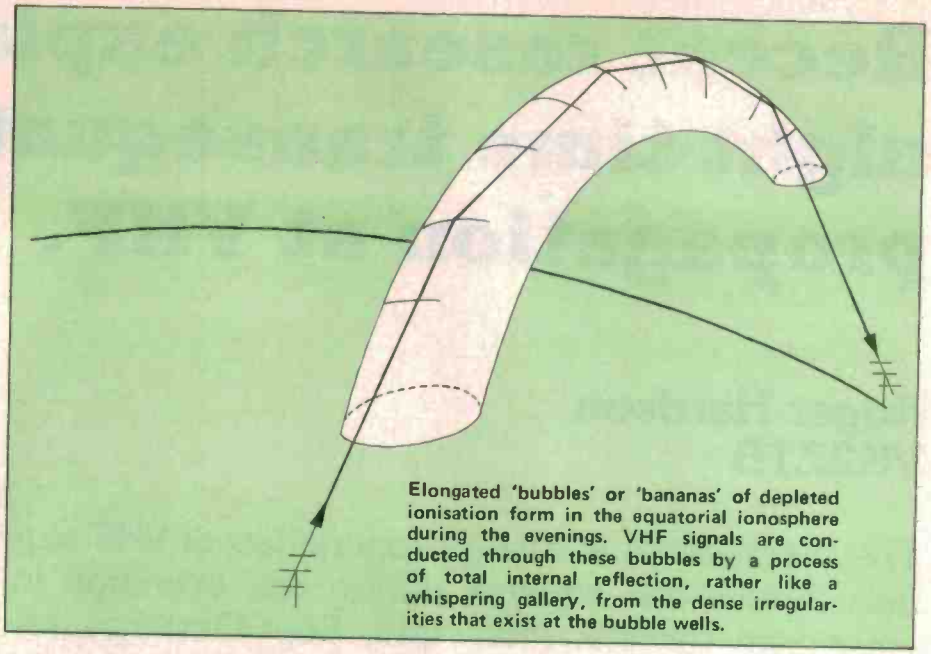
Recent models

Two recent papers by Australian researchers propose very similar models that provide very good prediction of the major observed characteristics of nighttime TEP.

I have already mentioned a paper by Mal Heron and Leo MacNamara (Ref. 4) in the May issue of ETI (page 90).

They explain nighttime transequatorial propagation in terms of guiding of the signals along the field-aligned 'tubes' or 'bubbles' already mentioned. Virtual total internal reflection from the walls of the bubbles (or 'bananas', Heron suggests) guides the signal from one hemisphere to the other, rather in the manner of a "whispering gallery" familiar to students of the physics of sound.

A paper by Clive Winkler (Ref. 5), presented at a conference on the ionosphere and propagation, conducted by the Ionospheric Prediction Service early in May, considered the bubbles as a dielectric discontinuity. Using geometric optics and applying Snell's Law and Fresnel's Law, Winkler achieves results ". . . so close to the experimental results, further analysis appears warranted".



Elongated 'bubbles' or 'bananas' of depleted ionisation form in the equatorial ionosphere during the evenings. VHF signals are conducted through these bubbles by a process of total internal reflection, rather like a whispering gallery, from the dense irregularities that exist at the bubble walls.

The amateurs' role

Historically, amateurs have been closely connected with research into transequatorial propagation since its discovery in 1947.

A large-scale observing programme was conducted over the 1958-59 International Geophysical Year and a paper by M.P. Southworth published in the Journal of Geophysical Research in 1960 (Vol. 65, pp 601-607). 'Task Bridger', a research programme on TEP conducted by the Australian Weapons Research Establishment in the mid-1960s, involved amateur observations (to which the writer contributed – my first association with TEP).

A 1969 report on "Long Range VHF Propagation Across the Geomagnetic Equator" by D.L. Nielson of the Stanford Research Institute (USA) acknowledged the considerable observing effort of Stuart Kingan ZK1AA, from the Cook Islands in the South Pacific.

Research results from reports of TEP obtained from Australian amateurs were presented in an Ionospheric Prediction Service Report (Ref. 6) in 1973, with which I was personally involved.

Reports of 144 MHz transequatorial propagation have been cited in a number of recent papers.

Personal discussions with a number of researchers in this field indicate that observations and reports of TEP at 144 MHz could play a significant role in further research, particularly in relation to the wave-guided mode through equatorial plasma bubbles.

Is it important?

Both the communications and interference potential of nighttime TEP may prove of some importance.

Extensions of the conventional 'maximum usable frequency' (MUF) for ionospheric propagation – typically less than 40 MHz – may prove useful for communications, relieving congestion in the crowded HF spectrum. Unfortunately, the very same extension can bring quite severe interference problems!

Traditional frequency allocation in the 50 MHz region assigns broadcasting (TV and FM) and land and aeronautical mobile services these frequencies. Future spectrum planning may have to take this into account (Ref. 7) as interference between countries in opposite hemispheres may be a sensitive problem. Where the military make use of this part of the spectrum, reduced communications security is a result in affected geographical areas. It is believed this mode of propagation is already exploited to monitor military activity in remote regions.

Can amateurs contribute to further research? Certainly in fact, they are probably best placed to do so. The conclusion of the Heron – MacNamara paper (Ref.4) says:

"Notwithstanding its limitations, the model may be used to infer various properties of the plasma bubbles and to suggest possible future experiements. The most significant observations which are suggested by this work pertain to individual TEP events. Higher frequency waves in particular are likely to propagate through only one bubble at a given time. Simultaneous recording of power, Doppler shift and direction of arrival of received TEP rays, interpreted through this model will allow inexpensive observation of the properties and time development of the equatorial plasma bubbles. Also, more observations of east-west asymmetry of VHF TEP paths are required to establish the need for a tilted bubble mechanism as discussed here."

I would like to hear from any amateurs wishing to cooperate in an observation programme. Write to me c/o ETI.

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1. R.F. Woodman and C. LaHoz, "Radar observations of F-region equatorial irregularities", Journal of Geophysical Research, 1976, 81, pp 5447 – 5466.
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4. M.L. Heron and L.F. MacNamara, "Transequatorial VHF propagation through equatorial plasma bubbles", Radio Science 1979 (to be published).
5. C. Winkler, "Ionospheric transequatorial radio wave guidance at VHF", unpublished.
7. M.L. Heron, "A spectrum managment solution to VHF transequatorial propagation interference", unpublished.

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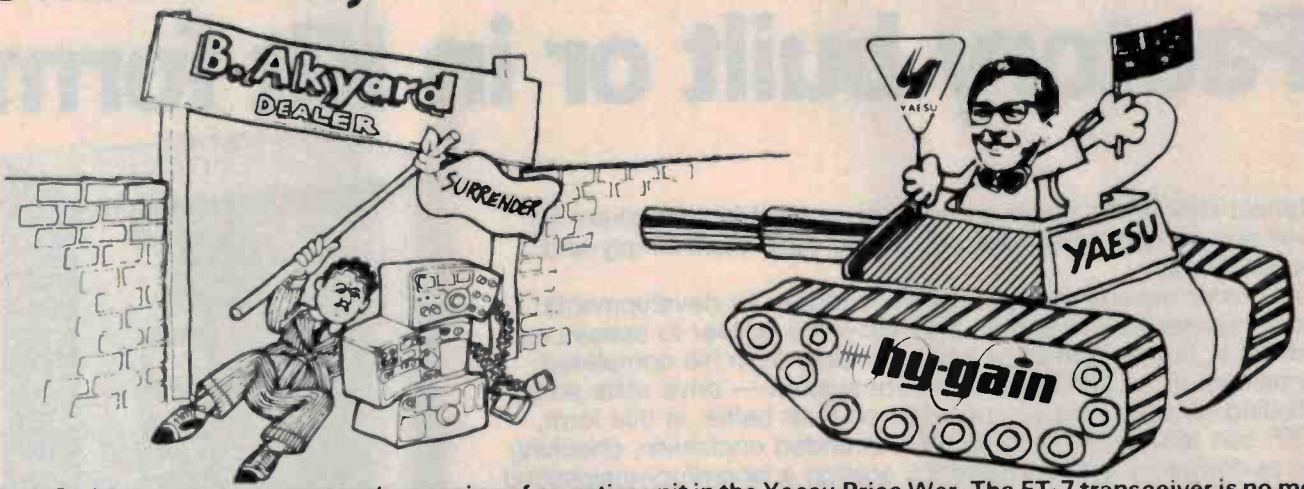

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'Metal Particle' tapes revolution

A new tape formulation using 'metal particles' seems set to bring about a revolution in tape technology and performance. It will alter equipment requirements too — Brian Dance reports.

THERE HAS BEEN much publicity about the new audio tapes which will employ metallic iron particles instead of the conventional iron oxide (see ETI, September 1978) to provide considerably enhanced performance.

This will be most noticeable in the case of cassette tapes, since the conventional tapes currently available do not offer the highest standards of performance. At the present time there is a race between a number of tape manufacturers to be first to release metal particle cassettes onto the market.

Phillips were expected to get their "Metal" cassettes into production by about April or May 1979, in which case it seems likely that they will become available before their competitors' products, but both TDK and 3M (Scotch) are likely to prove very strong competitors in the race.

All these manufacturers have announced they are developing iron particle cassette tapes, but none has yet released samples at the time of writing. Indeed, Philips announced no less than two years ago that they intended to show metal particle tapes at the 1977 Berlin show, but we still await their appearance.

It should not pass without comment that TDK of Japan have been reported as having commenced research into the use of metal particle tapes over 25 years ago! This shows that their development has met with a considerable number of difficult problems which are only just being solved.

Properties

The metal particle tapes have a coercivity and remanence nearly twice as great as that of the best cobalt-enriched ferrite tapes (such as TDK's Super Avilyn).

A comparison of the hysteresis loops of these two tapes is shown in Figure 1. The magnetic energy stored in a tape under saturation conditions is proportional to the area within the hysteresis loop, so the metal tape can store about four times as much magnetic energy as the Super Avilyn type – and the latter can store more energy than many of the tapes in use today. Thus it is not difficult to understand why iron particle tapes can produce higher outputs from a tape head than conventional tapes.

A Nakamichi sample metal tape – supplied with their 582 cassette deck, reviewed on p.30.

Metal tapes contain a coating of pure iron particles which must be coated with a protective layer to prevent oxidation (rusting). The production of these particles of the correct shape and size, with a very thin coating, and the distribution of the particles on a tape is no easy matter – which is why their appearance has been so long delayed.

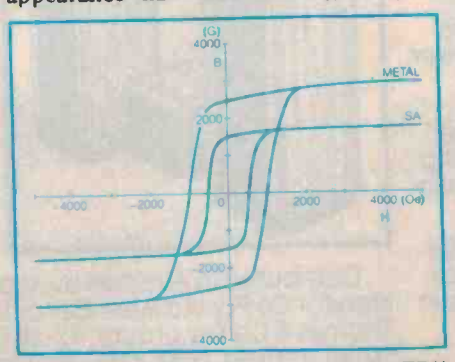

Figure 1. B-H Hysteresis loops of the TDK metal and Super Avilyn tape coatings.

TDK has developed a method of forming the iron particles by a reduction process involving an iron compound in solution with sodium borohydride. The resulting particles are composed of small spheres having a diameter of about 30 mm strung together in chains.

This type of tape may be compared with TDK's Super Avilyn in which the particles are needle-like in shape with a length averaging about 500 mm.

The formulation of the metal alloy particle system enables a greater number of particles to be packed onto unit area of the coated tape film. This can result in a coercivity of about 0.35 Tesla (3500 Gauss) as opposed to about 0.155 Tesla for Super Avilyn.

A technique developed by TDK, produces the protective film on each metal particle which protects it from the atmosphere; as illustrated in Table 1. The changes in the magnetic properties of the metal tapes are only a little worse than those of conventional 'gamma' type iron oxide tapes.

Vital considerations

There are a number of vital points which must be carefully considered when one is designing metal particle cassette tapes and the equipment with which they are to be used. ▶

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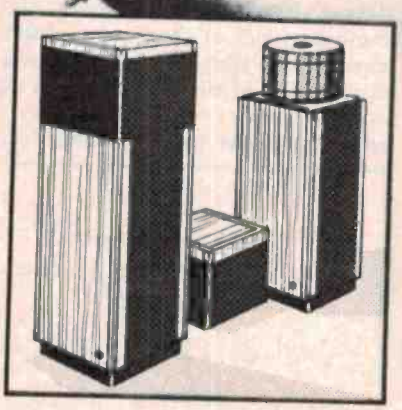

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...tapes revolution

Metal tapes are able to produce higher maximum output levels (MOL) than conventional tapes and care must be taken to ensure that these higher levels are available, throughout the whole of the audio spectrum, in any amplifier system.

The metal particle tapes have a high remanence allowing the thickness of the active coating on the tape base material to be reduced. The result is a considerable improvement in high frequency performance greater clarity of reproduction, and extended frequency response and a most welcome improvement in MOL. This improvement in the MOL also implies that the signal-to-noise ratio at the optimum recording level is increased.

This is the same thing as saying that for a given signal-to-noise ratio, the dynamic range of reproduction is increased.

Each of the parameters of a tape must be considered in relation to the others. Figure 2 shows some of these relationships for TDK's metal tapes. TDK have decided to select a tape type which operates in the 'optimum' region contained in the centre circle of Figure 2. In this region the coating thickness is about 4 μm and the coercivity about 1050 Oersted. At 333 Hz the new TDK metal tape offers a MOL of +1 dB over Super Avilyn, but at 16 kHz the corresponding figure is 7 dB. TDK claim that the higher MOL of their metal tape is available over the whole of the audio range.

There are many other factors which affect the performance of a tape, including its durability during the transport, how effectively the film adheres to the backing layer, how it is affected by ageing and by the type of environment in which it is kept, etc.

The sensitivity of the TDK metal tape is said to be about the same as that of their Super Avilyn and both types show a flat response up to the limits of the high frequency range. If a metal tape is employed, a flat response should be obtained at the "O VU" recording level at frequencies of up to at least 10 kHz.

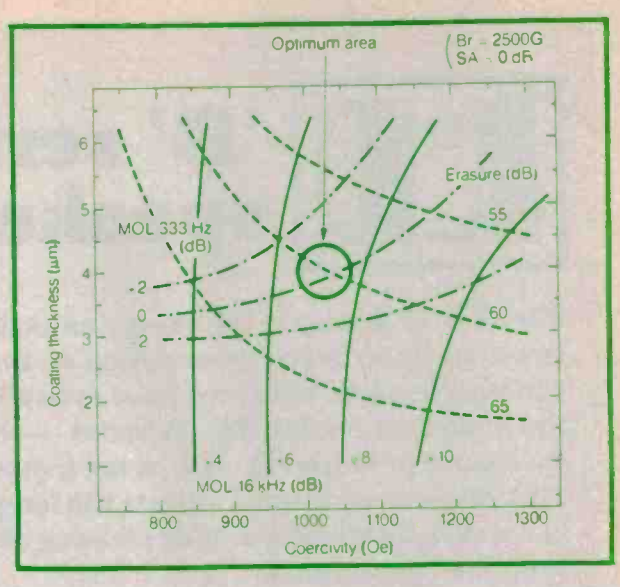

Figure 2. **The performance parameters of TDK metal tapes.**

Equipment

Many manufacturers of cassette recorders are following Tandberg in developing equipment suitable for use with the new metal tapes which can provide the optimum bias level and recording equalisation characteristics. Philips have produced a new cassette housing employing a lid-and-box design which, it is claimed, will add rigidity and reduce azimuth errors.

Perhaps it is rather surprising that Philips claim their new metal tapes can be used on existing decks if they are set for use with chromium dioxide tapes. However, not all of the decks designed for chromium dioxide tapes will be able to erase the metal tapes, as these decks are designed for lower erasing levels. Nevertheless, Philips claim that some 90% of the existing tape decks will be suitable for use with their new metal tapes.

One would imagine that there will be no trouble on playback of metal tapes, but a somewhat different deck design is needed to obtain the best possible recordings on metal tapes.

New cassette decks are being introduced by Philips, JVC and AIWA for use with metal tapes, but they will not be cheap (typically around the $750 level or more, as far as one can guess at the moment). In addition, the metal tapes will cost at least one and a half times that of more conventional cassettes, so the total price is going to make a big hole in the enthusiast's bank account.

Many people will wait to see if the prices of the new equipment and tapes falls quickly with increasing sales volume once the manufacturers have recouped some of the money they have spent on research.

When the new metal tapes are used in specially-designed recorders (such as the Nakamichi 582), they can certainly provide a performance appreciably better than that of a normal good quality cassette instrument using conventional tape.

One should remember that cassette recorders, although convenient, are very much of a 'second best' as regards quality of reproduction to the reel-to-reel recorder. The Philips manager of tape development is reported as saying that metal tapes will create a new era in cassette recording, but added that they will not provide absolutely real hi-fi though they will come very close to the quality of good disc records. As disc recordings involve a reel-to-reel recorder of the highest quality during their manufacture, one can only wonder whether it is not worth while accepting the little extra trouble of starting off with a reel-to-reel recorder of good quality rather than investing in a cassette system.

However, the new metal cassette tapes, when available, will offer a convenient system of quite high quality for those who just wish to insert a cassette and press a knob. ●

(This probably represents the conservative view of metal tapes. For different opinions, read the Nakamichi 582 deck review on page 30 and the Around Sound column on page 178).

	Days	0	7	100	300
Metal tape	Coercivity	1.00	1.04	1.05	1.05
	Remanence	1.00	0.96	0.95	0.95
Gamma iron oxide tape	Coercivity	1.00	0.98	0.98	0.98
	Remanence	1.00	0.98	0.98	0.98

Table 1. **Stability of TDK metal tape and Super Avilyn at 50°C and 90% relative humidity; all values are relative to the initial value.**

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Bass Driver	12" Roll Surround High Compliance Bass Drive Unit
Mid Range	5" Curvlinear Cone Type
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Frequency Response	25 Hz to 20,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000-10,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
Dimensions	685mm H x 470mm W x 340mm D
Colour	Australian Walnut

Model LD-D-104H

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

Model LD-D-1555H

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

Model LD-D-125H

System Type	12" 3 way 3 Speaker
Speaker Component:	
Bass Driver	12" Roll Surround Bass Drive Unit
Mid Range	5" Curvlinear Cone Type
Tweeter	3" Horn
Power Capacity	40 watts RMS Integrated Programme
Frequency Response	30-18,000 Hz ± 3 dB
Crossover Frequency	1,000-5,000 Hz
Nominal Impedance	8 ohms at 1,000 Hz
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Sound Concepts' SD550R

Electronic reverberation system

The difference between the concert hall and the home listening environments, acoustically speaking, is much that of the proverbial 'chalk and cheese'. The psycho-acoustic effects of reverberation account for the difference. David Tilbrook examines the acoustic shortcomings of home listening situations and reviews a recently-released device designed to reproduce that 'concert-hall realism'.

FEW HI-FI SYSTEMS are capable of reproducing the concert hall or live performance "sound". There always seems to be something missing, something that either the microphone is not capturing or the hi-fi system is not capable of reproducing.

The reason for this lies with differences between the listening environments. Wherever sound is produced only a small part of the sound heard travels directly from the source to your ears. Most of it radiates off in all directions, bouncing off reflective or partially reflective surfaces, eventually reaching the listener. This reflected sound can bounce back and forth between reflective surfaces, producing echoes or reverberation giving rise to "live" listening environments.

In some circumstances such as the measurement of loudspeaker frequency response we want the absolute minimum of reflected sound. The reflections would interfere with the directly radiated sound and give misleading frequency response measurements. In other cases such as the measurement of loudspeaker efficiency we need as much reflected sound as possible. It is necessary to collect and measure all the sound produced by a loudspeaker so that this can be compared to the electrical energy used and arrive at an efficiency figure.

Listening environments fall somewhere between these two extremes. The size of the concert hall gives rise to reverberated sounds that are delayed much more than they would be in the listening room. This pattern of reverberation is different for each listening environment and gives rise to the characteristic sound of concert halls, the sound that the listening room inevitably lacks.

The Sound Concepts SD550R Reverberation System attempts to cure some of the problems by introducing into the listening room a slightly delayed and reverberant replica of the original sound. The SD550R sends an unprocessed signal to the front speakers and processed signals to the rear speakers to introduce the ambiance required. The amount of time delay can be adjusted from 5 to 100 ms. This is broken up into two ranges which are selected by a range switch. The low range covers 5 to 50 ms in 5 ms intervals and the high range 10 to 100 ms in 10 ms intervals. A reverberation control is provided which governs the amount of output of each delayed channel that is fed back into the input of the other delayed channel. By doing this the sound is made to bounce back and forth between the rear speakers to simulate the reverberation of the 'live' auditorium. This is calibrated from 0 to 10 and based on our listening experience the best setting was almost 1.5-2. But more about this later.

The reflected wave in live situations always has decreased treble content, and ▶

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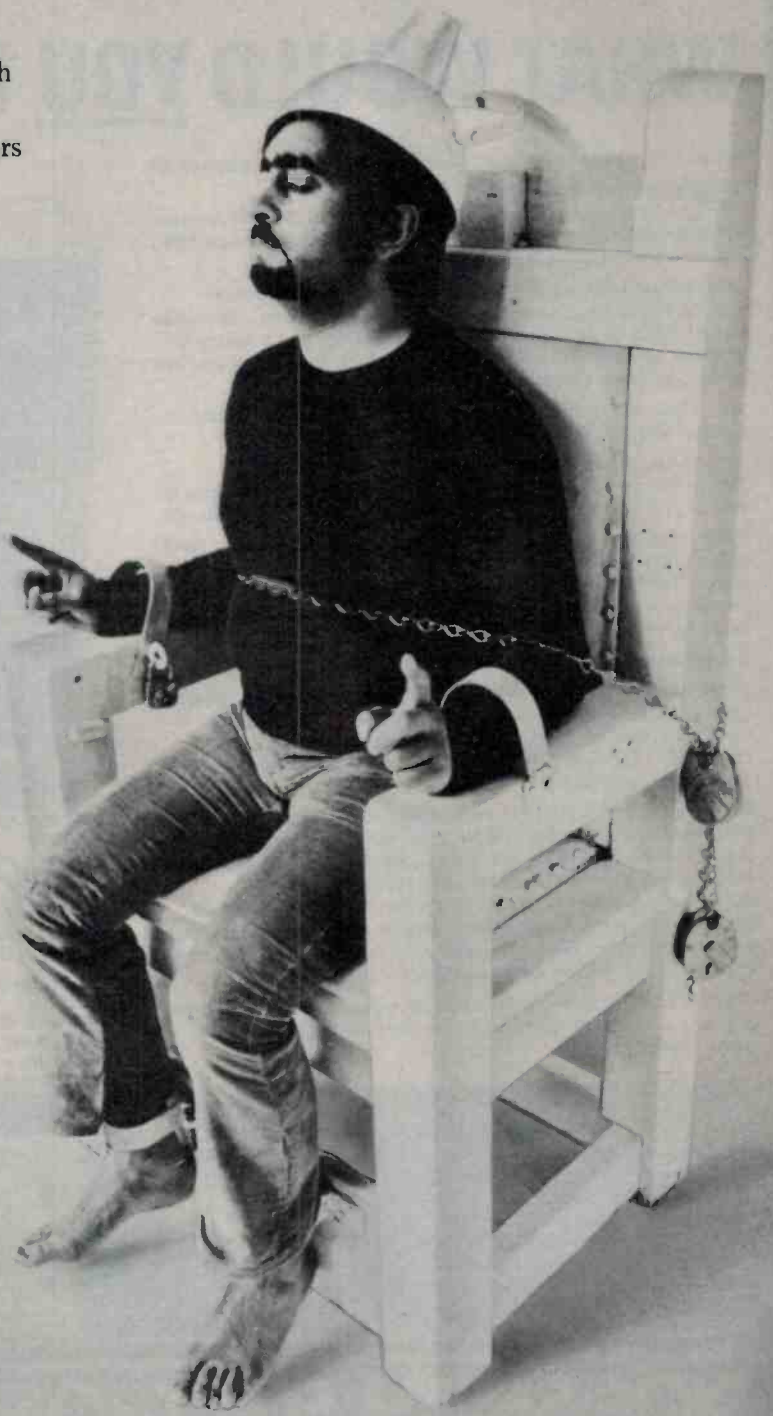
Mirsch speakers are relatively new to Australia.



