$2.15* NZ $2.50
NOV 1982

eti
ELECTRONICS TODAY INTERNATIONAL

SERIES 5000
GRAPHIC EQUALISER

5 CAR COMPUTERS TO WIN!

HI-FI:
Quad electrostatic speakers reviewed

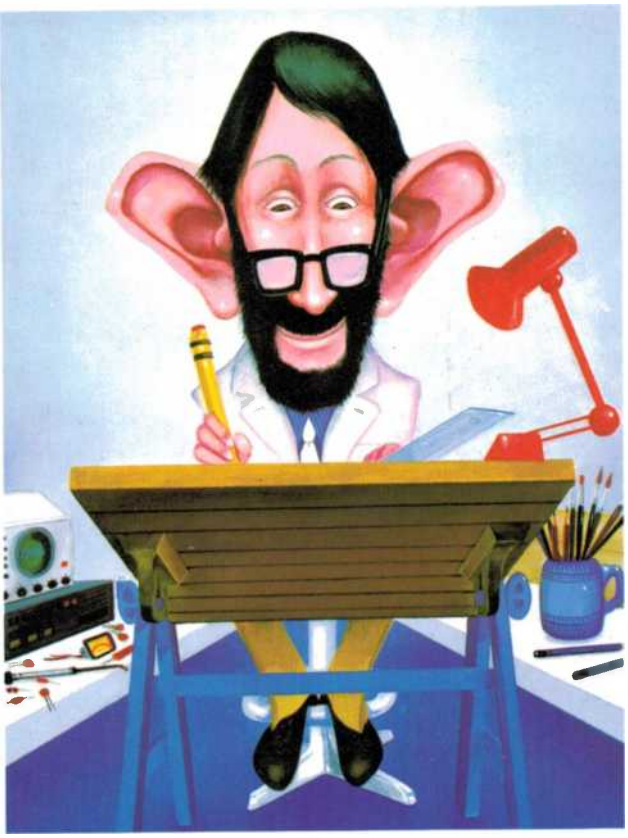
CIRCUIT FILE: Voltage and window comparators

Six super programs for the '660 computer

Digital car alarm system

Winners of our Grand Hi-Fi Contest announced

The average hi-fi designer versus the human ear.



The human ear forms part of a sound receiving system that outperforms the best audio equipment known to science.

Capable of interpreting a dynamic range of 120db or 10 octaves, it has double the capability of any man made electronic equipment.

The ear can discern direction, coloration and musical within a complex detail rendition of a 50 piece orchestra in a manner no electronic equip ment is able to do.

It is, in short, a sophisticated piece of equipment that should represent the most stimulating challenge to any designer of audio equipment.

Unfortunately it's a challenge that's largely ignored. Which is why in most stereo

systems handling power and volume are substituted for subtlety and frequency response. Vector Research however is one of the few exceptions. Developed by a team of highly experienced audio engineers who were tired of comprom ise, Vector Research represents a new standard in high fidelity excellence.

Discussing the Vector VRX 9000, *Stereo Review* states "The receiver surpassed virtually every one of its performance specific ations... it sounds as good as it looks, which is saying a lot..."

High Fidelity states "a receiver with such sophisticated per formance and functions demands attention." *Popular Electronics* on the Vector VCX 600 cassette deck, "Lower Flutter readings than those of the VCX 600 are hard to find... while not cheap, it affords excellent value." *Hi-Fi Buyer's Review* sums up.

"Vector Research is a newcomer to the audio scene, but if the VCX 600 is any guide, this company should be very successful."

If then you are an audiophile whose interest goes beyond famous names and shiny knobs then you owe it to yourself to learn more about Vector Research.

Dear V.R., In my book, beauty is in the ear of the beholder. Send me the test reports and the name of my nearest stockist.

Name _____

Address _____

_____ Postcode _____

Keio International Pty. Ltd.
198 Normanby Road, South Melbourne 3205.
Telephone: (03) 64 3546.

KO 404 ETI

Vector Research. A fraction better than excellent.

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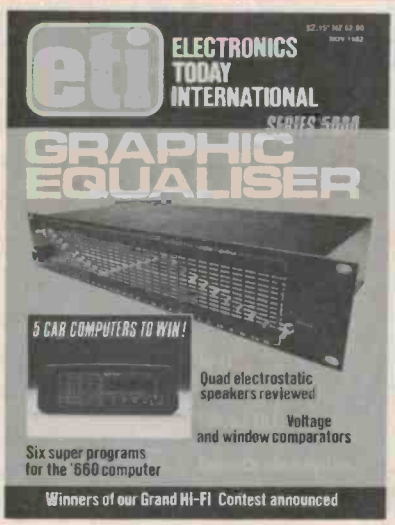

This month's cover features David Tilbrook's Series 5000 Graphic Equaliser project and the Sparkrite 'Voyager' car computer — five of which can be won in our super contest.

Cover design: All White

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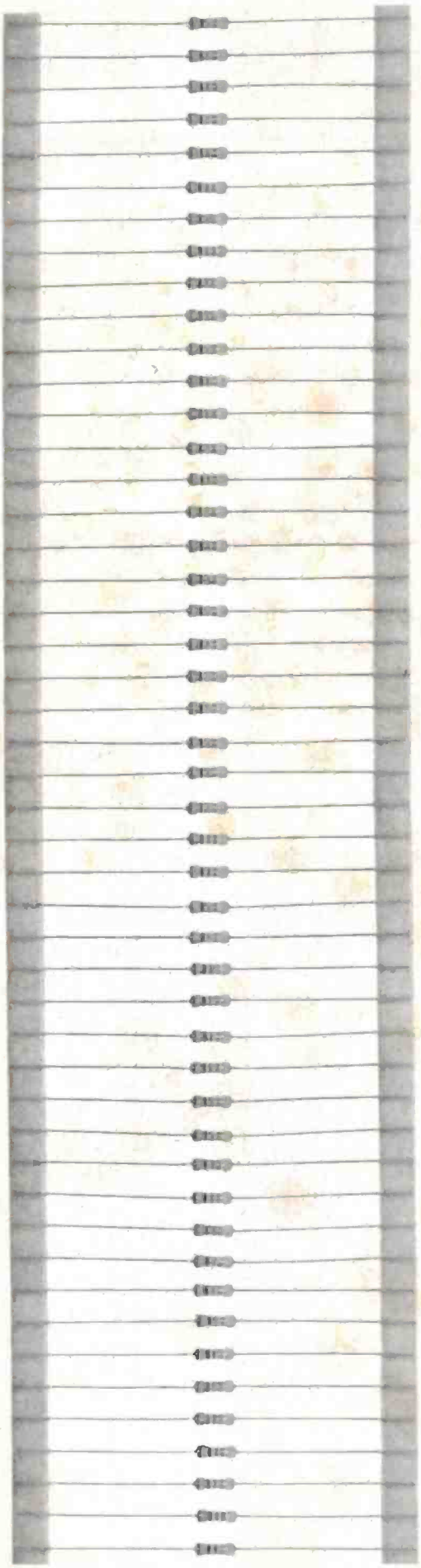

Metal Film technology at carbon prices

SFR

Standard Film Resistors

PHILIPS

At last. A range of metal film resistors with improved performance over carbon film types, at the low prices you'd expect to pay for carbon film resistors!

We're talking about Philips' new SFR25 range of 5% tolerance — ¼W metal film resistors. With a quality and price made possible only by advancements in metal film technology and the massive scale of our automated manufacture.

SFR25's feature a 'clean lead' finish and are constructed to the same high standard as the Company's 'MR' series. Resistance coverage from 1Ω to 1MΩ (E24 values) with a tolerance of ±5% is assured. Maximum power dissipation is 0.33W at 70°C ambient.

They have a noise figure of less than 0.1μV/V (a tenth of the carbon film noise figure) and a temperature coefficient of less than 250ppm/°C. Even more important, neither parameter shows degradation with increasing ohmic value. These improvements stem primarily from the homogeneity and stability of the resistive deposition.

PHILIPS

Electronic Components and Materials

So there you have it. Another quality product, ahead of its time, from Philips.

For further information phone:
Philips Electronic Components and Materials,
P.O. Box 50, Lane Cove, 2066. Phone: **Sydney** 427 0888,
Melbourne 542 3333, **Adelaide** 243 0155, **Brisbane** 44 0191
Perth 277 4199.

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* Recommended retail price only

comment

Roger Harrison
Editor

services

Mail enquiries: There is no charge for replies, but a foolscap-sized, stamped addressed envelope must be enclosed. Queries relating to projects can only be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are other than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.

Phone enquiries: We can only answer readers' technical enquiries by telephone after 4.30 pm. The number to ring is: **(02)33-5669.**
In enquiring by telephone about back issues or photostats, please ring **(02)268-9015.**

The publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

next month

TRAIN CONTROLLER PROJECT

This dual-circuit unit provides throttle and brake controls that work in the same manner as on a 'real' train. The circuitry gives the driver the feel of inertia as well as loading. It can run anything from micro-gauge to twin '0' gauge engines and it's low in cost. More a 'railway controller' than a simple model train controller!

30 V/1 A PROTECTED POWER SUPPLY PROJECT

No electronic hobbyist's bench should be without one! This fully-protected supply is simple to build, low in cost and features both voltage and current metering.

POLYPHONIC TOUCH ORGAN PROJECT

Featuring a 'touch' sensor keyboard on the unit's printed circuit board, fully polyphonic capability, two-octave range (F below middle — C to F above), two 'voices' and loudspeaker output, this battery or plugpack operated organ is low in cost and simple to build. The circuitry has been specially designed so that the keyboard is not plagued by finger moisture or humidity problems.

WHAT BATTERY?

The widespread availability of low cost CMOS and other devices of staggering complexity and low power demand has led to increasing miniaturisation of a wide variety of electronic equipment. This, in turn, has led to a resurgence in battery operated devices. At the same time, advances in technology have led to some remarkable developments in batteries today. Which type of battery is best, dry cells, NiCads or alkalines? Philip Clark discusses their merits and applications.

THE MICROBEE REVIEWED

The Microbee, from Applied Technology, lays claim to being Australia's fastest selling microcomputer. This multiple review examines the microcomputer industry's hottest property and throws up some surprising results.

CHIP-8 PROGRAMMING HINTS AND TIPS FOR ETI-660 OWNERS

This article covers a host of useful hints, tips and routines for owners of the ETI-660 Learners' Microcomputer but it should be of interest to any CHIP-8 programmer.

THE VECTOR RESEARCH VCX500 CASSETTE DECK

Vector Research is a relatively new name on the Australian hi-fi market. This cassette deck has all the makings of a first class machine with an outstanding appearance, well made electronics, solid construction and performance claims which ought to place the unit in the 'top shelf' bracket.

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

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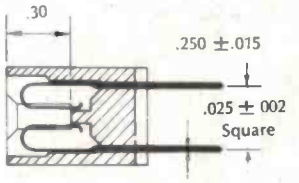
CARLINGFORD 872 4422

BOTTOM-OF-THE-HARBOR

WE'VE DREDGED MORE GREAT BARGAINS!!

S 100 Socket Sensation *



Quantities strictly limited.

ONLY $4.95 each
10+ $4.45 each

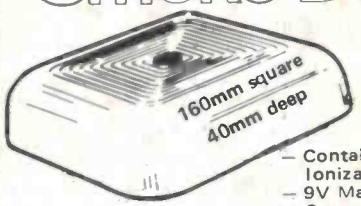
A socket of this quality is normally around $12. Not this bottom of the harbor special! We dealt these from the mighty Yarral

We have secured a bulk-buy of HIGH QUALITY S-100 card edge connectors. Remember! the S-100 Standard is a "queer" 0.125" pitch. Each connector features gold plated bifurcated contacts with wire wrap pins in a Diallyl Phthalate moulded body. If you want to solder into a PCB this is O.K., simply cut the pins down to suit.

final runout of GE Consumer Products

WE HAVE SOLD OVER 1000 OF EACH OF THESE ITEMS. ONLY A FEW ARE LEFT NOW.
WHY NOT BUY ONE FOR YOUR MUM?

Smoke Detector



- Contains Americium 241 Ionization Chamber
- 9V Mallory Duracell included
- Contains very loud solid state buzzer
- 12 month factory warranty.

FROM $12.50

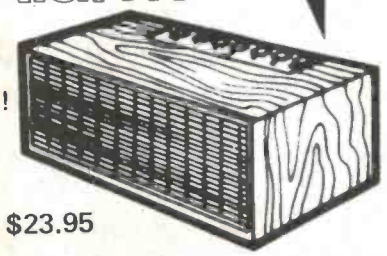
One of the greatest consumer flops of the last decade was the Ionization Chamber Smoke Detector. Even though it is a brilliant product (reliable compact, easy installation, fail-safe etc) it just did not sell. Human nature being what it is finds safety-oriented products just not worth the investment. We all know that accidents and fires never happen to US!! As smoke is the greatest killer in a fire, the market research gurus thought that such a product would have a wide appeal. When they were $49.50 no-one wanted them. The price fell to a very reasonable $29.50 and still they stayed on the shelf. We have now been instructed to clear them for less than ½ of $29.50,

QUANTITY PRICES
1-$14.50: 2-5 $13.50ea: 6-10 $13.00ea: 10 up $12.50ea

Burglar Alarm

GENERAL ELECTRIC

BURGLAR ALARM SLASHED!!!
HUGE SCOOP PURCHASE –
ONCE SOLD FOR OVER $100



FROM $23.95

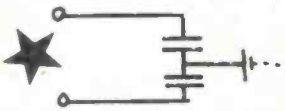
Amazingly low price for a full feature ultrasonic proximity/burglar alarm. + Completely self contained + 12 month manufacturer guarantee + Instant or delayed alarm + Handsome imitation woodgrain + Cabinet measures 180(w)x85(h)x100(d)mm + Programmable multi-code disable switch + Single 9V Alkaline battery* lasts one year + unit beeps when battery gets low + Contains receiver element designed for greater sensitivity without false triggering + Uses state-of-the-art LSI circuitry + Worth the money in parts alone + Comprehensive 24 page manual included + Comes complete with 4 window deterrent stickers + Absolutely no installation needed * Battery extra.

1-$29.50: 2-5 $25ea: 6-10 $24.50ea: 10up $23.95ea

Buy one for Mum for Christmas. . .

MainsWidget

Nifty little 2 x 0.1uF 250V ceramic which schematically looks like this:



PACK OF 4
$1.00

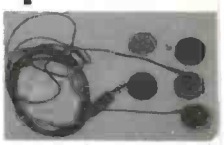
Ideal to mount across the mains chocolate block with the centre terminal going to earth. Helps prevent mains interference.
Found floating in the sea off Bondi!!

rotary mains switch 99¢

– A 20 year throwback.
These days all we do is flick our toggles. In the past a quick twist of the knob turned things on.
You can relive this experience with our DPST mains switch. Convenient bushing mount with ¼" shaft. Ideal replacements. Genuine 240VAC 3 amp rated.

micro headphones

AS REVIEWED
SEPT EA Page 45
FEATURES:
MODEL MT310
Samarium Cobalt magnets
102dB/mW
Weight 15 grams
Response: 50Hz-20kHz
Impedance: 32 ohms



Unit fits into the cusp of your ear. Can be worn under motorcycle helmets. Unbelievably clean sound.

ONLY $19.50

-1 Edgeconnectors * *

1-9 $3.50 ea
10+ $2.95 ea

Collectors special. Made by UECL of England. Sold in quantity for over $10 each. Each Diallyl Phthalate moulded connector contains 170 heavily gold plated bifurcated contacts. (2x 85 way). Each contact is solder eyelet terminated. The connector is 217mm long but you can cut it down to any length you wish. Outstanding quality and they did not get wet after laying at the bottom of the Swan river.

X'TAL FILTERS

10,965MHz from $3.75

Narrow band-pass type – Ideal for communications equipment. High quality multi-stage unit suitable for precision I.F. work. Incredible value: Manufacturers distress stock. YOU SAVE.
ONLY $5.00 each (1-9)
worth 4 times this amount.
Oscillator crystals to suit;
10.240MHz or 10.695MHz
ONLY $2.50 each
10 up on both – less 25%

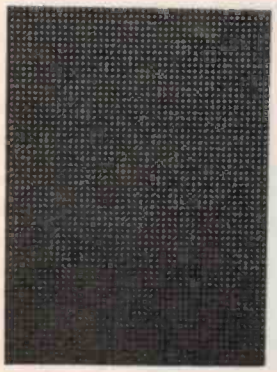
BARGAINS

BIG MAL IS CALLING A ROYAL COMMISSION!!

new store now open
CARLINGFORD 872 4422

fibreglass matrix board

Not flimsy Bakelite junk. You will be able to use this board over and over again without deterioration. Measuring a massive 115 x 164mm and contains 2816 x 1.0mm diameter holes. Worth over $8 but our special for November only $2.95 each.
Source: Brisbane River.



$2.95

NOVEMBER ONLY

JUMBO SPEAKER CABLE

Now you can have super-quality cable without breaking the bank! Each conductor contains a MASSIVE 259 strands of 0.12mm wire!! It could carry 30 amps! Great for Hi Fi or high power amps.

Only $2.50/m
100m $2.00/m

Motorola Piezo Horns ~ back in stock

Model KSN 1005A
50 WATT P.A.
ONLY $17.00 EACH
Model KSN 1025A
100 WATT P.A.
ONLY $26.00 EACH

buy now

top value

Model KSN 1038A
50 WATT HI-FI/P.A.
ONLY $17.00 EACH
Model KSN 1039A
50 WATT HI-FI
ONLY $13.00 EACH

Electric Eels??

No. One metre long 7.5A appliance cords. Each (black) cord has a moulded 3 pin approved mains plug on the end. Why so cheap? Well they ARE only a metre long. But consider this:
– Any benchtop piece of equipment only needs a short mains cord. A long mains cord gets in the way and is positively dangerous!!
– Ideal for power supplies or any bench or rack mounted audio or test equipment.
We have HEAPS. But we have said that before.
Buy in bulk and save. We doubt whether you will ever see mains cords this cheap again.

1-9pcs 69 cents each
10-24pcs 50 cents each
25-99pcs 45 cents each
100 up 39 cents each

GENUINE APPROVED cords from the Parramatta River

Walkie Talkies Sensational price for X'tal controlled units

Sensational price for CRYSTAL CONTROLLED UNITS!! Not your super-regen rubbish!!
Don't be fooled! These units actually do work – well in fact. Will transmit voice or morse over fairly respectable distance (over a mile in ideal conditions).
Fitted with proper transmit/receive crystal controlled superhet circuitry. DO NOT COMPARE with far inferior units that may only be a dollar or so cheaper anyway and almost always are a disappointment.
At only $12.50 each, how could you go wrong?
Place of origin: Botany Bay

only $12.50

Proximity Switch

1/2 price

$14.75

Shown this time the right way around. In August we advertised this product and the picture showed the 'bum' end facing you. It was sort of like having a sump-eye-view of a Ferrari – you didn't see the nice part.
They didn't sell in any case and we're not sure whether it was the photo or not.
So this month we've HALVED the price and showing it to you the right way round.
FEATURES: 12V powered unit. When metal object passes near to target face, output swings low. Ideal for Roller shutter doors, Burglar alarms or counting metal objects passing by.
Were $29.50 in August – NOW $14.75 and they have not suffered from their dunking in the Derwent!!

Factory Seconds ~

YOU COME FIRST...

We have secured a smallish quantity of 5 pin DIN to 4 RCA audio leads that are on the wrong side of the Q.C. inspection. Shame though. Because the DIN plug is ALL METAL and GOLD plated. So are the RCA plugs. Problem is that the gold plating is bubbling on the gold DIN plug. (As far as we can see the 4 gold RCA's are PERFECT.)
An ordinary NICKEL PLATED lead set like this costs around $4.75. The gold versions normally are around $9.95. You can have one of these for $3.95 and that's better than Nickel any day! Worth it for the 4 x RCA's alone!

value $3.95

NUMERIC KEYPAD ELASTOMERIC

Get in quick!! Only 35 available. High quality 12 button keypad. 0-9 with 2 extra push-buttons. As seen on U.S. style telephones. Measures 76x57x10mm approximately. $4.95

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MINIMUM MAIL ORDER $5.00

POST AND PACKING CHARGES
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

NEW SHOP HOURS
Mon-Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Walter Cronkite to address cable and subscription TV symposium

All aspects of introducing cable and subscription television to Australia are to be discussed at a major symposium. Former CBS anchorman, Walter Cronkite, will address the symposium as the keynote speaker.

The symposium, sponsored by the recently formed Australian Cable and Subscription Communications Association, will be held at the Lakeside Hotel in Canberra on November 8 and 9.

The Executive Director of ACASCA, Mr. Dick Rowe, said Mr. Cronkite had agreed to travel to Australia especially to address the symposium.

Other speakers would include:

- Lord Hunt of Tanworth, who heads a crucial British Government committee inquiring into a recommendation from the Cabinet Information Technology Panel that cable services in the United Kingdom be immediately expanded
- The Minister for Communications, the Hon. N.A. Brown
- The Chairman of the Australian Broadcasting Tribunal, Mr. David Jones, who headed the inquiry which in August recommended that cable and subscription television be introduced to Australia as soon as possible
- Mr. David Jull, the Chairman of the Government Backbench committee on communications.

Mr. Rowe said further invitations to top level speakers were currently in progress.

"In structuring the programme, we have been conscious of the need for issues to be discussed as broadly as possible because cable and subscription television will make wide ranging changes in Australia's media, the business community, education and various arts. We do not believe the nature of these changes is adequately understood by all sectors of the community which will benefit from them," said Mr. Rowe.

"As well as being ACASCA's first convention, the symposium is also the first public forum at which all the issues will be covered."

Mr. Rowe said strong interest in the event had already been expressed by business leaders, politicians, consumer groups, sociologists, educationists, the entertainment and media industries, academics, investors, electronics companies and industrial relations experts.

For further information please contact Mr. Dick Rowe, Richard J. Rowe and Associates, 2/225 Miller St, North Sydney 2060. P.O. Box 268, Spit Junction NSW 2088. (02)438-4814, 438-4815.

Powerful guarantee

Scientific Electronics are giving a five year guarantee on all their power supplies.

This covers repairs on a no-charge basis (other than freight) on all power supplies manufactured by Scientific Electronics.

For further information contact Mr. Peter Lloyd, Scientific Electronics, 6 Holloway Drive, Bayswater Vic. 3153. (03)762-5777.

New faces at ETI

Jennifer Whyte, Assistant Editor

Jennifer grew up on a farm in Western Australia. She received a Chemistry set for Christmas at age 12 and proceeded to experiment in the family kitchen. The production of some malodorous concoctions had her banished to the fruit packing shed. There she threw the results of her 'experiments' out the window into the paddock. This brought about a series of drastic events — killing the grass, giving the chooks constipation and the cows acidic milk. That's when she gave up chemistry. Playing with a wind-up gramophone and an old crystal radio, her thoughts naturally turned to electronics.

Growing up in the great outdoors provided a never-ending fund of questions, but not all the answers were available. Jennifer found out about sowing seeds, roosters and hens and artificial insemination and decided to study science.

Attending a girls-only boarding school in Perth taught her about living behind bars, falling in love with your science teacher (the only male brave enough to enter the school grounds) and going to church twice on Sundays.

Undaunted by this cloistered experience, Jennifer tackled university next, doing a Bachelor of Applied Science at the Western Australian Institute of Technology, majoring in Physics, men and all-night parties. Electronics was a major unit in the course and her father still uses the arc welder she built as a project. Boolean algebra and flip-flops appealed but she never did appreciate Schrodinger's equation explaining the behaviour of an electron in a one-dimensional box (too much like girls-only boarding school). She says she was spellbound by Einstein's theories, but that could have been a hangover.

While studying, she spent four months at the Carnarvon NASA tracking station, tracking satellites and kangaroos, doing some computer programming and sailing.

Jennifer's first job was teaching maths at a girls-only school, but that was 'a bit too close to home'. After a year she joined the Medical Physics department at Royal Perth Hospital where she stayed for three years calibrating linear accelerators, cobalt machines and attending operations where radioactive sealed sources were implanted. Part time she studied anatomy, human physiology and oncology. Whilst there she rode a bicycle everywhere and learned Scuba diving.

Caught by the wanderbug, she left the hospital and travelled south-east Asia, India, England and Europe for a year. Returning to Australia, Jennifer settled in Sydney where she spent the past two years working for the Radiation Branch of the Health Commission. Jennifer collected samples from all over NSW for radiation analysis, wrote several articles for Hobby Electronics and started producing a monthly newsletter for a Scuba diving club. As she wanted to write and produce a magazine, Jennifer leapt at the chance to join ETI. Whilst she will be involved with the whole magazine, Jennifer will concentrate on the Electronic Lifestyle section.