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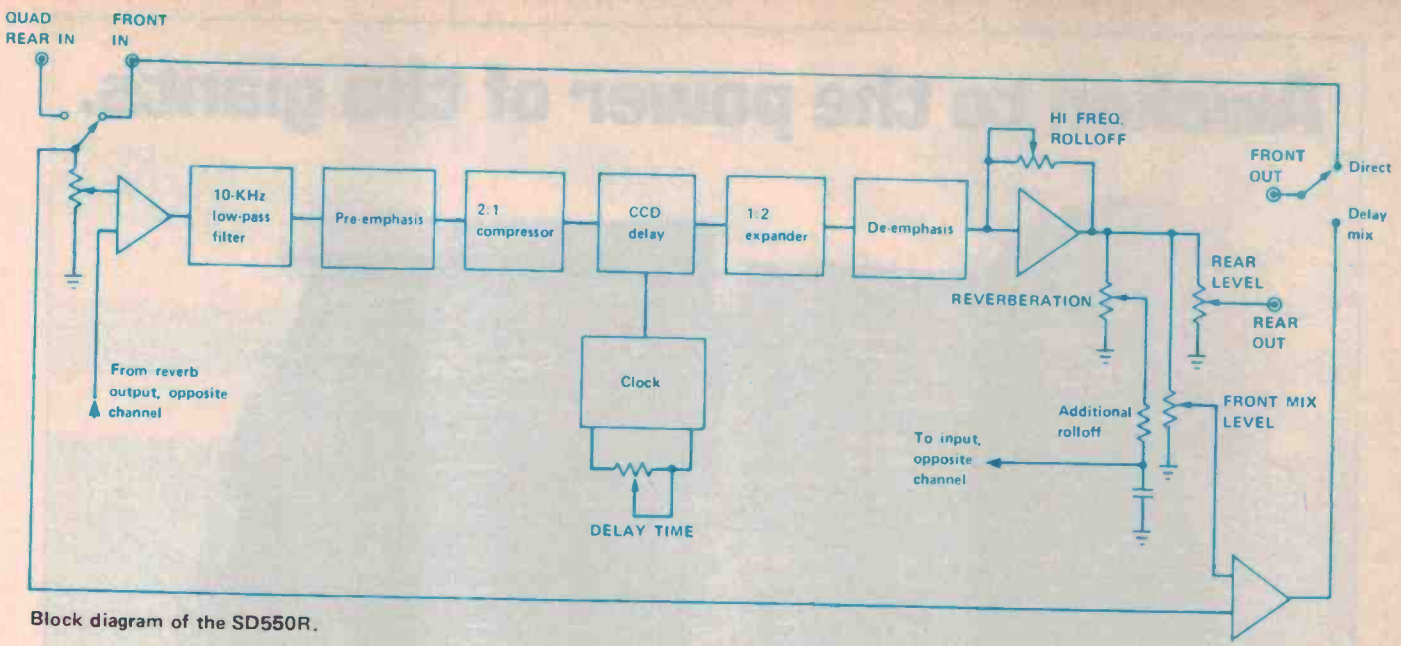

Block diagram of the SD550R.

so for realism in the listening room the delayed signal should also be attenuated at the top end. The SD550R uses a bucket-brigade device to generate its time delay – and bucket-brigade systems have a natural roll-off at high frequencies. A high frequency roll-off adjust is provided and is calibrated from -3 to +6 dB.

When set on the 0 dB setting Sound Concepts claim that the roll-off at high frequencies matches that of the average concert hall.

Another slider control on the front panel controls the amount of delayed signal that can be injected into the front speakers.

The circuitry of the Sound Concepts SD550R includes a two-to-one Compander that provides typical signal to noise ratio of 90 dB and ensures that the unit is non-critical in its input level requirements.

The handbook supplied with the unit shows some recommended settings for the front panel controls and our listening tests largely confirmed these settings as amongst the best. Both reverberation and delay can be overdone and, like tone controls, need to be adjusted carefully to achieve a result that is not unnecessarily synthesised and false. The listening room we used needed a little more than the 1 setting on the reverberation control but after much experimentation all the other controls ended up in roughly the positions shown in the handbook.

The SD550R proved very effective and greatly improved the feeling of depth and realism, especially when playing some older recordings that were otherwise very flat and unspectacular.

A few years ago when quadraphonic systems were all the rage, they were marketed as being able to produce more reality, more of that "concert hall sound" – but did not live up to expectation.

The Sound Concept SD550R to my ear, succeeds where quad failed. ●

SOUND CONCEPTS SD550R

Supplied by:–
Harman Aust. P/L
271 Harbord Road
BROOKVALE 2100
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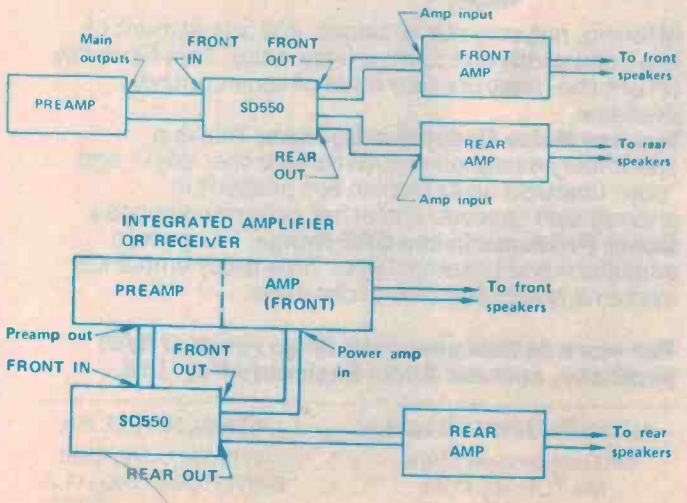
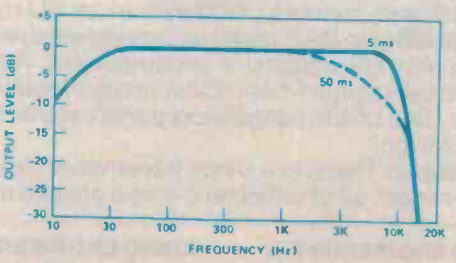
Two ways to connect the SD550R into common hi-fi system components.



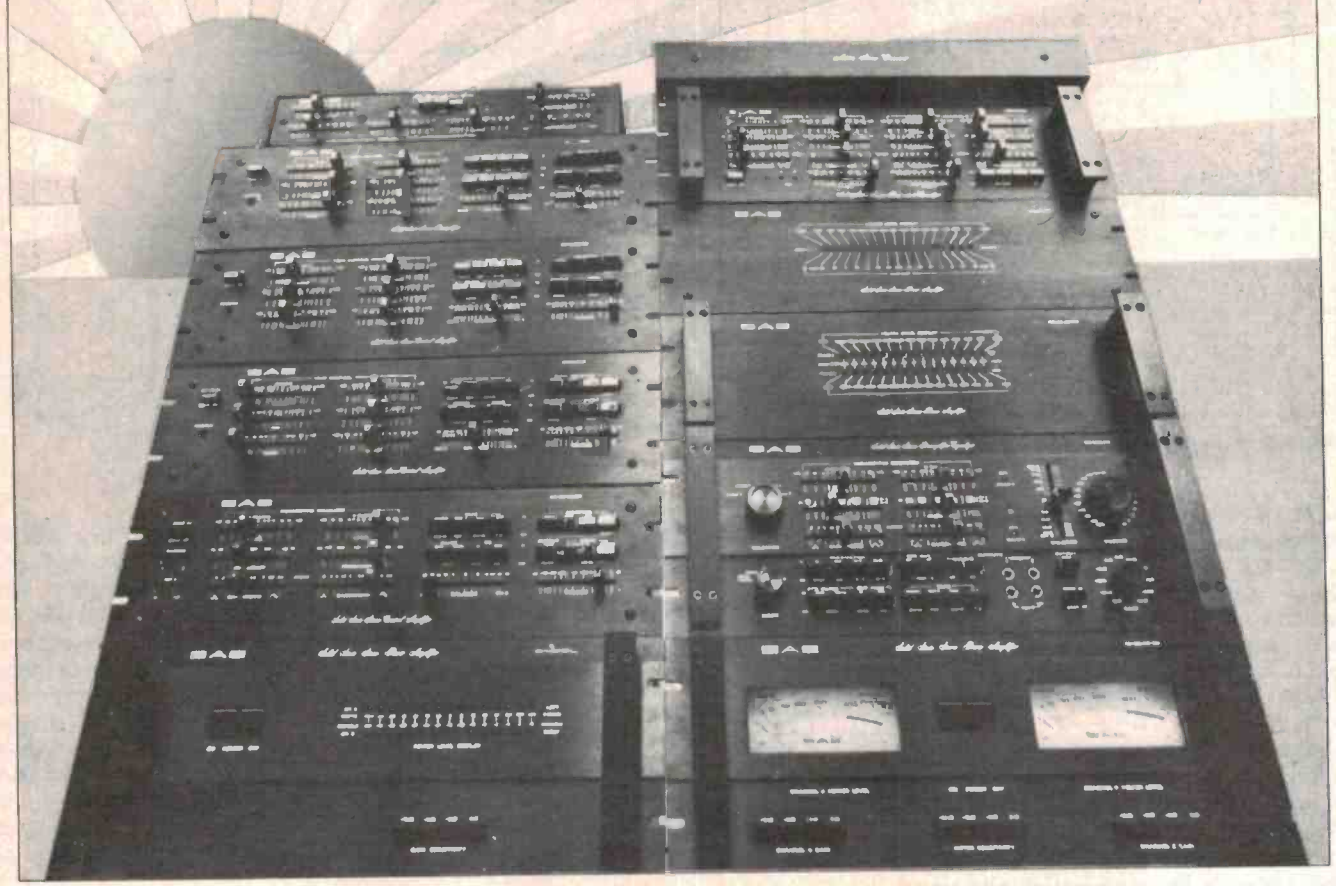
Specifications

Delay Range:	5 to 50 milliseconds ±3 or 10 to 100 milliseconds ±5.
Input Impedance (front):	60,000 ohms minimum.
Output Impedance:	300 ohms maximum.
Gain:	Set for 1.0 maximum. May be adjusted on the rear panel.
Frequency Response:	±1 dB 20 Hz to 5 kHz with 5 ms delay and 0 dB high frequency rolloff. –3 dB at 8 kHz with rolloff set to match delay. (See graph.)
Signal-to-Noise Ratio:	85 dB minimum, 90 dB typical (A weighted).
Distortion:	1% maximum at 1 kHz and 1 volt RMS input, consisting almost entirely of 2nd harmonic.
Dimensions:	89 mm high, 230 mm deep, 394 mm wide (483 mm with rack panel).
Weight:	15.4 kg



SD550 Frequency Response Versus Delay (Rolloff 0 dB)

Awaken to the power of the giants.



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Equalizers: There are three parametric equalizers in the range, all of which are three octave and offering, not only cut or boost, but adjustment of the band width and centre frequency. This flexibility offers the most precise form of tone control available.
Impulse Noise Reduction System: This is a specificaly designed unit to reduce the "click" and "pop" (impulse noise) which are present in phonograph records and other program sources.
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AE138/FP

Maruni HV-3000R headphones

THE HV-3000R HEADPHONES come in a glossy box with no separate technical data except for a statement that the frequency response extends from 8 Hz to 28 kHz. The description on the box and the engraving on the headphones claim that these are 'studio monitor' 'phones. The difference between ordinary and studio monitor headphones may be a little hard to define but we will try.

Either the word "studio" or the word "monitor" has these connotations:

* That the unit is designed for studio use and specifically for monitoring;
* That the frequency linearity should be exemplary;
* That the distortion characteristics should be particularly low;
* That the headphones should not cause discomfort when worn for a long time.
* That they should be rugged enough to withstand the daily abuse which professional headphones receive.

The only other useful piece of information printed on the box states that the units use rare earth metal magnets; that the weight is 6¼ oz (excluding the heavy flex); and that the diaphragm is a mere 16 micron thick. This indicated that these are semi-conventional dynamic head phones and not necessarily electrostatic or other esoteric state-of-the-art development. Fortunately we had two sets which gave us the opportunity of comparing one set against another.

The ear pieces of the HV-300R are unusual. They offer less vertical adjustment than is desirable. If you have an average size head then these headphones will fit. If, however, you have a small head, or your ears are higher than average, or the slope of your ears is not parallel, you may find these headphones do not sit easily on your head because the ear pieces will slip below your ear lobes.

We suspect that the designers think that all heads overseas are bigger than Japanese heads and have designed the headphones accordingly. Fortunately most people try headphones in the shop before buying so will notice if they don't fit. Whilst the headphones themselves are particularly light, the connecting cord (a yoke arrangement with a heavy flex directly connected to each ear piece), is far from light. If anything, the flex weighs more than the head phones (160 gm vs 150 gm). It is obviously designed to be rugged and to withstand abuse.

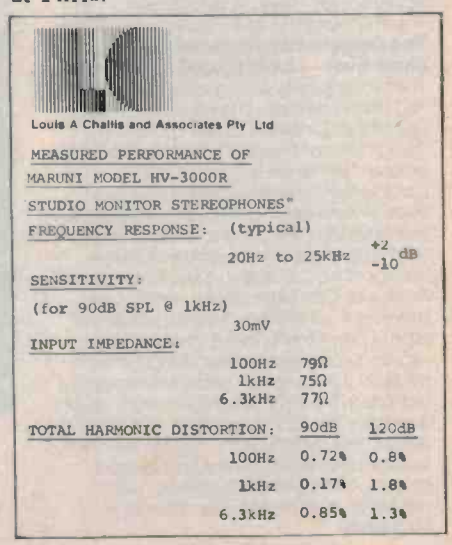
Even the tip-ring-and-sleeve plug on the end of the cord is one of the most rugged that we have seen and appears able to withstand plenty of abuse.

Test results

Our first series of tests checked out all of the four ear pieces for frequency response using our Artificial Ear, Bruel & Kjaer type 4153. This ear is currently the most suitable means of measuring the frequency response of headphones. A new artificial head will soon be standardised by the International Electro-Technical Commission, Committee TC29, to provide what we hope will be an even better measurement procedure. But our current test procedure provides not only a stable and accurate assessment of frequency performance but also readily allows the determination of the other significant parameters as well.

The frequency response of the four earpieces, as the level recordings show, were all slightly different although all featured the same dominant notch at around 2 kHz and three of them also exhibited a significant notch at 7½-8 kHz. In each case the frequency response was relatively flat to beyond 1 kHz and dropped away at close to the expected rate above 15 kHz. Maybe the headphones do have a frequency response to the claimed 28 kHz but it is in excess of 30dB down. Anyway we don't know anyone (apart from dogs) who can hear at 28 kHz.

Each of the four headphones had a slightly different sensitivity and in both cases the difference between the right ear and the left ear was typically 3 dB at 1 kHz. ▶



Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF
MARUNI MODEL HV-3000R
STUDIO MONITOR STEREOPHONES"

FREQUENCY RESPONSE: (typical)
20Hz to 25kHz $^{+2}_{-10}$ dB

SENSITIVITY:
(for 90dB SPL @ 1kHz)
30mV

INPUT IMPEDANCE:

100Hz	79Ω
1kHz	75Ω
6.3kHz	77Ω

TOTAL HARMONIC DISTORTION:	90dB	120dB
100Hz	0.72%	0.8%
1kHz	0.17%	1.8%
6.3kHz	0.85%	1.3%

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THE 4TH AUSTRALIAN CONSUMER ELECTRONICS SHOW.

Read the list below carefully. Here are some of the exhibitors at the 4th Australian Consumer Electronics Show. If your suppliers are listed here, if you'd like to meet new suppliers, if you'd like to see and have demonstrated the latest in electronics equipment at the one place at the one time — you must attend! After all, your competitors will be there. A.G.S. Electronics, Aiwa, Akai, Acoustic Monitor, Acoustic Research, Audio Engineers, B.J.D. Electronics, Communications Power, Maurice Chapman, Computerland, Concept Audio, Convoy, Casio, Electro Voice, Electronics Today International, Falk, Farrell, Futuretronics, Graham Audio, H.M.V., Hagemeyer, Hanimex, Hitachi, Hoskins, Kriesler, National Panasonic, Nipper, Peterson, Philips, Pioneer, Pye, Radio Rentals, Rose, Roland, Sanyo, Sharp, Superscope, Teac, Tokyo Boeki, Trio-Kenwood, Union Carbide and Van Fi.

The biggest consumer electronics show ever — over 80,000 square feet!

These suppliers will be exhibiting over 100 brand names. They'll be offering special show deals to get you off to a flying start for the peak selling Christmas period. Remember over 25,000 consumers who attended last year's show were seeking direction on outlets stocking the new products. So make sure you're right up to date and see these products from Europe, Asia, America and Australia. Cassette decks, turntables, receivers, amplifiers, tuners, speakers, tapes, equalizers, three in ones, car radios, professional sound equipment, musical instruments, microwave ovens, batteries, lighting, electronic toys, audio accessories, CB equipment, personal computers, calculators, digital watches, radios, televisions (including closed circuit), computerized games, video cameras, video cassette recorders, TV games.

Trade Times and Functions:

Trade Cocktail Party — meet and talk with your fellow retailers at the Boulevard Hotel, Wed., July 18, 6.30 – 8.00 pm.

Informal BBQ and country and western night. Wind up the show at a real 'wing ding'! At the Showgrounds. Sun., July 22nd from 7.00 pm.

Show open to trade only.
Wed., July 18. 12 noon – 5.00 pm.
Thur., July 19 – Sat., July 21. 10 am – 1 pm.
Sunday, July 22. 9 am – 12 noon.

Public Admitted.
Thursday 19th July, 1pm-10pm.
Friday 20th July, 1pm-10pm.
Saturday 21st July, 1pm-10pm.
Sunday 22nd July, 12 noon-7pm.

Adults $2.00. Children 60c. Pensioners $1.00.
For further details and passes contact Riddell Exhibition Promotions, 166 Albert Road, South Melbourne, 3205. Telephone: (03) 699 1066.

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All during the show there will be fun and prizes, and anyone who comes can join in and have a chance to win!

Whiz Kid Competition.
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Computer Chess.
The Australian Open Chess Champion and various members of the public will compete with a computer chess machine at different times during the show.

Door Prizes.
Every person who attends the show will have a chance to win exciting and valuable door prizes! So don't miss it. The 4th Consumer Electronics Show is going to be bigger and better than any other show.

Another exciting Riddell Exhibition.

RP 390

Maruni headphones

The distortion characteristics at the standard 90 decibels level were exemplary being less than 0.2% at 1 kHz; less than 1% at 100 Hz; and less than 0.9% at 6.3 kHz.

If they could perform so well at 90 dB we thought we should evaluate their performance at higher levels. Much to our surprise as we increased the output level, distortion did not increase at the expected rate. By the time we had reached 120 decibels, an operating point at which the diaphragms in most other headphones either droop, wilt or go soft, the distortion levels were still quite good. These were — less than 1.8% total harmonic distortion at 1 kHz; less than 1% at 100 Hz; and only 1.3% at 6.3 kHz.

This performance is outstanding.The power input level into the headphones even at 120 dB level was particularly low and well within the capabilities of either a small monitor amplifier or conventional domestic amplifier system. We carried out a standard impedance determination on the headphones and this showed that they had no significant droop, being typically 79 Ω ±5 Ω from 20 Hz to 20 kHz. This high impedance shouldn't disturb your amplifier and allows these headphones to be designed into other professional systems without creating loading problems — as would standard 8 Ω head phones.

The next obvious question was how would the headphones perform on subjective tests particularly using the type of programme content that can "separate the men from the boys". The first thing we noticed on donning the Maruni headphones was the lack of tape hiss. We have experienced tape hiss with most other headphones, related to the accentuation of high frequency background noise in the 5-15 kHz region even with recorders having a Dolby noise reduction system.

At first we did not trust our own observations and resorted to comparison testing with four other sets of headphones, each with different characteristics. It was immediately obvious that the Maruni headphones do not artificially accentuate the high frequencies. This feature alone must gain high marks. Equally important, we immediately noticed that on high level transient material there appeared to be no significant increase in distortion of the type we have experienced with conventional dynamic and high quality electrostatic head phones.

We used a series of specially selected programme material produced in Sweden, Italy and Russia. This material is designed for evaluating loudspeakers and headphones and includes classical music, jazz, percussion, tympani and choral works. Whilst the Maruni headphones were not better than the best loudspeakers we have listened to, the presence and fidelity were impressive.

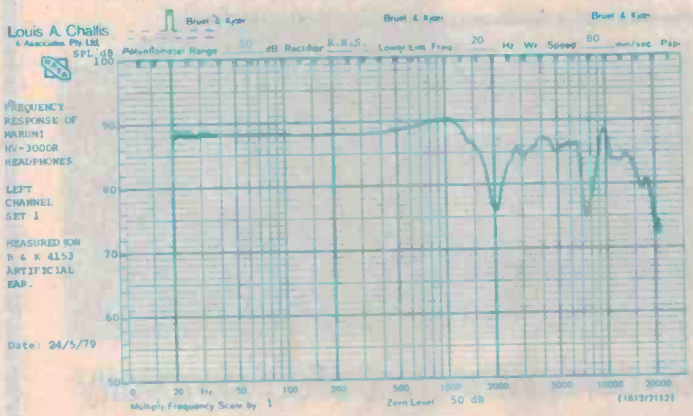
We then conducted a series of AB comparison tests with a set of reference electrostatic headphones. At high listening levels the Maruni headphones outperformed the electrostatic type.

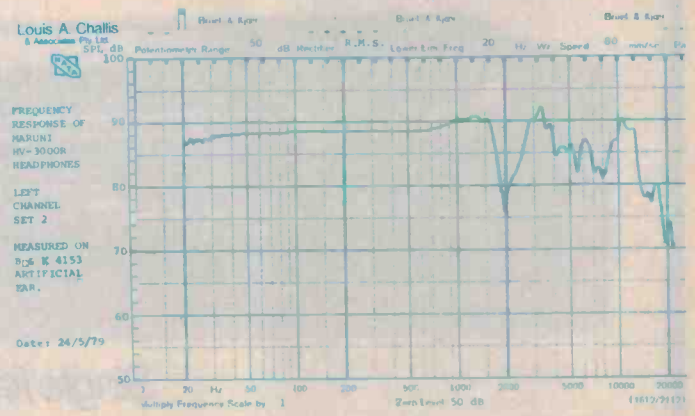
We found the Maruni headphones reasonably comfortable to use but everyone might not agree. Children, in particular, might find there was not sufficient adjustment in the head band for comfortable listening. However, this is probably our most serious criticism of these head phones and we understand from the importers that the headband is currently being redesigned in light of our criticisms.

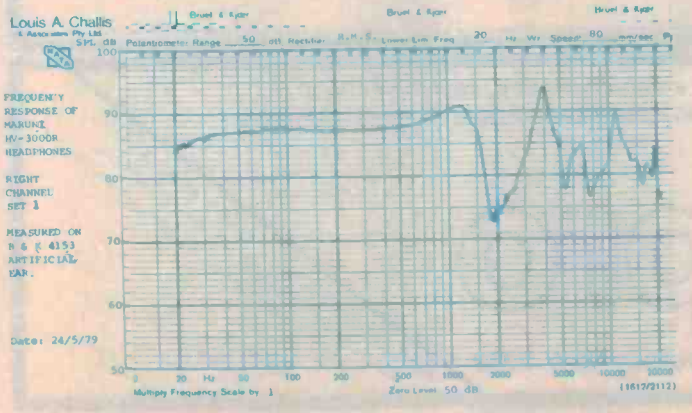
Their performance is superior in most areas to the majority of other headphones that we have reviewed. Although the frequency performance is not as flat as we would like from 'studio monitor' head phones, the other performance attributes and lack of artificial accentuation at high frequencies could yet earn the Maruni headphones this accolade. ●

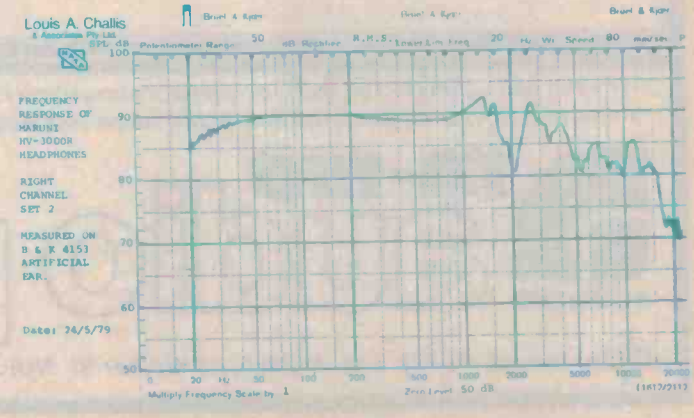
MARUNI HV-3000R STEREO HEADPHONES

Two units supplied by Maruni Corp, 337 Queensbury St, North Melbourne, 3000. RRP: under $70









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Consider the turntable system . . .

A guided tour of modern turntable systems, their advantages and disadvantages and the dilemmas that face designers. Richard Timmins reports.

PERHAPS THE MOST interesting area of recent developments has been the turntable system, particularly in view of the major swing away from low-mass, high compliance pickup systems in favour of the apparently more old fashioned moving-coil systems.

The main limitation in low-mass pickups is the stylus itself, or specifically the effective tip mass of the stylus/cantilever system.

Some low tracking-force cartridges – the original ADC XLM is a good example – had ridiculously high compliance leading to inadequate tracking performance. The chief problem with such cartridges was applying sufficient tracking force to keep the stylus firmly in place in the groove; by its inertia, the stylus tended to lose contact with the groove walls and lack of stiffness in the suspension did little to control this.