Star sign: Aries.

Beliefs: herself, magic, sea nymphs and ESP.

Likes: circuits that work, rain forests, the sun, sailing, Scuba diving, elephants, music and dancing.

Dislikes: eating meat, bagpipes, junk food, beer guts, hi-fi salesmen, old blue Mazdas, poseurs, Sydney traffic and wearing shoes.

Quote: "Einstein said, 'everything should be made as simple as possible', so why complicate things?"

(Next month: Geoff Nicholls, engineer extraordinaire. Well, engineer anyway.)

World's fastest IC

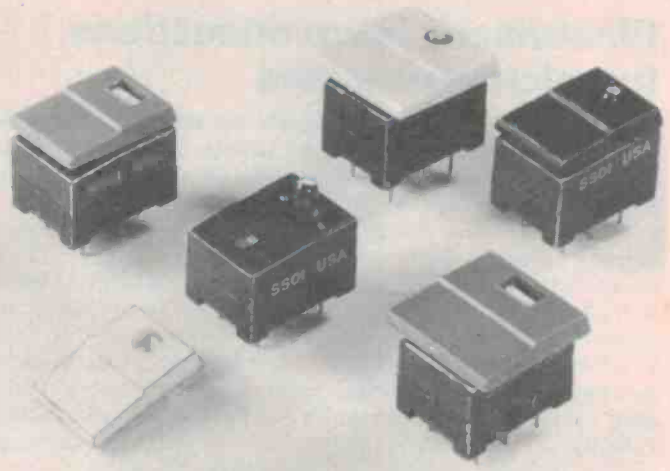
Workers at Thomson-CSF's Central Research Laboratory in France claim they have developed the world's fastest IC for room temperature (25°C) operation.

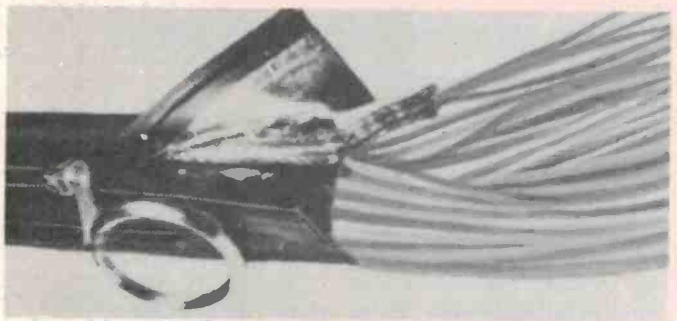
It is an eleven-stage ring oscillator with a gate delay time of 22 picoseconds (10^{-12} s)!

The device has a GaAlAs/GaAs structure which confines electrons at its heterojunctions. It was fabricated by a molecular beam epitaxial process capable of controlling crystal growth to 0.4 nm — which is about the thickness of a single atomic layer. Electron beam lithography was used to define the 0.6 um gate lengths.

Thomson-CSF officials believe that their new technology will lead to shorter gate delay times than those currently achieved with circuits operating at very low temperatures. Indeed, circuits built with this new technology are expected to compete with Josephson effect devices for speed of operation.

Brian Dance





'Zippertubing'

Zippertubing offers a complete line of flexible, zip-on protective jacketing to bundle, insulate, protect, waterproof, assemble, shield, enclose, mark and identify wires, cables and other products.

Zippertubing is made from a wide variety of the latest plastic and allied materials designed to meet specific temperatures (high or low), abrasion, insulation, shielding (RFI, EMI, MF and HF system), chemical resistance, grounded or other special requirements.

Zippertubing features simple wrap-around quick-zip characteristics, and provides faster, easier and less expensive protection and covering than any other comparable method, the makers claim.

The closure device is a plastic zipper-track designed to give maximum flexibility without permanent sealing. It allows reworkability, modifications repairs or additions by simply unzipping and rezipping for the entire life of the installation, or the zipper-track can be sealed permanently with ZT sealer. This chemically fuses the track and provides water-tight protection.

Zippertubing is available in various colours for colour coding, and has the additional advantage of harmonising the installations to equipment or plant. Zippertubing can also be supplied in many sizes and special configurations to meet specific needs.

Contact Adimex, 80 Jeffrey Drive, Ringwood Vic. 3134. (03)690-3233.

Solid state pushbutton switches

C & K Electronics has introduced a new concept in logic-compatible pushbutton switches in their solid state pushbutton series 'SS01'

The products offers self-contained electronics, logic-compatible circuit, multi-mode operation (user-selectable — momentary or maintained), bounce-free outputs, wide supply voltage range 3-16 V complementary outputs — 8 mA min. 'source' — 20 mA min. 'sink', DIP pin compatible, built-in status LED (internally connected), variety of snap-on cap configurations and eight colours, round or rectangular LED and three colours, plus insert-moulded pc terminals.

The SS01 is a complete electronic pushbutton module featuring a custom-design integrated circuit triggered by mechanical switching contacts. The contact interface is not critical to switch performance. A single jumper change in the external circuit determines the mode of operation — momentary or alternate action.

For further information contact C & K Electronics, 15 Cowper Street, Parramatta NSW 2150. (02)635-0799.

Coline CRO probe kit

An oscilloscope probe kit, manufactured by the UK firm of Coline, is available from Elmeasco.

The probe provides switchable x1 and x10 attenuation, the probe-mounted switch also providing an 'input grounded' position which isolates the incoming signal and grounds the CRO input to permit adjusting the trace baseline.

On the x1 position, Coline claim the probe has a bandwidth of dc to 10 MHz, a 1 M input resistance and an input capacitance of 40 pF (+ CRO input capacitance). Working voltage is quoted as 600 volts (dc and peak ac).

On the x10 position, Coline specify a dc to 100 MHz bandwidth, 3.5 ns risetime, 10 M input resistance and 11.5 pF input capacitance (with 30 pF CRO input capacitance). Compensation range is given as 10-60 pF and working voltage 600 V (dc and ac peak).

The kit includes an insulating tip, sprung hook tip, trimmer tool, IC adaptor, BNC adaptor and a carry pouch. Cable length is 1.5 metres. Cost is $25 plus sales tax.

Enquiries to Elmeasco, P.O. Box 30, Concord NSW 2137. (02)736-2888.

NEWS digest

Elastomeric interconnections for microprocessors

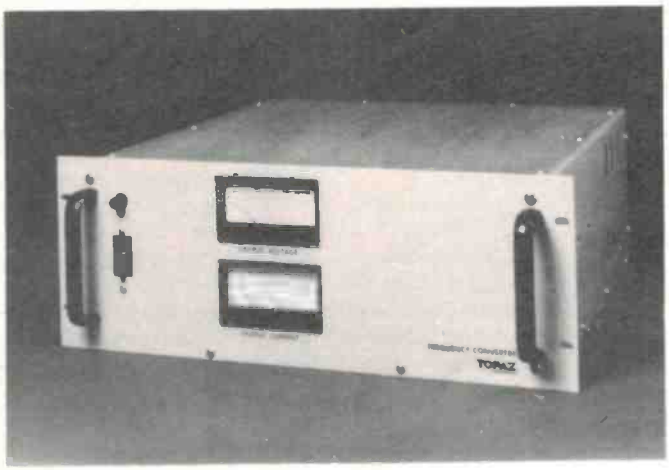
A metal-to-metal elastomeric connector system from Britain permits parallel or perpendicular planes of microprocessor circuitry to be reliably connected by pressure without any form of soldering or bonding.

'Cambiflex' from Cambion Electronic Products uses a non-conducting elastomeric core with parallel lines of gold-plated copper conductors on a thin film. When compressed between two parallel planes, the metallised lines interconnect the circuitry on each plane and provide multiple contacts. The elastomeric core produces the force for a reliable connection and serves as a resilient backing. This increases the contact area when under compression, accommodating surface irregularities and making correct contact resistance, the makers claim.

The 500 nm layer of gold provides an oxide-free surface and the standard circuitry pattern comprises 100 um lines on 0.2 mm centres.

The system is suitable for a wide range of interconnections. It can be used to make a connector for flat, flexible cable, independent of conductor spacing and accepting cable with conductors of 1.27 mm and 2.54 mm pitch.

The Australian agent for Cambion Electronic Products Ltd is Electronic Development Sales Pty Ltd, 92 Chandos Street, St. Leonards NSW 2065.



Frequency conversion with voltage regulation

Topaz International has recently introduced its Series Z frequency converters, designed to convert the frequency of available ac power to a fixed output of 50 Hz, 60 Hz or 400 Hz.

Series Z converters provide frequency stability, output voltage regulation and noise isolation. Standard models reduce input voltage variations as large as +8% or −13% of nominal to an output level of plus or minus 1% of nominal. Direct one-to-one voltage conversion is provided for 115 Vac or 230 Vac inputs.

They are available in power ratings ranging from 200 VA to 2 kVA. All models feature overload and short-circuit protection, automatic/manual restart selection and low harmonic distortion.

For more information contact Warburton Franki Ltd, 372 Eastern Valley Way, Chatswood NSW 2067. (02)407-3261.

High speed A-D converters

RIFA, Australian distributors for Precision Monolithics Inc, recently announced details of the DAC-08 8-bit monolithic digital-to-analogue converter, which provides very high-speed performance at low cost.

The DAC-08 is claimed to achieve 85 ns settling times with very low 'glitching' and at low power consumption.

Monotonic multiplying performance is attained over a 40 : 1 reference and full scale current eliminates the need for full scale trimming in most applications.

Direct interface to all popular logic families with full noise immunity is provided by the high swing, adjustable threshold logic inputs.

High voltage compliance dual-complementary current outputs are provided, increasing versatility and enabling differential operation to effectively double the peak-to-peak output swing.

In many applications, the outputs can be directly converted to voltage without the need for an external op-amp.

Device performance is essentially unchanged over the ±4.5 to ±18 V power supply range, with 33 mW power consumption attainable with ±5 V supplies.

For further information, contact RIFA Pty Ltd, 202 Bell Street, Preston Vic. 3072. (03)480-1300.

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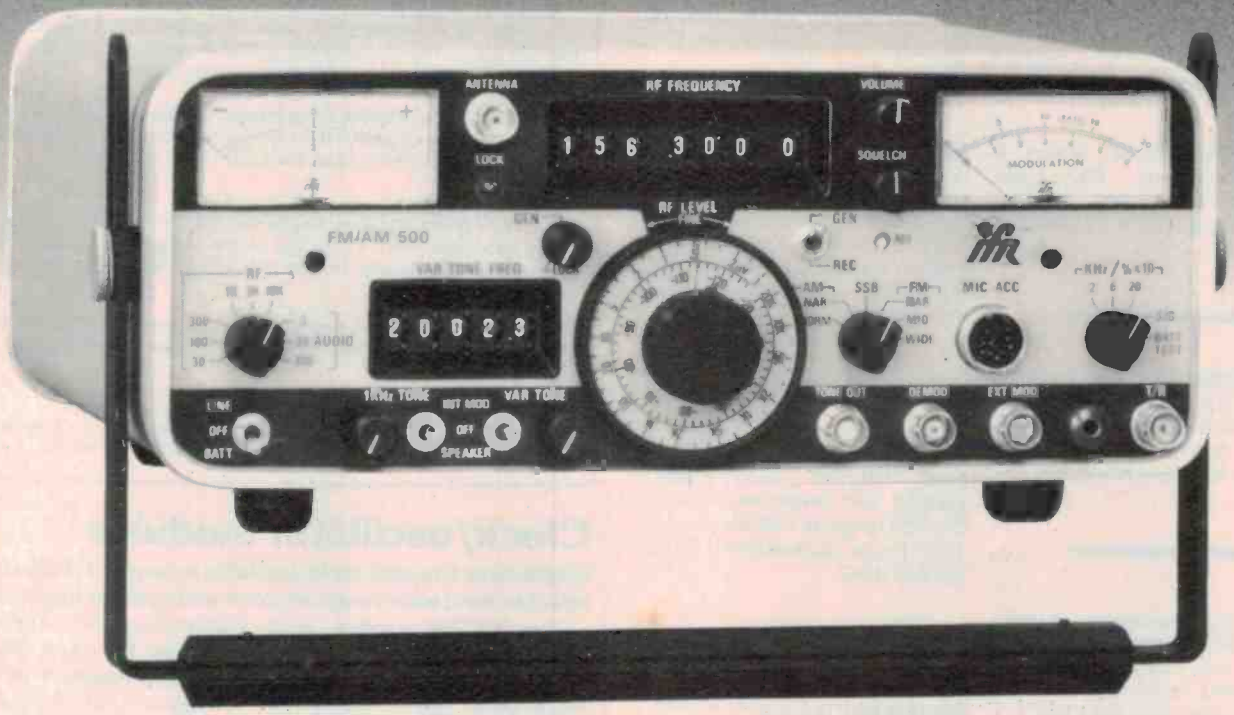

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The same professionalism has been employed to design test equipment for the communication industry. Small, rugged, lightweight and dependable test instruments designed with maximum performance and durability in mind.

The IFR FM/AM-500 is a classic example of IFR professional design engineering.

Size, weight, function and features have been carefully scrutinised at every step in its design to package this superb unit in an enclosure that measures only 29.2 cm W x 12.5 cm H x 36.2 cm A.

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There is absolutely no compromise in its performance, quality, dependability or features.

So if you're looking for a low-cost, uncompromisingly professional Communications Service Monitor, contact your nearest Vicom office.

The IFR FM/AM-500 comes with a two-year warranty and Vicom's unbeatable back-up service.

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- Microphone/accessory input
- Audio demodulator output
- Low price

Optional Features Include:

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NEWS digest

NOTES & ERRATA

ETI-644 Direct-connect modem; October '82. Note that R93 should be rated at 1 W or 1.6 W (e.g: Philips PR37 resistor). Capacitor C5 (in reference channel flip-flop, IC5) can be reduced to 680p to provide a better variation range for RV1 ('adjust output symmetry pot'). Also note that C18 connects to pin 3 of IC12a on the pc board, not pin 2 as shown in the circuit.

In the Parts List, transistors Q4, 6, 8 & 10 were cut off — they are all BC549s. C4 is shown as 1n, but 1n2 on the circuit — it can be either. C19 should be a 2n2 and C21 a 330p. R48 should be 6k8, not 68k. Resistors R53 to R64 are given as 10k in the Parts List and 47k on the circuit. Either is correct.

ETI-686 PPI-based EPROM programmer; October '82. In the power supply circuit at the bottom of page 72 the A-E-N on the 240 Vac input should be A-N-E. Q1 is missing from the Parts List. It is a BC547.

Inertial Navigation Systems; September '82. Pages 16-17 have been transposed with pages 18-19. From page 14, the article reads on to page 18, from page 19 it reads on to page 16, from page 17 it reads on to page 20.

Beating the RS232 Blues; August '82. Figure 3 on page 85 shows the STOP and PARITY bits transposed. The parity bit comes before the stop bit. The associated text is correct.

ETI-469 Percussion synthesiser; April '82. Diodes D1 to D6 were omitted from the Parts List on page 43. They are all 1N914s or 1N4148s.

Clock/oscillator modules

Bright Star Crystals have available a range of clock modules suitable for a wide range of clock and counter applications.

The BSC.BR module is a CMOS baud rate clock that can provide baud rate outputs from 300 to 9600. Stability is given as better than 10 ppm over an operating temperature range of 0 to 60°C. Supply required is between 5 and 12 Vdc.

Also available are three CMOS modules with a stability specification of 1 ppm over 0 — 60°C. Output frequency can be nominated by the user. Maximum frequency depends on supply voltage — 5 MHz at 5 V, 9 MHz at 12 V. Each module contains different counters to suit different applications.

For further details, contact Bright Star Crystals Pty Ltd, 35 Eileen Rd, Clayton Vic. 3169. (03)546-5076.

Industrial angular position sensors

Penny and Giles Potentiometers Ltd have introduced a new angular position sensor designed for use in severe rugged industrial environments.

Two models are available, both with potentiometric outputs. One incorporates the well-known hybrid technology for use in voltage divider modes and the other a wirewound track for use in variable resistance applications.

A wide range of potentiometer track resistances and operating angles is available. The potentiometer tracks are housed in a durable, zinc alloy cast body. The sensor input shaft is manufactured in stainless steel and has a diameter of 9.5 mm. The units have a typical operating life in excess of 100×10^6 cycles.

Penny and Giles are represented in Australia by Paton Electrical Pty Ltd, P.O. Box 363, Ashfield NSW 2131. (02)797-9222.

Mains filters

Hash on the mains can get you into more trouble than attempting to sing the pheasant plucker's song. But IRH can come to the rescue.

They are now stocking two mains filters rated at 250 Vac/3 A, one designed for chassis mounting and having quick-connect terminals, the other designed for pc board mounting. Both are D.O.T. approved.

Applications include general purpose noise filtering in computers, business machines, medical electronics and industrial controls, etc.

The quick-connect type is designated PLF-2V-3RA-501, and is claimed to provide in excess of 30 dB line-to-ground attenuation between 700 kHz and 30 MHz and 20 dB line-to-line attenuation between 800 kHz and 30 MHz.

The pc mount type is designated PLF-2V-3RA-302, and is claimed to provide similar attenuation characteristics between 2 MHz and 30 MHz line-to-line, and 1 MHz to 30 MHz line-to-ground.

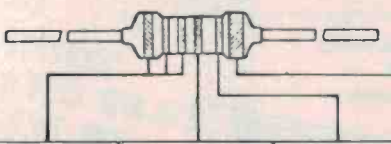
Details from IRH, 53 Garema Circuit, Kingsgrove NSW 2208. (02)750-6444.

Big digit LCD

Fairchild's LTR1340 127 mm LCD has glass-frit seals in place of epoxy. This gives the LTR1340 a projected life of more than 50 000 hours, according to Fairchild.

The LTR1340 operates from 3.5 to 15 V rms with an operating frequency of 32 Hz. Drive current at 5 V rms is typically 50 uA with all segments on. The digit has a 150 ms turn-on and turn-off response time and operates from −25 to +85°C.

It is available in transflective, reflective and transmissive versions from Fairchild Australia Pty Ltd, 366 Whitehorse Rd, Nunawading Vic. 3131. (03)877-5444.



colour	significant figures	multiplier	tol. (%)	TC (. 10^{-6}/K)
black	0	1 x		
brown	1	10 x	± 1%	100
red	2	100 x		50
orange	3	1 000 x		15
yellow	4	10 000 x		25
green	5	100 000 x	± 0,5	
blue	6	1 000 000 x	± 0,25	10
violet	7		± 0,1	5
grey	8			
white	9			1
silver	–	0,01 x		
gold	–	0,1 x		

Temperature Coefficient shown on resistors

The IEC committee number 40 has agreed upon a colour code system for temperature coefficients of resistors.

This new T.C. colour coding system will be used by Philips in all the MR25 and MR30 programs with tolerances of 1.0 and 0.5 percent.

A survey of the new T.C. colour coding system according to IEC62 is shown above.

When colour coded, the nominal resistance value and the tolerance are marked on these resistors by means of six coloured bands according to IEC publication 62 "Colour code for fixed resistors" (see also IEC publication 115-1 clause 4.5). For further information contact Philips Elcoma, 67 Mars Road, Lane Cove NSW 2066. (02)427-0888.

Quotation from Electronics Australia, June 1982

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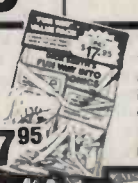

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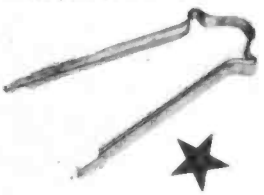

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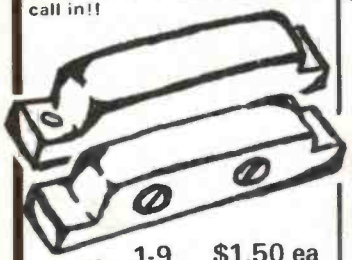

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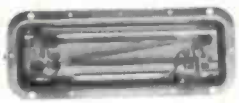

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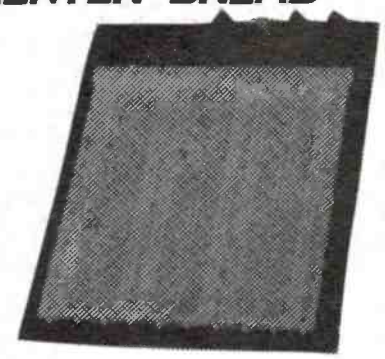

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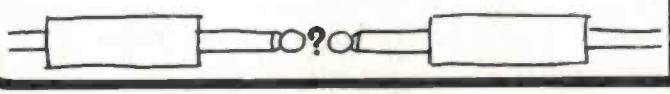

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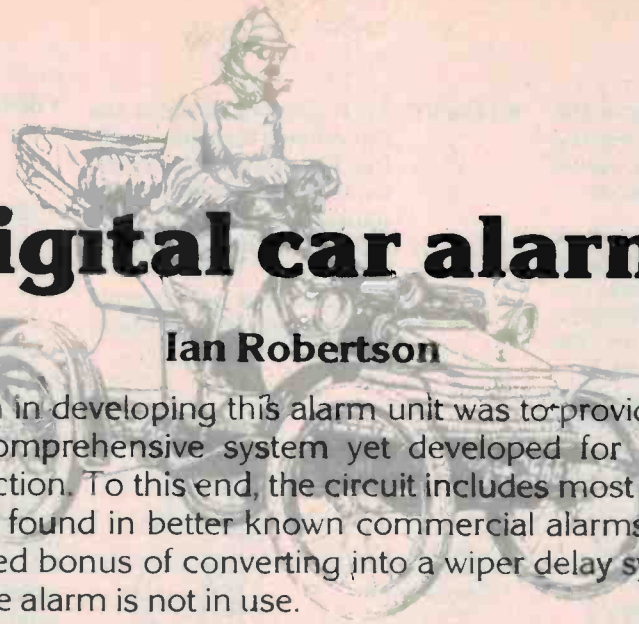


Digital car alarm

Ian Robertson

The aim in developing this alarm unit was to provide the most comprehensive system yet developed for home construction. To this end, the circuit includes most of the features found in better known commercial alarms, with the added bonus of converting into a wiper delay system when the alarm is not in use.

A MAJOR DIFFERENCE between this and other alarm circuits is the use of digital rather than analogue methods. The circuit uses a master oscillator feeding a divider chain to obtain the many time delays needed. Indeed the arrangement is in many ways similar to an electronic organ circuit.

An advantage of the digital technique is that all the delays maintain a fixed ratio to one another. They do not vary, as an analogue circuit will, due to component tolerance, leakage, temperature, etc and, by adjusting a single potentiometer in the master oscillator, all timing functions can be varied simultaneously. This means it is sufficient to check the accuracy of a single delay period to have, in effect, checked the accuracy of all delay periods. Further, by running the oscillator at, say, ten times normal frequency, a complete test that would normally take two minutes, will take under fifteen seconds.

With any alarm of this complexity the time and skill needed to carry out the installation within the car should not be underestimated. Fortunately there are a number of optional features in the system, and even if these are not used, the alarm will still be very effective. This gives each constructor the means whereby he can make the initial installation as simple or as complex as he wishes, while retaining the option of fitting the missing items at a later date.

Features

The following is a list of the main features in the system. Each item gives only a brief description. Greater detail will be found elsewhere in the text.

Flashing indicator
In operation whenever the alarm is set. Intended to deter a potential burglar, the indicator also reminds the owner to disable the system upon entering the car.

Battery detector
Sensitive to the drop in voltage occurring whenever the load on the electrical system changes. Normally opening a door, operating the brake, switching the headlights on, or a number of similar actions, will trip the detector.

Two delayed trigger inputs
Used in addition to (or in place of) the battery detector. These inputs are particularly useful in cars equipped with electric clocks, where the battery detector cannot always be successfully used. Suitable trigger inputs are the roof light, boot, bonnet and glove box lights. However, these must be powered from a circuit that remains energised at all times, even when the ignition is switched off.

Four instantaneous trigger inputs
These are suitable for the protection of driving lights, cassette player, radio, etc. In use a wire is clamped under one of the mounting bolts of the item to be protected. Should this wire become detached from the chassis, as it will if the protected item is removed, the horn will sound immediately.

Hidden switch option
Normally the alarm is cancelled by operating the ignition switch, however with this extra switch in circuit, a thief must locate both switches before he can cancel the alarm. The hidden switch will also prevent children, or curious adults, setting the alarm while the car is parked.