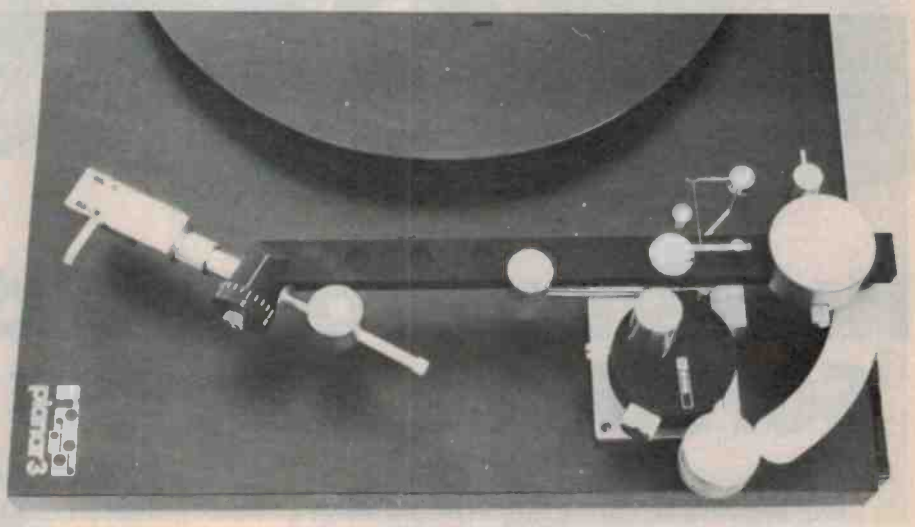
Application of a higher tracking force (the XLM needed ideally, about 1.5 gm in the SME II arm), simply caused the stylus to retract into the cartridge body, especially when playing warped or rippled records – and most are these days!

Thus until there are significant reductions in effective tip mass, it seems most unlikely that very high compliance cartridges in low-mass pickup systems will offer the performance of a medium-compliance cartridge in a fairly massive, substantial pickup arm.

Role of the pickup arm

This can perhaps be understood more clearly by considering the role of the pickup arm itself. The basic requirement is to hold the cartridge body completely still, to act as the stator in the generating system in which the stylus is linked rigidly (or so we hope) to the 'rotor'.

If the cartridge body is allowed to move in any way the required relative movement between the stylus/cantilever system will be modified and this will be reflected in the output, normally as a loss.



Dynavector employ a massive arm in their model DV505 to reduce the effects of relative cartridge-arm movement, improving low level distortion.

Some idea of how stable the cartridge body must be can be gained by looking at the actual size of low-level groove modulations – say, at -60 dB of maximum level.

Assuming a maximum groove deviation in the order of a millimetre or so, we're looking at mere thousandths of a millimetre at -60 dB; movement of this order in the cartridge carrying system will at best distort these low levels, at worst it will lose them entirely.

Dr Tominari, the mechanical engineer responsible for the Dynavector cartridges and DV505 arm tackled this problem by making his pickup arm very massive, adopting a neat ploy to reduce mass in the vertical plane without too great an overall performance compromise.

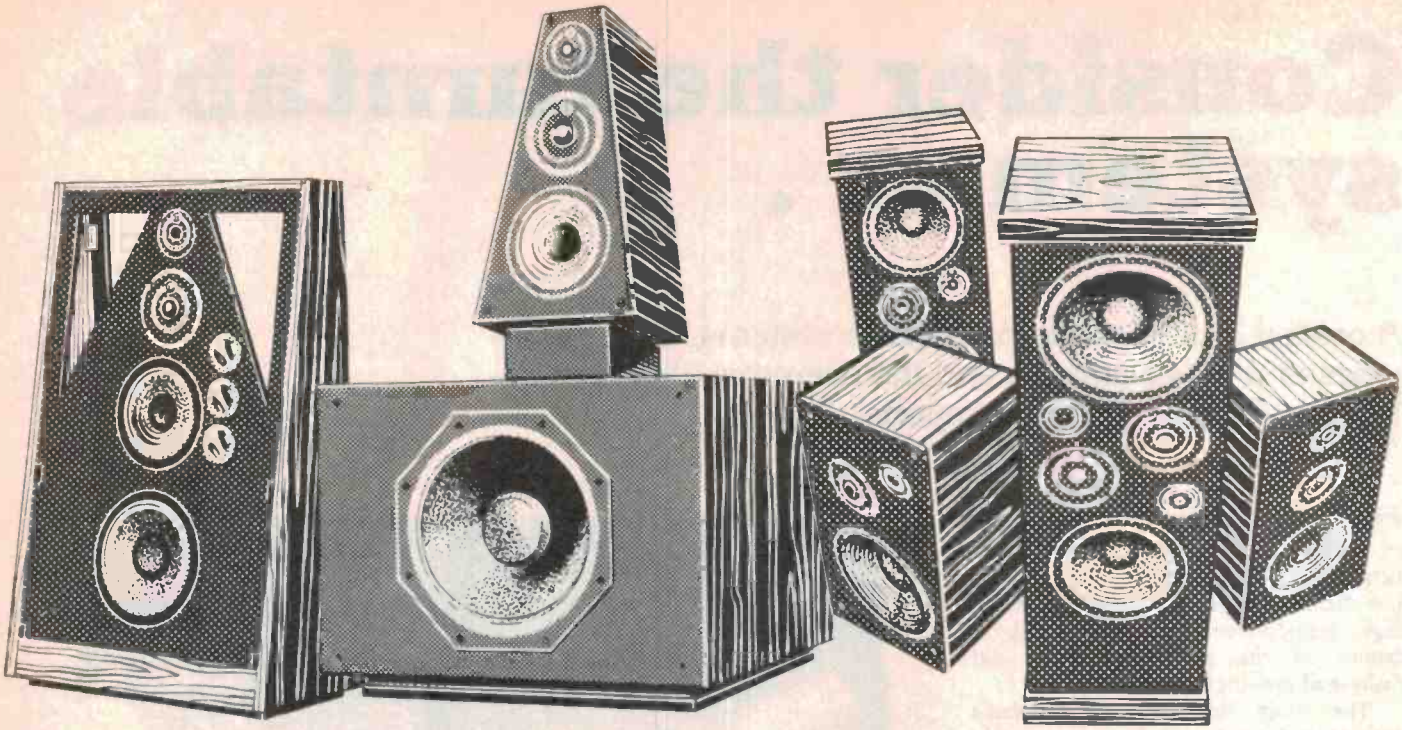
The general trend is, however, toward very rigid arms of medium-high effective mass. These are used with cartridges of low-medium compliance in which the effective tip mass is kept as low as possible to avoid mistracking problems due to inertia of the sylus.

The use of a fairly stiff stylus suspension ensures the arm/cartridge low frequency resonance is placed optimally beneath the lowest recorded audio frequencies and above the warp/ripple region. In the latter connection disturbance to the tracing performance, due to the fairly high overall inertia of the system, is thus minimised.

We can appreciate that the use of a low/medium compliance cartridge produces a situation where energy fed back into the arm is rather greater than when a high compliance cartridge is used. This is why a very rigid, non-resonant arm is therefore a must, and that necessary evil, the bearing system must also be very strong and tight to avoid unwanted resonances and spurious vibrations.

Other sources of unwanted resonance are the arm tube itself. This is prone to various forms of vibration such as structural resonances and reflections along its length arising from the cartridge. Then there's the counterweight system, usually decoupled from the rest of the system using a self-damped resilient material.

Fortunately, a heavy arm can possess ▶



New shapes of sound from RTR: Soft dome...the key to reality.

While the soft dome driver enjoys an enviable reputation for smooth frequency response and uniform dispersion, its limited power handling and low acoustic output normally result in higher distortion and less-than-lifelike sound reproduction.

Except for D-Series soft dome design.

RTR's new 1.5 inch soft dome midrange driver, utilising fresh coil-winding and bonding techniques, can dissipate a minimum 40 watts of continuous power and short-term power well in excess of 100 watts...with negligible distortion.

To complement the midrange, RTR has developed a new 1-inch soft dome tweeter, the first to possess the requisite dynamic range and power handling capability yet maintaining broad dispersion and ruler-flat frequency response.

One breakthrough demands another.

Conventional woofer and enclosure parameters cannot match such potential. As a result of intensive research, RTR engineers are now able to determine with precision the number of windings and bobbin material of the voice coil, magnet size and strength, cone material, surround and other specifics for each system. Consequently, each D-Series model includes a different woofer system mated to the optimum volume and dimension enclosure.

And yet another.

There's more. In any quality speaker the crossover shares importance with drivers. Any crossover distortion or loss will not permit individual drivers to program to their potential. Consequently, RTR's computer assistance program aids in selecting crossover frequencies for each driver, taking into account not only electrical but mechanical parameters such as moving mass, rigidity, driver area and rise time.

RTR D-Series crossovers employ premium, high tolerance components, and precision wire-wound controls allow adjustment of midrange and tweeter levels to suit room acoustics and personal taste.

Hear the remarkable difference at your audio specialist's or write for further imformation.

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SMA/AM6

a reasonably low effective mass provided the bulk of the weight is close to the pivot; it's interesting to note that many of the latest arms have enormous counterweights acting very close to the pivot where the moment of counterweight inertia is minimised.

Vibration

Reduction of unwanted vibration at the stylus also depends on careful design of the rest of the turntable system. This is where so many direct drive turntables fall down in performance compared with certain belt drive designs.

The solution embodied in the Linn-Sondek LP12, and a number of other recent designs, is a most interesting one. On the assumption that engineering standards aren't high enough to achieve vibration levels some 60 - 80 dB below the maximum recorded levels (and in real terms this means relative movement of less than thousandths and millionths of a millimetre!) then a way must be found to couple whatever vibration there is to both record surface and cartridge body equally – it doesn't matter if the system moves as long as every part moves in the same direction at the same time.

In the Linn and similar designs, a very massive platter system rests on a finely-engineered bearing which, by use of an oil bath, prevents any relative movement between platter and the turntable sub-chassis. The sub-chassis itself is substantial and also provides a rigid platform for mounting the arm.

This fully-coupled system floats on undamped springs so as to prevent the introduction of feedback and other external vibration components. In theory, if the coupling is 100% effective, springing and other expedients for isolating external vibration shouldn't really be needed.

An alternative approach is to decouple both arm (using a resilient mounting) and record surface (using a thick, soft mat) as completely as possible, as a means of ensuring isolation of unwanted vibrations at either record surface or cartridge body.

Direct-drive systems

Direct-drive turntables pose enormous problems becuase of the high levels of vibration resulting from the need to control rotational speed with a servo system.

To maintain correct speed, the platter must constantly go into error, thus producing a tiny vibrational product which is nevertheless of the same order as low-level recorded information. Many of the better direct-drives are, in reality, the worst offenders in this respect, correcting rotation as often as 1,000 times a second and therefore producing vibrations, of relatively high audio frequency, within the platter.

Because the platter, in its capacity as a rotor, is inherently decoupled from the chassis in a direct-drive system, there is little possibility of using a fully coupled system *a la* Linn.

Vibrations must be absorbed at some point between the point of their generation and the record surface. So, a must for direct drive turntables is a thick mat which damps the platter and absorbs vibrations. Unfortunately, complete decoupling seems to be a more difficult objective to achieve than complete coupling and the performance deficiencies characteristic of very many direct drive turntables are extreme sensitivity to mechanical and acoustic feedback and poor signal-to-noise ratio despite low rumble resulting from the use of very finely engineered centre spindle bearings.

The pickup again

Returning briefly to the pickup arm, many of the latest models seem to be rather ahead of their time. Low-mass designs using carbon-fibre and very light metal tubes simply aren't rigid or heavy enough to accept most cartridges; as indicated earlier, the root of the problem is stylus tip mass, which must be reduced considerably before very high compliance cartridges can be operated with any real success.

Reduction of effective tip mass doesn't necessarily involve making the stylus itself lighter, although this is one area where improvements could be made, while allowing sufficient stylus shank length to enable accumulation of debris and dust without the build-up lifting the stylus out of the groove.

Shorter cantilevers and lighter armatures will also give worthwhile reductions, enabling suspension compliance to be increased. Cartridges of this type feed less energy back into the arm than low-medium compliance models, and thus can be used in these latest low mass arms.

Whether, on the other hand, it is actually desirable to develop a pickup compromise along these lines is arguable. The great beauty of the better high tracking force (2.0 - 2.5 gm) systems is their ability to remain in contact with the groove walls even when encountering surface contamination that could deflect the stylus of a low force, low mass system.

Loss of groove/stylus contact allows the stylus to bump around due to its own inertia until contact is regained mainly through the restoring force of the suspension. The higher tracking force systems actually seem to suffer less from groove and stylus wear and tear largely because the stylus is in a constant-contact, low-wear situation.

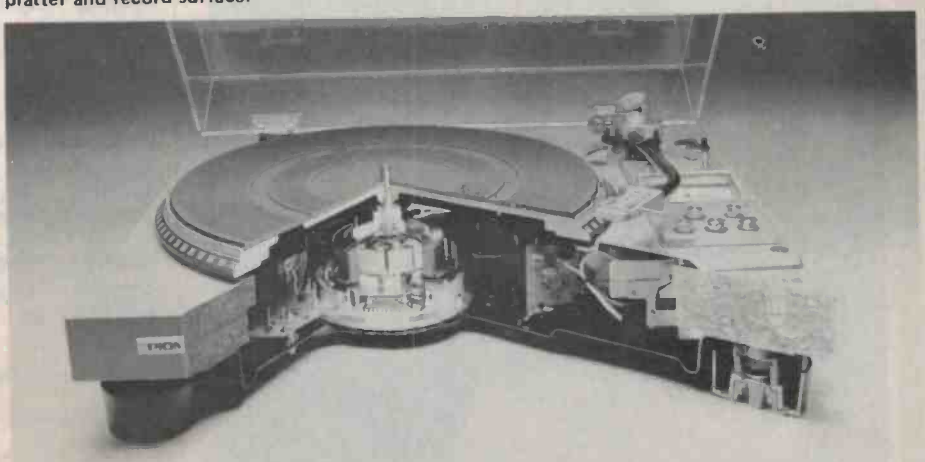
Perhaps the best course would be to retain low and medium compliance suspensions whilst still pursuing the low tip mass ideal, shifting the compromise in favour of improved transient response due to the improved acceleration potential of a light stylus.

The greatest benefits would be reduced high frequency distortion, especially at high levels, and the possibility of reducing the area of contact between stylus and groove to give improved definition from inner grooves; reduced inertia of a very light stylus would obviously help relieve pressure on the groove walls in the dynamic situation even if high tracking forces were maintained.

A by-product of this attractive situation would be reduction of vibration in the record itself as a result of stylus motion.

But that's another story. ●

Direct-drive turntables have good mechanical attributes but need good decoupling between the platter and record surface.



AMPEX 360 Professional Series Cassettes

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

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

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

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

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

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

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

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

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

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

AMPEX CASSETTES

SPECIAL READER OFFER!

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

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

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

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

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

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

SPECIAL BARGAIN PRICES

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

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

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. . . . . .C90 . . . . . .$ . . . . . .

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around SOUND

with

Douglas Saunders

DURING the past two years or so, tape enthusiasts have heard rumours of yet another tape formula being tried out at Philips in Holland and at 3M in their Scotch tape factory in the USA. Both these rumours were accompanied by tales of spontaneous combustion upon the formula being exposed to air and, of course, jokes persisted concerning hate gifts to other audiophiles. All these rumours were based on fact. After all, where there's smoke there's fire. This new tape, variously called metal tape and metalloy tape, is now one of those 'in' things we must know about and evaluate for ourselves. It is not actually a metal tape like the household measure but a formula spread onto a plasticised backing in similar fashion to our current cassette tapes. The formula uses pure iron powder which itself is subject to combustion when exposed to the atmosphere. It is not an oxide.

Ferric oxide, the first-used magnetic medium for tape, was improved upon by the chrome oxides, with a further clever variation into ferric-chromes.

Cobalt-diffused formulations were recently a significant advance. These dual layer ferrous and chrome tapes allowed deep penetration into the iron for lows (long wavelengths) and superb retention of high frequencies into the thinner chromium upper layer.

There are three companies currently producing metal alloy tapes: TDK, 3M and Sony. The Japanese Fuji Co. has just commenced marketing C46 and C60 tapes and Hitachi Maxwell are believed to have a C46 almost ready to market. TDK recently set up its own Australian distribution company in the premises of its previous long term Australian distributor, Convoy International, located in Sydney's Woolloomooloo area. TDK managing director Alexis Akakura, and their marketing manager John Anderson, were kind enough to send me a thirty minute, MA-C30, sample of this new breed tape. This is twice as long as the sample provided with the Nakamichi 582 discrete three head deck I have been using for the past month. Normal production will be available initially only in a C60 format. Anticipated prices are between $9 and $10.

As well as trying the new Nakamichi top line metal tape cassette deck I sampled a pre-production Technics RMS-63 three head metal tape deck. Other companies are either investigating or actually making suitable decks and a few of these will be seen at the CES. Tandberg are offering two cassette decks and one open reel machine, all metal tape designs with their Actilinear trade name prominently displayed. JVC's newest deck is the KDA-8 with an intriguing 24 second self alignment programme for bias, EQ and recording level.

Actual costs of these machines are also intriguing, ranging from Technics' low cost three head RMS-63 at about $450 through Nakamichi's two head 580 deck at $599 and their three head 582 at $799, with JVC's KDA-8 at about $940 and the Tandberg machines ranging even higher. The TCD320 will retail near enough to $800 while the TCD320A reaches the $1300 mark.

All these are cassette decks. Tandberg's TD20A is an open reel recorder with a retail price around $1400. This appears to be the only reel-to-reel system to employ the metal tape formula which could be of interest to studios not able to embark on digital processing.

Now what does metal tape do; is my current machine compatible with it?

These and many other questions have been asked during the past weeks and it is really necessary to experience the tape on top class programme material before making a simple up-grading. First of all, this superb new tape formula will be wasted on disc copying. Wasted due to the cost of the tape compared with the disc cost; and don't think you'll be able to copy all those expensive super discs or direct cuts as the various processing through your personal electronics will still not do justice to the fast rise times involved. So, we are left with live performances at home or from direct live broadcasts from well tuned FM receivers.

Now, this is where the new metal tape is certainly a worthwhile purchase. Live recording never had it so good on the cassette front. Considering the narrow width of each recording track, the slow tape movement and the small diameter of each storage bobbin, these metal tapes are capable of really ousting 190 mm/sec open reel tapes.

However, a new machine is necessary because the metal tape is difficult to magnetise and therefore difficult to erase; it will also take an enormous amount of overload which means a higher recording level. Today's 'normal' machines are not anywhere near capable of using this tape. A few of the really top notch cassette decks may provide an acceptable performance, somewhere similar to a lower quality deck using a high quality chrome formula. But, to draw the maximum, it is mandatory to buy one of the latest decks designed for metal tapes. However, on the Technics RS9900US I was able to increase the front panel bias adjustment until a most commendable performance resulted in dubbing from a master tape which was only slightly bettered by either of the specially designed decks to hand. Incidentally, all decks fitted with chromium equalisation of 70 uS can fully replay a pre-recorded metal tape due to international agreement between tape and equipment manufacturers.

Higher bias currents and specialised erase heads were developed by almost every company making a deck suitable for the metal formula. Nakamichi produced a single turn transformer-like winding for their erase head and claim a signal to noise ratio approaching virgin tape. Other features of the 582 include separate head sections for the record and replay functions; each is lapped into an opposing curve so that, together, they form the one smooth

— *continued page 193.* ▶

A Choice: Disposable Records or The New D3

Cleaning ability that is chemically "directed" at fingerprints and common disc contaminants.

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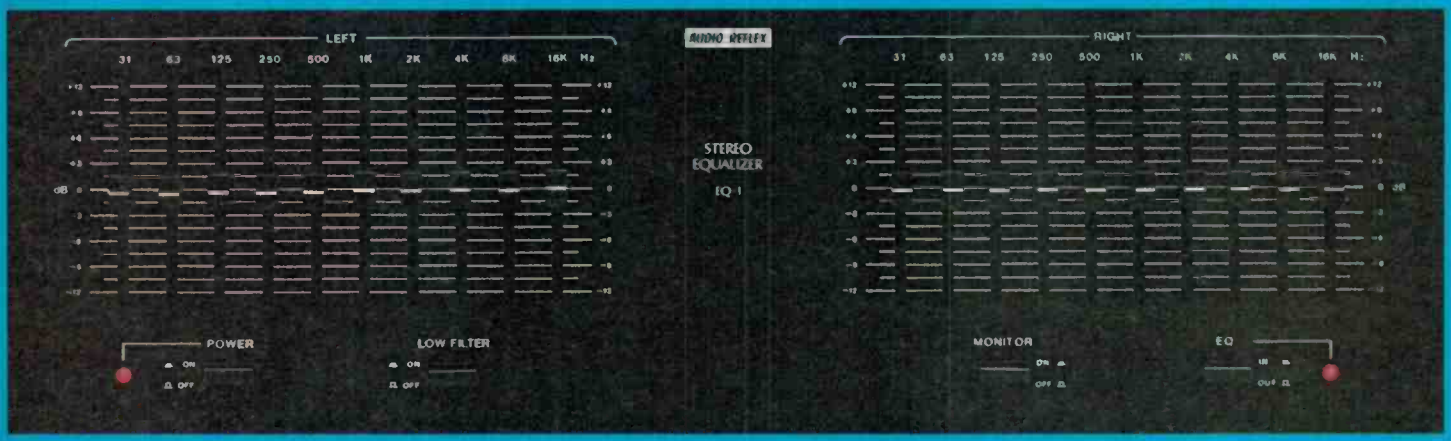
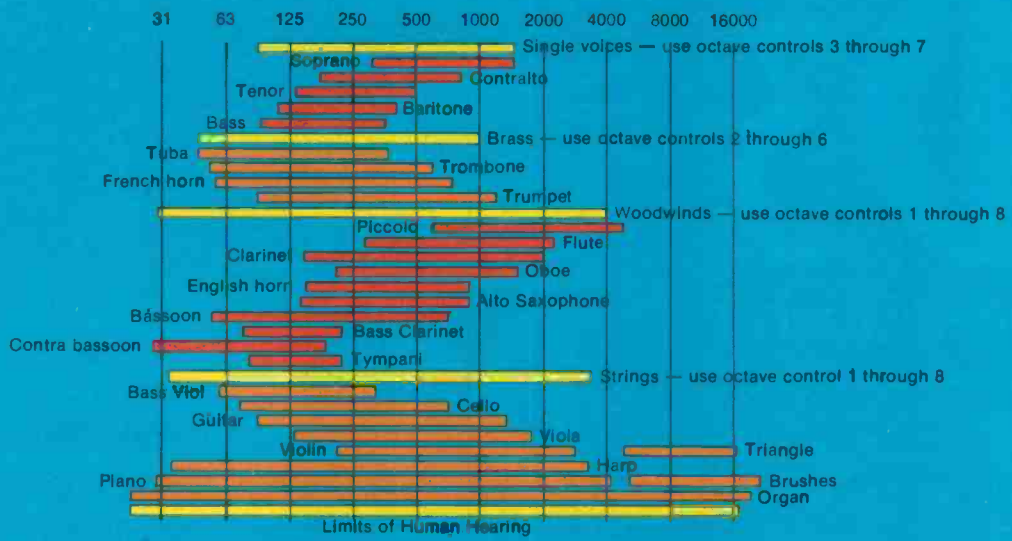
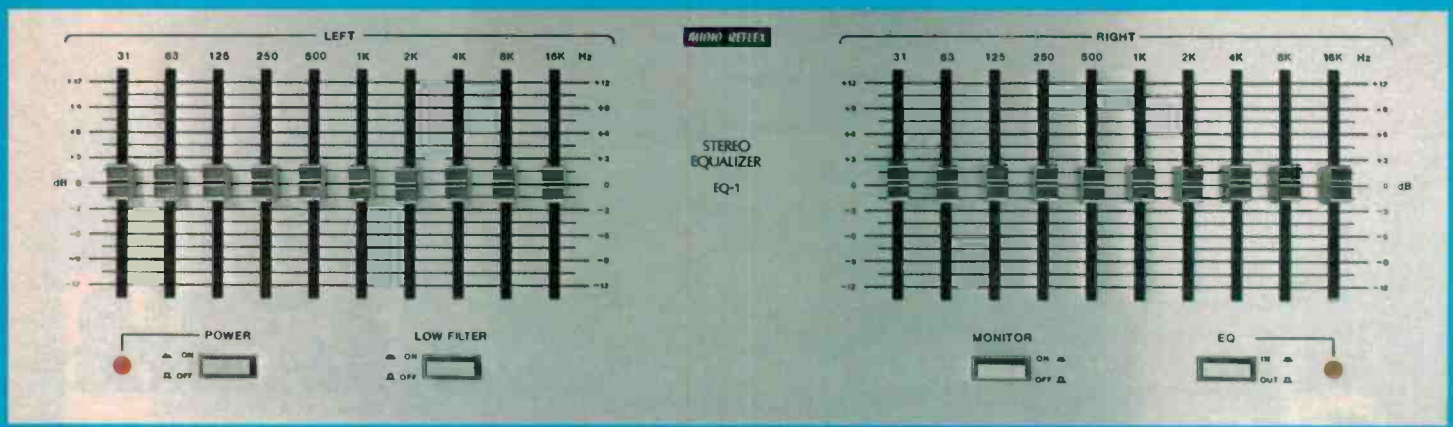




Frequency Ranges [Hertz] of musical instruments and voices



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An equalizer can improve speaker balance and ideally blend, according to your taste, the character of your speaker with the character of your room — Thus your speaker performance is greatly improved.

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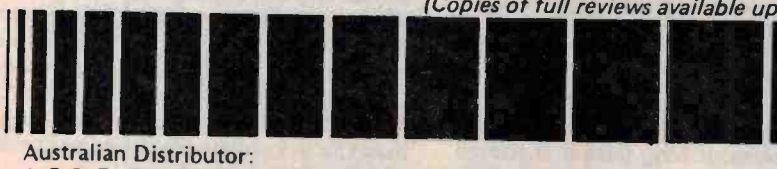
(Copies of full reviews available upon request.)



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STD 305M turntable with Hadcock GH228 arm

THERE ARE a significant number of enthusiasts who still prefer belt drive to direct-driven turntables, feeling perhaps that belt drive has special attributes, particularly in relation to the isolation of motor generated vibration components from the rotating platter.

Belt driven units do, however, have a problem which is all too often ignored by the designer and is sometimes only realised too late by the purchaser. This is the problem of long term belt stretch and fluctuations in belt tension which manifest themselves in terms of an increase in "wow" (the slow variation of pitch caused by speed fluctuations in the drive system). It was their superiority in this respect perhaps more than any other factor that rightly or wrongly gave direct drive turntables a general edge over belt drives in the market place.

The STD 305M turntable is a two-speed belt-driven unit designed to be used with a Shure SME arm (but the version we received was fitted with a Hadcock GH228). The unit appears to be a newer version of the STD 305D which utilises a 9 Vdc motor with a tacho generator and electronic governor to achieve speed stability and to maintain nominal speed. In the older 305M the motor drive is from a 16 pole synchronous motor. A stepped motor pulley on the 305D caters for 33 1/3 or 45 rpm operation.

Instead of a detailed brochure, we received a three-page photostat (the front page of which showed a photo of the unit fitted with the Shure SME Arm) and an apology for the unavoidable delay in the printing of the instruction manual which would normally accompany the turntable.

Fitting the cartridge and setting up proceeded without a hitch until we got half-way down the second page of the instructions. At this point we read that surgical gloves are supplied and should be worn whilst fitting the drive belt to prevent grease and other contaminants adhering to the belt or hub! As none was in the carton (by the time it was received by us) we decided to continue without them in the hope that they would not be needed. Whilst the task of assembling this system was not complex, it was nonetheless a little tedious, particularly as it was intended that the belt be covered by a special powder which acts as a clutch to assist smooth start up — the motor torque being higher than the belt might otherwise be capable of accepting.

When we looked for the speed change system the truth dawned on us that to change from 33 1/3 to 45 or back again

you have to remove the turntable platter, put on surgical gloves and, being careful not to dust off the powder, change the speed by shifting the belt to the other pulley. We might be prepared to do this once or twice, or even four or five times during an evaluation of a turntable but would be none too keen on undertaking this exercise regularly to obtain the virtues of the performance which this turntable is claimed to achieve.

The makers claim that only the highest standards of engineering and control specification can give the highest standards of reproduction and that is achieved in the 305M. We have no argument with this except that it doesn't matter how *good* a system can be, if it is hard to *use* the average person won't use it.

The designers claim that the plinth has been designed and built with the aim of reducing audio feed-back to a minimum. It is fabricated from a rigid 2 mm thick aluminium extrusion with a 6 mm thick top plate (in the same material) incorporating a mild steel pressing coated with a vibration damping material on its inner surface. The drive

turn to page 187 ▶

Louis A Challis and Associates Pty Ltd

Our Ref: E6

MEASURED PERFORMANCE OF

STD 305M TURNTABLE, S.N. 24M 001060 FITTED WITH GH228

SUPER ARM & SHURE V15 III CARTRIDGE

ABSOLUTE SPEED ACCURACY:

33 1/3 RPM - -0.35%

45 RPM - -0.10%

WOW & FLUTTER:

Wow - 0.5% p-p

Flutter - 0.085% weighted RMS

- 0.16% unweighted RMS

RUMBLE:

(re 2.24cm/sec at 1kHz) -33.1dB unweighted (BS4852)

-53.9dB weighted

FREQUENCY RESPONSE:

20Hz to 20kHz ±2dB

CROSSTALK:

100Hz	1kHz	6.3kHz
-28dB	-29dB	-24dB

TONE ARM RESONANCE:

6.6Hz (see graph)

TOTAL HARMONIC DISTORTION:

(at 2.24cm/sec. at 1kHz)

100Hz	1kHz	6.3kHz
2.09%	1.62%	8.1%

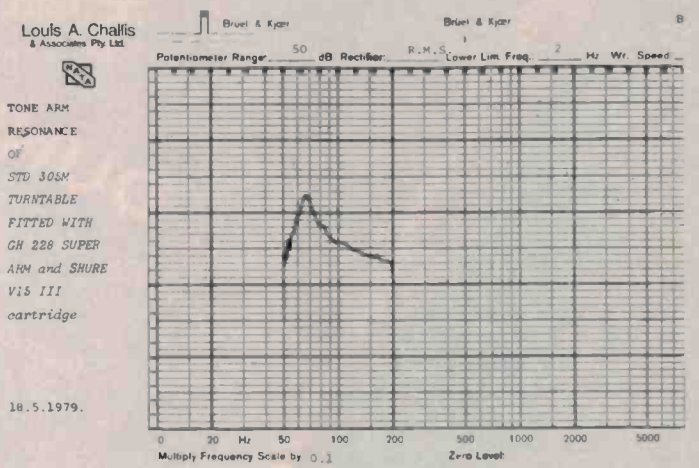
SENSITIVITY TO EXTERNAL VIBRATION:

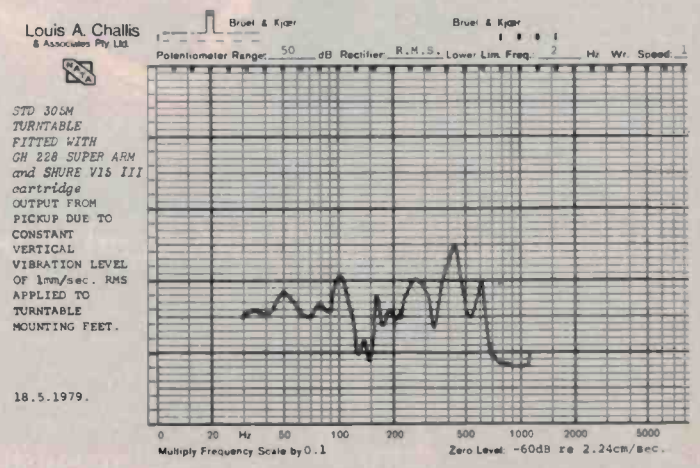
Vibration Level Applied: 1mm/sec. RMS constant velocity

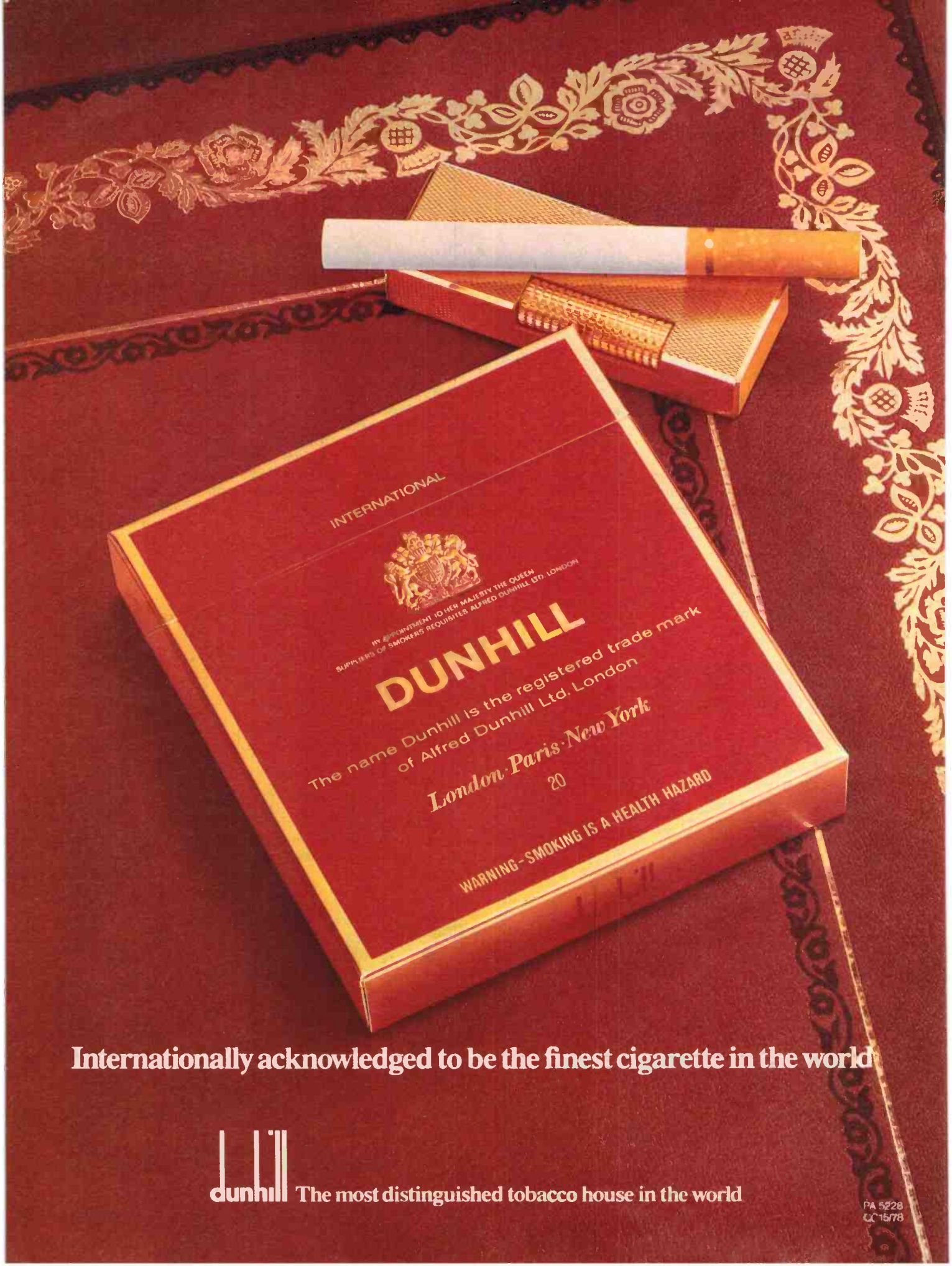
Maximum Pickup Output: -35dB (re 2.24cm/sec at 1kHz) - see graph

D.F. CRAIG

18th May, 1979.







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CC 15/78

We want you to hear all of the music.

The ear knows how to deal with gross distortion. It simply stops listening. But what happens when the distortion is so subtle that it is barely perceived? Usually this kind of distortion is accepted by the ear as part of the musical information. It's not until you've listened for a while that you start to sense something isn't quite right, that there's something between you and the music. To some, it's like listening through closed curtains; for others, it's an uneasy, fatigued feeling. What happens, in effect, is that your ears and brain try to listen through the distortion and end up working too hard to hear all of the music.

Harman Kardon's new generation of stereo receivers are designed, built and tested with new understandings about distortion and what makes one component sound better than another. Ultrawideband in design, for excellent phase linearity and superb transient response (transients are crisp, textures remain clean, open and transparent), these new receivers are also engineered for low distortion with **minimum** feedback. Negative feedback is in universal use to reduce conventional forms of distortion. But too much feedback causes TIM (transient intermodulation distortion). At Harman Kardon, we use an "open loop" design and engineer conventional forms of distortion down to the lowest possible levels **without** the use of feedback. Then, we add just the slightest bit of feedback to reduce those levels even further, while keeping TIM at **almost** a non-existent level. You hear **all** of the music, free from dynamic, as well as static, forms of distortion.

But if there is a single element that separates our new receivers from the rest, it's the listening **energy** that has gone into every stage of development of these products. We discovered that transistors with the same specifications, from different manufacturers, had a totally different sound. So each transistor, each capacitor, indeed each and every component, was listened to until we were absolutely sure we had the **exact** sound we wanted. Then, and only then, did we release the products for manufacture.
As a result, we think you'll agree that the new series of Harman Kardon receivers are subtly different and immeasurably better . . . designed, engineered and tested to let you hear **all** of the music.

Pictured here:
hk340 Ultrawideband AM/FM Stereo Receiver 20/20 Watts
hk450 DC Coupled Ultrawideband AM/FM Stereo Receiver 30/30 Watts
hk560 DC Coupled Ultrawideband AM/FM Stereo Receiver 40/40 Watts
hk670 Twin Powered DC Coupled Ultrawideband AM/FM Stereo Receiver 60/60 Watts

harman/kardon
Hear all of the music

For complete technical information contact:
HARMAN AUSTRALIA PTY. LTD.,
P.O. Box 6, BROOKVALE, N.S.W. 2100.
Telephone: (02) 939 2922

HA124/7B

The High Speed DC integrated amplifier has arrived!

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

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

THE AUDIBLE DIFFERENCE
HI-SPEED

KA-907

KA-701

KA-801

KENWOOD

For information, please write to: HM-SECTION,
TRIO-KENWOOD CORPORATION 6-17, 3-chome, Aobadai, Meguro-ku, Tokyo, Japan.
TRIO-KENWOOD (AUSTRALIA) PTY. LTD. 30 Whiting St., Artarmon, N.S.W. 2064, Australia Tel: 439-4322

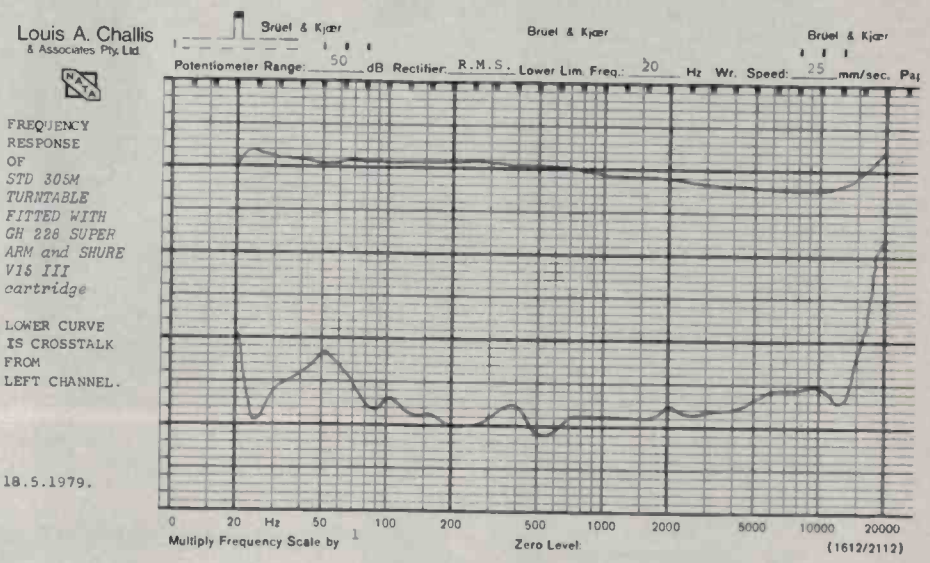
motor, platter bearing and tone arm are separately supported on a common 1.5 mm thick mild steel sub-assembly. This too is coated with a damping material and is supported by a spring suspension at four points with adjustable screw mounts to allow for different tone arm mounts and to achieve critical damping.

We fitted a Shure V15 Mk III cartridge which, tracking at a nominal 0.75 grams should theoretically be capable of providing a very high level of performance: nevertheless the mechanical attributes of the system seemed to be lacking.

The speed accuracy of the turntable at 33 1/3 rpm was outside the normal bounds that we would regard as acceptable for a precision turntable offering the standards of engineering claimed. The wow was particularly high at 0.5% peak to peak. Flutter was moderately high at 0.085% weighted RMS and the rumble was only -53.9 dB weighted. These figures are high compared with those quoted by the manufacturer and lead us to suspect that those surgical gloves were in fact essential if this unit was to perform in the way intended.

To ensure a fair review we arranged for the supplier to come out to the laboratory and carry out the necessary restorative work. This he did, acknowledging that it was essential that the surgical gloves be used. He dutifully performed his operations and we re-evaluated the unit once again but the performance was not significantly better.

We continued testing and evaluated the frequency response of the cartridge (whose performance we already knew to be good), the crosstalk between the two channels, which is as much a measure of the cartridge as it is of the wiring, the tone arm resonance of the Hadcock tone arm, which was particularly good



at 6.6 Hz and the vibration isolation of the plinth – which is one of the strong selling features of this turntable.

Here, the manufacturers were right up to the mark as this plinth and turntable provided a level of vibration isolation markedly superior to any other unit we have evaluated. In fact, in this regard it was approximately ten times better than the next best performance we have measured.

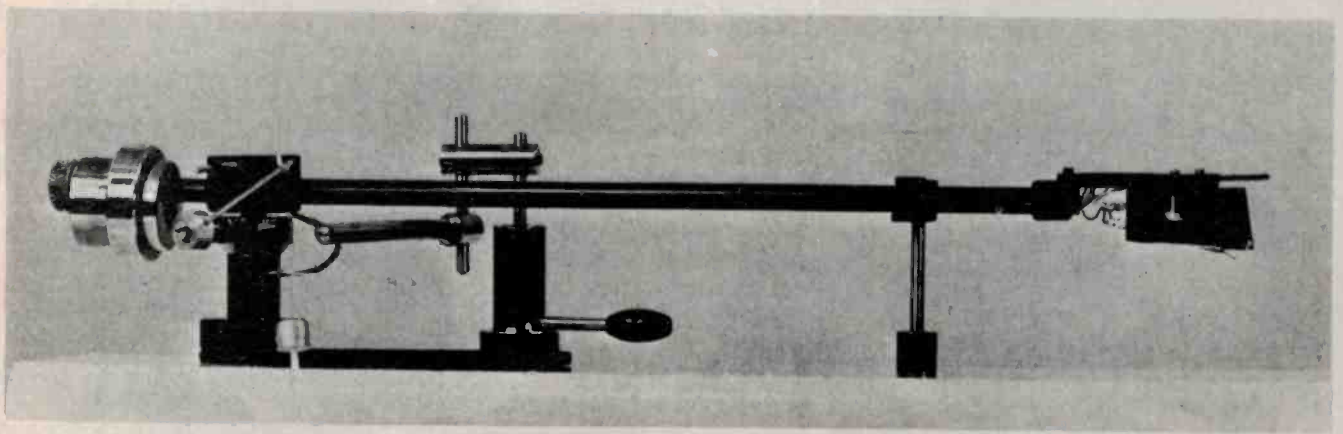
Subsequent visual inspection showed that the motor drive pulley appeared to have been machined slightly eccentrically – as indeed had the rotating component supporting the platter assembly.

We are aware that STD turntables have received 'rave' reviews in other periodicals – nevertheless the unit evaluated had clearly apparent mechanical faults which degraded the performance. We were able to detect the wow audibly and this detracted from what was otherwise a good performance. This is particularly unfortunate because we believe that there will always be a small group of enthusiasts who are looking for a system which is different and are prepared to sacrifice operational convenience for improved performance.

●

STD305M TURNTABLE WITH HADCOCK G228 ARM

Turntable manufactured by the Strathclyde Transcription Development Co. Arm by Hadcock.
Turntable RRP: $695 including tax.
Arm RRP: $175 including tax.
Available from Audio 2000.



A good tuner/amp shouldn't put

It's going to receive an excellent reception in Australia.

Not just for its price. But for its sheer value-for-money.

It's the JCX2400K, one of two exciting new tuner amps. from Sanyo.

They both have a computer-designed power supply that holds ripple in critical circuits to 0.1% or less.

An FM section that employs a dual-gate MOSFET to amplify incoming signals and a wide Automatic Gain Control that picks up weak distant stations, while preventing overload distortion on strong local ones.

Stereo separation greatly exceeds

you into the hands of the receiver.

that of turntable pickups in FM stations. And the power amplifiers use the latest solid state devices, highly advanced bias circuitry and massive heatsinks.

The phono pre-amplifier sections give an equalisation accuracy within 1/5dB of the perfect RIAA playback curve.

And signal to noise ratio is at least 10dB better than the vast majority of records sold.

Sanyo's tuner amps. truly meet our philosophy of Hi-fi without Hi-finance.

SANYO Hi-fi, not Hi-finance.

SAN 3245/4

THERE'S MORE TO AGFA FERRO COLOR THAN MEETS THE EARS.

Agfa Ferro Color Cassettes offer superb reproduction of sound and a convenient colour-coded reference system.

With a choice of three colours and three tape durations – 60, 90 and 120 – you have up to nine combinations for a comprehensive, easy-select library.

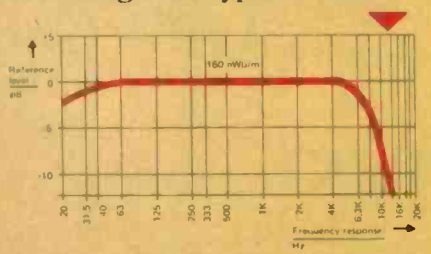
Add colour-coding to the many other features and it's easy to choose Agfa Ferro Color Cassettes.

COLOR CODE

z.B.: e.g.:	FOLK	POP	JAZZ
C60			
C90			
C120			

High Dynamics: Agfa Ferro Color Cassettes have a high quality iron oxide coating to increase dynamic range and frequency responses.

The result is a rich, clear, transparent sound ideal for the recording of all types of music.

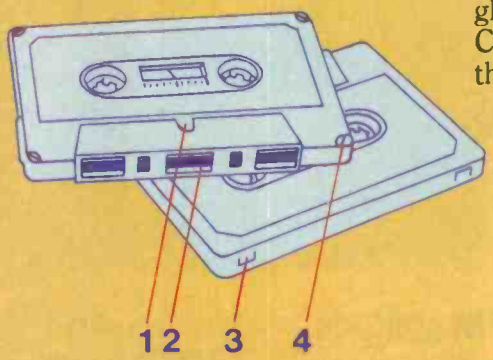


A Better Designed Case: Cases are of smooth lines, with rounded edges and corners to improve handling and efficiency.

A Better Designed Cassette: The Cassettes are of the screwed type and side one can be easily identified.

Inside the cassette is a special noise shield to avoid unwanted 'hum'.

To prevent unintentional erasure, knock-out tabs are located in the rear. These are optional either side.



Practical aids in Agfa-Gevaert cassettes:

1. immediate positive identification of side one.
2. metal noise-shield avoids unwanted "hum".
3. knock-out tabs at rear of cassette prevent unintentional erasure (optionally either side).
4. screwed cassettes.

For the convenience of colour-coding and for superb sound reproduction you'll be glad you chose Agfa Ferro Color Cassettes – there's more to them than meets the ears!

Agfa*

*Registered trademark of Agfa Gevaert Antwerp/Leverkusen

Agfa-Gevaert for still cameras, flash-guns, colour film for slides, prints and movies, magnetic tapes.

K381

Toshiba's 335 System Components are a reflection of high technology from the inside out. It takes precision engineering to give you this coordinated, well-balanced sound.

For your records there's a fully automatic direct drive turntable (SR-F335) with auto-repeat up to six times, arm cueing control, stroboscope, anti-skating, and a die-cast aluminium platter. Wow and flutter measures an incredibly low 0.035% and the S/N ratio is better than 65 dB (DIN B).

As for the tuner (ST-335), it uses flat group delay ceramic filters, instead of the ordinary coil and capacitor type, for high selectivity — rarely heard in a tuner near its price.

The main amplifier (SC-335) delivers 40W+40W RMS (1 KHz, 8 ohms) with total harmonic distortion less than 0.1%. The pre-amplifier (SY-335) is separate for maximum performance without distortion and offers mic mixing, professional click-stop controls, polystyrol capacitors, carbon resistors, and achieves ±0.5 dB response (RIAA).

For maximum convenience and superb fidelity, the cassette deck (PC-335) features a soft eject, 3-step bias and equalization and a Dolby* noise reduction system.

From the innermost circuitry to its rich, full sound. The Toshiba 335 System Components are Toshiba technology throughout.

*Dolby is a trademark of Dolby Laboratories.