Alarm relay
The alarm section is fitted with a two pole relay. One contact set is used to operate the horn while the other contacts may be used to flash the headlights or disable the ignition circuit or perhaps operate a second horn installed in the boot. It helps to have a second line of defence should the horn be faulty or disconnected.

Alarm timing
- Time to exit vehicle: 15 seconds
- Time to enter vehicle: 15 seconds
- Duration of horn: 96 seconds
- Horn pulse rate: one second on, one second off
- Indicator pulse rate: half second on, half second off.

Wiper option
Whenever the alarm is not in use, the circuit converts into a wiper control unit. The output from this section is once again via a relay, it has a single changeover contact and will suit most wiper systems.

Wiper timing
The wiper control switch settings are:
- Continuous wipe (CW), normal slow speed wiper operation
- Single wipe (SW), single operation every 2, 4, 8, 16, 32 or 64 seconds.
- Multiple wipe (MW), dual operation every 8, 16, 32 or 64 seconds.

Operation

The heart of the alarm is an eight stage binary counter (ICs B & C) clocked by a 1 Hz master oscillator. By this means a delay of 256 seconds will occur whenever the counter is taken from zero count to maximum count. Shorter delays are available by using the various outputs, Q1 through Q8. In fact, any delay between one second and 256 seconds can be obtained by suitably decoding the 'Q' outputs.

Below is a list of the outputs that have been decoded and also their main functions:

- **Zero** Interrupts the clock pulses, freezes the counter, holds the indicator off. Pressing the set pushbutton advances the counter. ▶

- **1 to 15** Time allowed to leave the car without triggering the alarm. During this period the indicator remains on.
- **16** Interrupts the clock pulses, freezes the counter, flashes the indicator. Counter re-started by a signal from the battery detector or the delayed trigger inputs.
- **17 to 31** Time allowed to enter the car without the horn sounding. The alarm may be reset to zero by operating the ignition switch (also the hidden switch should this be fitted).
  The indicator will remain on for any count greater than 16.
- **32 to 127** Alarm relay operates, pulsing the horn at one second intervals.
- **128** Returns the count to 16 where it may be retriggered should further interference to the car be detected.

In addition to the above, if at any time one of the instantaneous trigger inputs becomes detached from the chassis, the counter will set to 32 and the sequence will begin with the horn sounding immediately.

Similarly, any interruption to the power supply will set the counter to 32. This item is included to prevent cancelling of the alarm by simply removing the battery lead for a few seconds.

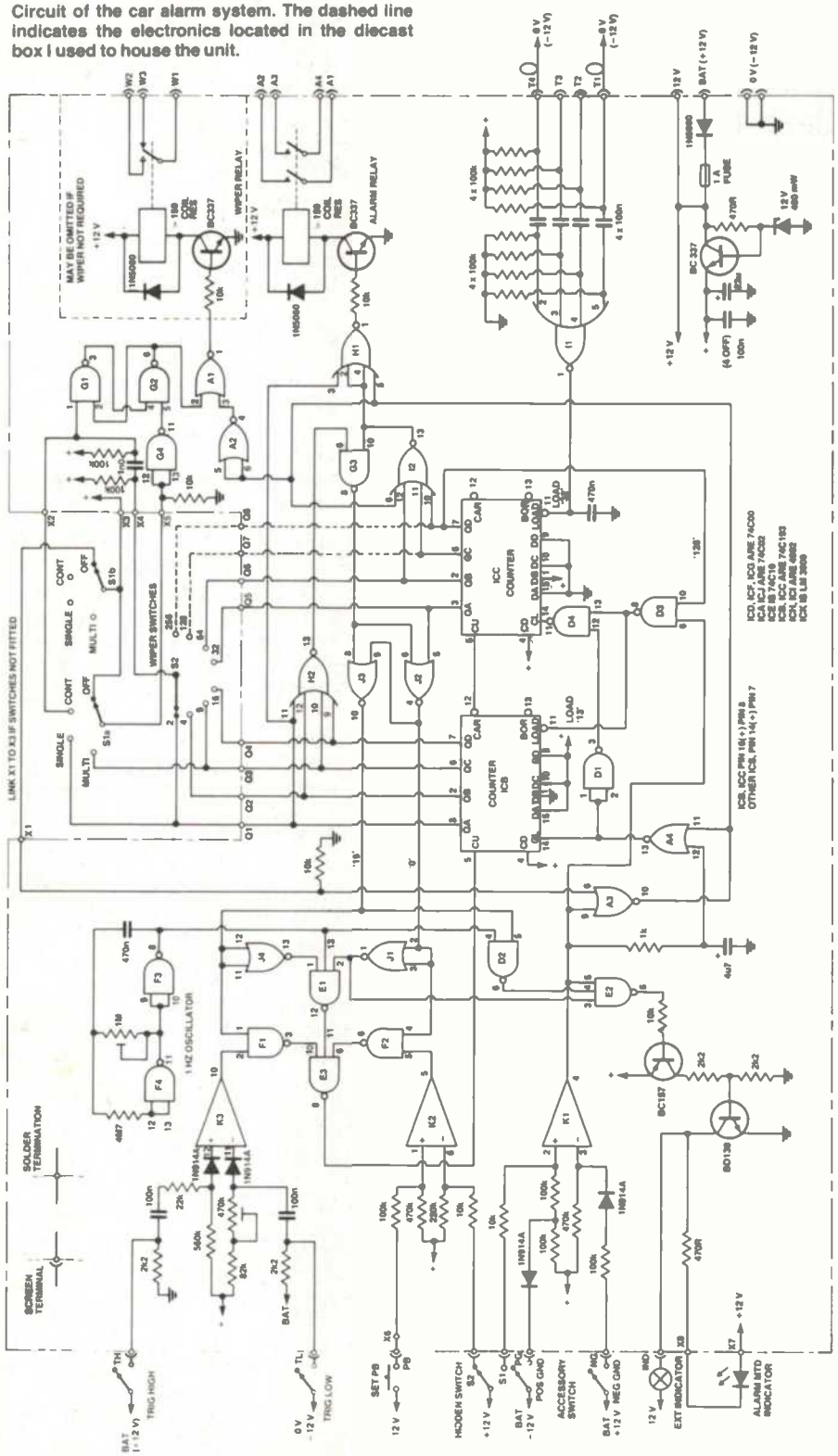
The conversion of the circuit from an alarm to a wiper system is under the control of the car ignition circuit:

- With the ignition and hidden switches OFF the alarm is activated, the wiper disabled
- With the ignition and hidden switches ON the wiper is activated, the alarm disabled. Or more simply, the alarm is enabled when the car is not in use, the wiper when the car is in use.

The basic requirement of any wiper control system is to pulse the wiper motor for approximately one second, then follow with a delay (variable) before the next one-second pulse. The length of the pulse is not critical, once the wiper has started to move the normal parking contacts will take over and complete the wipe cycle. Should the pulse be longer than required for a single wipe of the screen then more than one wipe will occur, and this is the method used to obtain dual wipes in the multi-wipe switch setting.

This circuit operates by allowing the counter to free run, while feeding the signal from a Q output (selected for the delay required) via a one-second pulsing network to the wiper relay. This gives a chain of one-second pulses separated by a switched delay interval. The pulse is extended to four seconds in the multi-wipe setting.

Circuit of the car alarm system. The dashed line indicates the electronics located in the diecast box I used to house the unit.



Circuit description

Readers should refer to the various logic and circuit diagrams to clarify points raised in the following description.

All system timing is developed around the eight stage binary counter (ICs B & C). Two 74C193 up/down counters are used. However, in this circuit the down-count facility is not used. This proved to be the simplest way to obtain asynchronous load and clear inputs. Other counters I considered either lacked these inputs or they were of the synchronous type.

The counters are clocked by the 1 Hz master oscillator (ICs F3 & F4). This is a standard CMOS two-gate squarewave oscillator where the frequency can be adjusted over a wide range by the 500k preset.

Selective decoding of the counter outputs is carried out by the gates shown above the counter (main circuit); decoded are 0, 16, > 32 and 128.

Normally the counter will free run unless the clock pulses are interrupted by gates E1 & E3, and this will occur at counts 0 and 16. If the count is stopped at zero it may be restarted by a pulse from the set push button, if stopped at 16 may be restarted by a pulse from the battery detector, trigger high or trigger low inputs.

Any counter greater than 32 will operate the horn via the horn relay and gate H1. Note also that gate H1, and therefore the horn, is pulsed on and off by output Q1 on counter B.

Various gates below ICs C and B are used to clear and load the counters. These inputs, as mentioned earlier, are synchronous and may be operated at any time, even during periods when the clock is halted. The way these inputs have been used needs explanation.

Turning the ignition on resets both counters, and this in turn interrupts the clock and holds the alarm in the standby position.

A signal from one of the four instantaneous trigger inputs will set the counter. In this instance a count of ≥ 32 will be loaded, causing the horn to sound, and continue to sound, while the counter steps through to 128. In a similar manner, the capacitor on the load terminal of C will force the output to ≥ 32 for each power up of the circuit.

Reaching a count of 128 resets the counters to 13 which involves clearing counter C while loading 13 into counter B. Loading 13 will silence the horn while giving three counts for the electrical system to settle before the battery detector is rearmed at a count of 16.

Most input signals are buffered by the LM3900 quad op-amp. Keep in mind that this device compares input currents whereas the conventional op-amp compares input voltages. Using resistors to convert voltages to currents, standard operational amplifier circuitry can be realised, but note when testing that both inputs are clamped to within 0.5 V of negative by the base-emitter junction of the input transistors.

Nonetheless, the circuit operation is straightforward with K1 handling the accessory switch inputs (positive or negative ground systems), K2 buffers the set push button, while the hidden switch feeds both K1 and K2. The low value (10k) resistors used in the switch circuit can override any other input signal and will prevent the alarm being set in position S2 or cancelled in position S1.

A short RC delay network is fitted in one line from the output of K1, which resets the counters each time the accessory switch is turned off, thereby ensuring the alarm sequence will start from zero and overcome a problem that occurs if the ignition is switched off with the wiper running.

Section K3 functions as the battery drop detector while also functioning as the trigger high/low input buffer. Figure 10 shows the battery detector in a simpler form. Both inputs are fed from a common voltage, but the lower value resistor feeding the inverter input drives the output low.

If a negative pulse occurs on the battery line it will be coupled into the inverting input by the 100n capacitor. This will reverse-bias the inverting input resulting in the op-amp output going high and developing a pulse to advance the counter one count. In the final circuit a diode is included in series with the op-amp input, this means the diode and not the inverting input is driven negative, and prevents possible damage to the IC.

Delayed trigger inputs TL and TH operate in a similar fashion. Note that in this instance the TL input feeds a negative pulse into the inverting input while the TH input is somewhat different as it feeds a positive pulse into the non-inverting input. The result however, is the same — a positive pulse at the output of K3.

The instantaneous trigger inputs (T1 and T4) are quite different. Normally, the four inputs are held at earth potential so that, should any input be detached, a pulse will enter the NOR gate via the appropriate RC network. A negative-going pulse occures at the output of the gate, loading 32 into the counter, thereby enabling the horn sequence. Unused inputs can in practice be left floating, as they respond to the change in voltage not the voltage level.

An important feature is the indicating light. This may be a LED or lamp and is operated by a two transistor driver stage, under the control of gate E2. The indicator may be off, illuminated or flashing and the sequence is as follows:

- Off when wiper operation selected
- Off for standby mode, counter zero
- Flashing when armed, count of 16
- Illuminated for all other counts.

The ICs are supplied via a series pass transistor and the function on this stage is not primarily as a regulator. The intention is to limit the voltage fed to the ICs to below the rated maximum of 15 V. In order to limit dissipation in the series transistor a 12 V zener is used. This means that the transistor is hard on with a nominal 12 V rail and will not start to regulate until the input voltage is some volts above this value.

Conversion into a wiper control unit requires that the counters free run, and to obtain this the load and clear inputs must be overridden and the gates decoding 0 and 16 must be blocked. This is under the control of the ignition switch. A logic '0' on the output of K1 sets the circuit as a wiper control and a logic '1' at this point sets the alarm function.

The free-running counter will give a squarewave signal from the various 'Q' outputs. The period in seconds given at each stage is two at Q1, four at Q2, eight at Q3, extending through to 256 at Q8. By means of an RS flip-flop (cross-coupled gates, G1 and G2) the squarewaves are converted into an asymmetrical wave having one second ON periods and switch-selectable OFF periods.

Diagram 12 shows Q3 with a period of eight seconds setting the RS flip-flop, while the inversion of Q1 resets the same flip-flop every two seconds. The resulting output, one second on seven seconds off, is clearly shown.

On the multiple wipe setting the flip-flop is reset by the inversion of Q3, not Q1, and this will give a pulse four seconds long in lieu of the previous one-second pulse. Depending on the speed of individual wiper motors two or three wipes will occur during this period.

Construction

Construction is fairly straightforward, however there are two forms this may take. The first is to build only the alarm, the second is to built the alarm/wiper combination. There are points for and against either approach and these are covered in the installation notes. In the construction there is little difference between systems, although in units without the wiper option, one relay, two switches and a couple of minor components can be omitted.

(Note that this article is not intended as an ETI constructional project and thus no pc board details are given.)

Testing

A completed unit should operate with a minimum of adjustment, however I recommend setting up the test circuit (Figure 9) to check out the alarm before fitting it into the car.

Simple faults may be located with a multimeter, but for more elusive faults an oscilloscope will be required.

The 12 V for testing may be obtained from the car's own battery, in situ, or more conveniently from a battery on the work bench. Alternatively a bench power supply may be used with the restriction that it may not test the battery detector circuit in all respects.

Steps for testing using Figure 9 are:

- Set preset potentiometers to approximately mid-way ▶

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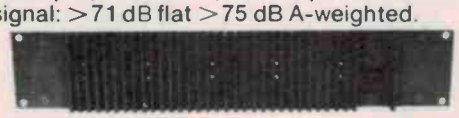

N.B. Picture is only of original heatsink supplied with this project. Our one is tapped from the rear so that no screw heads are visible. New picture next month.

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Hum:	−100dB below full output (flat).
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- With the power and accessory switches on, all other switches off, check that the indicator light, alarm relay and wiper relay are all off
- Move the wiper switch to continuous wipe (CW) and the wiper relay will pick up and remain up
- Move to the single wipe position (SW) and the relay will pulse at an interval determined by the second wiper switch. By adjustment of the 1M oscillator preset, the interval can be matched to the times marked on the switch. Reducing the resistance of the preset too far (frequency increasing) will stop the oscillator
- The multiple wipe setting (MW) is similar to the single wipe setting, however the relay pulse will be longer (four seconds) and switch settings 2 and 4 will give the same timing as position 8
- Turn the wiper and accessory switches off and the indicator, alarm relay and wiper relay should be off
- Momentarily operate the push button. This will set the alarm, and light the indicator for a period of 15 s (exit time)
- After the exit time the indicator will flash at one second intervals showing the alarm is set
- The alarm may now be triggered by means of the battery detector, opening a car door if the car battery is being used, or with a bench supply momentarily reducing the voltage by about three volts. If a bench battery is being used, connect a load, say a 15 W lamp, across the battery terminals. For correct operation the 470k sensitivity preset may need adjustment as maximum sensitivity is obtained with maximum resistance in circuit. Slowly rotate the preset until the indicator latches on, back off 1 mm, reset circuit (using accessory switch and the push button) and then try again
- The 15 s entry delay will occur, followed by the horn relay pulsing at one second intervals for a period of just over one and a half minutes. The circuit will reset with the indicator flashing
- The alarm may also be triggered by either the TH or TL switch and these operate in the same manner as the battery detector
- At any point during the above sequence, closing the accessory switch should cancel the alarm, forcing the relay and indicator off
- Close the instantaneous trigger switch (T1). Reset the alarm using the accessory switch and push button. Opening switch T1 will cause the horn relay to operate, pulsing for the normal 1½ minute horn period
- Momentarily opening the power switch will also cause the horn relay to operate
- Other switches can be added for a more detailed test. Add the hidden switch, PG, T2, T3, T4 switches and with either an ohmmeter or lamp, check the alarm relay contacts, wiper relay contacts and also the indicator output.

Installation

The alarm may be installed with or without the wiper components. The combined alarm/wiper system must be mounted within reach of the driver, and this can mean the unit is more accessible if the car is broken into. By foregoing the wiper control the electronics may be hidden, and by using extended leads, the push button and indicator may still be fitted in the dash. I, however, advise against mounting the wiper switches outside the alarm as the circuit could be effected by noise pulses introduced by the connecting cables.

Keep the wattage of the indicator down and use a high output LED or a low power lamp. Each time the indicator turns on it attempts to trip the battery detector. This in turn is set less sensitive, and if taken too far the system may not respond in an emergency. The roof light must be not less than four times the wattage of the indicator.

In mounting the alarm, each constructor must determine the most suitable position in his car.

Wiring should be carried out in stages, starting with the basic circuit (Figure 1 or Figure 2) followed by the optional items (Figure 3 to Figure 8). As each stage is fitted, the circuitry may be tested and the faults found. Testing stage by stage is possible with this alarm circuit because careful design has eliminated the need to bridge unused terminals to override the redundant function.

Care is required to select the correct horn circuit as this should match the existing wiring whilst also taking into account the current demand of the horn(s) to be driven. The wiring must suit the currents involved. As a guide the cables used for the relay contacts (also the 0 V and BAT circuits) should have approximately the same area as the horn wiring already fitted in your car. The remaining runs can be any standard hook-up wire and the size can be chosen for mechanical rather than electrical reasons.

During the alarm installation it is easy to overlook the part played by the wiring, for it is often the wiring and not the alarm that is most vulnerable. Take particular care to conceal the cable runs and to ensure all connections are sound and will not cause intermittent operation at a later date.

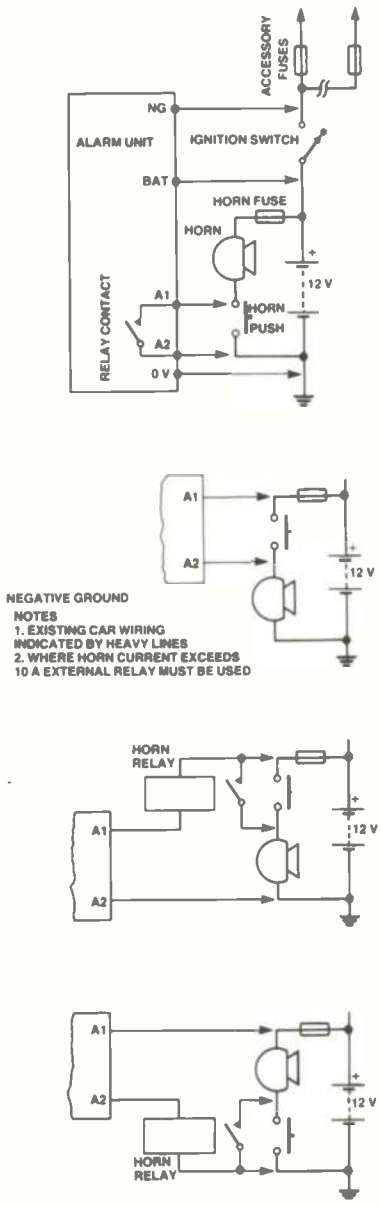


Figure 1. **Basic alarm system, negative ground, with variations to the horn circuit.**

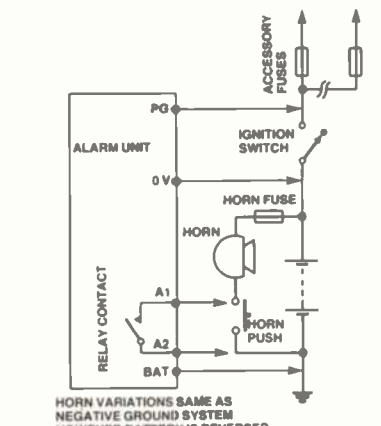


Figure 2. **Basic alarm system, positive ground.**

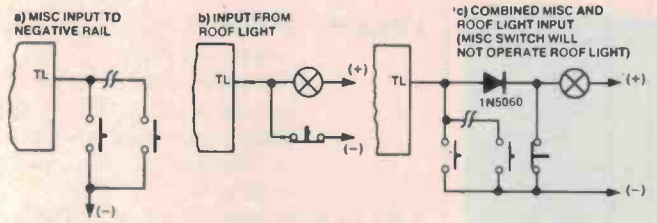


Figure 3. TL input: using added switches or roof light.

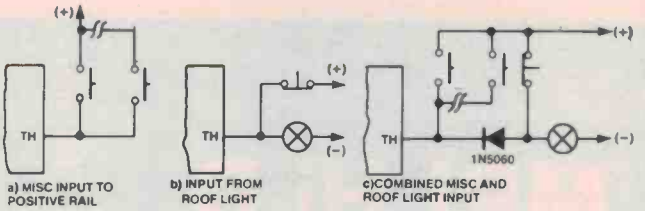


Figure 4. TH input: using added switches or existing roof light.

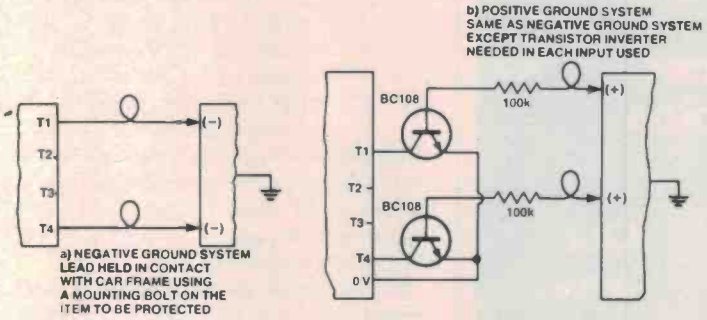


Figure 5. T1 to T4 inputs: for driving light and radio protector.

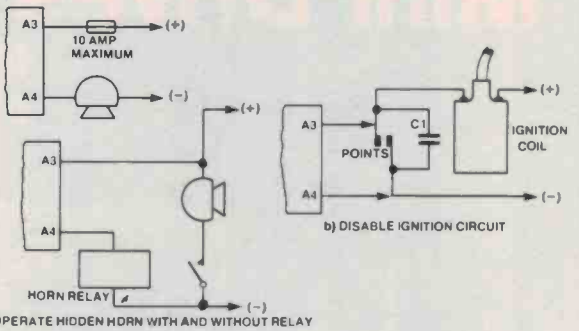


Figure 6. A3 and A4 alarm relay contact; giving extra protection.

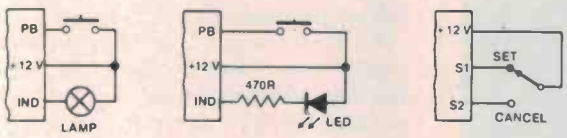


Figure 7. PB and IND terminals: external pushbutton and indicator.

Figure 8. Wiring a hidden switch.

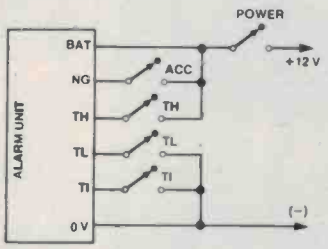


Figure 9. Basic test circuit.

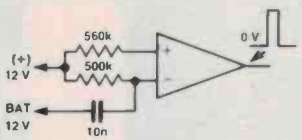
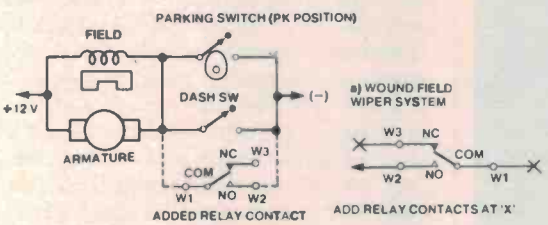


Figure 10. Simplified battery-drop detector.



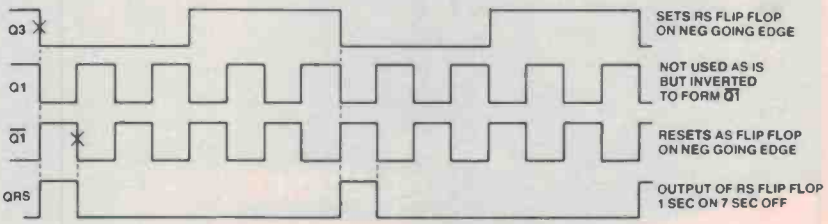


Figure 12. Wiper circuit timing diagram.

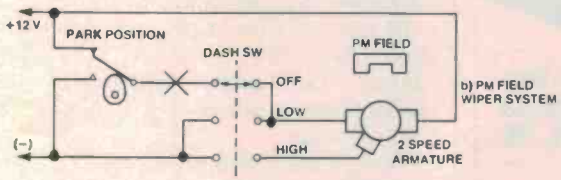
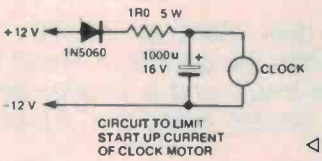


Figure 11. Wiper operation.



◁ *Figure 13.* Clock circuit modification to prevent tripping of alarm.

Included are a number of diagrams and these show how to wire the optional features.

- **TH & TL** Delayed inputs for connection to the roof light circuit may also be fed from any number of additional points. Possible switch positions are rear doors, tail-gate or glovebox (Figure 3 & 4).
- **T1 to T4** Instantaneous inputs are clamped under driving lights, cassette, radio, etc and will sound the horn as soon as the connection is broken. A transistor inverter stage will be necessary in vehicles with a positive ground system, however this stage should only be fitted to inputs that are actually used (Figure 5).
- **A3 & A4** Spare contacts on alarm relay may be used for a number of auxiliary functions. The contacts have a current limit of 10 A and larger currents require a horn or lamp relay to be fitted (Figure 6). ▶

- **S1 & S2** Hidden switch, normally concealed under the dash or front seat, must be in the set position to activate the alarm or the cancel position to deactivate the alarm (Figure 8).
- **W1 to W3** Wiper control relay contact with W1, W2, W3 corresponding to the common, normally open and normally closed relay contacts. This relay is suitable for the majority of wiper motors, the exception being a continuously variable system.

A number of wiper arrangements have been used over the years but these can be loosely divided into two categories, motors with wound fields or motors with permanent magnet fields.

The earliest type of motor employed a wound field, and these were characterised by a good self-braking action. All that is required for control is a simple on-off switch. Self parking is achieved by a mechanically linked parking switch which keeps power applied in all but the parking position (Figure 11a).

The more recent type of permanent magnet motor does not have the same braking characteristics, and it is necessary to apply dynamic braking by placing a short across the armature. Here a changeover self-parking contact is used which either applies power to the armature or places a short across it (Figure 11b). The added relay contact opens the brake circuit and then applies power to the armature low speed brush. (Dashboard switch is off.) Once the wipers are in motion the cam-operated contacts parallel the relay contacts, allowing the relay to be released and the wiper action to continue until one complete sweep has been made. Thus the wiper will give a single low speed stroke for each relay operation.

In vehicles fitted with an electrically driven clock there is a possibility of false alarms. This applies particularly to clocks that are rewound at intervals by a small motor.

Two general approaches may overcome this problem. Reduce the sensitivity of the battery detector or limit the starting current of the clock motor.

The sensitivity of the battery detector is adjusted by the 470k preset, while the start-up current can be reduced by the network shown in Figure 13. The component values are a guide only and in certain instances a series resistor may be found to be all that is required.

If all else fails the alarm may be triggered by the TH or TL inputs via the roof light circuit. Hopefully the battery detector can still be set to operate with the brake light or similar high current circuit. ●

The Sparkrite 'Voyager' car computer

High technology on the highway. This 'third generation' car computer is a marvel of modern electronic engineering.

THE FIRST generation 'car computers' used a combination of analogue and digital circuit techniques to calculate and display various parameters of a vehicle's performance. Of major interest was fuel consumption — the result of rapid rises in the price of fuel. The 'real time' display of fuel consumption enables a driver to see the rate of consumption during various phases of driving — whilst accelerating, climbing hills, passing, changing gears etc. This sort of information is very handy for learning to drive 'economically'. Also of interest was performance over a trip — average fuel consumption over the distance travelled. Relative consumptions between 'city driving' and 'highway driving' can be compared.

The first generation of car computers gave these parameters and a few others. They were expensive and generally sold as an 'after market' item. But, they did a job and some motorists saw them as useful.

The second generation of car computers rapidly followed on the heels of the first. They incorporated microprocessors and featured a great many more functions, some of which were there 'because they could be easily incorporated'. These second generation units featured many more components than the earlier ones, in many instances, the use of a microprocessor notwithstanding. By this time, a car computer became either an 'optional accessory' or part of a 'standard pack' on vehicles, as well as being an after market item. By this time, too, most motorists knew what a 'car computer' was.

The Sparkrite 'Voyager' car computer, designed and manufactured in Britain, represents the 'third generation' car computer. It is an after market unit, imported and sold in Australia by Jaycar Pty Ltd. The thing that makes this a third generation unit is the incorporation of a specially-designed and manufactured mask-programmed microprocessor, which is basically four computers in one. In addition, the latest in display technology is employed: a gas discharge vacuum fluorescent display tube with large, bright digits that can be readily seen under widely varying conditions of ambient light — very important in a motor vehicle. The traditional LED displays are always problematical in a vehicle. The result is a reduction in component count and thus a reduction in manufacturing cost, whilst still retaining all the previous features demanded and allowing the addition of new ones.

To provide input data for the computer, two sensors are required: a *fuel flow* sensor and a *distance* sensor. The fuel flow sensor is inserted in series with the fuel line to the carburettor. The fuel passes through an internal mechanism which spins a disc consisting of alternate translucent and opaque sectors. On the outside casing of the sensor are mounted an LED, providing a light source, and a light-sensitive diode. The casing is translucent, allowing the internal disc to 'chop' the light beam transmitted through the casing, thus providing a series of pulses for the computer to work with. The spinning rate of the disc varies with varying fuel flow, providing a varying pulse rate to the computer from which rate of fuel consumption can be calculated.

The distance sensor requires magnets to be mounted on a drive shaft — the tail shaft on rear wheel drive vehicles, the drive shaft on front wheel drive vehicles. A magnetic pickup is located on the chassis adjacent to the drive shaft mounted magnets. As the drive shaft rotates, the magnets create varying currents in the pickup coil — a pulse for each pass of each magnet. These pulses will vary directly with speed of rotation of the drive shaft, enabling vehicle speed to be determined, and the number of pulses will be proportional to the distance travelled. Non-linearity in the sensors is compensated for in the microprocessor.

The computer in the Voyager contains a 'memory' enabling you to enter information on fuel, distance and time; the capacity being in excess of 3200 km (2000 ml) for distance, 820 litres of fuel (180 gal.) and 100 hours for time. ▶

There are three primary 'computing' modes. There's the LOG mode which can display average fuel consumption since setting the computer — with readout in imperial mpg, or litres per 100 km (to 0.1) or the new British standard of miles per litre (also to 0.1). The last would be of little interest here, but being able to get consumption (metric, l/100 km) or its inverse (imperial, mpg) is very handy. The LOG mode also gives you fuel used since setting the computer — to 0.05 gal., or 0.1 litres, and you can read out distance travelled since setting to 0.1 miles or km.

The NOW mode gives instantaneous readout of consumption from second to second as you drive, in mpg, l/100 km or miles per litre. This mode also gives a clock — time of day in hours and minutes in 12 hour format as well as providing a stopwatch. Great for rallying! In addition, the NOW mode provides instantaneous speed from second to second in kph or mph — and the readout is digital, don't forget, and reacts much faster than conventional speedometers.

The TRIP mode gives distance travelled since setting the computer, elapsed time (which stops automatically when you turn off the ignition) and average speed over the trip, computed continuously to 0.1 kph or mph.

In addition, several ALARM functions are provided — a very handy feature. You can set two speed alarms — providing a high-pitched note when you exceed a preprogrammed limit, a low note when you drop back below it. Actual speed is displayed as the alarm sounds. There is a time alarm, which acts just like an alarm clock, even when the ignition is turned off and there is a 'lights left on alarm' which sounds if you turn off the ignition and leave your lights on.

The display brightness is automatically controlled by a light sensor mounted behind the front panel, the brightness being increased or reduced according to the level of ambient light incident on the front panel of the unit. Very handy.

Construction-wise, the Voyager is very well engineered. It seems as much attention has been paid to the electronic engineering as to the mechanical. Also, it is clear a great deal of thought has gone into the ergonomic design. The unit is compact, has a logically laid out front panel with tactile-feel pushbuttons and a beeper which sounds when you operate any button. The front panel is of a 'sandwich' construction. The neutral brown background has the designations silk screened on top, each mode having the associated buttons grouped together and bracketed. The panel is lit from the rear by six parallel-connected filament lamps. The rear of the front panel is clear perspex, with an intermediate translucent white section which disperses the light to evenly illuminate the front of the panel. The display is behind a red panel. The case front surround overhangs the front panel at the top, providing some shading. The case is only about 70 mm deep, inside of which mount two pc boards, sandwiched together immediately behind the front panel. Each board is fibreglass with double-sided tracks and plated-through holes. The board immediately behind the front panel contains the buttons, light sensor, lamps and a few sundry components. It has sockets which plug into the rear board which contains all the electronics and the fluorescent display. A piezoelectric beeper is mounted on the rear of this board. Clearly, top-quality components are used throughout, many from the European electronics giants, some Japanese. Overall, impressively designed and constructed.

Connection to the outside world is via a multipin connector, accessed from the rear of the case, to which a flat ribbon cable is attached via a plug.

The makers have thought of virtually everything in the way of attachments and connections for installing their Voyager car computer. The 'command module', as they call it, can be mounted on or under the dash, on the centre console, on the windscreen or a side window. Attachment hardware is extremely versatile. Installation instructions that come with the unit are clearly written and copiously illustrated. The same could be said of the operating instructions.

As soon as he saw the Voyager, Jonathan Scott *wanted* it. Now, Jonathan Scott likes 'things Italian': food, women and cars. He drives a Fiat X1-9. Problem. Where to put the Voyager. The X1-9 is compact, Jonathan is very tall. When he gets in wearing his shades, the only room left is on the passenger side dash. Problem. When the Italian lady 'passenger' gets in, certain parts of her anatomy would obscure the Voyager's display and randomly operate the buttons. Solution — get a more demure passenger. Jonathan is presently working on installing the Voyager and removing the stilletto heel scratches from the Fiat's bodywork. The scratches on *his* bodywork will heal themselves, in time.

No matter if you own a Fiat X1-9 or 1973 Holden Kingswood, if you want to know how your car performs, or keep an accurate log, then the Sparkrite Voyager is worth a hard look. At $199, one wouldn't have to look too hard. Contact Jaycar Pty Ltd, 125 York St, Sydney or Cnr Carlingford and Pennant Hills Rds, Carlingford NSW. ●

5 CAR COMPUTERS TO WIN!

WOW! Five diligent, lucky, perserverant, persistent contestants will each receive a Sparkrite Voyager car computer, supplied by Jaycar.

Here's a chance to own a top line, high technology car computer of your own. **JAYCAR** has agreed to supply no less than five **Sparkrite VOYAGER** car computers as prizes for this simple to enter contest. All you have to do is answer these half-dozen questions, complete the coupon and send it to:

ETI/JAYCAR CAR COMPUTER CONTEST
ETI Magazine, 15 Boundary St
RUCHCUTTERS BAY NSW 2011

There's a bit of a challenge in answering the questions, so with a modicum of resourcefulness you stand a good chance of winning a car computer. Go to it!

HOW TO ENTER. All you have to do is answer the questions on the entry form, fill out the coupon and send the completed entry form to the address given above. Please read the rules carefully. Multiple entries will be accepted. You must enter you name and address on each entry submitted. Photostats or clearly written copies of the entry form will be accepted, but if sending copies you must cut out and include with each entry form the month and page number from the bottom of the page of the contest. When sending multiple entries, then, you will need extra copies of the magazine so that you send an original page number with each entry.

RULES. This contest is open to all persons normally resident within Australia with the exception of members of the staff of Jaycar Pty Ltd, Murray Publishers, Offset Alpine, Australian Consolidated Press and/or associated companies. Closing date for this contest is 31 December 1982. Entries received within 7 days of the closing date will be accepted if postmarked prior to and including 31 December 1982. The winning entries will be drawn by the Editor of ETI whose decision will be final. No correspondence will be entered into regarding that decision.

Winners will be advised by telegram the same day the result is declared. The name of the winners, together with the winning answers, will be published in the next possible issue of ETI.

Contestants must enter their name and address where indicated on each entry form and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

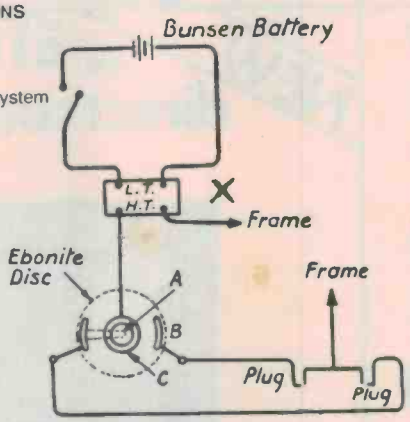
Entrants must sign the declaration, accompanying this contest, that they have read the above rules and agree to abide by their conditions.

You may enter as many times as you wish but you must use a separate entry form for each entry and include the month and page number cut from the bottom right hand portion of the page containing the entry form. You must put your name and address on the entry form and sign it where indicated.

CONTEST CLOSES 31 DECEMBER 1982

ANSWER THESE SIX QUESTIONS

1) What is this circuit?
- ☐ A trembler coil ignition
- ☐ The first battery/coil ignition system
- ☐ An early electric fence



2) Who designed the circuit in question 1?
- ☐ Davy
- ☐ Clerk
- ☐ Faraday
- ☐ Kettering
- ☐ Lenoir

3) Which mechanician designed the coil marked X in the circuit in question 1?
- ☐ Runbaken
- ☐ Lucas
- ☐ Kettering
- ☐ Lenoir
- ☐ Ruhmkorff
- ☐ Ruhmkove

4) How does this quotation end?
"A traveller without knowledge is . . .
- ☐ like a fish without a bicycle
- ☐ a bird without wings

5) Who said the above?
- ☐ Samuel Johnson
- ☐ Richard Burton
- ☐ Jack (walks-on-the-water) O'Donnell
- ☐ Sa'di
- ☐ Robert Louis Stevenson

6) Apart from computing everything you want to know about your car's performance, the Sparkrite Voyager provides three alarm functions. Describe one and, on a separate sheet of paper tell us, in less than 25 words, for what purpose you would use this feature.

.....

Name .....

Address .....

..... Postcode .....

Send to: ETI/JAYCAR Car Computer Contest, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.

I have read the rules of the contest and agree to abid by their conditions:

Signed .....

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ref: EA May 1982

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- FITS INTO YOUR DASHBOARD
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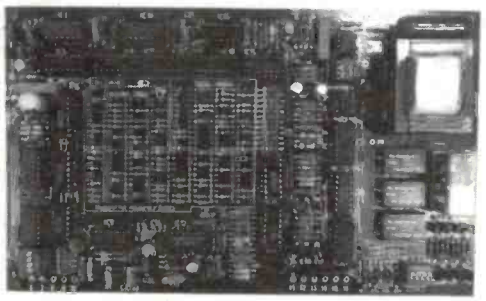

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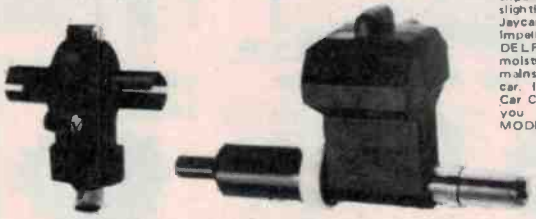

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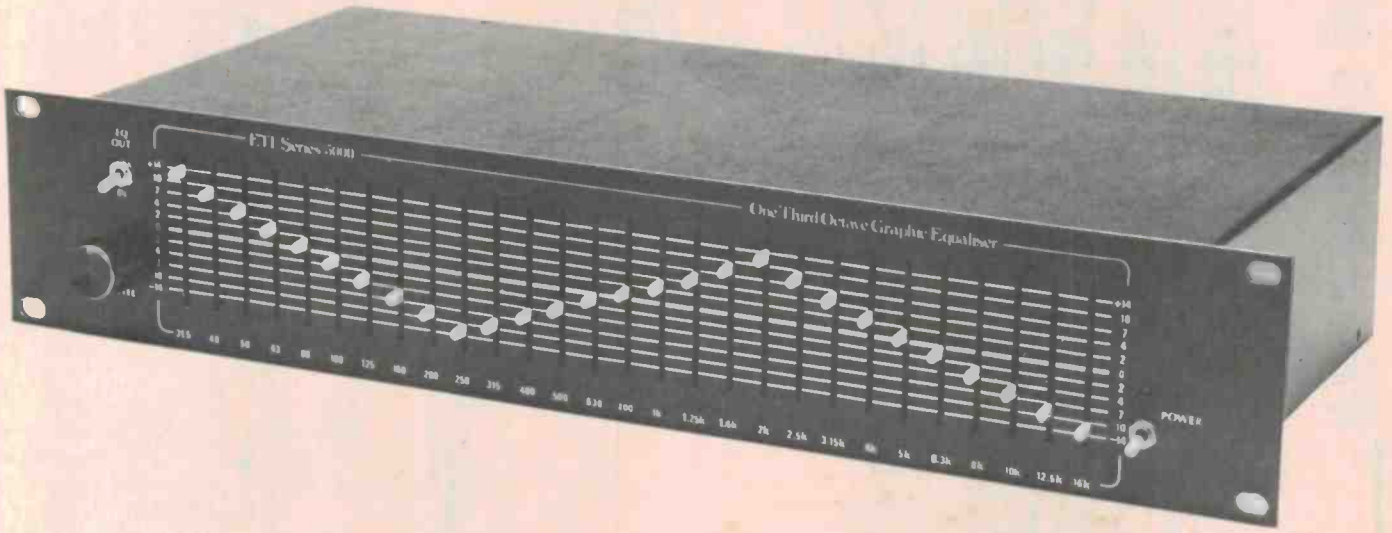


Series 5000 one-third octave graphic equaliser

Is your listening room/concert hall dull and lifeless? Or does it echo and ring with a multitude of sounds long after the last note has died away? If changing the environment is unacceptable or too expensive, then this graphic equaliser will likely effect a distinct improvement. For obvious mechanical reasons, this is a mono unit; two are required for stereo.

David Tilbrook

SINCE the Series 5000 preamplifier and power amplifier were published (during 1981) we have had many requests for this project. The inherent reliability and superlative performance of the MOSFET power stage makes the 5000 power amp ideally suited for use in professional applications. Unfortunately many of these applications are in difficult or 'problem' listening environments such as large halls or simply rooms with poor acoustic properties. Listening environments with too little damping lead to resonances and reverberation that can seriously degrade the intelligibility of music or speech. By contrast, rooms with too much damping lead to muffled and lifeless acoustic performance due to excessive attenuation of certain bands of the audio spectrum. To a certain extent these problems are unavoidable, at least with present technology. It is impossible to completely cure a listening environment of inherent problems such as resonances or excessive reverberation. The latter phenomena can cause feedback resulting in oscillation of the sound system or 'howl round'. The problem is that the amplitude of an oscillation is not related in a simple way to the amount of excitation. The maximum amplitude is a function of several variables, one of which is the damping of the listening environment. This converts sound energy into heat and prevents it from being reflected back into the room to further excite the resonance. The time taken for the resonance or oscillation to reach its maximum is also a function of the excitation level, i.e: the volume at which the sound is being reproduced. Problems associated with overdamped listening environments are slightly easier to correct, although a complete cure is again almost impossible, especially in bad cases.

The equipment used most often to correct faults in the listening environment is the one-third octave graphic equaliser. This divides the audio spectrum into roughly one-third octave intervals and allows effectively independent amplitude control over each of the frequency bands. We have published one-octave equalisers in the past, as a compromise between the full one-third octave design and the simple tone control system provided on most preamplifiers. These are not suitable however for professional applications which demand more control than is offered by these simpler units. To meet the demand for a full one-third octave equaliser we have designed the Series 5000 unit offering noise and distortion performance that will not ▶

Project 459 third-octave graphic

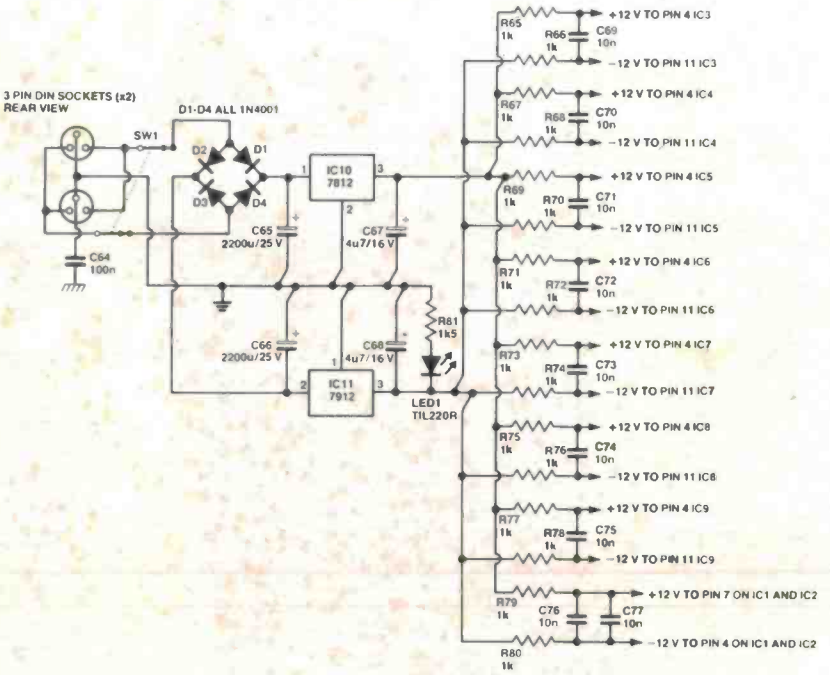
seriously degrade the performance of such a high quality system. It should be noted however, that the use of any one-third octave equaliser will affect the performance of the system simply because it is in circuit. Each of the filters has a relatively high Q and will therefore cause significant modification to the overall phase linearity as well as the frequency response when cut or boost is applied. I have seen many otherwise high quality systems degraded significantly by the excessive use of one-third octave equalisers and we do not recommend the incorporation of these units into a high quality system unless a specific need is apparent. Nevertheless, when modification of the frequency response is required, no matter how drastic or how modest, a one-third octave graphic equaliser is an almost ideal way of doing this.

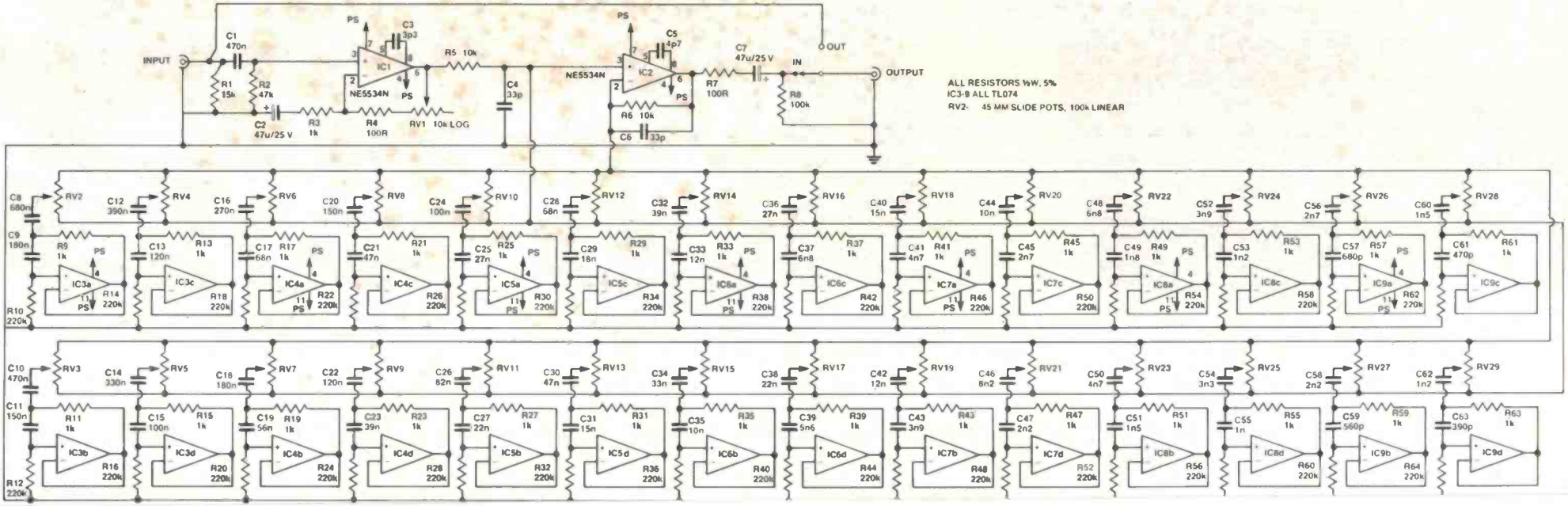
Each channel of the equaliser is controlled by a separate slide potentiometer so the array of pots gives an approximate indication of the response inserted by the device. Further, the relative ease of operation ensures that setting up can be accomplished in a reasonable time.