TOSHIBA

TOSHIBA (AUSTRALIA) PTY., LIMITED
16 Mars Road, Lane Cove, N.S.W. 2066
Tel: Sydney(428)-2055 Telex: AA27235

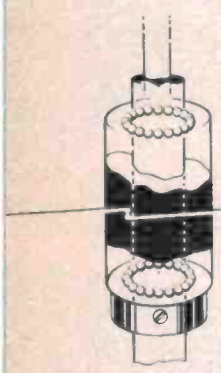
Total Toshiba sound packs a powerful punch.
40W+40W RMS.

Another Achievement of Toshiba Technology
The 335 System Components

Take the Pioneer to pieces to find what makes it unique.

On the surface, most turntables appear to be very much the same.

That's why we suggest you should look at the PL-560 in more depth.



First, take our arm.

Our tone arm moves smoothly and silently. Where other makes rely on as few as 3 ball bearings, Pioneer uses 40.

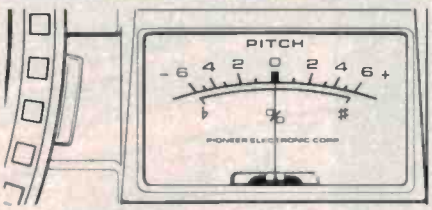
Some turntables mount their arms on cheap plastic and piano wire that vibrates. Ours floats on pivot bearings. This explains why we sound better.

Accuracy at every turn.

By using our own Quartz locked DC Hall motor just to power the platter, Pioneer give you accuracy and reliability for the life of the turntable.

The Hall motor assures the PL-560 turns silently. Any vibration or radiation is also eliminated.

Moreover, if you keep delving, every piece of Pioneer engineering you reveal will be backed by precision componentry.



A feature that's obvious.

While you're finding out how the PL-560 compares on the inside, look up for a minute. Note the Analogue Pitch display meter next to our strobe.

Use it expressly for tuning your music by 6% up or down.

A second motor. Just for moving our arm.

Many automatic turntables don't hesitate to put strain on one motor by asking it to perform extra functions.

However, Pioneer prefer to use a Warren gear motor to move their tone arm, which in turn takes the load off the primary drive.

The extra power gained makes "Arm drag" on the PL-560 non-existent.

At this point, please continue the examination at your own speed. You'll find we're much more turntable than we appear to be.

All the turntables illustrated offer the excellence synonymous with Pioneer.

PL-560 $559.00*

– from page 178.

hump. The 582 also provides front tape path without the usual double panel adjustment of head heights and head azimuths with locking pawls on each circular screw head. This is truly excellent and could only be bettered by distinctive marking to ensure correct realignment if accidentally moved.

Other front panel adjustments are for separate left and right channel bias and record level for each of three tape types; standard ferric, chrome and chrome equivalents, and the new metal formula. Assisting with these are miniature selectors for basic bias, equalisation time constants and a seldom used 400 Hz and 10 kHz tone generator for the actual alignment procedures. Similar small switches are for tape timer, search, Dolby operation and tape monitor.

Metering is by horizontal peak reading ballistics with a maximum from -40 dB to +7 dB. Dolby level adjustments and tracking are set to a reference level of 0 dB on the scale which did not always agree with other cassette decks also using peak reading ballistics. However, this will not cause problems; it is simply a manufacturer's alignment level indication.

The 582 can be remote operated either by a direct wire connection control unit or else by an infrared remote control. The cabinet is fully steel shielded except for the aluminium front panel which is fitted with its own steel backing plate and input signals are not subject to any hum level except at maximum settings.

The motor transport is reasonably quiet except in the lowest level sound environments.

Actual operation of the 582 was very simple once the arrangement of tape transport functions was noted. Play mode causes the tape heads to move up into the cassette shell and it is recommended that the Pause/Record buttons be used for all recording operation as it ensures seamless joins and immediate takeup. All cassette housings employ a felt pad behind the central cutout to assist with pressure of the tape against the heads. Nakamichi believe this is one cause of incorrect tape travel and have provided a rimmed surface around the replay head to push this pad back and away from the tape. Other Nakamichi designs for smoother operation include an expensive ($750,000 I'm told) single piece tooling for the whole of the head and plate assembly. In addition, each of the moving and rotating pieces of the transport and capstan system is designed for a different resonance thereby spreading resonances instead of their being cumulative.

Actual use of the metal tapes proved time and again that the new formula is certainly a vast improvement over all other types. Regardless of how well the machines were aligned for superior chrome or chrome equivalents, the metals always proved best for signal to noise (absolutely quiet), dynamic range, clarity in soft playing, detail in loud passages and overall sonic accuracy. Perhaps the most appealing and surprising aspect is the totally quiet background to all music and all spaces between the music. The erasure currents really do a good job on these metal tape design decks. In comparison, the best I could get was a still definable signal some forty five to fifty decibels down when erasing a recorded metal tape on the RS9900US set to maximum bias by the front panel adjustment.

However, apart from the occasional use of the metal tape, I believe that the new era tape heads, their electronics and transports, are put to better use in everyday recording situations using today's top quality chromium dioxides and equivalent ferrics. These tapes are super quality and are perhaps still too good for simple disc copying but able to deliver splendid results when dubbing from high quality master tapes. Here again, the widebank smoothness is brought about by the very deep erasure currents and optimised three head construction of these new machines.

Both the Technics RMS-63 and the more flexible Nakamichi 582 make a good case for optimising erasure, recording EQ and bias for the newer metal tape formula. But I believe the true benefit is to be obtained by using the controls for today's standard top level cassette tapes during ordinary taping. Even a quick erasure trial without input signal is sufficiently convincing when a replay noise level is dead quiet without the usual slitherings or burblings or hiss levels that you just know will protrude on any programme about to be recorded on a normal machine.

So, there it is, a new tape formula with spectacular results. A tape that will cost about ten dollars for one hour's programme (which precludes disc copying) demands live source material, and is able to record everything with a clarity of sound rarely heard outside the highest quality semi-professional tape equipment. ●

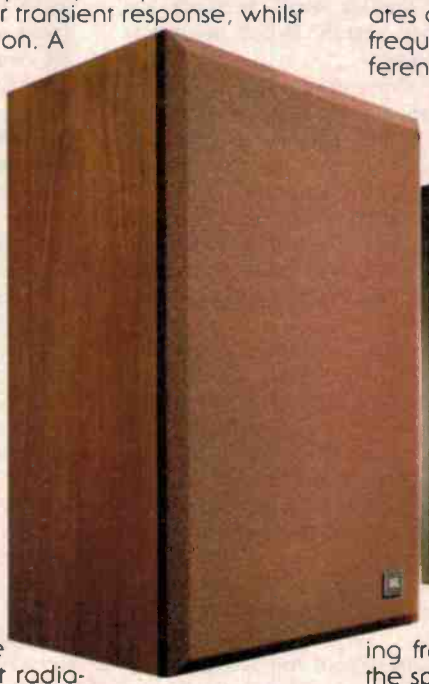
JBL L19

Acoustically identical to the JBL professional broadcast monitor, the L19 is both a small and highly accurate 2-way bookshelf loudspeaker system, capable of delivering substantial sound output from a moderately powered amplifier.

LOW FREQUENCY

Due to the L19's compact size, JBL engineers designed a 200mm low frequency loudspeaker which delivers an unusually smooth frequency response, wide dynamic range, and superior transient response, whilst maintaining very low distortion. A cast aluminium frame sup-

ports an integrally stiffened core of controlled mass and compliance, driven by a 50mm copper voice coil in a magnetic assembly weighing 1.1kg. The result is a no compromise, smooth and efficient low frequency loudspeaker.



HIGH FREQUENCY

For its amazing clarity, transient ability, and open high frequency reproduction, the L19 employs a 36mm direct radiator. Despite its relatively large voice coil and magnetic structure, the overall diameter has been kept small to achieve excellent dispersion. Irregular reflections and discontinuities from this radiator are eliminated by means of a rigid, sloped baffle, serving as a transition to the enclosure baffle. This provides a more even power distribution than sound absorbant materials.

A sophisticated frequency dividing network controls impedance as well as the amplitude of the drivers, thus ensuring a smooth blended operation of both high and low frequency components. This network also incorporates a level control for regularing loudness of the high frequency component to allow for personal preferences to accommodate variations in room acoustics.

Traditional JBL cabinetry complements the fine JBL engineering. The American black walnut veneer is hand finished with a special oil-wax polish, hand-rubbed to a rich, deep lustre. L19 grill colours available are brown, black and tan.

JBL loudspeakers are virtually hand made. All components and cabinetwork are made by JBL. For this reason, JBL maintain their belief in their products by offering to repair, free of charge, any fault arising from defect in original manufacture for the life of the speaker.

To hear the JBL L19 or any other JBL speaker, visit your nearest JBL Hi Fidelity specialist—his name is on the list adjacent to this advertisement.

James B. Lansing Sound Inc.
Los Angeles, Calif., U.S.A.

Shown on the left: the L19, L40, L50, L110, L166. Others not shown: L65, L220, L212, L300 and the Paragon.

JBL

Distributed by
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HA136/78

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Car Radio	Wagga
Ron Chapman Hi Fi	Newcastle
Newcastle Hi Fi	Newcastle
Park Street Hi Fi	Sydney
Terry's Sound Lounge	Bowral
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Hi Fi Gallery	Tamworth
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JBL

HA133/78

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SR 30
Socket Recess Cup to fit hole size 27mm

SR 69
Corner Piece

SR 35E
Grille 142mm x 36mm

SR38E
Bar Bandle 10½" x 6"

SR 31E
Pocket Handle to fit hole size 48m x 105mm

SR70E
Castor Cup

SR32 Foot
38mm x 15mm

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CLIFF PLUGS

TP1 Terminal 2mm cross hole and 4mm hole in end 40c ea. 15A 250V. **P12** 15c ea. 2mm plug silver plated. **P14** 20c ea. 4mm plug silver plated.

S1: 6.5mm socket 45c robust nylon silver contacts fully insulated earth. Various make and break contacts.

S3 6.5mm stereo socket. 70c robust nylon silver contacts fully insulated earth. Various make and break contacts.

S6 3.5mm socket 35c robust nylon silver contacts fully insulated earth chrome nut.

P2 6.5mm plug 65c virtually unbreakable cover, nickel plated brass (also in stereo).

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P6 3.5mm plug 35c virtually unbreakable cover, nickel plated brass (also in stereo).

P5 3.5mm metal plug 40c polished aluminium cover.

SEP 1 6.5mm metal right angled plug $1.30.

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Colours available for plugs, sockets and terminals: red, yellow, black, blue, green, white, grey.

For further information, local agents and wholesale prices, write to the Australian importers:

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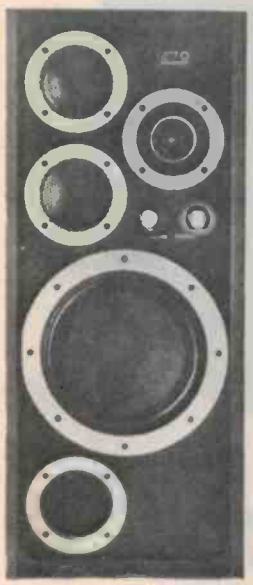
THORENS - Outstanding Transcription Turntable Technology

The precision Thorens TD115 turntable is one of the excellent range of Thorens turntables.

THE TD115 FEATURES:

• New 4 point ortho-inertial suspension • Servo-controlled electronic belt-drive system with DC motor 72 Pole Tacho generator • Load correcting automatic pitch control (APC) • ISOTRACK TP30 tone arm with very low effective mass of 8 grammes • Shock-proof jewel bearings for extremely low friction • Low resonance tone arm tube utilising "split wave technology" • Friction-free velocity-sensing electronic shut-off • Rumble unweighted — 48 dB to Din 45539 — Rumble weighted — 68dB to Din 45539

THORENS



WHARFEDALE

E70 Speakers

The Wharfedale E Series of speakers are exciting in design concept, integrating beautiful looks, classical accuracy and high output capability.

A FEW FACTS

• Power Handling (DIN 45573) — 100 watts • Sensitivity 94 dB at 1 watt at 1 metre • Frequency Response 50 Hz — 18 KHz ±3 dB • Crossover Points 300 Hz & 7 KHz at 6dB & 12dB per octave • Bass loading — Optimised reflex Maximally flat fourth order — Butterworth • Dimensions — H32". W 13½. D 14" • Weight — 70 lbs each enclosure.

ALTEC LANSING

Model Nine Speakers

A special book-shelf speaker that's elegant in design and outstanding in performance.

FEATURES INCLUDE:

• Speaker Components — Low Frequency: 12" bass driver Mid Frequency: 6½" frame cone driver High Frequency: 5" frame cone driver • Crossover Frequency: 800 Hz, 7 kHz • Enclosure Type: Vented • Sensitivity: 93 dB SPL • Frequency Response 40 Hz to 20 kHz • Long Term Broad Band Maximum Power: 60 watts • Finish: Hand-rubbed oiled walnut • Dimensions: 26½" H x 17½" W x 15" D (67.3cm H x 44.5cm W x 38.1cm D)

Distributed by

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For further information please ✓ the following
☐ Thorens ☐ Altec ☐ Wharfedale

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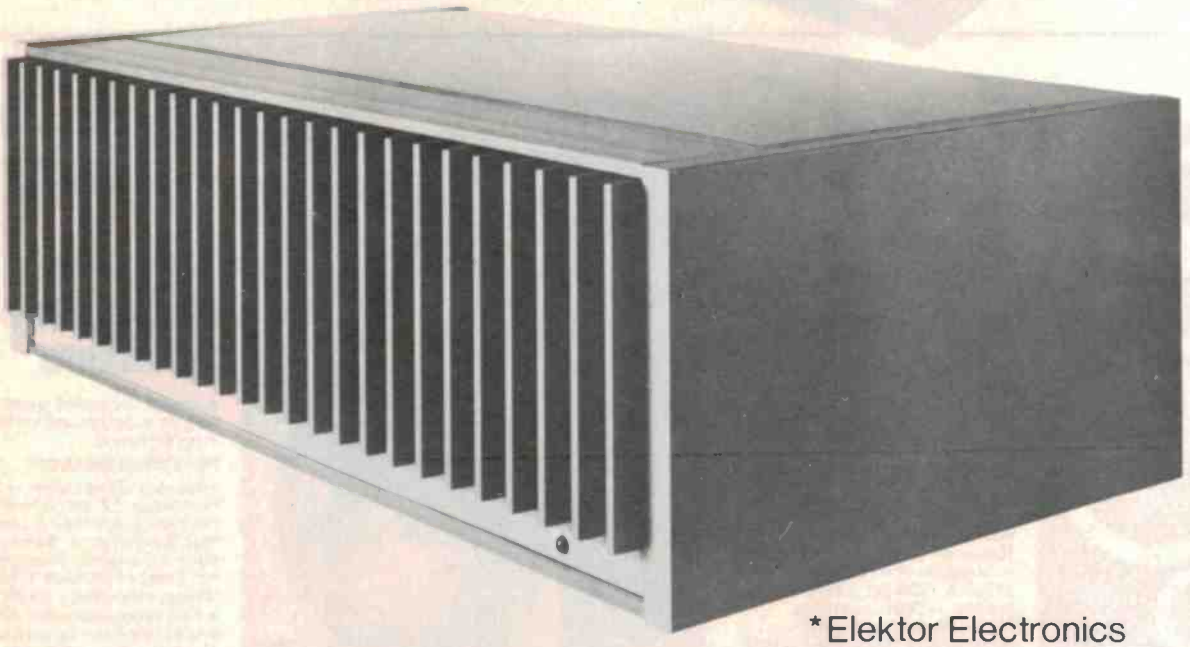
Not a win on the pools, a trip to a Pacific paradise, or a reduction in income tax, but distortionless "current dumping".

Z's 1 to 4 are the four passive components which interconnect the current dumpers, (the output transistors which supply the power), to the small high quality amplifier which provides the error signal, so that when the above condition is met the current in the load, the loud-speaker, is independent of the current in the dumpers and hence distortion is solely dependent on the quality of the error amplifier, which because it is small can be very good.

Wonderful indeed.

For further details write to
Audioson International Pty. Ltd.
64 Winbourne Road, Brookvale,
N.S.W. 2100.

"Something wonderful happens when $Z_1Z_3=Z_2Z_4$" *



*Elektor Electronics Magazine No. 8. Dec. 1975

QUAD

for the closest approach to the original sound for twenty-five years

QUAD is a Registered Trade Mark

ETI'S GUIDE TO THE

Fourth Australian Consumer Electronics Show

SYDNEY SHOWGROUND
WEDNESDAY 18 JULY – SUNDAY 22 JULY, 1979

THE FOURTH Australian Consumer Electronics Show, which opens to the public at the R.A.S. Showgrounds on July 19, promises to be the biggest and best yet.

It will be staged in both the Manufacturer's and Commemorative Pavilions, with the Wincham Castle Hall being used for special promotions.

Many new exhibitors have 'come to the party', and the'79 Show should be the most comprehensive concentration of consumer electronics yet seen in Australia.

Apart from the 50-plus exhibitors at the Show, a number of special displays and activities have been planned.

Visitors to the Show will stand to win daily door prizes, including AR18 speakers to the value of $288 from Acoustic Research Australia, $38 digital clocks from Superscope, and $50 headphones supplied by Audio Engineers (four daily).

The major door prize is a Hitachi UMS Video Recorder model VT 5000, valued at $1250, plus video tapes.

A special audio/visual presentation, "102 Years of Recorded Music", will outline the growth of the recording industry.

Computer Chess will be featured at a special stand where chess players will be able to pit their skill against some of the world's most sophisticated chess programs.

A very special attraction for junior-technican types will be the Pioneer C.E.S. Whiz Kid competition. The object of the exercise is to assemble a collection of audio components in the quickest time possible. Six would-be Whiz Kids will contest for the daily prize of a Pioneer Centrex RK-304 cassette/radio portable; the grand final winner will receive a Pioneer Rondo 5000X hi-fi system valued at $500.

Sydney radio station 2UW (We love you, yeah, yeah, yeah!) will be covering the Show with daily broadcasts live from the showgrounds.

A group of "sound" cars featuring the latest in mobile hi-fi will be of great interest to motorists – the increasing sophistication of car stereo equipment in recent years is truly astounding.

Most importantly however, the Fourth C.E.S. will allow an opportunity to view the latest developments in hi-fi and general consumer electronics on the Australian market.

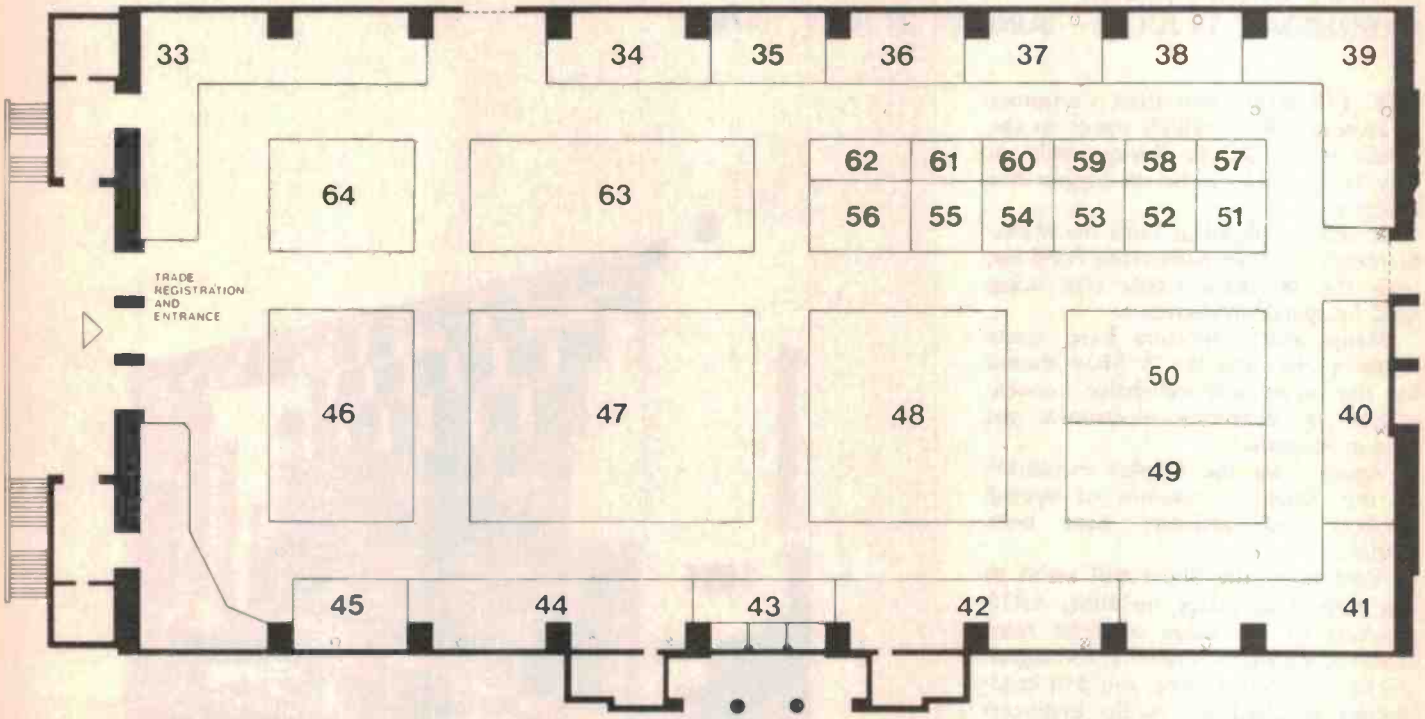
The range of products is diverse; there will be "something for everyone" at the C.E.S. ▶

Admission charges are:	Adults, $2.00 Children, $0.60 Pensioners, $1.00	
Public hours will be:	Thursday, July 19:	1.00 p.m. – 10.00 p.m.
	Friday, July 20:	1.00 p.m. – 10.00 p.m.
	Saturday, July 21:	1.00 p.m. – 10.00 p.m.
	Sunday, July 22:	12 noon – 7.00 p.m.

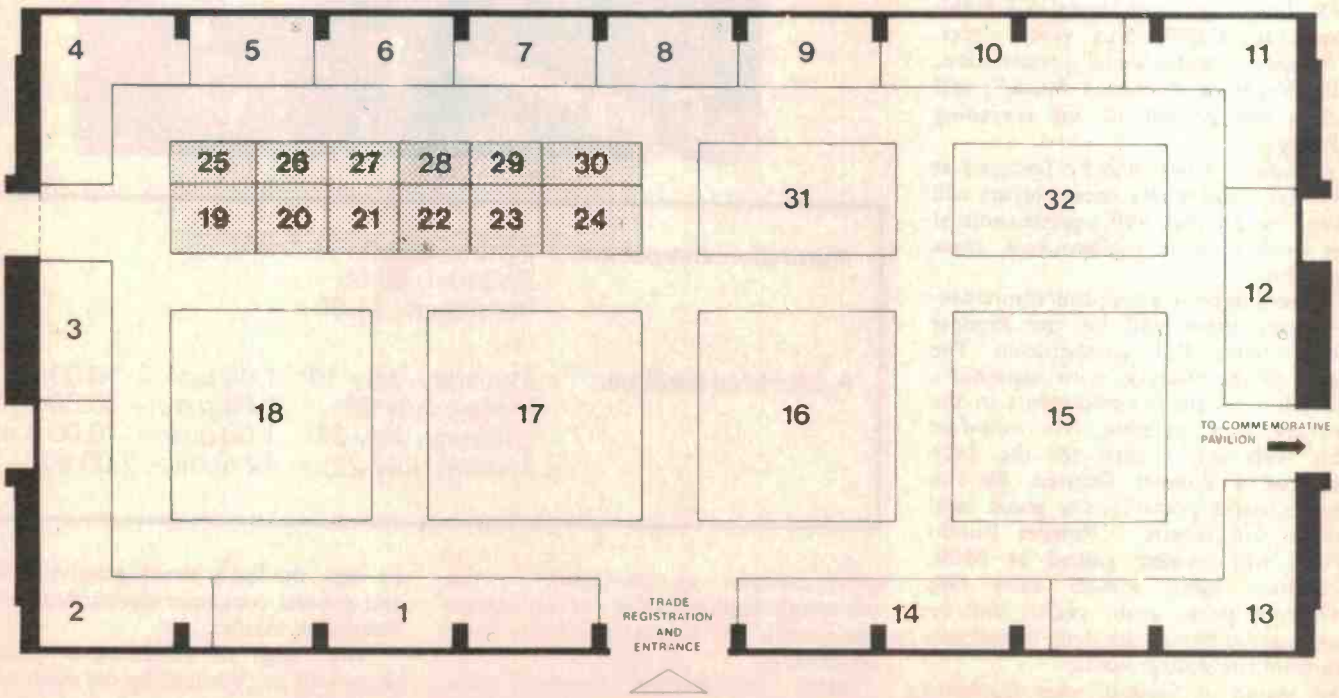
FLOOR PLAN

Fourth Australian Consumer Electronics Show

COMMEMORATIVE PAVILION



MANUFACTURER'S PAVILION



Guide to Exhibitors

STAND 1

The Sharp Corporation will be showing several new products, including a VTR Receiver, microwave ovens, calculators, business equipment, and dual vision colour TV.