Design

The Series 5000 graphic is basically an extension of the principle used in the older ETI-485 one-octave stereo graphic equaliser. Each filter is formed by a series resonant network incorporated into the feedback loop of a high quality operational amplifier. In this case we have used the NE5534N, the same op-amp used in the Series 5000 pre-amplifier. The advantages of this device are covered in the series of articles describing that project (Sept.-Oct. '81).

'Gyrators' are used to simulate the inductors necessary for the series of band-pass filters so there are no coils to wind. The gyrator is covered in more detail in the How it Works section, but the main problem associated with this approach is caused by phase shifts occuring in the op-amps used in the gyrators. The basic principle of a gyrator is to invert the





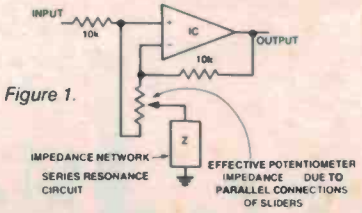


Figure 1.

In order to illustrate the principle of operation of the graphic equaliser we first need to consider the operation of a simplified version of a single stage, as illustrated in Figure 1. Here, the input signal is fed to the non-inverting input of an op-amp through a 10k resistor. A potentiometer is connected between the non-inverting and inverting inputs with its wiper going to signal common (ground) via a network represented by Z. Here, a series-resonant circuit is employed. Feedback is provided between the op-amp output and the inverting input.

The input resistor forms a potential divider with part of the potentiometer (from the op-amp + input to the wiper) and the impedance Z to common. The feedback resistor also forms a potential divider with the end of the pot from the inverting input and the impedance Z to ground.

If the wiper of the pot is set to mid-travel, the attenuation of the input signal due to the potential divider is compensated by the gain of the op-amp and the overall gain from input to output is unity. If the pot wiper is now moved toward that end of the pot connected to the op-amp's inverting input, the gain of the stage is increased as the feedback ratio is reduced owing to a reduction of the impedance from the op-amp's inverting input to common. At the same time less attenuation of the input signal occurs as the impedance from the non-inverting input to common is decreased. The stage will have gain, maximum gain being determined by the impedance of the series resonant network. If this is low, gain will be high. Series resonant networks exhibit very low impedance at resonance, rising either side of that frequency.

When the wiper of the pot is moved toward the non-inverting input of the op-amp, the attenuation due to the input potential divider is increased. The gain of the op-amp is decreased at the same time as the feedback ratio is increased because the impedance from the inverting input to common is increased. Once again, the overall gain of the circuit is a function of the impedance of the series resonant circuit, but this time the gain is at a minimum — in fact, attenuation occurs.

By choosing a suitable Q for the series resonant network, the bandwidth can be set to cover a desired frequency range. The potentiometer then sets gain or attenuation of the stage at the centre of the chosen frequency band.

The technique just described above can be used whenever it is desired to incorporate a relatively large number of filters into the signal path as in graphic equalisers or tone controls. The filter networks need not be bandpass or notch filters, simpler bass and treble controls can also be used.

Once this basic configuration is set up, all that remains is to design the filter networks. As mentioned before, series resonant networks were used since these give the required characteristic of low impedance at the resonant frequency. In their simplest form these networks consist of an inductor, capacitor and resistor in series. At the resonant frequency, the impedance of the circuit is equal to that of the resistor assuming a perfect inductor and capacitor were used. To eliminate the inductor an op-amp circuit has been used to simulate the characteristics of an inductor. Such a circuit is called a 'gyrator'.

The gyrator circuit can provide both the inductance and the series resistance required in the network so this can simply be placed in series with the capacitor to form the required resonant circuit. This is shown in block diagram form in Figure 2.

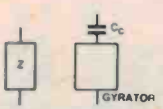


Figure 2.

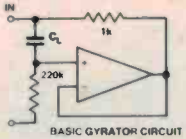


Figure 3.

Figure 3 shows the general circuit of the gyrator used in this project. The amount of inductance 'generated' by this circuit is given by the simple equation:

L = 1k x 220k x Cc in Henries

where the value of Cc is in Farads

The equivalent circuit of the gyrator is shown in Figure 4. The series resistance is equal to the 1k resistor while the 220k resistor becomes the parallel resistance of the coil. This value is high enough not to affect circuit operation drastically. The resonant frequency of this filter is given by the standard formula:

$$F = \frac{1}{2\sqrt{LC}} \text{ in Hertz}$$

The general circuit, simplified, of the Series 5000 third-octave graphic equaliser is shown in Figure 5. IC1 is simply a variable gain stage which also provides some input buffering. IC2 is the filter stage with a group of 28 gyrator circuits, all connected in parallel, in the feedback circuit. Commencing at a centre frequency of 31.5 Hz, each gyrator filter has a Q chosen such that its bandwidth covers one-third of an octave. Thus the upper and lower the 3 dB points of adjacent filters 'touch'. A total of 28 filters are required to cover the audio frequency band. Filters are not placed on the band limits of 20 Hz and 20 kHz as they are not really required. To reduce the IC count a set of seven quad op-amps (TL074s or uA774s) are used for the gyrators.

Slide pots are used to set the gain or attenuation inserted for each third-octave band as it is easy to see, at a glance, how much gain or attenuation has been set and, as all the pots are lined up in parallel across the front panel, one can instantly see the total modification made to the audio system's frequency response.

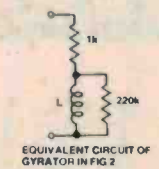


Figure 4.

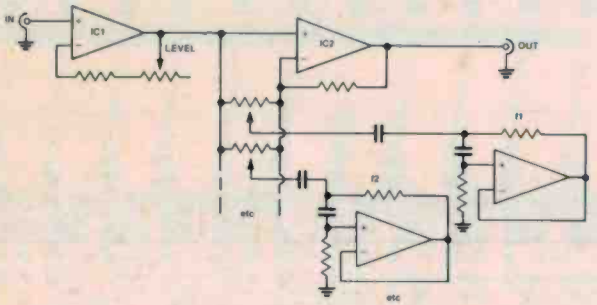


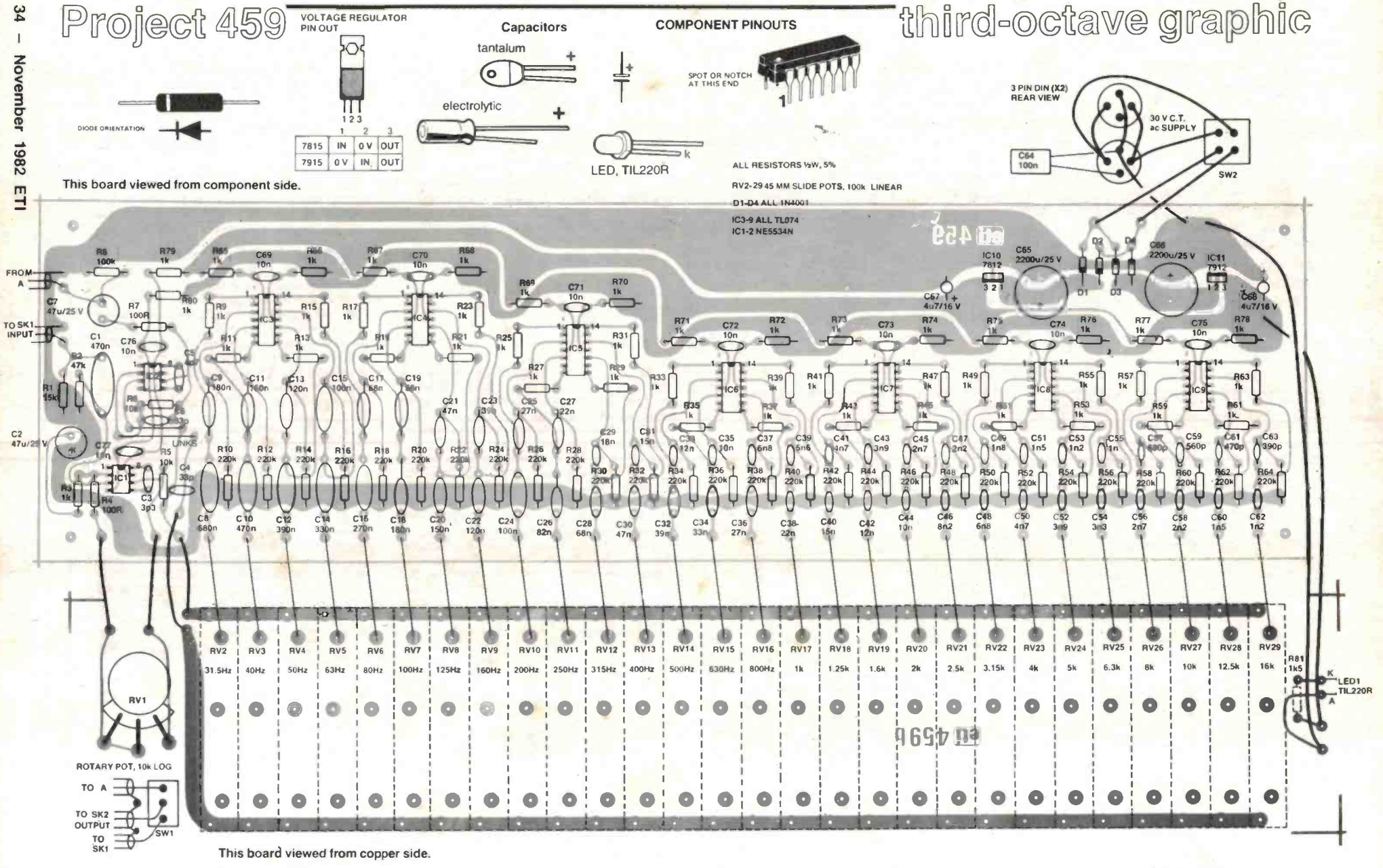
Figure 5. **Simplified diagram of the equaliser.**

phase response of a capacitor to simulate the characteristics of an inductor. The problem is that all amplifiers introduce a phase shift which increases towards the extremes of the frequency response. For this reason, care must be taken when choosing op-amps for use in gyrators at the top end of the frequency spectrum. This problem is accentuated when the Q of the filters concerned is increased. Since the Q of the filters must be higher in a one-third octave equaliser than in a one-octave equaliser, an op-amp with greater phase linearity at high frequencies must be used. Fortunately, op-amps with the desired characteristics are not difficult to obtain and we are using the TL074 or uA774. These are both quad FET op-amps with almost identical performance and are capable of excellent results in the circuit, even at the top-most filter.

Construction

The one-third octave equaliser divides the audio frequency band into 28 segments so a total of 28 slide pots are used. Cutting the required slots in a front panel is an extremely difficult task so this is one project that is probably best built from one of the kits, supplied by various outlets, which incorporate a pre-punched chassis and front panel. For those with the necessary equipment to construct their own chassis we have supplied detailed drawings of the metalwork required. Assuming that the project is constructed from a kit, most of the work is restricted to assembling two pc boards. One of these holds the bulk of the components while the other holds the slide pots and the 'power on' LED and its associated current limiting resistor. ▶

Project 459 third-octave graphic



PARTS LIST — ETI-459

Resistors ..... all ½W, 5%
- R1,5,6 ..... 15k
- R2 ..... 47k
- R3,9,11,13,15,17, 19,21,23,25,27,29, 31,33,35,37,39,41, 43,45,47,49,51,53, 55,57,59,61,63, 65-80 ..... 1k
- R4 ..... 100R
- R7 ..... 100R
- R8 ..... 100k
- R10,12,14,16,18,20, 22,24,26,28,30,32, 34,36,38,40,42,44, 46,48,50,52,54,56, 58,60,62,64 ..... 220k
- R81 ..... 1k5
- RV1 ..... rotary pot, 10k log
- RV2-29 ..... 45 mm slide pots, 100k or 50k linear.

Capacitors
- C1,10 ..... 470n
- C2,7 ..... 47u/25 V RB electro
- C3 ..... 3p3 NPO ceramic
- C4,6 ..... 33p NPO ceramic
- C5 ..... 4p7 NPO ceramic
- C8 ..... 680n
- C9,18 ..... 180n
- C11,20 ..... 150n
- C12 ..... 390n
- C13,22 ..... 120n
- C14 ..... 330n
- C15,24,64 ..... 100n
- C16 ..... 270n
- C17,28 ..... 68n
- C19 ..... 56n
- C21,30 ..... 47n
- C23,32 ..... 39n
- C25,36 ..... 27n
- C26 ..... 82n
- C27,38 ..... 22n
- C29 ..... 18n
- C31,40 ..... 15n
- C33 ..... 12n
- C34 ..... 33n
- C35,44,69-77 ..... 10n
- C37,48 ..... 6n8
- C39 ..... 5n6
- C41,50 ..... 4n7
- C42 ..... 12n
- C43,52 ..... 3n9
- C45,56 ..... 2n7
- C46 ..... 8n2
- C47,58 ..... 2n2
- C49 ..... 1n8
- C51,60 ..... 1n5
- C53,62 ..... 1n2
- C54 ..... 3n3
- C55 ..... 1n
- C57 ..... 680p ceramic
- C59 ..... 560p ceramic
- C61 ..... 470p ceramic
- C63 ..... 390p ceramic
- C65,66 ..... 2200u/25 V electro.
- C67,68 ..... 4u7/16 V tantalum

Semiconductors
- IC1,IC2 ..... NE5534N
- IC3,4,5-9 ..... TL074
- IC10 7812
- IC11 7912
- D1-D4 ..... 1N4001
- LED1 ..... TIL220R

Miscellaneous

ETI-459 a & b pc boards; SW1 — DPST toggle switch; chassis and panel as per drawings; two 3-pin DIN sockets; knobs for slide pots; SW2 — SPDT toggle switch; nuts, bolts, wire, etc.

Price estimate $200 — $220

Construction of the main pc board is not difficult. The usual precautions should be taken with the orientation of all polarised components such as electrolytic capacitors, transistors, diodes and ICs. Note that the two voltage regulator ICs are not mounted in the same direction. Check the component overlay for the correct orientation. It is probably wise to leave the insertion of the quad op-amps until last since these are FET devices and are therefore more sensitive to static electricity than the other components in the unit. Be careful when handling these devices before insertion on the board. Use an earthed soldering iron and discharge yourself by touching an earthed metal appliance before handling the ICs. The inputs are protected and should therefore be reasonably safe from damage by static electricity.

Construction of the second pc board is not difficult either, although some care should be taken to ensure that the slide pots are mounted so that their shafts are as close as possible to forming a right angle with the pc board. Probably the easiest way to do this is to first solder one pin of the slide pot and adjust the position of the slider while heating the joint with a soldering iron. When the pot position is satisfactory, solder the remaining pins and proceed to the next slider. The single resistor can be soldered on at this stage but I found it easier to leave the mounting of the LED until after the pc board is attached to the front chassis.

Mount the RCA sockets on the rear panel. Note that these sockets are insulated from the chassis. The same technique is used for this as was used in the Series 5000 preamplifier. First insert a rubber washer of the appropriate inside diameter into the holes drilled in the rear panel, then mount the sockets. A photograph has been included with the construction details to illustrate this.

The chassis of the unit is not connected directly to the power supply earth. A 100n capacitor is soldered between the 0 V point on the power supply DIN sockets and the chassis to provide RF shielding to the rest of the circuitry but no dc connection should be used. This is consistent with the earthing principle of the entire Series 5000 range of components and is a good general principle to adopt to ensure freedom from earth loops. If you are constructing the unit for operation in systems not including a Series 5000 power amplifier you will need a small transformer to supply the necessary 30 V centre-tapped ac supply. There is sufficient room to allow mounting of the transformer on the back panel above the centre section of the pc board. When using a transformer inside the chassis the mains earth must of course be connected securely to the chassis using a solder tag bolted directly to the chassis. Do not however connect the chassis earth directly to the signal earth, use the 100n capacitor as mentioned before.

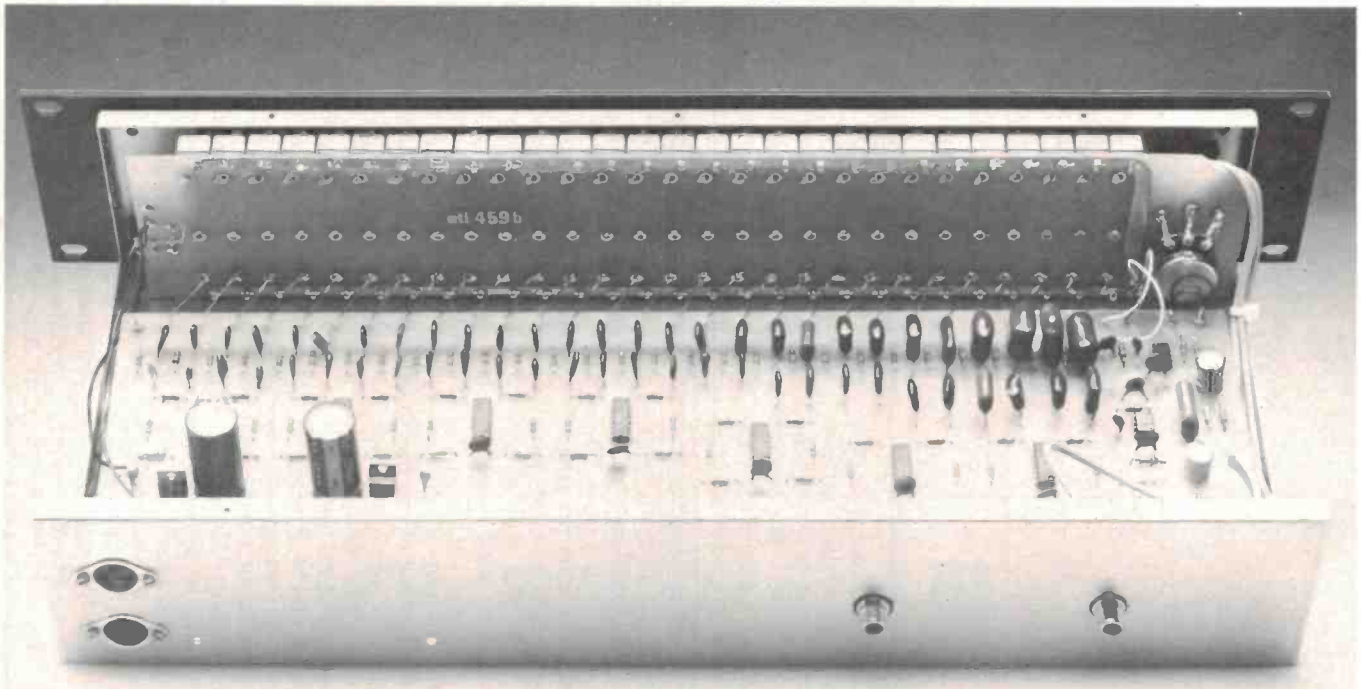
When the rear panel has been completed, the main pc board can be roughly positioned in place and all flying leads soldered to it allowing sufficient length to run to front and back panels. The connection between the slide pot wipers and the main pc board is best done with tinned copper wire. The rest of the wiring should be done with insulated wire.

The most difficult part of the construction is the mounting of the front panel components. The two switches are mounted directly to the front panel, behind the slide pot pc board. All wiring to these switches should be done before mounting since it is not possible to solder to these once the switches are in place. Shielded cable should be used for the three cables going to the equaliser in/out switch. Two of these must be sufficiently long to go to the input and output sockets on the rear panel, and the other must go to the input on the main pc board. The shields of the three cables going to this switch can be connected together using the unused half of the switch. Put a shorting link between the three unused contacts on the back of the switch and use this as a tag point. Now solder four wires to the power switch. Two of these must go to the rear panel and the other two to the power input points on the main pc board. Check the construction diagrams if in doubt about these connections.

The slide pot pc board is secured to the front panel by eight bolts that are screwed directly into eight of the slide pots. Countersunk bolts are used and the heads of these bolts are concealed by the front panel. The two switches should first be placed in their respective holes and secured by nuts to the front of the chassis. These nuts must be removed later when fitting the front panel but are used at this stage to hold the switches in place while the front pc board is mounted.

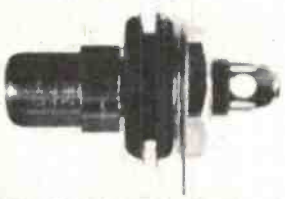
The easiest way to mount this pc board is to pass all of the bolts through the chassis front securing them in place with a small piece of adhesive tape placed across the front on the head. Slide brass spacers over the bolts, tilting the chassis up if necessary to keep these from sliding off the bolts. Now position the pc board in place, passing the slide pot shafts through their respective slots. One at a time the pieces of tape can be removed and the bolt screwed into the slide pots.

Mount the main pc board on spacers and carry out the necessary inter-▶



connections using the flying leads already secured to the board.

Finally, mount the front panel to the chassis. First remove the switch nuts. Secure the front panel with four 2 BA nuts and bolts. Use a washer between the front panel and the switch nuts when securing the switches to the front panel. This helps prevent the possibility of scratching the front panel when tightening the nuts. Push a LED mounting washer through the front panel. The LED can now be mounted. Be careful to insert the LED the correct way around.



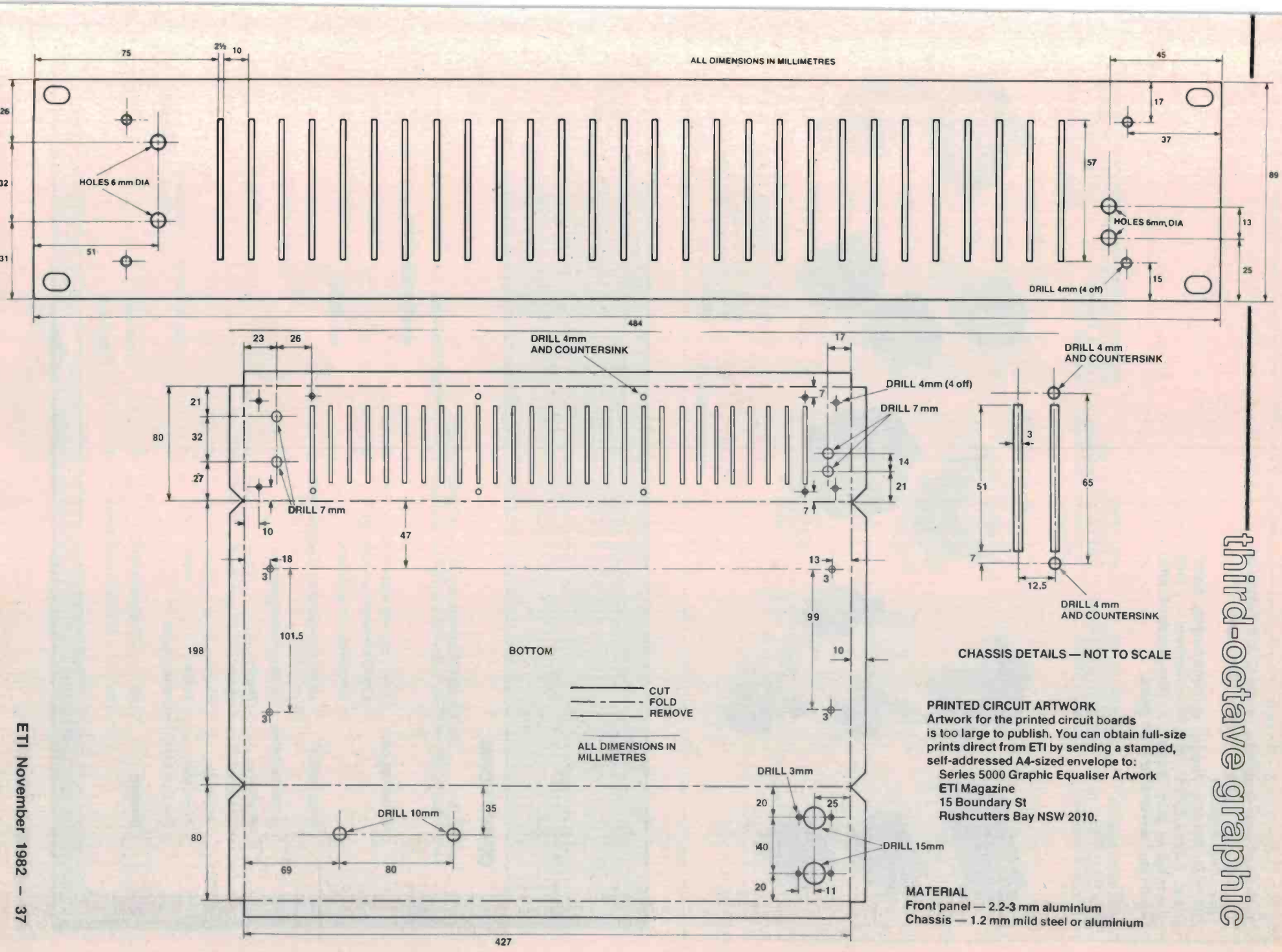
The RCA sockets mount through the hole of rubber grommets fixed to the rear panel, electrically isolating them from the panel.

Place the leads through the pc board and then push the LED into the washer from behind. You may have to bend the leads a little to get them into the holes in the pc board. Finally, solder leads. All that remains is to secure the cover. Use self tappers passed through the cover into the main chassis. Since the pots are mounted on half inch (12.5 mm) spacings there is not enough room for the usual slide pot knobs. We used small rubber covers supplied originally for use with small toggle switches. These are very common and are available in a variety of colours.

Power up

Once construction is complete check all power supply wiring before powering up. This is especially important if a transformer has been included inside the chassis. In the latter case, make certain all 240 V connections are secure and check the chassis earth. If all is correct, power the unit up. The LED should light to indicate that the unit is on.

An equaliser in/out switch has been provided to ensure that a flat response can be obtained easily and without the necessity of changing the equalisation that may have taken some time to set up. The equaliser is intended for use immediately before the power amplifier. If used in this position the level control will probably not be used. In this case turn the control fully *counterclockwise*. The overall gain of the equaliser with the controls set at centre will be approximately unity. If the equaliser is intended for use from a typical line level output, the gain control can be used to supply the output levels needed by the power amplifier input. ●



PRINTED CIRCUIT ARTWORK
Artwork for the printed circuit boards is too large to publish. You can obtain full-size prints direct from ETI by sending a stamped, self-addressed A4-sized envelope to:
Series 5000 Graphic Equaliser Artwork
ETI Magazine
15 Boundary St
Rushcutters Bay NSW 2010.

MATERIAL
Front panel — 2.2-3 mm aluminium
Chassis — 1.2 mm mild steel or aluminium

third-octave graphic

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100Mfd 25V RB's	26c	$1.30
220Mfd 25V RB's	36c	$1.80
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.0047Mfd 100V Greencaps	8c	40c
.01Mfd 100V Greencaps	14c	70c
.012Mfd 100V Greencaps	14c	70c
.022Mfd 100V Greencaps	14c	70c
.033Mfd 100V Greencaps	14c	70c
.039Mfd 100V Greencaps	14c	70c
.056Mfd 100V Greencaps	14c	70c
.068Mfd 100V Greencaps	14c	70c
.1Mfd 100V Greencaps	14c	70c
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RCA Chassis sockets	35c	$1.75
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½W 50 per pack		$1.00

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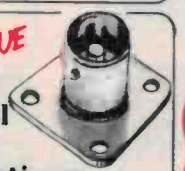
MB8118 16K DYNAMIC RAM (Intel 2118) 120ns	$4.00

SUPER VALUE

Amphenol BNC Panel Jacks for RF applications



Panel Jack $1.25
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Flat Cable 50 way, standard disc drive interface connector

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ET1-6

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Prices subject to alteration

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1st time offer - Litronix Red Single Digit Light Pipe Dip "Displays"
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Typ. 5.0. Min. 2.0 = 20ma
Fwd. volt. Typ. 3.4. Max 4.00

ONLY $9.00 for 10!!

2716 EPROMS

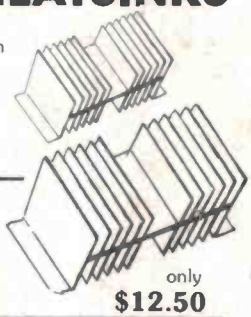
A fantastic scoop purchase of prime spec 2716 EPROMS by National. This is a once in a lifetime offer. Be quick and grap them now!!

$3.99
10 for $37

HUGE SAVINGS ON PHILIPS HEATSINKS

Type 45D3CB
13cm wide 7½cm tall 6cm tall undrilled, black anodised ready to use on amps, powersupply etc. Limited stocks going out the door at
only $6.50

Type 55D6CB
Huge cooling fins for the biggest job. Now at this crazy low price.
19cm wide 15cm tall 6cm deep. Get in early at
only **$12.50**



IC CLEAROUT

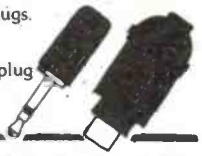
Huge shipment of ICs at under wholesale prices must be cleared soon. Prices are slashed to an all time low!!
4001AE Quad two input nor gate
10 for $1.20
100 for $10.00
1000 for $90.00
4020 14 stage ripple/carry binary counter divider.
10 for $3.00
100 for $25.00
1000 for $220.00

All these are brand new prime spec devices from SGS-ATES.

$100 SOCKETS SLASHED

Solder type. **$4.00 each or 10 for $36.00.** Wire Wrap type **$6.00 each or 10 for $55.00**

PLUG BARGAINS



3.5mm miniature phono plugs.
10 for $1.80
100 for $12.00
75 ohm plastic body coax plug
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100 for $10.00

FANTASTIC DEALS ON MINIATURE SWITCHES

These switches are selling at less than half the normal retail price. All are top quality with 2A/250VAC contacts. Under wholesale price. Only available in lots of 10 at these prices.
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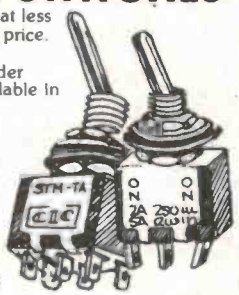
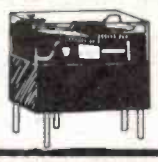
DPDT 10 for **$7.00**
2SP centre off (Lock/lock) 10 for **$9.00**
SP centre off (Lock/spring return) 10 for **$9.00**
DP centre off (Lock/lock) 10 for **$10.00**
DP centre off (Lock/spring return) 10 for **$10.00**



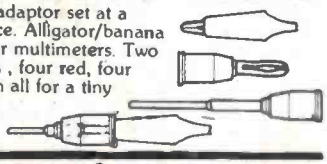
RELAY BARGAINS

New shipment of superb miniature PC mount relays. Both types have SPDT contacts. Rated at 1A/125V and 2A/30V. 5V-75ohm coil and 12V-400ohm coil **only $1.75 each $1.50 each ten up.**



CLIP SETS SALE

Miyama clip adaptor set at a knockout price. Alligator/banana set is great for multimeters. Two complete sets, four red, four black, eight in all for a tiny
$1.00

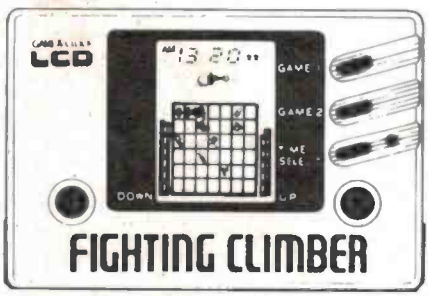


BRILLIANT NEW LCD GAME/CLOCKS

These superb new Japanese game clocks are simply the best we have seen. And of course we are offering them at a fantastic introductory price. These games are a real challenge to play. (Harder than Game and Watch). Both include a clock with alarm function.

FIGHTING CLIMBER

Find a way out to the top roof by avoiding many falling obstacles and get out by helicopter. But beware of King Kong!!! only **$19.95**



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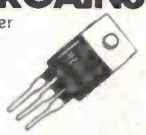
BD537 50W/8A/80V TO220 power transistor **10 for $2.00**
TIP29B **10 for $2.00**
NPN Power Transistor
BC547, BC557 **$6.00 per 100**
2N3565 NPN 30V 200mV small signal **10 for $1.00**



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2SK134 and 2SJ49. Back in stock at unbeatable prices again. **$5.50 each or $5.00 each 10 up.** (Note the ten up price is for 10 of one type, not for a mixture of types)

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Shoot a heart. The devils prevent the heart going up. **$19.95.**

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FOR PERFORMANCE & VALUE AARON HAS TO BE YOUR FIRST SCOPE CHOICE

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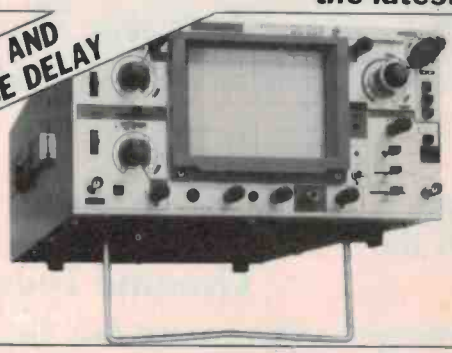

- 7.7nS risetime
- Single sweep
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45MHz/1mV

BS625 $990.00

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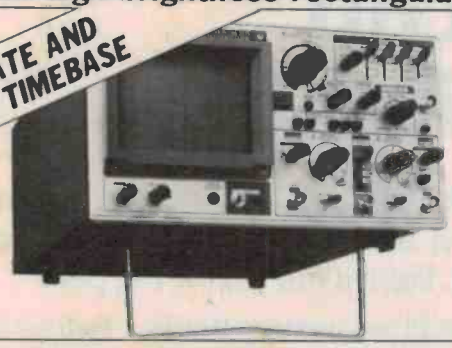

- 21 range timebase
- 100mS-1 uS trigger delay
- Front panel trace rotate
- X-Y, dual, chop, add, subtract etc.

35MHz/1mV

BS635 $790.00

BUILT-IN COMPONENT TESTER

- Check components on screen
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- Triggerable to over 30MHz
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New low price for popular AARON scope

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20MHz/5mV

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- Auto trigger free run
- TV sync

15MHz/2mV

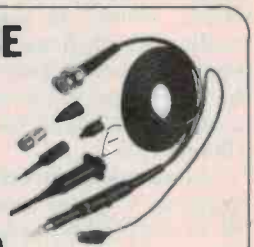
BS310 $720.00

QUICK SPEC CHECK

MODEL	B'WIDTH	SENS	SIG DEL	TRIG DEL	SCREEN	T'BASE
625	45MHz	1mV	Y	Y	150mm	0.2uS - 0.5S/div
635	35MHz	1mV	N	Y	150mm	0.1uS - 0.5S/div
601	20MHz	5mV	N	N	150mm	0.5uS - 0.5S/div
310	15MHz	2mV	N	N	95mm	0.5uS - 0.5S/div

COLINE SP100 PROBE

Professional 100MHz probe offering x1, ref, x10 positions. 1.5m lead with BNC connector and selection of tips. Complete in heavy duty plastic pouch. **$25.00**



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Tacho calibrator

A handy test instrument for the motoring enthusiast. Installing and calibrating a new tacho is a pain in the exhaust. Here's the pill for the pain.

Graeme Teesdale

THIS PROJECT was developed initially to calibrate Smiths impulse tachometers, but with the addition of a transformer and diode can be used with peak reading or pulse types. The unit has also been useful in testing transistor-assisted ignitions by simulating the pulses from the distributor breaker points.

The calibrator is locked to the mains frequency — 50 Hz. It provides a selection of 14 different pulse rates from 25 Hz to 450 Hz in 25 or 50 Hz steps. Using the conversion chart, the pulse rate can be converted into RPM for the number of cylinders in the vehicle's engine.

Construction

Two printed circuit boards are used and the whole unit is housed in a low cost ABS plastic case which is locally produced by Sigea in Melbourne (case model EC.1001). We 'dressed up' the front panel with Scotchcal.

One pc board holds the power supply and most of the circuitry, with the exception of one IC and the rotary switch, which are located on another smaller board along with a few other components. This board mounts behind the front panel of the case and connects to the main board via two lengths of ribbon cable.

Commence construction by using the larger pc board as a template to mark out mounting holes on the case bottom. Also mark out the mains cable inlet grommet hole and terminating block position. The front panel can be marked out using the Scotchcal as a template.

Drill the case, then mount and terminate the mains cable as indicated in the drawings.

Now you can start assembling the pc boards. Note the three links on the small pc board. LED1 actually mounts on this board, as does SW2. Make sure you cut the shaft of this switch to suit the knob you're using. Leave the leads of LED1 long and don't solder it in place until you have determined how long they should be by making a trial assembly once all the other components are mounted. SW1 is wired to the board after mounting to the panel.

When assembling the larger pc board, leave T1 and C1 till last. Watch orientation of the ICs, transistors, diodes and polarised capacitors, as usual. Note that the ICs are CMOS types, so observe the usual handling precautions. Don't handle the pins, pick them up with thumb and forefinger on the ends of the package; solder the power supply pins first.

When mounting T1, secure it in place with two PK screws before soldering to the pins to avoid straining the pins and possibly breaking the wires terminated to them.

When both boards have been assembled and checked, wire them together with two lengths of 5-way ribbon cable about 130 mm long each. Solder flying leads to the 240 Vac input terminals on the board (use mains cable).

Then, mount the larger pc board in the case and terminate the 240 Vac input wires to the mains terminal block.

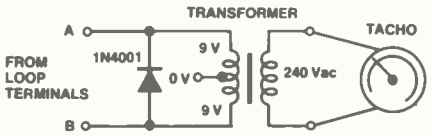
Attach the Scotchcal to the front panel of the case and mount SW1. Take care of the Scotchcal when tightening the nut. Solder three wires to its terminals and terminate them on the appropriate place on the small pc board. Then mount the small board. Take care when tightening the nut on the shaft of the rotary switch that you don't damage the Scotchcal.

After a careful final check, you're ready to switch on.

Testing it out

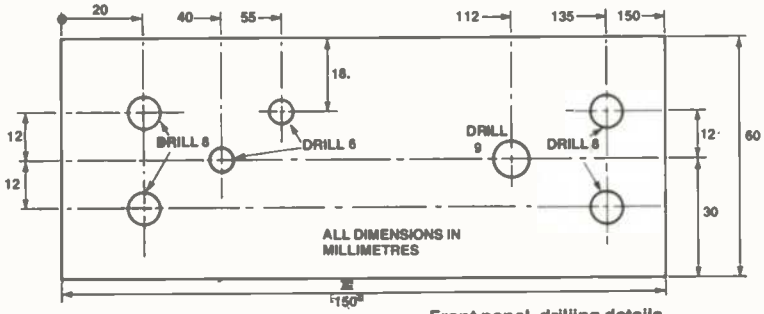
Set the range switch to position 1 and switch on. The pulse LED will flash at a rate of one second on, one second off. As you vary the range switch, the LED will flash at an increasing rate. If nothing's happening, then switch off and check your wiring, component orientation etc. See that supply voltage exists on the small pc board. Otherwise, you'll need either a logic probe or a CRO to fault-find.

If all is well, connect the primary loop of the pickup coil of a tachometer to the loop terminals. Vary the number of turns in the loop until the tachometer gives a reading. Use the accompanying table to determine the RPM, knowing the pulse rate and number of cylinders. Alternatively, if a peak reading or pulse type tacho is used, connect up the following additional circuitry:



Beware of the high voltage pulses on the secondary of the transformer in this circuit.

A little experimentation will show you how versatile this pulse generator can be. ▶



Front panel, drilling details.

PARTS LIST — ETI-165

Resistors ..... all ½ W, 5% unless noted
- R1 ..... 22k
- R2 ..... 8k2
- R3 ..... 1k5
- R4 ..... 100R
- R5 ..... 470k
- R6 ..... 27k
- R7 ..... 100k
- R8 ..... 10k
- R9 ..... 560R
- R10 ..... 1k
- R11 ..... 22R, 5 W

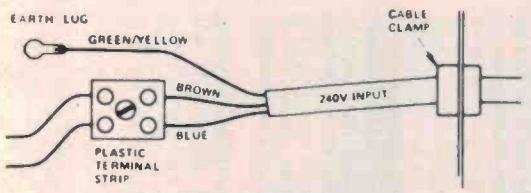
Capacitors
- C1 ..... 1000u/25 V axial electro.
- C2 ..... 10n greencap
- C3 ..... 1n greencap
- C4 ..... 1u/16 V tant.
- C5 ..... 22u/16 V RB electro.

Semiconductors
- D1, 2, 3, 4 ..... 1N4001, EM401 etc.
- IC1 ..... LM340T/12, 7812
- IC2 4046
- IC3 4017
- IC4 4093
- IC5 4040
- LED1 ..... TIL220R red LED
- Q1, Q2 ..... BC548
- Q3 ..... BD266 or similar

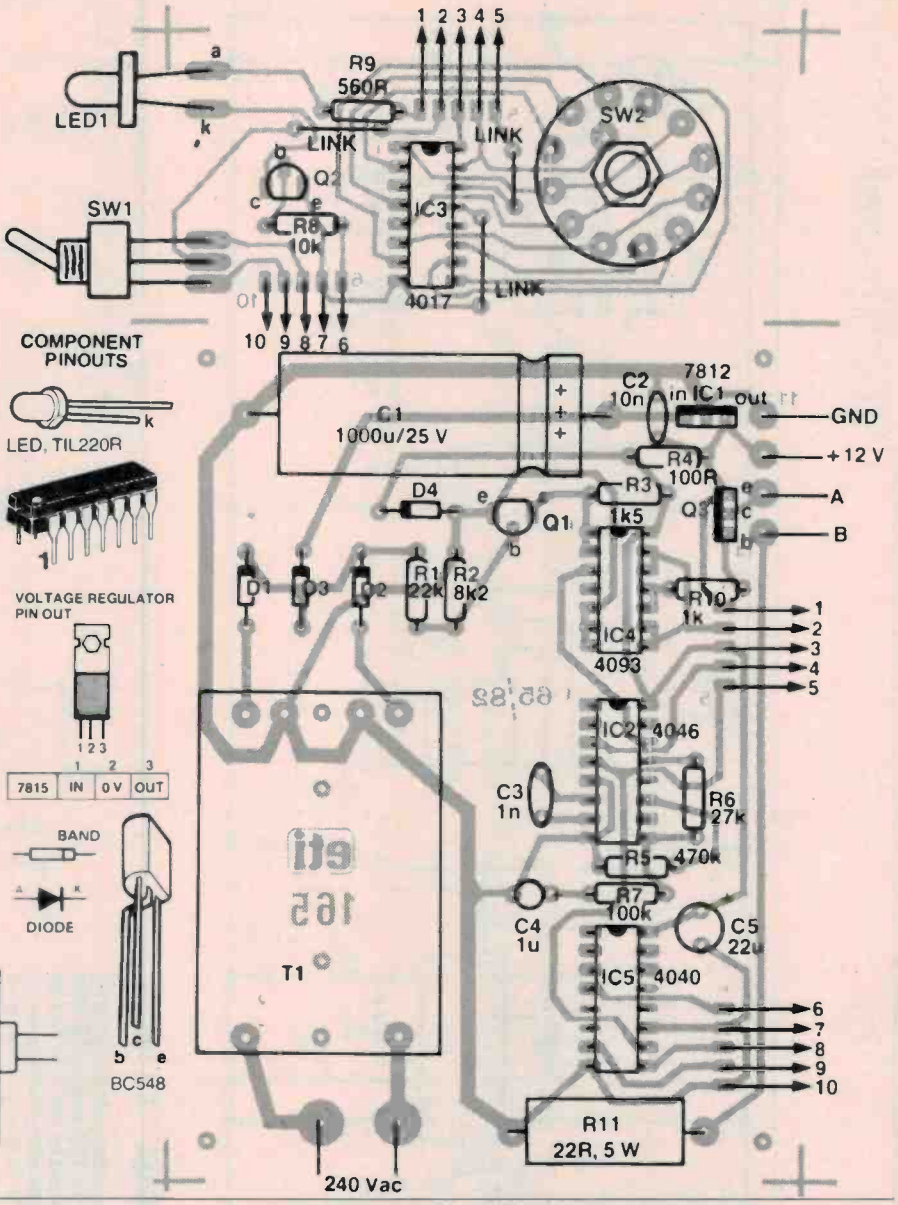
Miscellaneous
- TR1 ..... PL24/5 VA, Ferguson
- SW1 ..... SPDT switch
- SW2 ..... 1-pole, 9-position rotary C&K Lorlin or similar.

ETI-165 pc board(s); two lengths of five-conductor ribbon cable (or hookup wire); case to suit; mains cord and clamp; etc.

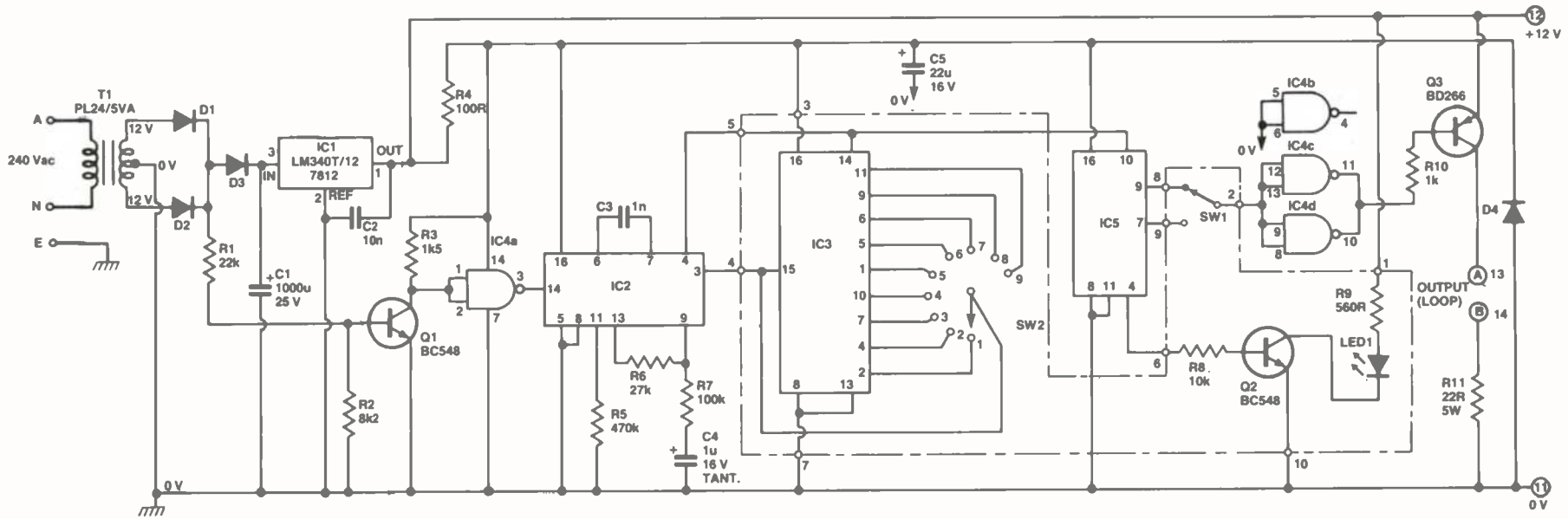
Price estimate $36-$40



MAINS INPUT WIRING



Project 165 tacho calibrator



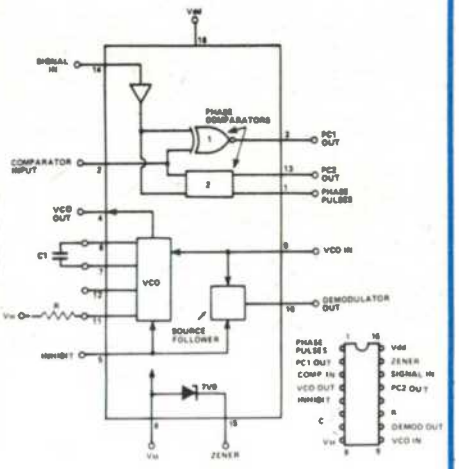
HOW IT WORKS ETI-165

Diodes D1 and D2 are a full wave rectifier, delivering half-sine pulses of 17 V peak at their cathodes. These half-sine pulses are coupled to a smoothing capacitor, C1, via D3 and also to the base of Q1 via R1. D3 serves to isolate the smoothing effect of C1. A 12 V regulated supply rail for the rest of the circuitry is provided by a 7812 three-terminal regulator.