The new compact range of Optonica hi-fi gear covers amplifiers (three new models), tuners, turntables, cassette decks and speakers. Microprocessor-based control functions are a special feature of the Optonica line.

STANDS 2 & 18

Last year's award winners, Sanyo, will be featuring colour TVs, VCRs and cameras, sound equipment for the car and home, and new gas and microwave ovens.

You can cook it up with Sanyo (thats life!) at Stands 2 and 18, in the Manufacturer's Pavilion.

STAND 3

Accoustic Research Australia will be demonstrating (naturally) A.R. loudspeaker systems at their stand, No. 3, in the Manufacturer's Pavilion. The speakers will be powered by Soundcraftsmen amplifier/preamplifier combinations, and this set-up can be expected to produce some of the cleanest, loudest, sounds at the Show.

STAND 4

Teac will be introducing a substantial number of new products, in almost every category, at their stand, No. 4, in the Manufacturer's Pavilion. The range includes eleven new cassette decks, including the sophisticated C-series, two amplifiers of 35 W and 55 W per channel, two tuners, two direct-drive turntables, and four very tasty open-reel tape decks.

AR9's – hear them at the Show.

STAND 5

B.J.D. Electronics, on Stand No. 5, in the Manufacturer's Pavilion, will feature Amcron amplifiers, Linear Design consoles and speakers, Cerwin-Vega speakers, and will launch the new range of Jenson loudspeakers.

STAND 6

Concept Audio will be displaying several "first release" audio products. The full range of Jennings Research loudspeakers, made in Los Angeles, will be seen for the first time.

Mirsch loudspeakers, from Sweden, are reminiscent of the old Sonab speakers, and will appeal to all who have previously owned or admired Sonab.

The Rega turntable will be on display, fitted with a Dynavector ▶

You can see and hear the BX-300 amp at Teac's stand; No.4., in the Manufacturer's Pavilion.

DV.505 tone arm. Both Dynavector and Empire cartridges will be demonstrated, no doubt using a disc from Salisbury Laboratory Direct-Cut Records.

The David Hafler Preamplifier and Power Amplifier, from the David Hafler Company of Philadelphia, will debut at the C.E.S., as will Permostat, a product which "eliminates static electricity from the surface of a gramophone record permanently".

Other products on show at Concept's stand, No. 6, in the Manufacturer's Pavilion, will be Pixall Record Cleaners, and Empire record care accessories.

STANDS 7 & 8

Hanimex will be demonstrating an extensive range of home audio equipment, table lamps, TV games calculators, 200 mm TVs, the Commodore "PET" computer, and both digital and quartz analog clocks, all at Stands 7 and 8, in the Manufacturer's Pavilion.

STAND 10

This year the already extensive selection of Aiwa sound equipment is being boosted with a range of receivers, amplifiers, tuners, cassette decks, turntables, component and 'mini' component systems. See them at Stand 10, the Manufacturer's Pavilion.

Vanfi will be displaying Sansui's DD/DC model AU-X1 amplifier and matching TU-X1 tuner.

STAND 12

New products from Sansui will be displayed at Vanfi's stand, No. 12, in the Manufacturer's Pavilion. Of particular interest is the new DD/DC (Diamond Differential DC) amplifier, the AU-X1, and matching TUX-1 tuner.

Other new products are two direct-drive turntables, the SP-X11000 four-way eight-speaker system featuring dual 432 mm woofers each side, and three FM/AM stereo receivers.

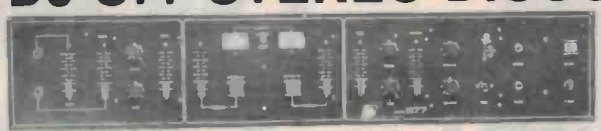
Electro-Voice will introduce their range of dbx equipment, among which you'll find this Model 2BX stereo expander.

STANDS 13 & 14

On Stands 13 and 14, in the Manufacturer's Pavilion, Electro-Voice Australia will be exhibiting not only the full range of E-V consumer and professional products, but also Tapco, dbx, Uni-Sync, Intersound, Spectro-Acoustics and Micro-Acoustics equipment.

Many new models will be on display, including new Interface and E.V.S. speakers, new E.V. component speakers and Sentry professional monitor speakers, new Stage and Encore Series PA speakers, E.V.M. PA and Musical Instrument speakers, and new horns and direct radiators from the E.V. Professional Sound Reinforcement Product Group.

In addition 134 new products in the Commercial Microphone and Loudspeaker range will be introduced for the first time. ▶



Celestion Ditton 551

Our superb new Ditton 551 loudspeakers have been conceived by designers and engineers who are among the elite in their field. They represent an impressive achievement in the successful integration of exceptional acoustic performance and a high-quality furniture appeal. Mahler or Marley, Wagner or Wakeman, whatever your taste, you hear your music the way you want to hear it. In the famous Celestion tradition, the Ditton 551 offers something truly outstanding for even the most critical enthusiast. Every subtle detail contributes towards their perfection. For example, a unique fabric construction has been developed for the substantial front grille which is transparent to sound and opaque to light. This, coupled with the asymmetric positioning of the mid-range and tweeter units, obviates any dispersion problems that might have otherwise been created. One of the principal design features is a vented box, which provides excellent extension of the low frequencies from the 290mm PC101 Bass Unit, which is fed via a quasi-Butterworth third order low pass filter. For the mid range, the MD701 unit is fed from a constant impedance attenuator, which enables the level to be adjusted by up to 2dB boost, and more than 6dB cut, by using the level control on the front baffle. The HF2001 treble unit has a similar control with the addition of an overload protection circuit incorporating a quick-acting fuse with LED failure indicator. The Ditton 551 is suitable for amplifiers of 20 to 140 watts (continuous rated sine wave output) and has a frequency response of 38Hz to 20kHz ± 3dB into half space (2 π steradians).

. . . advanced loudspeaker technology — at its most tasteful

The full Celestion range is now on show at:

M & G HOSKINS PTY. LTD.

400 Kent Street
Sydney
29-1005

268 Princes H'Way
Arncliffe
597-3683

5 YEARS GUARANTEE
Sole Australian and New Zealand distributors

Tapco products include new model power amplifiers, a studio mixer, and a graphic equaliser. dbx have new expanders, adding to their well-known range of noise-reduction systems. Uni-Sync are a relatively new arrival on the Australian market, and while no new releases are scheduled for the Show, their existing product range deserves close inspection.

Intersound is a company who have introduced a new product called an Instrument Voicing Preamplifier, which will debut at the Show. Spectro-Acoustics amplifiers, preamplifiers and graphics will be on display, with the Micro-Acoustics line of cartridges and replacement stylii.

STAND 16

Akai will be displaying a new range of PRO SERIES components hi-fi systems. The series follows from the PRO-1 and PRO-2 systems introduced last year.

Top-end products on display for the first time are a preamplifier (PA-200C), two power amps (PS-200M, 200 W per channel, and PS-120M, 120 W per channel), and a digital synthesizer tuner (PS-200T).

Pioneer's first direct-drive turntable — see it!

Also on display for the first time will be the CXC-706DX front-loading cassette deck with ADRES (Automatic Dynamic Range Expansion System), and two new DC amplifiers, the AM-2950 (120 W per channel) and the AM-2850 (85 W per channel).

Akai's newly developed Rapid Sensor Head is featured in two new auto-reverse cassette decks, the GXC-735D and CS-732D. Also on display, new ranges of portable radio-cassette recorders and music centres.

STAND 17

Pioneer will introduce five new amplifiers, from 25W to 100W per channel, with fluorescent displays. The two top-end models (SA-9800 and SA-8800) utilise "non-switching" power amps. The new TX-9800 tuner, with quartz-locked tuning, is designed to rack with these models, while the other new tuner matches the three remaining amps in the new range.

Pioneer will also be demonstrating its first release decks with metal tape facilities and fluorescent level metering, and a 254 mm-reel version of their RT-707 open-reel model is expected in time for the Show. Rack-mounting components on display will include a graphic equaliser, a dynamic compressor, and a reverb amplifier.

Topping the rack will be Pioneer's first direct-drive turntable with a linear tracking tonearm.

Other new products on show will be a sevenpiece mini hi-fi system, two 3-in-1's, lightweight headphones, and an updated HPM speaker series.

The full range of existing systems and components will also be on display.

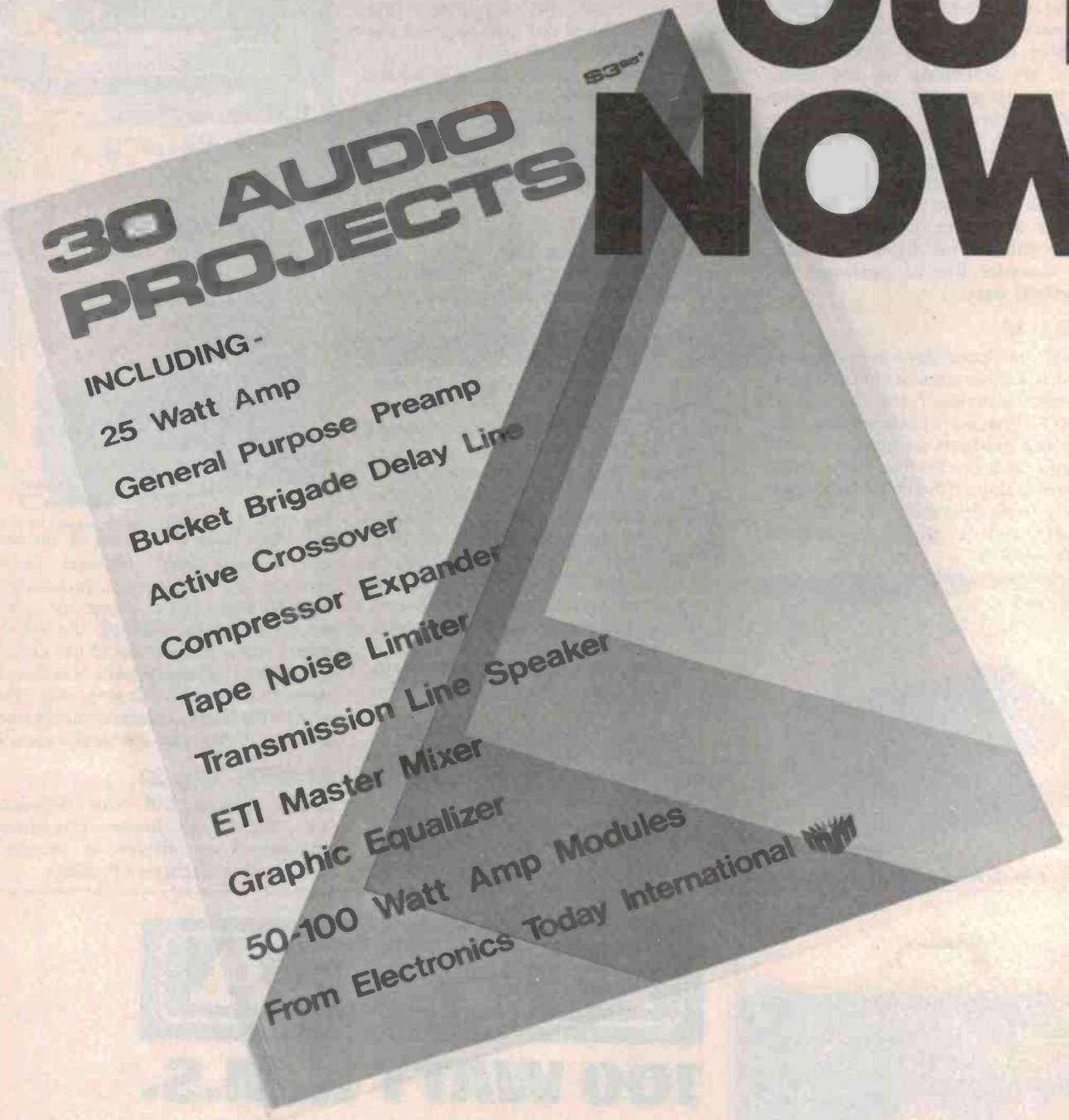
Pioneer's Car Sound Sales Division will display new products in the modular car stereo range, including the GEX-8 tuner with electronic pre-set tuning for both AM/FM, the GM-120 power amp, rated at 60 W per channel, a selection of component woofers and tweeters to match this amp, and a range of AM/FM Radio/Cassette combinations, cassette decks, and car stereo speakers.

The PRO-400 system, above, is part of Akai's new PRO Series — debuting at the Show.

STANDS 19 & 20

Radio Rentals will have large-screen TV, VCRs and home entertainment equipment on display at Stands 19 and 20, Manufacturer's Pavilion. ▶

OUT NOW



Thirty Audio Projects is the latest in our line of books designed especially with the serious constructor in mind. Ever found yourself leafing through back-issues of ETI for the circuit of a low-noise input stage? Or looking for some information on bucket brigade devices? Or do you need to know that the design you're using has been checked and re-checked for circuit errors and built by people all over the world before it is published? Thirty Audio Projects contains just that — thirty projects of the highest ETI standard, checked and re-checked and then presented in a compact and complete form.

The price is $3.95 — that's under fifteen cents per full project design — and they're all audio projects, thirty of our most sought-after designs. Projects include: Simple 25 watt amp; Bucket brigade delay line; Active crossover; Compresser/expander; Tape noise limiter; ETI speaker system; Professional-feature mixer; Howl-round suppressor; the ever-popular 50/100 watt amp modules; Graphic equaliser; Spectrum analyser; audio millivoltmeter.

STANDS 21,22 & 27,28

Acoustic Monitor Co. will be demonstrating a diverse range of equipment, from Phase Linear's massive Dual 500 Series Two amplifier (505 W per channel minimum into 8 ohms) to the Gusdorf range of consumer electronics furniture.

The Phase Linear Series Two Audio Components line includes 120 W, 210 W and 360 W per channel amplifiers, an audio delay, preamplifiers, an Autocorrelation Preamplifier and an Autocorrelation Noise Reduction System.

RTR Soft Dome and Direct Drive Electrostatic speakers will also be on display. Their DAC/1 Rhombus Subwoofer and PS/1 Pyramid Satellite loudspeaker will premiere at the Show.

Phase Linear, 'Series Two' amp from the Acoustic Monitor Co.

STANDS 23,24 & 29,30

Kenwood's KT-917 FM tuner won the Gold Award at this year's Japan Stereo Component Show, the industry's highest award, and also picked up Category awards for the KD-650 turntable, KA-701 High Speed Integrated Amplifier, and the LO7M MKII High Speed Power Amplifier.

Award-winning tuner, new from Kenwood

All these, together with the new 1979 range of Kenwood hi-fi equipment, will be on display at the C.E.S. at Stands 23, 24, 29 and 30.

STAND 26

Tokyo Boeki (Australia) Pty. Ltd., Stand No. 26, in the Manufacturer's Pavilion, will be promoting a car stereo system, loudspeakers, vacuum cleaners, juicers, etc, a 12V car refrigerator, and micro-cassette recorders.

STAND 31

Hagemeyer (A/Asia) B.V., sole marketers of JVC products in Australia, have announced new and improved additions to the JVC hi-fi range, to be released at the C.E.S.

These include one budget-priced belt-drive turntable, two quartz-locked direct-drive turntables, the QLA5 and QLF6, two budget receivers, and four models with in-built SEA graphic equalisation.

JVC will release three new amplifiers, AS-3, AS-5 and As-7, and retain the four current models, JA-S22, JA-S44, JA-S55 and JA-S77. The JA-S44 will feature the SEA graphic EQ. A new range of complementary tuners will be released; top-of-the-line is the T-40P, with quartz-PLL frequency synthesis and eight preset station settings.

The new SEA 80 graphic equaliser, with a fluorescent Spectrum Analysis display will be of special interest.

Four new models, with features such as ANRS, Dolby, and LED indicators, have been added to the current range of cassette decks, and JVC's second generation speakers will also be on show.

No less than nine all new packaged hi-fi systems, with various cassette, tuner, speaker and turntable options, will be released along with a new range of stereo radio/cassette portables; this range includes the 1635 III portable professional recorder, the 3060 portable TV/radio/cassette combination, the 3050 TV/radio combo, and the micro P100 64 mm monochrome TV/AM-FM radio combination.

Augmenting the "visuals" at the show will be JVC's range of colour TV receivers, including the 7885 508 ▶

WE BELIEVE THAT SOUND SHOULD BE HEARD, NOT SEEN!

Specifications:
Dimensions: 41 x 30 x 25 cm. Transducers: 25 cm L.F.; 5 cm H.F. spkrs. Crossover: 1400 Hz. Frequency Response: 50 Hz-20,000 Hz ±6 db; 100 Hz -6,000 Hz ± 1.5 db. Power Rating: 100 Watts Continuous Program (equipped with overload circuit breaker)

Now available at **The Contemporary Sound Centre**, 87-89 Riversdale Road, Hawthorn. Phone: 818-5585

Distributor & Wholesaler, Link Audio Distributors Pty Ltd, P.O. Box 85, Hawthorn, 3122.

A paradox? Not at all. When it's bookshelf speaker systems; our Link philosophy is devoted to maximum performance from minimum dimensions! Take our Link bookshelf audio transducers. They represent a modest milestone in the quest of winning big sound from small spaces. Range is 50 Hz¼0 kHz with a remarkably smooth, detailed response. Specifications and test reports only hint at what your ears will tell you in seconds. Hear them soon.

Recommended retail price:

$369 pair

LINK

— the realistic connection between you and the original performance.

The Best Advice We Can Give About Recording Consoles:

"Contact your closest Studiomaster dealer"

VIC
Acoustic Transducer Co.
GPO Box 210,
Bendigo, 3550.
(054) 43-6098

Central Musical Instruments
41 Leeds St.,
Footscray.
(03) 689-4475

NSW
Wirra-Willa Studio
Belmont Rd.,
Glenfield.
(02) 605-1203

QLD
Sound City
Blue Arcade,
Surfers Paradise
(075) 38-5237

ACT
John's Music
Units 1-2
16 Kembla St.,
Fyshwick.
(062) 80-6558

The Studiomaster Mixing Consoles are rapidly becoming the leading affordably-priced, professionally designed recording and sound reinforcement boards in the industry. Not only does Studiomaster offer five equalisation controls per channel, but the desks have the ability to allow the soundman to record a live four-track tape of a group's performance while providing a stereo programme and monitor mix independently (without disturbing the record mix).

mm cordless remote unit, backed up by the VHS HR-3000 colour TV Video Recorder; colour cameras will be at the Hagemeyer stand, No. 31, in the Manufacturer's Pavilion.

STAND 43

Computerland will demonstrate the Apple II home/professional computer. The Apple is a flexible device with capabilities for sound (music and voice synthesis) output, data aquisition, high resolution colour graphics. and much more. It runs with up to 48K Bytes of memory, ROM Basic or Pascal.

STAND 44

Koss, SAE, SME, Shure: An impressive list of names, famous in pro-audio as well as hi-fi. They are all represented by Audio Engineers, and will be on display at their stand, No. 44, in the Commemorative Pavilion. Nothing new has been announced for the Fourth C.E.S., but quality equipment is always worth a second (or third) look.

STAND 45

Nakamichi audio equipment should need no introduction, but those who would like to meet-up with Mr. Nakamichi-san's gear can do so at Convoy International's stand, No. 45, in the Commemorative Pavilion.

Also on display at Stand 45, the B & W range of "no compromise" loudspeakers.

STAND 46

The Superscope/Marantz collection will be exhibited at Stand No. 46, in the Commemorative Pavilion. The display will feature Superscope's new range of hi-fi equipment, headed by the SD-8000 two-speed cassette deck, but the main attraction should be the Marantz Pianocorder Reproducing System, the player-piano of the Seventies.

Also on show, the excellent Marantz range of hi-fi gear and Superscope by Marantz portable AM/FM cassette decjs and microphones. Marantz Car Stereo equipment will be displayed in a special stand, enabling instant comparison of all the units in the range.

STAND 47

Hitachi will feature with direct-drive Unitorque quartz PLL motor system turntables, power MOS FET amplifiers, three-head cassette decks with fluorescent displays, IC logic controls, ATRS microprocessor and autoequaliser systems, and AM/FM receivers with "Class G Dynaharmony" amplification.

STAND 48

Technics have announced the release of several new items in time for the Show: A quartz phase-locked direct drive turntable (model SL-5200), two slimline amplifiers rated at 25 W and 35 W per channel (models SU-8011 and SU-8022), and a matching AM/FM stereo tuner.

These and other National products can be seen at the National Panasonics Stand, No. 48, in the Commemorative Pavilion.

STAND 51

Communications Power Incorporated (CPI), Stand No. 51, in the Commemorative Pavilion, will be showing Allsop 3 cassette deck head cleaners. The Allsop 3 is totally non-abrasive, and simultaneously cleans heads, capstan and pinchroller.

STAND 52

Farrell's Total Music will be exhibiting a selection from their large range of musical instruments and accessories at

A JBL MONITOR KNOWS ITS PLACE

A studio monitor is only a tool. It is not supposed to enhance, add to, subtract from, or in any way modify sound.

That's your job.

What a studio monitor is supposed to do is tell you precisely what's on tape. Because you have to know everything that's there. And everything that isn't. Before it's too late.

That's why JBL monitors are in thousands of recording and broadcast studios around the world. In fact, according to the Recording Institute of America, JBL's were used to make 30 of last year's top 50 albums.

A JBL monitor plays what it's told. Nothing more. Nothing less. If that sounds good to you, put a JBL in your place.

The 4301: Our newest 2-way monitor. Compact and efficient, for small broadcast control rooms, and home studios.

The 4311: The most popular monitor going. A compact, full-range 3-way.

The 4315: An ultra-shallow 4-way, for maximum sound in minimum space.

JBL studio monitors come in three other models, too. All fully compatible for accurate cross referencing.

JBL

GET IT ALL.

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the Show. Roland's Jupiter 4 is a four-voice polyphonic synthesizer with ten preset sounds and eight programmable sounds. The Prophet 5, also from Roland, is a fivevoice polyphonic with front panel control and forty programmable patches.

Some of the strangest sounds to be heard at the Show will be coming from the Moog Vocoder, which imposes the characteristic of a speech signal onto any other signal input – usually a musical sound.

STAND 54

Pro-Sound Pty. Ltd. and Auto Acoustics will share Stand No. 54, in the Commemorative Pavilion.

Pro-Sound will be showing Sound Dynamics hi-fi and studio speakers from Canada, Cerwin Vega disco and PA equipment from the US of A, Australian made professional electronics from Audio Design, and Profile custom audio and lighting gear.

Auto Acoustics specialise in (what else) car stereo equipment. They will be featuring Eurovox stereo radio/cassette equipment and, particularly, Fosgate car stereo power boosters from the US.

STAND 55

Casio Computer Co.'s printing and non-printing calculators, can be seen at Stand No. 55, in the Commemorative Pavilion. Also on display, a combination calculator/alarm-clock/lighter, and (!) a clock/auto-calendar alarm/alarm timer/stopwatch/calculator which is also a "push-key melody composer"! (again).

STANDS 58 & 59

That's us! The ETI stand will feature the 'Series 4000' stereo amplifier plus a host of our other projects which have been popular over the years. You may see – and perhaps play with – a 4600 music synthesizer. Magazine staff will be on hand to answer your questions and generally "talk shop". Why not pop in and introduce yourself ?

STAND 61

If you get that underpowered feeling, visit Union Carbides stand, No. 61, in the Commemorative Pavilion, where Everready will give you a charge with their display of batteries, flashlights, and lanterns. You'll be illuminated!

STAND 62

A.G.S. Electronics (Aust) will be showing the Audio Reflex range of products at Stand No. 62, in the Commemorative Pavilion. Equipment on show will include graphic equalisers, amplifiers, turntables, speakers, cassette decks and AM/FM receivers, and A.G.S.'s own line of car audio products.

STAND 64

Yamaha, one of the world's largest manufacturers of musical instruments, will release a new range of hi-fi components at the C.E.S. The new models will be displayed in an audio-visual presentation at Rose Music's Stand, No. 64, in the Commemorative Pavilion. ▶

Audio Reflex mini speaker from A.G.S.

Roland
SYSTEM 100M

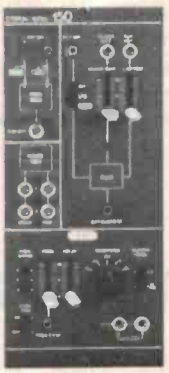
Create the electronic music system you need with Roland's compact modular System 100M

The voltage controlled synthesizer is a musical instrument which contains elements that can be connected together, much like building blocks, to build or create almost any sound imaginable. As with most professional systems, the System 100M puts these synthesizer elements into separate modules so that you can build a system which meets your own particular needs.