The half-sine pulses coupled to the base of Q1 turn it on and off 100 times per second, the 100 Hz pulses on Q1's collector driving the input of IC4a, a Schmitt NAND gate connected as a buffer (4093). The output of IC4a drives the 'signal' input of IC2, a 4046 CMOS phase-locked loop (PLL). Its internal block diagram is shown in Figure 1. The VCO centre frequency of the PLL is determined by R5 and C3. An error signal from the phase comparator 2 (PC2) output (pin 13) is fed back to the VCO input (pin 9) via a second order low-pass filter consisting of R6, R7 and C4. Between the VCO output (pin 4) and the phase comparator input (pin 3) a divider having selectable outputs (IC3 — a 4017) is connected. This provides 1x to 9x the 100 Hz input frequency at the VCO output. The VCO output is further divided by two or by four by IC5 (a 4040) to provide scale multiplication of x1 (÷ 4) and x2 (÷ 2). To give an indication of the unit's operation, an output is taken from pin 4 on IC5. Q2 acts as a buffer between LED1 and the pin 4 output from IC5. The LED pulses on and off to show the unit is operating.

The selectable output from SW1 is connected to two paralleled sections of IC4 (IC4c and d) to interface to the 'loop' switch, Q3, a Darlington PNP transistor. For impulse operation, the primary loop of the tacho pickup coil is connected between the output loop terminals A and B.

The 12 V supply rail is available for powering any external equipment. R4 and D4 are included to protect the CMOS ICs against damage from negative spikes and unintentional application of an external voltage to the 12 V rail the wrong way round.



RANGE x1	RANGE x2	OUTPUT pulses/sec.	READING. rpm 4 cyl. tacho	READING. rpm 6 cyl. tacho	READING. rpm 8 cyl. tacho
1		25	750	509	375
2	1	50	1500	1000	750
3		75	2250	1500	1125
4	2	100	3000	2000	1500
5		125	3750	2500	1875
6	3	150	4500	3000	2250
7		175	5250	3500	2625
8	4	200	6000	4000	3000
9		225	6750	4500	3375
	5	250	7500	5000	3750
	6	300	9000	6000	4500
	7	350	10 500	7000	5250
	8	400	12 000	8000	6000
	9	450	13 500	9000	6750

NOTE: Printed circuit board and front panel artwork is located on page 127.

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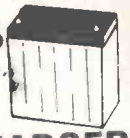

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COMPUTER VDU & KEYBOARD

- 240V AC MAINS
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- KEYBOARD EASILY ENCODED
- SELF-CONTAINED CABINET WITH MODERN "SWEPT-BACK" STYLE

$169

10 only ex-computer (from a famous manufacturer) terminals avail. for desk-top mounting. Late model, untested but assumed working. Standard video input to monitor, keyboard output easily interfaced to hobbyist computer. MAIL ORDERS - FREIGHT ON BY COMET!

AM/FM STEREO RADIO CASSETTE WITH SPEAKERS

AUTO-STOP, FAST FORWARD, WARRANTY, WAS $99.00 $79

TV PCB'S

From AWA, these new circuit boards have over 80 parts incl. 8 trans. (2SC1014, 2SC711, 2SA673, 2SA628, 2SC620), 10 diodes, caps, resistors, trimpots, etc. GREAT VALUE HERE! $1 EACH 10 FOR $8.00

Push-Button TUNER BOARDS

$3 EACH 10 For $25.

Comprises 2 boards, one has 8xDPDT push-button switches, similar to Isostat - the other has 8x100K multi-turn trimpots with 3 position band-change switches. LTD. QTY.

12 VOLT SIEMENS CRADLE RELAYS $2

Double pole on-off contacts normally open

Regular price is over $4.00for this quality!

Telescopic AERIALS for TV's $1.95

170 to 875mm POPULAR TYPE

pivots and swivels

Pack of 10 *$16

4 NEW PA AMPS

NEW

- ALL WITH SIREN, FOG HORN SOUND.
- LATEST, MODERN, COMPACT STYLING.
- DETAILS, SPECS, AVAIL WITH S.A.E.

12V MARINE MODEL WITH REMOTE MIKE CONTROL
Features- power level meter, siren/fog horn switch with manual or auto select, 4 switched speaker outputs, all with intercom facility, 20 WATTS rms output power. $185

12V MARINE MODEL WITHOUT REMOTE MIKE
Features as above but only 3 speaker outputs. $152

240vAC/12vDC MODEL WITH 20WRMS OUTPUT
Features- siren/fog horn switch, mike and aux. volume controls, 4/8/16 ohms output imped. inputs for radio cassette recorder, tuner, tape deck, mike 200-50k ohm. $159

240vAC/12vDC MODEL WITH 50WRMS OUTPUT
This model illustrated above.
Features- 2 mike inputs, siren/fog horn and 4 tone chime switch, 4/8/16 ohms plus 25/70/100 volt outputs, other features as above. $249

AUDIO MIXERS

for Home, Group & Semi-pro use.

$99 GREAT VALUE!

NEW IMPROVED MODEL!
- 2 Mic channels, 2 Phono channels, 1 channel for Tape or Tuner
- Magnetic or Ceramic inputs
- Tape outputs
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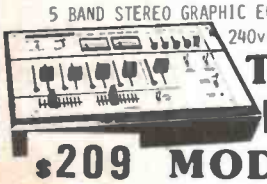

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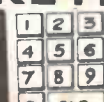

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Voltage and window comparators

Comparators are circuits in which the output changes state when the input varies above or below a set limit, or within two limits. Applications abound.

Ray Marston

THERE ARE MANY occasions in electronics when it is necessary to have a circuit that abruptly changes its output stage when an input voltage, or a quantity that can be represented by a voltage (such as a current, resistance, temperature or light level, etc), goes above or below a preset reference value. Circuits that perform this basic function are known as voltage comparators.

Voltage comparators have plenty of practical applications apart from the obvious ones of over and under-voltage switches. They can readily be made to activate relays, alarms and other mechanisms when load currents or temperatures or light levels exceed, or fall within, preset limits, and have a stack of domestic and industrial uses. We'll look at some practical circuits in the next few pages.

Basic voltage comparator circuits

The easiest way to make a voltage comparator is to use a CA3140 op-amp in one or other of the basic configurations shown in Figures 1 and 2. The 3140 op-amp has a typical basic

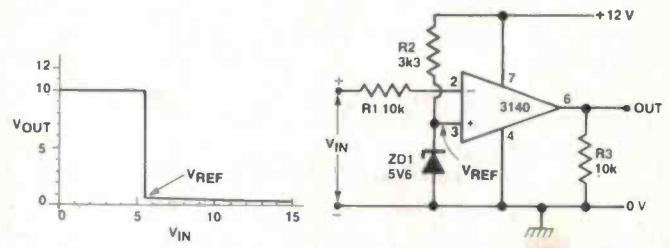

Figure 1. Basic op-amp comparator that functions as an under-voltage switch: the output is high when Vin is below Vref.

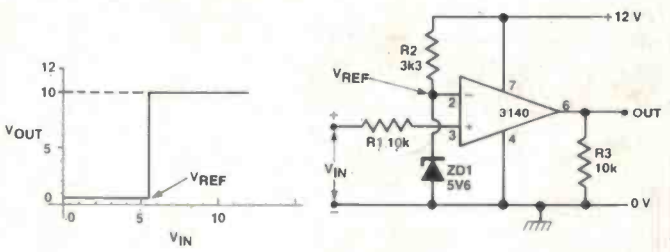

Figure 2. Alternative op-amp voltage comparator that functions as an over-voltage switch: the output is high when Vin is above Vref.

(open-loop) low frequency voltage gain of about 100 dB, so its output can be shifted from the high to the low state (or vice versa) by shifting the input voltage a mere 100 uV or so above or below the reference voltage value. This particular op-amp can be powered from either single-ended or split supply rails and provides an output that typically swings to within a couple of volts of its positive rail value or to within a few millivolts of its negative (or zero) supply rail value: Unlike many other op-amps, the 3140 can accept input voltages all the way down to the negative rail value.

The operation of the Figure 1 circuit is very simple. A fixed reference voltage (Vref) is generated via R2-ZD1 and is applied directly to the non-inverting input terminal (pin 3) of the op-amp, and the test or input voltage is applied to the inverting input terminal (pin 2) via current-limiting resistor R1. When Vin is below Vref the op-amp output is driven high (to positive saturation), but when Vin is above Vref the output is driven low (to negative saturation) as shown in the diagram. The action of the circuit can be reversed, so that the op-amp output is normally low but goes high when Vin exceeds Vref, by simply transposing the pin 2 and pin 3 connections of the op-amp, as shown in Figure 2.

There are a few points worth noting about the basic single-supply Figure 1 and Figure 2 3140 voltage comparator circuits. The first point is that the 'reference' voltage can be given any value from zero up to within two volts of the positive supply rail value, so either circuit can be made to trigger at any desired value between these limits by simply interposing a preset pot between a fixed voltage-reference source and the 'Vref' pin of the op-amp.

The second point to note is that the 'input' pin of the op-amp must be constrained to the range from zero volts up to within two volts below the positive supply rail value. Thus, if you want the circuit to trigger at some high value of input voltage, this action can be obtained by feeding the input voltage to a simple potential divider before it reaches the actual input of the op-amp.

The final point to note about the basic voltage comparator circuits is that they give a non-regenerative switching action, so that the op-amp is driven into the linear (non-saturated) mode when the 'input' voltage is within a few tens of microvolts of Vref, and under this circumstance the op-amp output generates lots of spurious noise. In some applications this type of action may be unacceptable, in which case the problem can be overcome by feeding a small part of the op-amp output voltage back to the non-inverting input terminal, so that a regenerative switching action is obtained. The feedback signal introduces a degree of hysteresis in the voltage switching levels, the degree of hysteresis being directly proportional to the amount of feedback.

Special voltage comparators

Figures 3 to 7 show how the three points mentioned above can be put to practical use to make various types of 'special' voltage comparator circuits; plenty of other variations are possible.

Figures 3 and 4 show how the basic comparator circuits can be modified to give variable-voltage switching by using a pre-set pot (PR1) to set the desired 'reference' or trigger voltage at any value in the range 0 — 5V6, and to give regenerative ('noiseless') switching by feeding part of the op-amp output back to the non-inverting terminal via R3; note in the Figure 4 circuit that the input terminal is terminated via R5, to ensure controlled hysteresis.

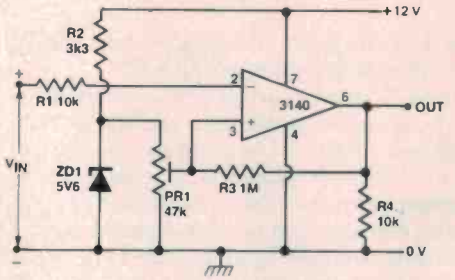

Figure 3. Variable under-voltage switch with degenerative feedback overcomes intermediate-voltage problems with Figure 1 and 2 circuits.

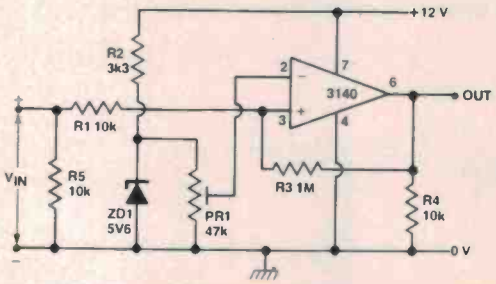

Figure 4. Variable over-voltage switch with regenerative feedback.

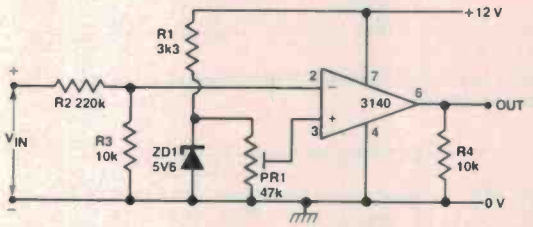

Figure 5. High value (0 — 130 V) under-voltage switch.

Figures 5 and 6 show examples of how the circuits can be modified to give high-value variable-voltage (0 — 130 V) triggering by interposing a simple potential divider (R2-R3) between the input signal and the input of the op-amp: The Figure 5 circuit gives non-regenerative switching, while the Figure 6 circuit gives regenerative switching.

Finally, Figure 7 shows how the comparator can be used as a sensitive audio sine-square converter that can operate from input signal amplitudes as low as 10 mV peak-to-peak at 1 kHz and which produces decent squarewave outputs from sinewave inputs with frequencies up to about 15 kHz. Input impedance is 100k.

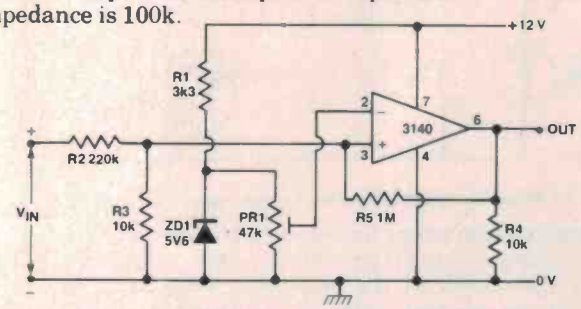

Figure 6. High value (0 — 130 V) regenerative over-voltage switch.

The operation of the Figure 7 circuit is simple. Voltage divider R1-R2 and capacitor C2 apply a decoupled reference voltage to pin 2 of the op-amp and an almost identical voltage is applied to signal-input pin 3 via isolating resistor R3. When a sinewave is fed to pin 3 via C1 it swings pin 3 about the pin 2 reference level, causing the op-amp output to change state at

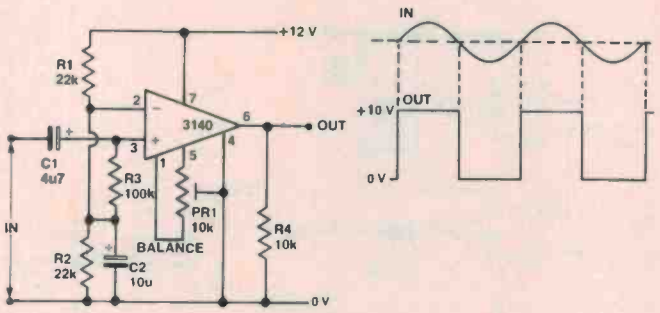

Figure 7. This sensitive sine-square converter needs only a few tens of millivolts of input signal to produce a decent squarewave output up to about 15 kHz.

the 'zero voltage difference' crossover points of the input waveform and produce a squarewave output. Preset pot PR1 is used to bias the op-amp so that its output is just pulled low with zero input signal applied, so that the circuit operates with maximum sensitivity and stability. Note that, because of the gain-bandwidth product characteristics of the op-amp, the circuit sensitivity decreases as the input frequency is increased.

Window comparators

The voltage comparator circuits that we've looked at so far give an output transition when the inputs go above or below a single reference voltage value. It's a fairly simple matter to interconnect a pair of voltage comparators so that an output transition is obtained when the inputs fall between, or outside of, a *pair* of reference voltage levels. Figure 8 shows the basic circuit configuration, which is generally known as a *window comparator* or *discriminator*.

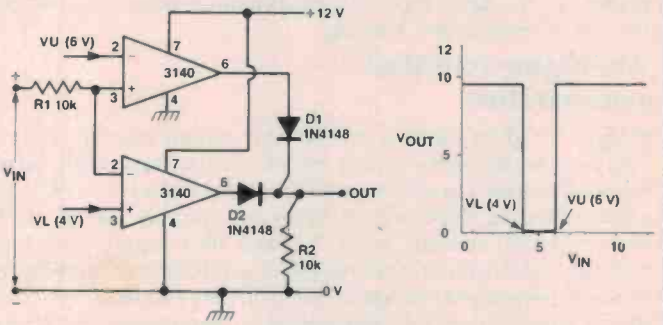

Figure 8. A voltage window comparator or discriminator. The output goes high when Vin goes outside of the V_L or V_U limits.

The action of the Figure 8 circuit is such that the output of the upper op-amp goes high when Vin exceeds the six volt V_U 'upper limit' reference value, and the output of the lower op-amp goes high when Vin falls below the four volt V_L 'lower limit' reference value. By feeding the outputs of the two op-amps to R4 via the D1-D2 diode OR gate we get the situation where the final output is low when Vin is within the limits set by V_U and V_L, but goes high whenever the input goes beyond these limits.

The action of the Figure 8 circuit can be reversed, so that its output goes high only when the input voltage is within the 'window' limits, by taking the output signal via a simple inverter stage. Alternatively, the required action can be obtained by transposing the two reference voltages and taking the output via a diode AND gate, as shown in Figure 9.

Window discriminators can readily be made to activate from any parameter that can be turned into an analogue voltage, in the same way as a 'normal' voltage comparator can. They can thus be used to activate relays or alarms whenever temper- ▶

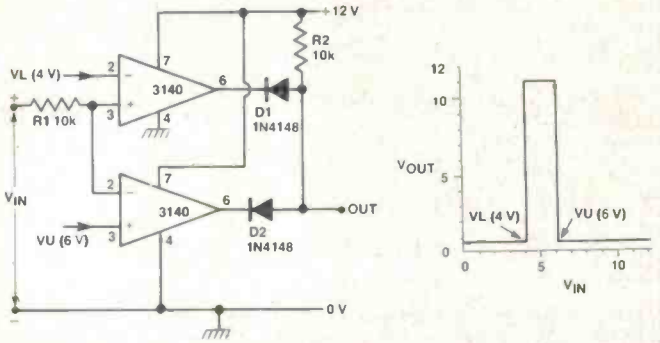

Figure 9. An alternative window discriminator in which the output goes high when VIn falls between the two limits.

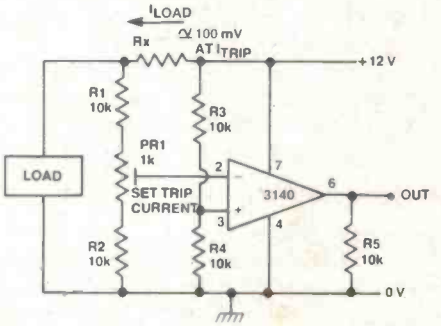

Figure 10. An over-current switch: the output goes high when the load current exceeds a preset value. The action can be reversed by transposing pins 2 and 3 of the op-amp.

atures, voltages, currents or light levels etc, go outside of preset limits. Let's look now at some examples of 'analogue-activated' comparator circuits.

Analogue-activated comparators

Figure 10 shows how a comparator circuit can be made to function as an over-current switch that gives a high output when the load current exceeds a value preset via PR1; the value of Rx is chosen so that it develops roughly 100 mV at the required trip current level. A fixed half-supply 'reference' voltage is fed to pin 3 of the op-amp via R3-R4 and a similar but current-dependent voltage is fed to pin 2 via Rx-R1-PR1-R2; in effect, these two sets of components are configured as a Wheatstone bridge, with one side feeding pin 3 and the other side feeding pin 2, and the op-amp is used as a bridge-balance detector; consequently, the trip points of the circuit are not significantly influenced by supply voltage variations but are highly sensitive to load current variations.

Note that the action of the Figure 10 circuit can be reversed, so that it functions as an undercurrent switch, by simply transposing the connections to pins 2 and 3 of the op-amp. The circuit can then be used as a lamp or load-failure indicator in cars or in test gear, etc.

Figure 11 shows the circuit of a sensitive ac over-voltage switch, which gives a high output when the input signal exceeds a peak value (6 mV to 111 mV) preset via PR1. The ac input signal is applied to the input of non-inverting variable gain amplifier IC1, which has its gain variable from x45 to x850 via PR1. Note that the input of IC1 is dc-grounded via R1-R2, so the op-amp responds only to the positive half-cycles of the input signal. Consequently, the output of IC1 is an amplified but positively half-wave rectified version of the input signal; this signal is peak-detected via R5-D1-C2-R6-R7 and fed to the input of non-inverting voltage comparator IC2, which thus gives a positive output when the C2 voltage exceeds the value on the junction of R8-R9.

Figures 12 to 15 show a variety of ways of using comparator circuits as light or temperature-activated switches. All of these circuits use a light or temperature-sensitive transducer (and LDR or cadmium sulphide photocell for light, or a negative-temperature-coefficent thermistor for temperature) as the sensing element and use the element as one arm of a Wheatstone bridge and the op-amp as a simple bridge-balance detector so that the 'trip' point of each circuit is independent of supply line variations. In all cases, the sensing element must have a resistance in the range 5k to 100k at the required 'trip' point and PR1 is chosen to have the same resistance value as

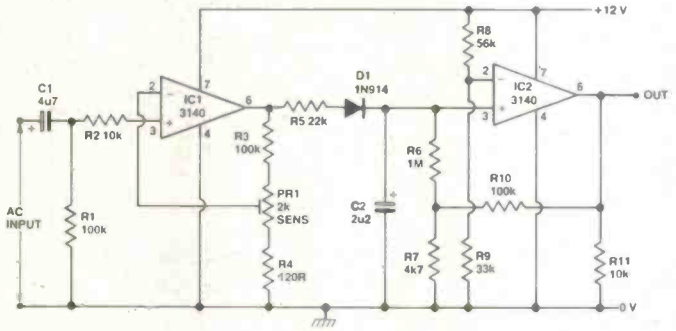

Figure 11. This ac over-voltage switch can be triggered by input signals in the range 6 mV to 111 mV peak.

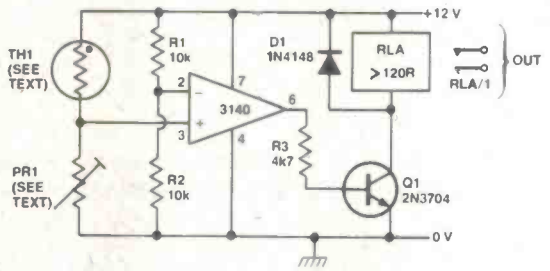

Figure 12. Precision over-temperature switch with transistor/relay output.

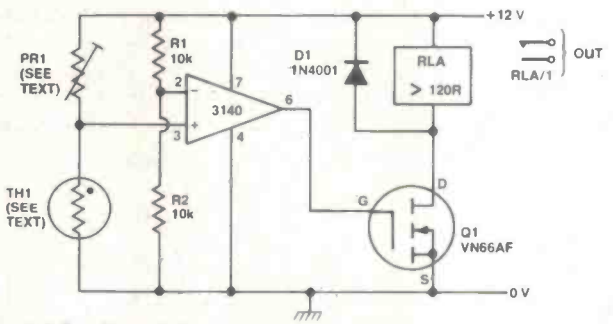

Figure 13. Precision under-temperature switch with VFET/relay output.

the sensing element at the required trip level.

The Figure 12 to 15 circuits also show a variety of ways of using the output of the op-amp to activate a relay or to generate an acoustic alarm signal. Thus, the Figure 12 over-temperature switch has a transistor-driven relay output, while the Figure 13 under-temperature switch has a VFET-driven relay output. Similarly, the light-operated switch circuit of Figure 14 generates a monotone alarm output signal in a small speaker, while the dark-operated switch of Figure 15 generates a low-power pulsed-tone signal in a small piezo-electric transducer.

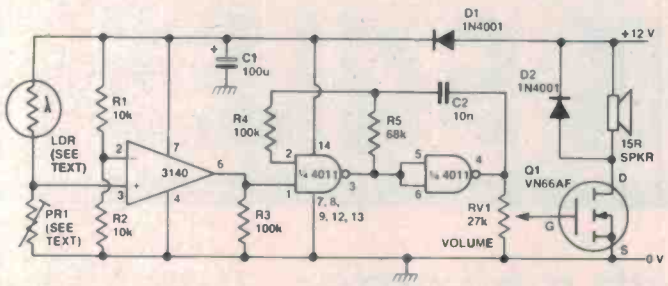

Figure 14. Light-operated switch with monotone alarm output.

Micro-power operation

All of the 3140-based comparator circuits that we have looked at so far are continuously powered; they draw continuous currents of about 4 mA per op-amp and will thus flatten a small 9 V battery in less than two days of continuous operation. These circuits are thus not well suited to battery operation in 'portable' applications. In practice, however, all of these circuits can easily be modified for long-life battery operation by using a micro-power 'sampling' technique; the principle can be explained with a simple example, as follows.

The Figure 13 under-temperature switch circuit monitors temperature continuously and draws about 5 mA of quiescent current (with the relay off). In reality, however, temperature is a slowly-varying parameter and thus does not need to be monitored continuously; instead, it can be efficiently monitored by briefly 'inspecting' or 'sampling' it (by connecting the supply power and inspecting the op-amp output) only once every second or so; if the sample periods are very brief (say 300 uS) relative to the sampling interval (one second), the *mean* current consumption of the monitor can be reduced by a factor equal to the interval/period ratio (e.g: by a factor of 3300) by using the sampling technique, so that, for example, the 5 mA consumption of the Figure 13 circuit can be reduced to a *mean* value of a mere 1.6 uA, thus giving years of continuous operation from a 9 V battery. The 'sampling' technique thus enables true micro-power monitor or comparator designs to be implemented.