VCO-VCF-VCA **110**

2ENV-LFO **140**

RING-NOISE **150** S/H LFO



181 49-KEY KEYBOARD CONTROLLER **190** 3 MODULE RACK

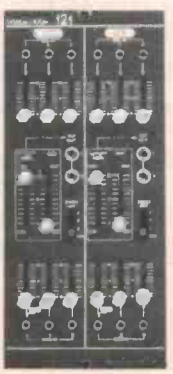
180 32-KEY KEYBOARD CONTROLLER **191** 5 MODULE RACK

A Flexible System for Today's Creative Musician

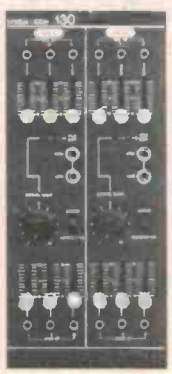
The System 100M is sold as separate units so that you can build up a system to match your own particular needs. The keyboards include 6-conductor cords for power, internal CV, gate, and trigger connections to the system. The racks (190 and 191) contain the power supply, power switch, and voltage regulators for the modules and keyboard. Module mounting screws and a patch cord set (PCS-2) are included.

2VCO **112**

2VCF **121**



2VCA **130**

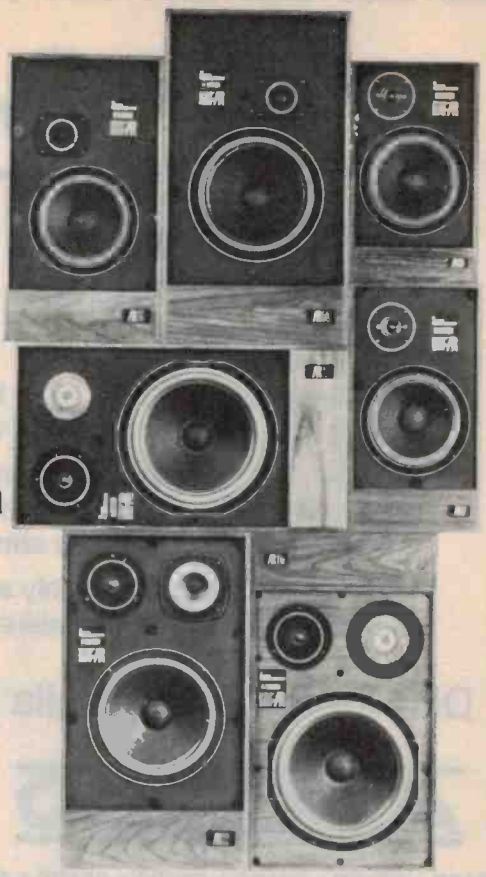


All major control and audio inputs for each module have their own input mixers which greatly simplifies patches where multiple inputs are needed. This also means that all patch cord signal levels are high for a much better signal-to-noise ratio. All module inputs and outputs are compatible so that any output may be connected with each other and with most equipment found in the recording studio. Keyboard control voltage, gate and trigger are internally connected so that normally patch cords are not needed for these.
All modules are the same size and weight: 104(W) x 230(H) x 200(D)mm: 1.6kg.

Create with Roland

Roland Corporation
13 Chard Road,
Brookvale, 2100 N.S.W.

HOW MUCH MUST YOU PAY FOR A PAIR OF "DYNAMITE" SPEAKERS?



READ ABOUT THEM ALL. OUR FULL COLOR BOOKLETS DESCRIBE THESE SPEAKERS AND HOW TO MAKE YOUR CHOICE. GET ONE FROM YOUR DEALER OR WRITE TO AR AT THE ADDRESS BELOW.

Would you believe that you can step up from merely "OK" to "absolutely dynamite" for only about $110 per speaker?

Well it's true.

For only about $220 an AR dealer can put you into a pair of AR18s... an amazing listening experience that sounds a lot more expensive than it really is.

This is what you'll hear.

A firm, well-controlled, reproduction of source material. Accurate and uncolored by minor resonances in the speaker itself.

A nice flat response curve. In layman's language that means bass notes that don't get overemphasized. Middle frequencies, where vocal passages occur, that come through beautifully. And, on the high end, strings that don't sound over bright.

AR SPEAKERS RANGE IN PRICE FROM ABOUT $110 TO ABOUT $1350. THIS IS THE $1350 ONE — THE INCREDIBLE AR9. ALL ARE COVERED BY THE SAME 5-YEAR WARRANTY WHICH AN AR DEALER WILL SHOW YOU.

There are, of course, other AR speakers beside the AR18 which boast these qualities. The bigger they come the more power they'll handle and more sound level they'll produce.

Truth In Listening

But size doesn't determine quality at AR, and every AR speaker is built (in our own factories) to deliver the same thing: truth in listening.

So stop fooling around. Buy a pair... any pair. Discover what the smart money's learning all the time. That listening to a pair of dynamite speakers can really be a blast.

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3 Ford Street, PO Box 21,
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Tel: 642-2595

Exhibitors

A.G.S. ELECTRONICS (AUST) PTY. LTD.
7 Orchard Rd., Brookvale, 2100.
Stand 62.

AIWA AUSTRALIA PTY. LTD.
14 Gertrude St., Arncliffe, 2205.
Stand 11.

AKAI AUDIO VISUAL AUSTRALIA P/L
P.O. Box 309, North Ryde, 2113.
Stand 16.

ACOUSTIC MONITOR CO. PTY. LTD.
12-16 Gould St., Enfield, 2136.
Stands 21, 22, 27, 28.

ACOUSTIC RESEARCH AUSTRALIA
3-5 Ford St., Greenacre, 2190.
Stand 3.

AUDIO ENGINEERS PTY. LTD.
342-344 Kent St, Sydney, 2000.
Stand 44.

B.J.D. ELECTRONICS
202 Bourke St., Melbourne, 3000.
Stand 5.

BRECKWOLDT & CO. PTY. LTD.
King George Tower, George St., Sydney, 2000.
Stand 56.

CASIO COMPUTER CO. AUST.
175 Pitt St., Sydney, 2000.
Stand 55.

COMMUNICATIONS POWER PTY. LTD.
P.O. Box 246, Double Bay, 2028.
Stand 51.

COMPUTERLAND AUST.
55 Clarence St., Sydney, 2000.
Stand 43.

CONCEPT AUDIO PTY. LTD.
13 Rickard Rd., Nth Narrabeen, 2101.
Stand 6.

CONVOY INTERNATIONAL PTY. LTD.
4 Dowling St., Woolloomooloo, 2011.
Stand 45.

ELECTRO VOICE PTY. LTD.
174 Taren Point Rd., Taren Point, 2229.
Stands 13 and 14.

EXPO INTERNATIONAL TRADING
P.O.Box 272, St. Marys, 2760.
Stand 33B.

THE FALK ELECTROSOUND GROUP
28 King St., Rockdale, 2216.
Stand 9.

FARRELLS MUSIC
503 Pittwater Rd., Brookvale, 2100.
Stand 52.

FUTURETRONICS AUSTRALIA PTY. LTD.
79-81 Levanswell Rd., Moorabbin, 3189.
Stand 32.

HAGEMEYER (A/ASIA) B.V.
Unit C, Centre Court Estate, 25-27 Paul St., North Ryde, 2113.
Stand 31.

HANIMEX PTY. LTD.
108 Old Pittwater Rd., Brookvale, 2100.
Stands 7 and 8.

HI-FI CITY
251 Church St., Parramatta, 2150.
Stand 35.

M. & G. HOSKINS PTY. LTD.
268 Princes Highway, Arncliffe, 2205.
Stand 34.

JORLEN AUDIO IMPORTS PTY. LTD.
23 Colleen St., Blakehurst, 2221.
Stand 33C.

KRIESLER A/ASIA PTY. LTD.
12.30 Cawarra Rd., Caringbah, 2229.
Stand 50.

ELECTRONICS TODAY
Ryrie House, 15 Boundary St., Rushcutters Bay, 2011.
Stands 58 and 59.

NATIONAL PANASONIC (AUST) PTY. LTD.
61 Anzac Pde., Kensington, 2033.
Stand 48.

NIPPER PRODUCTS PTY. LTD.
20 Barcoo St., East Roseville, 2069.
Stand 33A.

PETERSON SPEAKERS
Walter St., Moorabbin, 3189.
Stand 60.

PHILIPS CONSUMER PRODUCTS
1092 Centre Rd., Clayton, 3168.
Stand 15.

PIONEER MARKETING SERVICES PTY. LTD.
178 Boundary Rd., Braeside, 3195.
Stand 17.

PRO-SOUND/AUTO ACOUSTICS
144 Brougham St., Kings Cross, 2011.
Stand 54.

PYE CONSUMER PRODUCTS
P.O. Box 12, Marrickville, 2204.
Stand 10.

RADIO RENTALS
Baird House, Cnr. Mitchell & Chandos Sts., St. Leonards, 2065.
Stands 19 and 20.

ROSE MUSIC PTY. LTD.
17-33 Market St., South Melbourne, 3205.
Stand 64.

SANYO AUSTRALIA PTY. LTD.
14 Mars Rd., Lane Cove, 2066.
Stands 2 and 18.

SHARP CORPORATION OF AUSTRALIA
64 Seville St., Fairfield, 2165.
Stand 1.

SUPERSCOPE A/ASIA PTY. LTD.
32 Cross St., Brookvale, 2100.
Stand 16.

TEAC AUSTRALIA PTY. LTD.
165 Gladstone St., South Melbourne, 3205.
Stand 4.

TOKYO BOEKI (AUSTRALIA) PTY. LTD.
8th Floor, 333-339 George St., Sydney, 2000.
Stand 26.

TRIO-KENWOOD AUSTRALIA PTY. LTD.
P.O. Box 425, Artarmon, 2064.
Stands 23, 24, 29, 30.

UNION CARBIDE AUSTRALIA LIMITED
157 Liverpool St., Sydney, 2000.
Stand 61.

VANFI (AUSTRALIA) PTY. LTD.
162 Albert Rd., South Melbourne, 3205.
Stand 12.

KITS FOR ETI PROJECTS

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

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

Key To Companies

A. Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077.
B. Bill Edge Electronic Agencies, 115 Parramatta Road, Concord, (PO Box 1005, Burwood North 2134).
C. J R Components, PO Box 128, Eastwood NSW 2122.
D. Dick Smith Electronics P/L, PO Box 747, Crows Nest, NSW 2065.
E. All Electronic Components, 118 Lonsdale Street, Melbourne, Vic 3000.
J. Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000.
K. S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109.
L. Tasman Electronics, 12 Victoria Street, Coburg Vic 3058.
M. Mode Electronics, PO Box 365, Mascot, NSW 2020.
N. Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011.
O. Orbit Electronics, PO Box 7176, Auckland, New Zealand.
P. Pre-Pak Electronics, 718 Parramatta Road, Croydon, NSW 2132.
R. Rod Irving Electronics, Shop 499, High Street, Northcote, (P.O. Box 135), Vic 3070. Phone (03)489 8131.
T. Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville Qld 4812.
V. Silicon Valley, 23 Chandos Street, St Leonards, NSW 2065.

Project Electronics

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

Test Equipment

132. . . .Experimenter's Power-Supply	Feb 77 . .	.E
133. . . .Phase Meter	Apr 77 . .	.E
134. . . .True RMS Voltmeter	Aug 77 . .	.E
135. . . .Digital Panel Meter	Oct 77. . .	.E
136. . . .Linear Scale Capacitance Meter	Mar 78 . .	.E

137. . . .Audio Oscillator . . . . . .May 78 . .E
138. . . .Audio Wattmeter. . . . . .Nov 78
139. . . .SWR/Power Meter . . . . . .May 78
140. . . .1 GHz Frequency Meter-timer . . . . . .Mar 78 . .C

Simple Projects

243. . . .Bip Beacon. . . . . .Apr 77
244. . . .Alarm Alarm . . . . . .Feb 77
245. . . .White Line Follower . . . . . .Nov 77
246. . . .Rain Alarm . . . . . .Apr 78 L
248. . . .Simple 12V to 22V Converter . . . . . .Jul 78

Motorists' Projects

316. . . .Transistor Assisted Ignition. . . . . .May 77 . .K,O,E
317. . . .Rev Monitor Counter . . . . . .Jul 77 . . .E
318. . . .Digital Car Tacho . . . . . .Jul 78 . . .K, E
319. . . .Variwiper MK II . . . . . .Sep 78. . .E

Audio Projects

448. . . .Disco Mixer . . . . . .Nov 76
449. . . .Balanced Microphone Amp. . . . . .Nov 76 . .J, E, L
450. . . .Bucket Brigade Audio Delay Line. . . . . .Dec 77 . .
480. . . .50-100 Watt Amp Modules . . . . . .Dec 76 . .J,E,D,O, R,A,B,L
481. . . .12 V 100 Watt Audio Amp. . . . . .May 77 . .E
481. . . .High Power PA/ Guitar Amp . . . . . .Jun 77. . .O
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 . . .E
485. . . .Graphic Equalizer . . . . . .Jun 77. . .J, E
486. . . .Howl-round Stabilizer . . . . . .Nov 77 . .J
487. . . .Audio Spectrum Analyser . . . . .Feb 78 . .E
489. . . .Audio Spectrum Analyser 2. . . .Apr 78 . .J, E
495. . . .Transmission Line Speakers. . . .Aug 77

Miscellaneous

546. . . .GSR Monitor . . . . . .Mar 77 . .E
547. . . .Telephone Bell Extender. . . . .Jun 77. . .E
548. . . .Photographic Strobe . . . . . .May 77 . .E
549. . . .Induction Balance Metal Detector . . . . . .May 77 . .E
550. . . .Digital Dial. . . . . .Aug 78 . .E
551. . . .Light Chaser. . . . . .Sep 78. . .E
552. . . .LED Pendant . . . . . .Sep 78
553. . . .Tape/Slide Synchroniser . . . . .Oct 78. . .E
581. . . .Dual Power Supply . . . . . .Jan 77. . .E
582. . . .House Alarm . . . . . .Jul 77 . . .T,O,E,A
House Alarm — Installation Instructions . . . . .Aug 77
583. . . .Marine Gas Alarm . . . . . .Aug 77 . .M,E
585. . . .Ultrasonic Switch . . . . . .Sep 77. . .R,O,E,T, L
586. . . .Shutter Speed Timer . . . . . .Oct 77. . .E
587. . . .UFO Detector. . . . . .May 78
588. . . .Theatrical Lighting Controller . . . . . .Nov & Dec 77 . .N Jan & Mar 78
589. . . .Digital Temperature Meter (PCB135) . . . . . .Dec 77 . .E
590. . . .LCD Stopwatch . . . . . .Oct 78. . .N
591. . . .Up/Down Presettable Counter . . . . . .Jul 78 . . .E
592. . . .Light Show Controller . . . . . .Aug 78 . .E

Electronic Music

602. . . .Mini Organ. . . . . .Aug 76 . .O,E,D,B
603. . . .Sequencer . . . . . .Aug 77
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 . .O, E, A
631. . . .Keyboard Encoder. . . . . .Apr 77 . .O, E, A
632. . . .Video Display Unit . . . . . .Jan- Mar 77 . . . .O, A
633. . . .TV Sync Generator . . . . . .Jan 77. . .E, A
634. . . .8080 Educational/ Prototyping Interface . . . . .Jul, Aug 78
635. . . .Microcomputer Power Supply . .Sep 77
637. . . .Cuts Cassette Interface . . . . . .Jan 78. . .V,O,E,A
638. . . .Eprom Programmer . . . . . .Jul 78 . . .E, A
639. . . .Computerised Musical Doorbell . . . . . .Mar 78 . .A
640. . . .S100 VDU. . . . . .Apr. Jun 78 . . . .V, O, A
641. . . .S100 Printer. . . . . .Sep 78
642. . . .16k S100 RAM Card . . . . . .Feb 78 . .K
650. . . .STAC Timer. . . . . .Nov 78

Radio Projects

712. . . .CB Power Supply . . . . . .Jun 77. . .O,E
713. . . .Add-on FM Tuner . . . . . .Sep 77
714. . . .VHF-Log-Periodic Antenna . . . . . .Feb 78 Mar 78
715. . . .VHF Power Amplifiers . . . . . .Nov 77
716. . . .VHF Power Amplifiers . . . . . .Jan 78 Feb 78
717. . . .Crosshatch Generator. . . . . .May 78 . .E
718. . . .SW Radio. . . . . .Oct 78. . .E
719. . . .RF Field Strength Indicator. . . . . .Nov 78

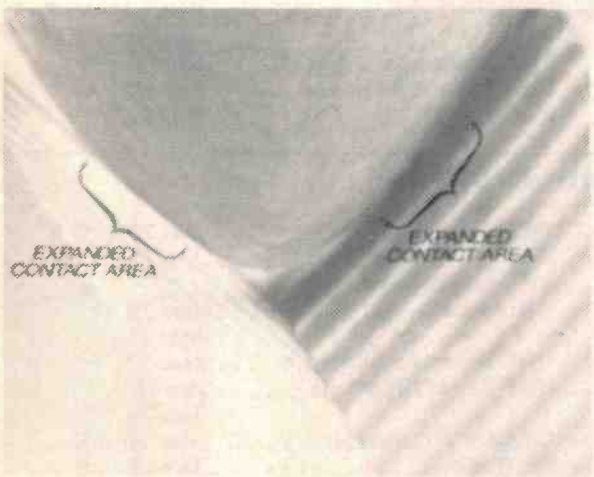
Electronic Games

804. . . .Selectagame . . . . . .Nov 76 . .O
804. . . .Selectagame (Rifle Project) . . . .Mar 77 . .O
805. . . .Puzzle of the Drunken Sailor . . .Oct 77
806. . . .Skeet . . . . . .Jan 78
810. . . .Stunt Cycle TV Game . . . . . .Jun 78. . .O,D,B
811. . . .TV Tank Game . . . . . .Oct 78. . .O,E,D,B

PROFESSIONAL

Nashville, the Center of Country Music, is Stanton Country, too!

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



The Nashville Production Co., uses Stanton exclusively throughout its two Disc Cutting Studios. Naturally, they are mostly involved with Country Music, but they also get into Pop and Rock.

John Eberle, Studio Manager, states that they use the Stanton Calibrated 681A "for cutting system calibration, including level and frequency response" . . . and they use the Calibrated 681 Triple-E in their Disc Cutting operation . . . with plans to soon move up to the new Professional Calibration Standard, Stanton's 881S.

Each Stanton 681 series and 881S cartridge, is guaranteed to meet its specifications within exacting limits, and each one boasts the most meaningful warranty . . . an individually calibrated test result is packed with each unit.

Whether your usage involves recording, broadcasting, or home entertainment, your choice should be the choice of the Professionals . . . the Stanton Calibrated Cartridge.

STANTON!

And remember, you can't get the best out of your Stanton Cartridge unless you use a genuine Stanton Stylus.

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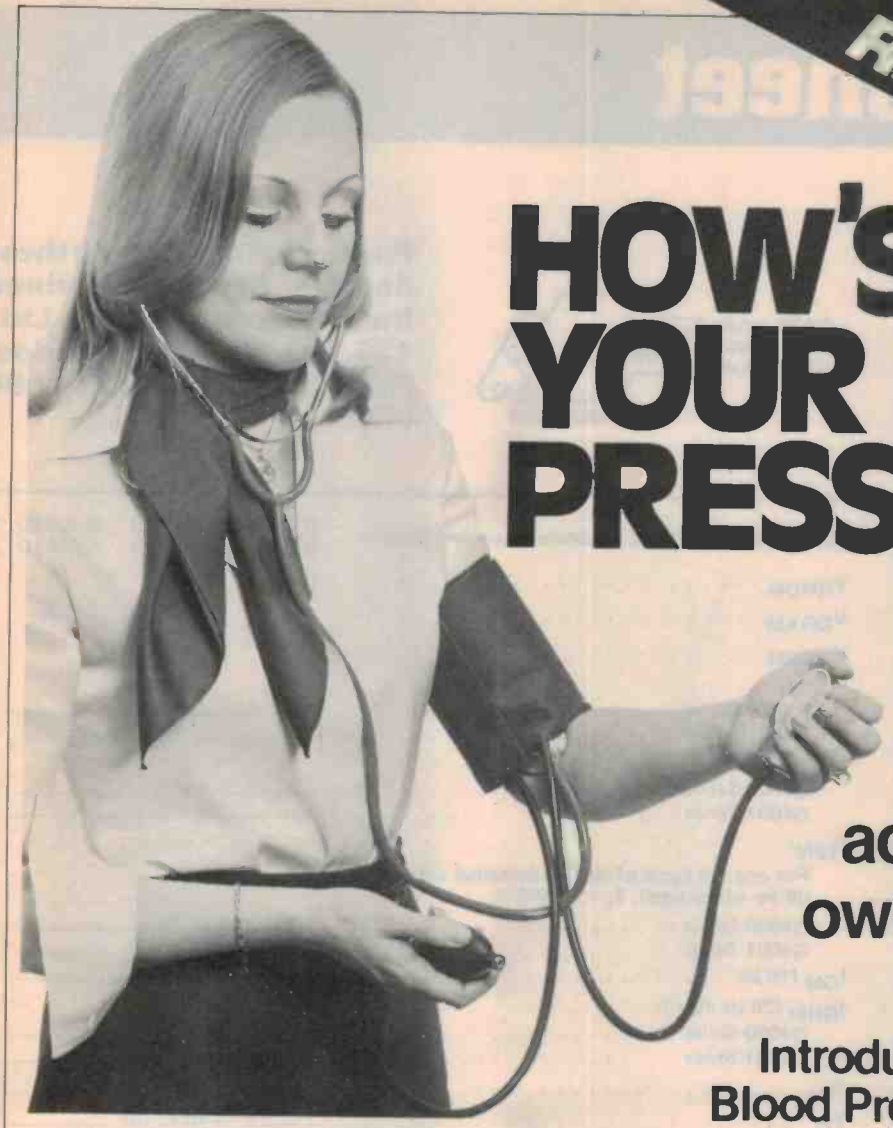
N.S.W. Office: 7 Jordan Rd., Wahroongah 2076. Phone 487 2543.

SPECIAL READER OFFER!



HOW'S YOUR BLOOD PRESSURE?

Take your own blood pressure quickly and accurately in your own home or office

Introducing the Unitrex Home Blood Pressure Monitoring Kits!

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

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

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

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

Caldor Offer

Please send me:

. . . . . .Quantity – Unitrex blood pressure monitoring kit/s at $19.95 each $ . . . . . .

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

TOTAL $

Name . . . . . .

Address . . . . . .

. . . . . .Postcode . . .

Please make cheques/postal notes payable to 'Caldor Offer' and send C/- Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011.

eti data sheet

SCRs should be fairly familiar to most readers — they are three-terminal devices which can be turned on by applying a pulse to a gate input and will stay on while sufficient current still flows through the device.

The main advantage that transistors have in switching applications is that transistors can be turned **off** by the control input, whereas SCRs cannot.

This is not true, however, of Gate Turn Off (GTO) SCRs. By applying a negative-going control pulse to the gate, the current flowing through the device can be interrupted, requiring another positive-going pulse to start it again. In short, GTO devices are power switching devices with a memory.

Applications range from a panel light dimmer for a car (where SCRs couldn't previously be used because they required a mains zero crossing to turn off) to switched-mode power supplies.

G4000/G4001

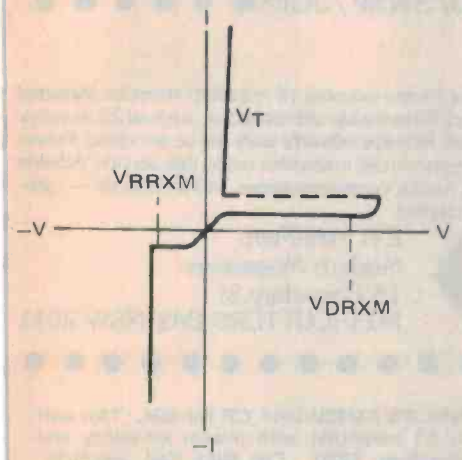
Further information on these devices can be obtained from: Amtron Tyree Pty. Ltd., 176 Botany St., Waterloo, NSW 2017. Tel: (02) 698 9666.

MAXIMUM RATINGS, *Absolute-Maximum Values:*	G4000A G4001A	G4000B G4001B	G4000D G4001D	
V_{RROM}	16	16	16	V
V_{DRXM}	100	200	100	V
V_{GRRM}	16	16	16	V
I_{TGOM}:				
G4000 Series		10		A
G4001 Series		5		A
I_T (T_C = 80°C):				
G4000 Series		15		A
G4001 Series		12		A
I_{TSM}:				
For one full cycle of applied principal voltage, 60 Hz (sinusoidal), T_C = 100°C:				
G4000 Series		86		A
G4001 Series		75		A
I_{GM} (10 μs)		3		A
I_{GRM} (20 μs max.):				
G4000 Series		10		A
G4001 Series		5		A
T_{stg}		−40 to 150		°C
T_C		−40 to 125		°C
T_L:				
At distance ≥ 1/32 in. (0.8 mm) from seating plane for 10 s max.		250		°C

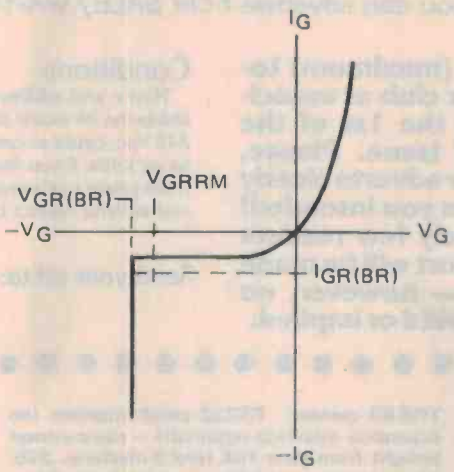
SYMBOLS

dv/dt	Critical rate of rise of off-state voltage
I_{DRXM}	Maximum (peak) repetitive dc off-state current with specified circuit between gate and cathode
I_G	DC gate current
I_{GM}	Maximum (peak) dc gate current
I_{gqM}	Maximum gate turn-off current
$I_{GR(BR)}$	Reverse gate breakdown current
I_{GRM}	Maximum (peak) reverse gate current
I_{GRRM}	Maximum (peak) repetitive reverse gate current.
I_{GT}	DC gate trigger current
I_H	DC holding current
I_L	DC latching current
I_{RROM}	Maximum (peak) reverse current (repetitive), gate open
I_T	DC on-state current
I_{TM}	Maximum (peak) dc on-state current
I_{TGOM}	Maximum (peak) on-state current gate-turn-off capability
I_{TSM}	Maximum (peak) surge on-state current (nonrepetitive)
R_{GK}	Gate-to-cathode resistance
$R_{\theta CA}$	Thermal resistance, case to ambient
$R_{\theta JC}$	Thermal resistance, junction to case
T_C	Case temperature
t_f	Fall time
t_{gq}	Gate-controlled turn-off time (t_s + t_f) comparable to turn-off time (t_{OFF}) for transistors
T_L	Lead (pin) temperature during soldering
t_s	Storage time
t_{stg}	Storage temperature
V_D	DC off-stage voltage
V_{DM}	Maximum (peak) dc off-state voltage
V_{DRXM}	Maximum (peak) repetitive off-state voltage with specified circuit between gate and cathode
V_G	DC gate voltage
V_{GR}	DC reverse gate voltage
$V_{GR(BR)}$	Reverse gate breakdown voltage
V_{GRRM}	Maximum (peak) repetitive reverse gate voltage
V_{GT}	DC gate trigger voltage
V_R	DC reverse voltage
V_{RROM}	Maximum (peak) repetitive reverse voltage, gate open
V_{RRXM}	Maximum (peak) repetitive reverse voltage with specified circuit between gate and cathode
V_T	DC on-state voltage

G4000 and G4001 – Gate Turn Off SCRs



Anode-cathode voltage-current characteristic.

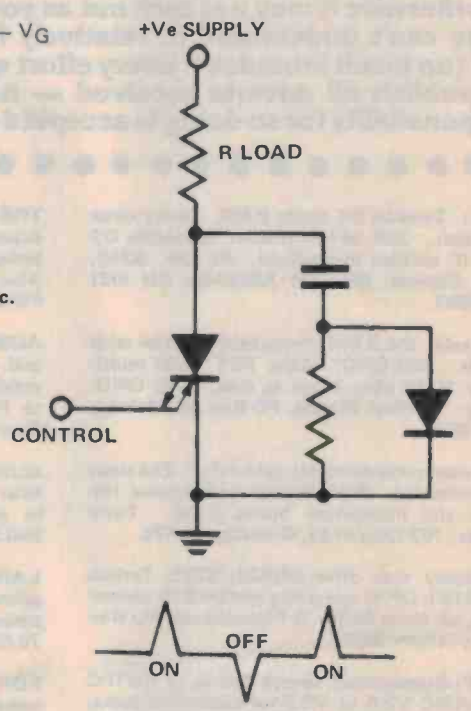


Gate-cathode voltage-current characteristic.

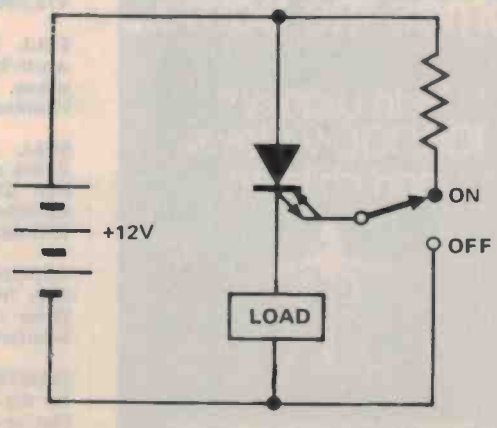
ELECTRICAL CHARACTERISTICS

At maximum ratings and T_c = 25°C, unless otherwise stated

CHARACTERISTIC	LIMITS FOR ALL TYPES UNLESS OTHERWISE SPECIFIED			UNITS
	Min.	Typ.	Max.	
I_{DRXM} (R_{GK} = 1000 Ω; T_C = 125°C):				
V_{DM} = V_{DRXM}	–	–	5	mA
V_D = 30 V	–	–	100	μA
I_{RROM}: V_R = 16 V, T_C = 125°C	–	–	5	mA
I_{GRRM}: V_{GR} = 16 V, T_C = 125°C	–	–	5	mA
V_T (T_C = 25°C):				
G4000 Series @ 10 A	–	–	103	V
G4001 Series @ 5 A	–	–	102	
I_{GT} (V_D = 12 V, R_L = 30 Ω):				
T_C = 25°C	–	–	3	mA
T_C = –40°C	–	–	20	
V_{GT} (V_D = 12 V, R_L = 30 Ω):				
T_C = 25°C	–	–	1	V
T_C = –40°C	–	–	1.5	
I_H (V_D = 12 V, Gate open):				
T_C = 25°C	–	10	–	mA
T_C = –40°C	–	50	–	
I_L (V_D = 6 V, I_{GT} = 20 mA):				
T_C = 25°C	–	–	20	mA
T_C = –40°C	–	–	100	
dv/dt V_D = V_{DRXM}, I_{GT} = 0, R_{GK} = 1000 Ω, T_C = 125°C	–	300	–	V/μs
t_{gqk} (t_{OFF}) I_T = I_{TGQM} I_{GQM} = 0.6 I_T V_{GG} < 0.2 V @ I_{GQ} = 300 mA T_C = 100°C			T_{GQ} = 25 t_s = 5 t_f = 2	μs
$R_{\theta JC}$	–	–	2	°C/W
$R_{\theta CA}$	–	–	50	°C/W



Two simple applications for the GTO:
Top: as a dc switch with memory – for applications such as push-button control.
Bottom: as an automotive applications switch, where previously the supply had to be interrupted to turn a conventional SCR off.



MINI-MART

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WE'LL PUBLISH up to 24 words (maximum) totally free of charge for you, or your club or association. Copy must be with us by the 1st of the month preceding the month of issue. Please, please write or preferably type your adverts clearly — otherwise it may not turn out as you intended! If we can't understand it, relatively few readers will (no insult intended). Every effort will be made to publish all adverts received — however, no responsibility for so doing is accepted or implied.

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Name and address plus phone number (if required) must be included within the 24 words allowed. Reasonable abbreviations, such as 25 Wrms or 240 Vac, count as one word. **Private adverts only** will be accepted. Please let us know if you find a commercial enterprise using this service. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.

Send your ad to:- ETI Mini-Mart, Modern Magazines, 15 Boundary St, RUSHCUTTERS BAY NSW 2011

SELL: Semcon 8K static RAM. Parity error detection. 250 ns low power. Motorola D2 bus. IC sockets throughout. As new. $200. Steve Caprow, BH (03) 726.6455, AH (03) 859.6691.

FOR sale: EA 3 MHz frequency counter with probes. $80 ONO. Also, FET VOM multimeter 10 M ohm input as new. $60 ONO. Apply: Michael Blowes, PO Box 28, Molong, NSW 2866.

TI52 card programmable calculator - 224 steps 20 memories. With BASIC and finance libraries and instruction books $100. Tony McGee, 107 Church St, Gloucester 2422.

8" floppy disk drive BR803, $375, Tarbell FDI $150, CP/M operating system $70 docum extra, all three $550. R Pfotenhauer, PO Box 81, Lyneham 2602.

SWAP disassembled source listing of SWTPC 8K BASIC V2.0 or V2.3 for cassette of same, specify your version. R Pfotenhauer, PO Box 81, Lyneham 2602.

SELL MEK 6800 D2 assembled. ½K RAM, full buffering, manuals; extra books, software. $275 ONO ring (03) 749.2627, after 7 pm ask for mark.

TRS-80 owners: RS232 serial interface (no expansion interface required!) — run a printer straight from your 16K level 2 machine. $65. Also programs available on an exchange basis. PO Box 122, Bondi Beach, NSW 2026.

AUSTRALIAN Radio DX Club, for shortwave and mediumwave DXers. Monthly magazine published, write for details with 30 cent stamp to PO Box 67, Highett, Vic or PO Box 79, Narrabeen, NSW.

QUAD 33/303 pre-amplifier and power amplifier for sale. Unmarked, perfect condition, in original packing $400. Melbourne (03) 590.8551.

LARGE C core Power Transformers 240 V primary 2 x 32 V secondaries. Ideal for power amplifiers $10 each. Earlwood, NSW 78.6249.

FOR sale: Mixed business; records and cassettes, musical instruments, hi-fi, electronics service. NSW far north coast. Air conditioned. Turnover $50,000 pa. Suit TV technician and wife or partner. Phone (066) 84.2335.

TRS-80 program swap. Send us your favourites on cassette (CLOAD or system) and we'll return ours. B Koziol, 36 Osburn Drive, Macgregor, ACT 2615.

MEMOREX 1280 cassette communication terminal RS232 tractor feed, numeric pad, $1800, John, 17 Victoria Street, Roseville 412.2409.

SELL 70 top quality metal glaze resistors worth $2.10 for $1.70 p & p free. All popular values. Garry Aydon, 46 Dickens Street, Hamilton, Vic 3300.

SELL transceiver AWA-SS220 6-channel 2-freq simplex 2—15 MHz SSB/AM 100 watt PEP 240 volt, supply manual, spare parts suitable for marine or mobile $560. Phone (02) 48.2424.

PROGRAMS! HP25/TI57 golf blackjack hi-lo (HP) golf Hi-lo (TI) $4 ea or 3/$10. Write J Lavett, Scotch College (ARH), 491 Glenferrie Road, Hawthorn, Vic 3122.

WANTED: Please, I need a circuit diagram for the "Timbra A40" stereo amp. Will pay. Can anyone help? Paul (03) 846.2036, 20 Little Valley Road, Templestowe, 3106. Thanks.

PHILIPS FM320 UHF CB for sale. This unit in A1 condition with proven reliability and operation, $250. Call Mike (08) 356.5010.

CRO Telequipment 3" 6 MHz 100 mV/ch $60. Intermodulation distortion analyser, power and millivoltmeter in one instrument — Heathkit $60. B Bloom (051) 49.4111, ext 4629 (after hours).

TRS-80 hard copy casino package. Tattslotto, One Arm Bandit, Russian Roulette. Brain teaser; Flip Flop, Roulette, Mini Dice $5 or $25 the lot. Box 283, Lorton 5333.

OSCILLOSCOPE for sale. Trio CO1303A. Excellent condition. Vert Amp 20 mV/cm to 50 V/ch. Hor Amp 10 Hz to 100 kHz. $150 or best offer. R Medson, Kilsyth, Vic phone 725.4415.

ROTEL turntable RP2500 servo belt drive, variable speed, two years old $100. Contact Mr Jenkins (02) 47.0319 BH or (02) 456.2075 (home).

US made, 28-30 MHz high gain low noise Oscar preamplifier. 12 VDC. Complete with circuit diagram. New $35. W Treloar. Phone (02) 239.5267 office hours.

TANDY TRS-80 computer level 2 with 16 K memory, video monitor, cassette recorder, power supply with all manuals. $1100 ONO. Adrian Smith (02) 47.0319 bus hours.

MEK6800 D2, Minibug III monitor, VDU interface, extra RAM. $200. EA low cost VDU, in case; working $200. D Johnson 2/13A Aberfeldy Ave, Edwardstown, 5039.

ICs 3 off 6800 CPU's $9.50 ea; 4 off 8212 I/O $2 ea, Ken Herbst, 73 Eric St, Goodna, 4300. Phone (07) 288.2757.

MORROW microcomputer front panel/CPU board, S100 assembled and fully socketed $180. R Pfotenhauer, PO Box 81, Lyneham 2602.

MAKE friends with your tape recorder - join ATRA the Australian Tapespondance Club, members in all states and overseas. SAE to ATRA, Box 970 GPO, Adelaide 5001.

FOR sale: 100 watt guitar head, new preamp, driver and output stages. Ex cond: must sell $90 ONO. After hours or w/ends only (02) 529.5997.

KT9500, DG640 VDU, P/S, cassette interface keyboard, 2650 M/B, 2K RAM, cabinet and documentation. Constructed but not working. Worth over $650, yours for $550 ONO. Apply 8 Adams St, Portland, Vic 3305.

ICOM IC22A 2m FM transceiver. Repeaters 2 to 8 Simplex 37-40-50-53 $175 Kraco AM/SSB $95, L Whitbourn, 24 Boronia Drive, O'Connor, ACT. Canberra (062) 47.3661 AH, 49.2695 BH.

SOUND Mixer - Sony MX20. 8 inputs/ 4 outputs with balanced, XL connections. 2 panpots. Equalization. New, tested but never used. Current RRP is over $1800. Best offer. (02) 437.6681.

FOR sale: 16 bit mini computer with circuit diagrams and instruction manual. 16 Kb Core Store Memory. System housed in 19 inch rack and is complete and operational. Best offer over $100. Phone bus hours 938.2333.

SELL: National Panasonic Communications Receiver, model DR48-MW/FM/SW/1.6–31 MHz SSB. New 4 month old $450. Zagora, 10 Norfolk St, Moonee Ponds 3039. Phone (03) 37.3690.

DESPERATE for a sale. EA Miniscamp with case, P/S, documentation and numerous programs. $65. J Muir, 32 Clarke St, Bendigo, Vic 3550.

TELETYPE ASR 33 new condition complete with stand, current loop interface, paper tape reader and punch $550, phone (02) 419.2839.

WOULD like correspond with anyone involved interested computer-assisted-reading instruction Australia exchange ideas, information. Have programs. George Parry, PO Box 280, Nelson Bay, NSW 2315.

PHONOGRAPH and early record collectors – join The Phonograph Society of Australia. Branches in both NSW and Vic. Information available – Vic: 27 Doveton Ave, Doveton, 3177; NSW: PO Box 36, Fairy Meadow 2519.

MELBOURNE Hi-Fi and Tape Friends, the Recording Society of Australia meets monthly for demonstrations, lectures and live-recordings. You are invited to come along. For syllabus and information write or phone: Harry Jay, 5 Iona Street, Black Rock, 3193, phone (03) 99.4185 (AH).

WANTED circuit diagram or service manual for Halicrafters SR 150 transceiver. T Salvemini, 28 Westmoreland Road, Grange, SA 5022 or phone (08) 356.2151 will pay.

PLEASE USE BLOCK LETTERS			

MICROCON PROGRAMMABLE CONTROLLER

ANOTHER GREAT ETI OFFER

$199 (incl. tax, plus $2.50 p&p)

Many of you will have seen our review of the MicroCon programmable controller. Our reviewer said things like:

"Probably the best of the 'teach-yourself' systems"

"A sensible way to get into machine code programming"

"The fact that it's simple to operate doesn't mean it's not powerful"

Every week, we get enquiries from people who want to get into computing the easiest and cheapest way possible. For this reason, we have arranged this offer so that ETI readers can have the MicroCon, complete with full instruction manual, for only $199 (plus $2.50 postage).

It requires only a fairly simple power supply (-12V @ 100 mA, +12V @ 100 mA and 5V @ 1 A) to be fully operational and is simple to use and expand.

NOTE: This offer is made by MicroPro and ETI is acting as a clearing house for orders only. Cheques should be made payable to 'MicroCon Offer' and sent, together with the order form or a copy thereof, to 'MicroCon Offer', ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. We will then process your order and send it on to MicroPro, who will send you the goods. Please allow at least three weeks for processing and mailing. Offer closes 15th August and is open to Australian residents only.

OFFER CLOSES 15th AUGUST, 1979

Name .....

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I enclose a cheque/money order for $201.50, payable to 'MicroCon Offer'.

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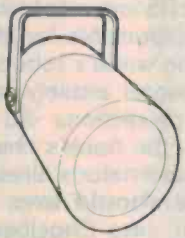

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DREGS

Doodles, Ramblings, Exclamations, Gee-whiz & Stuff like that

This is a true story.

A housewife walked into an electrical store in the UK (where they have fuses in their mains plugs) and complained about the quality of the mains fuses that the store supplied.

She said that they kept blowing.

She told the shopkeeper that **all five of the fuses in the packet she had bought were faulty** as, when she fitted them into the plug of her electric blanket, none of them lasted more than a fraction of a second. Taking her neighbour's advice, she used a piece of wire instead. Irately, she told the shopkeeper that **the wire held out even when the electric blanket caught fire.** Why should she pay so much for fuses when a length of wire performed better?

'1984' — closer than you think

George Orwell's classic novel, 1984, included 137 uncomfortably nasty predictions — of which **100 have come true already**, according to Joe Engelberger, president of Unimation. The giant US industrial robot manufacturer is responsible for about 30 percent of the world's robots.

Engelberger astutely points out that Orwell's predictions did not include robots — the book's characters were human automatons already.

People should love robots, not fear them, says Engelberger and engineers should manufacture more so that people do not become machines.

All this came out while Engelberger was castigating British industrialists during a visit to the UK back in April.

"Management is more worried about robots than unions — all the dirty talk is in the executive suites," he said. Pointing out that robots are in everybody's best interest, he said that **they save people having to do dirty and dangerous jobs.**

Sensible stuff, but one still feels that there are still some jobs better trusted to one's own hand.

Non-metric office to rent

Who wants 6000 sq feet of modern office space at Rushcutters Bay? Beaut carpet, fully air-conditioned, PABX, light and airy etc, under-cover car space, great for an advertising agency, art-production, exporter/importer and all of this is going for the incredibly low rental of $3.25 per sq foot.

Why don't we want the space ourselves? It's a long story, but anyway, we were planning to house several new magazines there but shifted them to Aust. Consolidated Press in the city instead. Which leaves us with 6000 sq feet of modern office space at Rushcutters Bay. Beaut carpet, fully air-conditioned, PABX, (I think we've been through all this already).

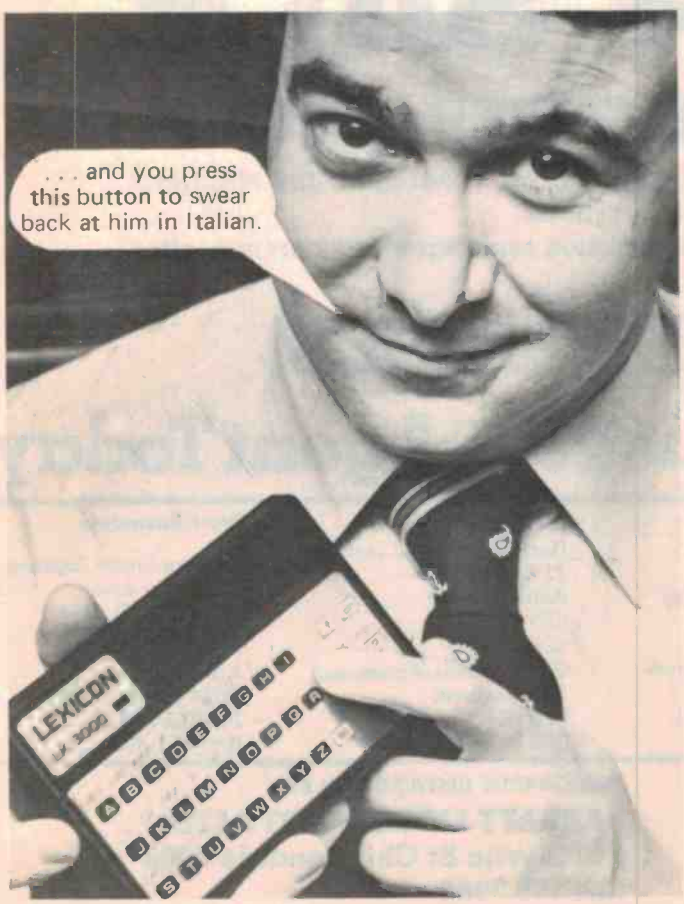
Speak to our Miss Virginia Grady on 33-4282; she just may be able to fulfil that need in your life . . .

World's third industrial revolution

"Automation will bring the world's second industrial revolution" cried the earnest sociologists and engineers of forty years ago.

"Microelectronics (read microprocessors) will bring the world's next industrial revolution" is the cry of earnest electronics engineers and sociologists these days, leastwise in Britain and America.

Don't hold your breath.



Our thanks to Lexicon for this month's picture. It shows Mr 'Tyki' Kyriakides with his invention, the LK-3000 translator.

REAL HI-FI

AND IT'S ALL IN OUR COLOUR CATALOGUE

The truth is, JVC have always produced real hi-fi components and we believe this current range represents JVC's finest range ever. Here are some real innovations and performance features to whet your appetite:— Quartz locked turntables with uncanny accuracy; Receivers/Amplifiers, some with built-in SEA Graphic Equaliser and DC, class A/B amplification; Cassette deck with JVC automatic computerised tape tuning; Computer designed speaker systems; Separate but matching JVC components designed to compliment one another, perfectly. And all this real hi-fi know-how is yours ...merely for the asking.

If you think they look different, wait till you've heard them!

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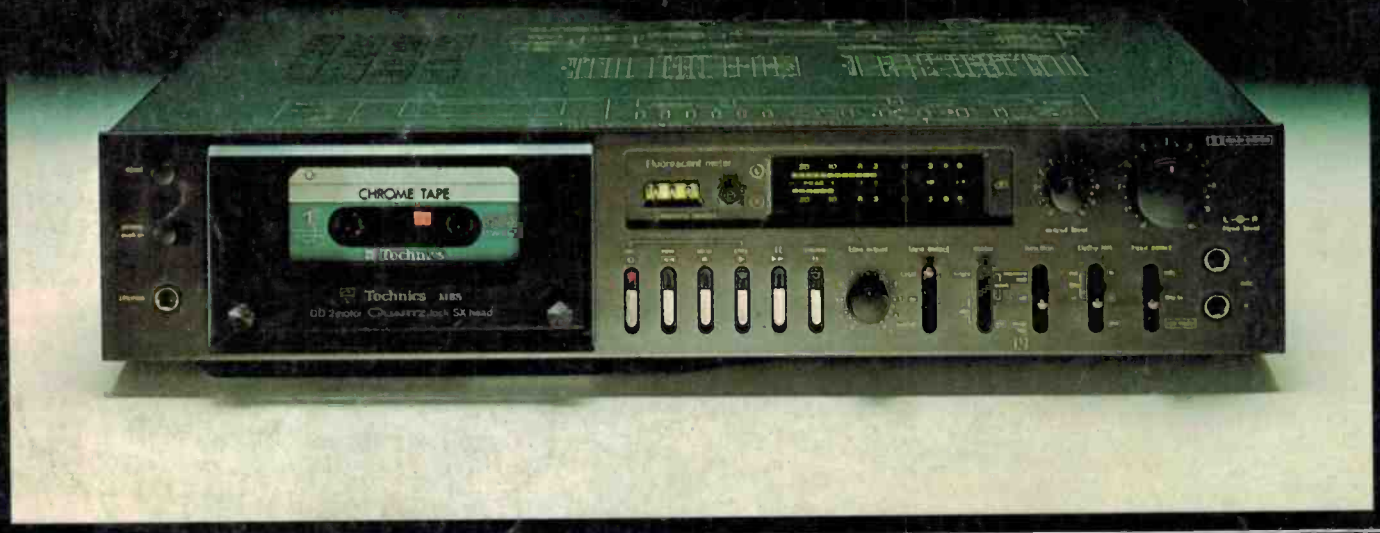

Yet another first for Technics.

Technics have been the innovators of so many outstanding new concepts in audio technology. And they have done it again: the RS-M85, the world's first quartz locked direct-drive flat type cassette deck.

It has so many design features – like the rugged two-motor tape drive including a direct-drive capstan motor; feather-touch IC logic controls; radically new style peak/VU meters; and an incredible wow and flutter rating of just 0.035% (WRMS).

The bar graph FL (fluorescent) level meters are the most novel features of the RS-M85. Electronically controlled, so response time is instantaneous, these make conventional needle-type meters obsolete. Highly accurate, the FL meters give direct parallel readout for instant comparison between channels.

The capstan drive has a quartz-locked servo system that keeps tape speed constant. The record/playback head is laminated with Sendust, a recently developed material which is exceptionally hard and durable. Wide frequency response and negligible distortion contribute to the high quality in sound reproduction.

The RS-M85 is just one of the exciting models from the range of Technics cassette decks. See them for yourself at your dealer.

Technics
hi-fi

For a National Technics catalogue please write to:
National Technics Advisory Service, P.O. Box 278, Kensington, N.S.W. 2033

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