Figure 16 shows the basic circuit of a 'micro-power' or sampling version of the Figure 13 under-temperature switch, which operates the relay when the TH1 temperature falls below a preset value but which draws a mean quiescent current of only a few uA. The TH1-PR1-R1-R2-IC1 monitor network is almost identical to that of Figure 13, but instead of being continuously powered it is powered via a 300 uS pulse just once every second via a sample-pulse generator and Q1.

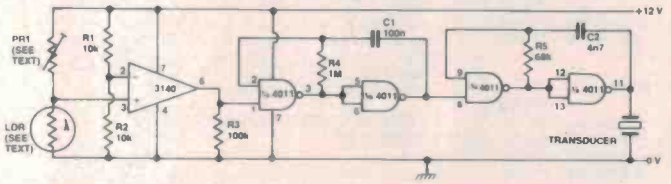

Figure 15. Dark-operated switch with low-power pulsed-tone output.

Note that the output of IC1 is fed to temporary 'memory' store R4-C1 via D1, and that the memory store operates the relay via VFET Q2.

Thus, if the TH1 temperature is outside of the trip level when the sample pulse arrives, IC1 output will remain low and no charge will be fed to C1, so Q2 and the relay will be off, but if the TH1 temperature is within the trip level when the sample pulse arrives the IC1 output will switch high for the duration of the pulse and thus rapidly charge C1 up via D1 and thence drive the relay on via Q2; the C1 charge will then easily hold the relay on until the arrival of the next sample pulse.

The Figure 16 circuit, then, illustrates the basic principles of the micro-power sampling technique. In reality the sampling interval and pulse-width used (and thus the reduction in mean power consumption) will depend on the specific application. If, for example, you wish to monitor transient changes in light or sound levels and know that these transients have minimum durations of 100 mS, you may have to use a 50 mS sampling interval and (say) a 500 uS sample pulse, in which case the mean consumption of your circuit will be reduced by a factor of 100.

In some cases you may have to slightly modify the operating principle of the sampling circuitry to obtain the desired micro-power operation. Figure 17, for example, shows how the

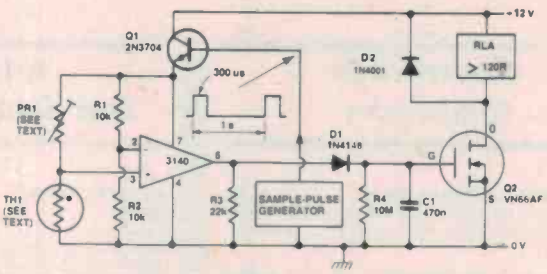

Figure 16. This micropower or 'sampling' version of the Figure 13 under-temperature switch draws a mean quiescent current of only a few microamps.

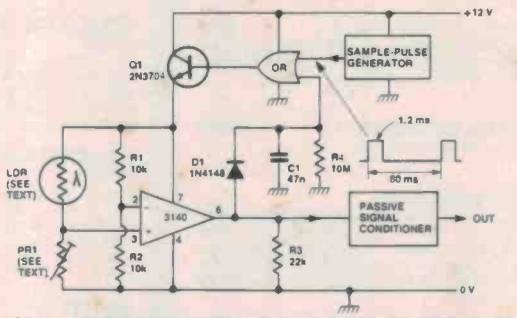

Figure 17. This coded light beam detector circuit uses a modified version of the micropower 'sampling' technique.

principle may be adapted to make a coded lightbeam detector, in which the 'code' light signal is modulated at 1 kHz for a minimum duration of 100 mS. Thus, the sample-pulse generator is designed to produce a minimum pulse width of 1.2 mS so that it can 'capture' at least one full 1 kHz code cycle, and the sampling interval is set at 60 mS so that part of a tone burst will always be captured. The sampling circuitry thus gives a 50:1 reduction in monitor current consumption.

Thus, in the Figure 17 circuit, the sample generator repeatedly feeds 1.2 mS 'inspection' pulses to the 3140 detector circuitry via one input of the OR gate and via Q1 to see if any trace of a coded signal exists. If no trace of a code signal is detected the output of the op-amp remains low and another sample pulse is applied 60 mS later, but if a trace of a code signal *is* detected the output of the op-amp immediately switches high and the resulting pulse is 'captured' by C1 via D1 and applied to the remaining input of the OR gate, thereby temporarily applying *full* power to the 3140 circuitry so that the code signal can be properly inspected via the passive signal conditioning circuitry to see if it conforms to the specified 'code' characteristics.

Note that, for a sampling system to be truly efficient, the actual sample-pulse generator must itself consume negligible current and may thus have to be a non-standard design. We'll show some possible suitable circuits in the next edition of 'Circuit File'. ●

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continued on page 62

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DAVID TILLBROOK HAS DONE IT AGAIN!! 5000 SERIES 1/3

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5000 SERIES GRAPHIC EQUALISERS

Latest addition to the thoroughbred 5000 Series stable! David Tillbrook has once again produced a 'No Compromise' design.
This new component, a 1/3 octave equaliser, gives you ABSOLUTE CONTROL over the acoustics of your particular listening enviroment. You get 3 SEPARATE CONTROLS for every octave of audio bandwidth to virtually eliminate the subtle nuances that are particular to your listening area.
1/3 octave equalisers have been used by professional engineers in Recording Studios and live concerts for over a decade now. It is no accident that the advent of the 1/3 octave equaliser and studio quality live sound have gone hand-in-hand. BUT THERE'S A CATCH. One of these equalisers is not enough. You will have to buy 2 (for stereo). Quite a lot of money — but worth it if you want the best.

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only $199

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Write in (SAE) for a new glossy leaflet on both amps.

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FREQUENCY RESPONSE	8Hz to 20kHz, +0 — 0.4dB 2.8Hz to 65kHz, +0 — 3dB Note: these figures are determined soley by passive filters
INPUT SENSITIVITY	1V RMS for 100W output
HUM	— 100dB below full output (flat)
NOISE	— 116dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION	<0.001% at 1kHz (0.0007% on prototypes) at 100W output using a ±56V supply rated at 4A continuous
3rd HARMONIC DISTORTION	<0.003% at 10kHz and 100W <0.0003% for all frequencies less than 10kHz and all powers below clipping
TOTAL HARMONIC DISTORTION	Determined by 2nd harmonic distortion (see above)
INTERMODULATION DISTORTION	<0.003% at 100W (50Hz and 7kHz mixed 4:1)
STABILITY	Unconditional

"BLUEPRINT"

5000 PREAMPLIFIER

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"One Swallow does not make a spring"
— Neither does a few gold RCA sockets!
Several of our competitors are imitating our "Blueprint" preamp by adding a few bits and pieces, notably gold plated RCA sockets to their standard kits. Unfortunately they have missed the point. We supply gold plated sockets in our "Blueprint" preamp but only where it makes sense to do this, i.e. on the inputs — NOT the outputs. 16 gold sockets are provided by us. This, however, does not make a "Blueprint". THIS DOES:
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- Original ETI designed front panel. Not an "ADAPTION". Our front panel is by far the nicest.
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- Quality LEDs, polished finish, multicoloured display.
- IC sockets on line amp board.
- Special rear panel.
- Special low noise selection LM394H NOT CH device in M.C. preamp.
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So don't "Swallow" the facts before they are properly digested!!
You can't make a silk purse out of a sow's ear. Send SAE for full specs.

BLUEPRINT $275

★ SPECIFICATIONS

Frequency Response	High level input: 15Hz-130kHz, +0, —1dB Low-level input—conforms to RIAA equalisation +0.2dB (see detail on Phono specs.)
Distortion	1kHz 0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N noise	High-level input, master full, with respect to 300mV input signal at full output (1.2V): 92dB flat 100dB A-weighted MM input, master full, with respect to full output (1.2V) at 5mV input, 500 ohm source resistance connected 86dB flat 92dB A-weighted MC input, master full, with respect to full output (1.2V) and 290uV input signal 71dB flat 75dB A-weighted

ETI-478MM Moving Magnet input stage	
Gain	½, 1kHz
Frequency Response	Conforms to RIAA Equalisation +0.2dB
Total Harmonic Disorder	0.001%, 1kHz, 10mV RMS input
Headroom	28dB with respect to 5mV RMS input signal, i.e. 135mV RMS
Noise	Total equivalent input noise, 122nV 'A' input shorted, 216nV flat, input shorted
S/N ratio	1mV 5mV 10mV Flat 73dB 87dB 93dB A-weighted 78dB 92dB 98dB
ETI-478MC Moving coil input stage	
Gain	24
Frequency Response	7Hz—135kHz+0, —1dB
Total Harmonic Disorder	0.003%, 1kHz, 30mV input
Noise	Total equivalent input noise 83nV flat, input shorted 42nV 'A', input shorted 56nV flat, after RIAA Eq. input shorted 34nV 'A', after RIAA Eq. input shorted

SERIES COMPONENT

OCTAVE GRAPHIC EQUALISER – BRILLIANT!!

FROM $495

8 CHANNEL MIXER KIT

The Jaycar 8002 Mixer was originally conceived to be the successor to the very popular ETI414 Master Mixer. The 414 was basically configured as a 'stage' mixer and suffered from a number of severe technical limitations – notably poor signal-to-noise figures. Enormous advances in Audio IC's have occurred since the 414 was designed, Jaycar engineers have taken advantage of this. The incredibly low noise and distortion figures of the 8002 are a testimony to the sound basic design of the mixer coupled with the performance capability of these IC's. Whilst the 8002 is the ideal 8 channel compact stage mixer, other applications have been kept in mind.

AS A "STUDIO" MIXER. The prime requirement of a studio mixer is that it must be quiet – i.e. have good S/N. Due to the fact that the "miracle" 5534 IC's are used in the 8002 studio applications are entirely feasible. In addition to this, metal film resistors are used in critical signal areas.

AS A DISCO MIXER. The balanced input feature of the 8002 is not really necessary for disco use. This section can easily be bypassed with either a moving magnet (Dynamic Cartridge) preamp, or a moving coil preamp. The sensible format of the 8002 and tremendous equalization facilities should make this mixer popular for disco use.

- Balanced (600 Ohm) Mic. Inputs/Line Inputs.
- Cannon Connectors included in the price.
- Bass, Mid & Treble Equalization on each Input.
- "Effects" (i.e. Echo etc.) capability.
- Foldback and Stereo Pan on ALL 8 Inputs.
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- 19" Rack Mount capability (or Console Mount).
- Professional Black Front Panel with Format borders & multi-coloured knobs to assist function identification.
- VU Metering.

Send SAE for full details + details on use as stage mixer

WIRELESS GUITAR LINK

— low cost breakthrough!

ONLY $149.50

Now you can roam almost anywhere without the hassle of a trailing cord back to the mixer or amp. The Musolink simply clips to either your belt or guitar strap and transmits back to any FM tuner. IT works on the largely unused section of the Australian FM band. The FM tuner then connects to the PA direct or thru a mixer. The results are spectacular and reliable. The transmitter is very stable. The massive price reduction is due to the fact that you don't need a special crystal controlled receiver, just your FM tuner.

SPECIFICATIONS

EFFECTIVE RADIATED POWER OF TRANSMITTER	30mW
RELIABLE RANGE	Over 50 metres
INPUT SENSITIVITY	Variable down to 15mV (RMS)
SIGNAL TO NOISE	60dB with typical tuners
TUNABLE FREQUENCY	88–100 MHz ie low (unused) part of FM band
FREQUENCY RESPONSE	10Hz to 16kHz (Flatter than most tuners)
FREQUENCY STABILITY	Similar to the frequency stability of high quality FM tuner so you can space many link units within 1MHz band without interference to each other
DIMENSIONS A COMPACT 40 x 40 120mm	
BATTERY LIFE	25 hours continuous (alkaline)
FACILITIES	Nicad charging socket low battery indicator LED mounting clip

KITS from EA ETI

EA KITS	
Le Gong – Electronic Doorbell Ref: EA3/81	$14.95
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479 – Bridging Adaptor ETI3/82	$9.95
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480/50 – 50W Economy amplifier – quality version	$23.00
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158 – Low Ohms Meter ETI11/81	$29.50
729 – UHF Masthead Amplifier	$35.00
735 – UHF Convertor	$32.50
477 – 5000 Series MOSFET Module – Quality	$59.00
478MC – 5000 Series Moving Coil Preamp	$29.50
478MM – 5000 Series Moving Magnet Preamp	$19.50
458 – 5000 Series Peak Reading Level Meter	$29.50

NEW 'Power UP'

Ref: EA 11/82

$39.50

What will they think of next??? Sensational project that detects the current drawn by one appliance to switch on up to 4 others – AUTOMATICALLY!

Great for computers, component HI FI etc. when you have to normally switch on several items in a system. Will switch total load of 240V 10A.

Complete kit including outlets, box, mains relay etc. ONLY $39.50

'super siren'

Incredible CMOS circuit drives a Motorola piezo horn (KSN 1038A) to achieve extremely high sound pressure levels. Makes a great alarm and only draws – would you believe – 5mA average?

Runs for ages on a 9V battery. You can get the electronics including the PCB for only $5.00. KSN1038A only $17 extra.

Ref: EA 11/82 FROM $5.00

Jaycar

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Telex: 72293

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CARLINGFORD
Phone: 872 4422

Mail Orders To: BOX K-39 HAYMARKET SYDNEY 2000

MINIMUM MAIL ORDER $5.00

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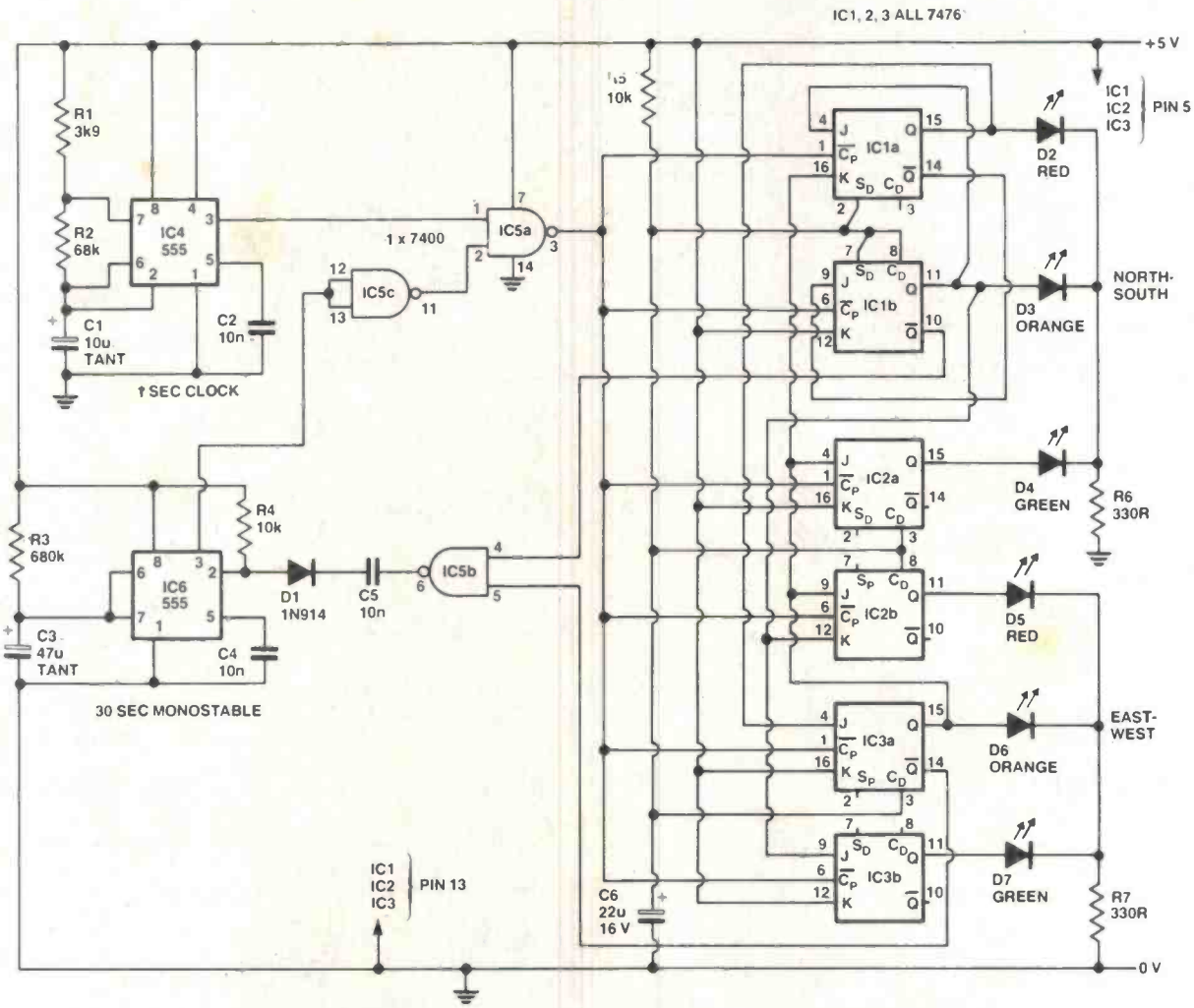
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

NEW SHOP HOURS
Mon-Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

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.



Traffic lights

This circuit for a traffic light system that can be used in model town applications or for a child's toy has been designed by **C.A. Symes of Flynn ACT.**

The six JK flip-flops form a sequence counter to achieve the same sequence of operation as traffic lights using red, green and orange LEDs.

When the circuit is switched on, R5 and C6 set the flip-flops ICa and IC3b and the other four flip-flops are reset. This turns the lights on in the correct sequence.

A one second clock is formed by IC4 and its associated circuitry, but the clocking of the flip-flops is inhibited by the NAND gate IC5a. IC6 forms a 30 s monostable flip-flop. Pin 3 is usually high for 30 s, then it goes low and the gate IC5a goes high and the clock then pulses the flip-flops.

The traffic lights then change from orange to red (green in the other direction) at a 1 s step rate. IC5b output changes from low to high as either orange light switches on. When the orange light switches off and the red goes on the output of IC5b goes low. This sends a pulse through the diode D1 which causes the monostable output to go high again and disables gate IC5a again for a further 30 s.

Resistor R4 holds the trigger line of IC6 high to prevent false triggering of IC6.

AUDIO KITS

JAYCAR IS NUMBER 1

sub woofer sensation

Ref: Electronics Australia June-August 1982

THE SUB-WOOFER

MODEL SW 250

This unit has been extremely popular with audio enthusiasts right across Australia! EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesisers, 1812 cannons etc!!

SPECS:
Diameter 10" (250mm) Cast Frame. QT=0.39. VAS=631
Power Handling = 100WRMS.
Free-air Resonance 32Hz ±1Hz
Voice Coil = 2" (51mm). Dia.
Magnet Assy = 3kg (6.6lbs).
A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!!

ONLY $79.50

THE ENCLOSURE

ONLY $79.50

This compact 63 litre vented enclosure was specifically designed around the parameters of the SW250 Sub-Woofer. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour.
NB. The photo shows the prototype which was finished in white. The production units are only available in black
Freight anywhere in Australia only $10.00.

AMPLIFIER/FILTER UNIT

AMPLIFIER/FILTER UNIT.
Amplifier Module $79
Transformer to suit $39.50
Metal case specially made to suit including front panel, hardware etc.(not a twin 25 case). Only $29.50
$148.00
Buy the lot for only $125.00 if you purchase the enclosure and woofer at the same time.

ONLY $79

REF. EA JULY 1982
State-of-the-art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!
FEATURES: Around 100WRMS Drive capability.
Low pass (sub-woofer) filters on board.
Can hook-up to pre-amp out or power-amp out.
Power supply on board.
(Transformer needed. ONLY $39.50)

TEST EQUIPMENT

EA dual tracking P/S

Extremely versatile power supply: Will give plus & minus 1.3V to 22V at up to 2 amps PLUS A FIXED +5V@0.9A. The supply is completely protected against short circuits, overloads and thermal runaway. A large meter with voltage calibration is supplied as well as IC sockets. A quality kit.

$84.50 Ref: EA March '82

Digital Storage CRO Adaptor $110

Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!! *Can display very slow waveforms * One shot triggering * Inbuilt graticule shows on TV screen * Crystal locked timebase * DC-100kHz bandwidth * Capable of storage operations. Ref: Feb 1982 EA

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$100 up ($6.20)		Thurs night to 8.30pm

MINIMUM MAIL ORDER $5.00

MARC NR82 MULTIBAND RECEIVER

AS REVIEWED IN ELECTRONICS AUSTRALIA AUGUST 1982
Virtually continuous coverage from 145kHz to 470MHz in all modes. AM, FM, SSB, CW. Built-in VFO, Squelch, RF Gain, Antenna trim and dozens more features!!
Measures a huge 484(H)x355(W)x165(D)mm and weighs 5 kilos (plus batteries!!) Fantastic performance from one radio.

$10 freight anywhere in Australia.

12 * band

GREAT VALUE

only $349

GOOD-BYE 3002

~~$489~~ **$399**

This 2x300WRMS P.A. Head is a classic road amp. Ruggedly constructed, 19" rack mount makes an ideal main P.A. or foldback unit. Great for Disco use as well.

We are discontinuing this amp because it is becoming too expensive to make. The metalwork costs alone now account for well over 50% of the unit. Because of this we have reluctantly decided to discontinue the unit.
You can grab one now while they last for only $399

Send SAE for full spec. sheet.

magazine binder

LOW IMPORT PRICE
ONLY $4.95
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Keep your precious (and expensive) magazines in order for easy reference. Smart blue colour with gold lettering. Heavy gauge and richly chromed metal fittings.

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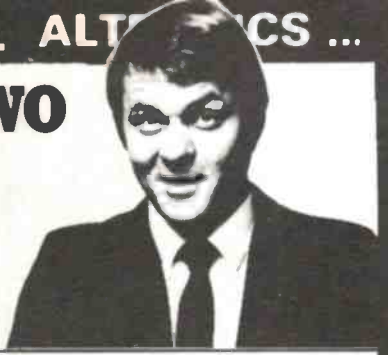
I'M BUILDING have built THE FIRST TWO



– what am I raving about? Well, having one of the World's finest home stereo systems (the brilliant ETI 5000 series amp and preamp together with my beloved B & W DM II loudspeakers of course!), I couldn't resist building ETI's 5000 series 1/3 octave Graphic Equalizers. I have been pestering ETI for well over a year – and **at last the many 1000's of 5000 series owners have the opportunity** *to complete their system with another* **classic, no compromise DAVID TILBROOK DESIGN.** *Details are on the other page of this ad. Cheers. Jack O'Donnell*

DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82

500 MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE

IMPORTANT NOTES:
(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.
(2) ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI – BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

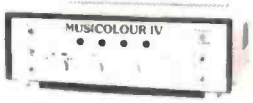
* Screened front panel * Bright high efficiency 7 segment display * Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler). * 4 gating times – .01, .1, 1, 10 seconds. * 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution. * High input sensitivity – 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance. * High accuracy – typically better than .005%/count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:
* IC sockets provided throughout.
* Low aging 10,000 MHZ XTAL.
* Thermalloy heatsink for 5V regulator.
* Quality Pactec instrument Case

K 2500 (50 MHZ version) $119.50
K 2501 Pre-scaler . . . . . $ 26.00
(add for 500 MHZ version)

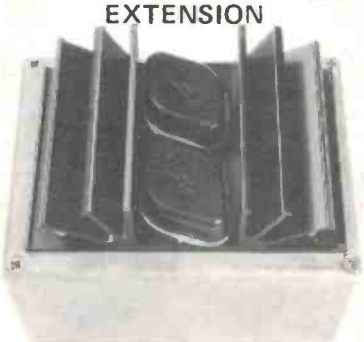
* THE EVER POPULAR * MUSICOLOUR IV EA PROJECT



Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts – that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K 1004 . . . . . $79.50

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

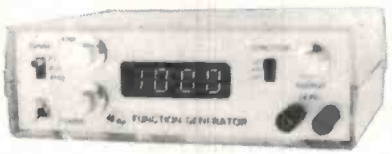


Petrol $2.00 a gallon – Good Grief!

Yes, it's bad enough paying $2.00 a gallon for petrol without waisting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K 1010. . . . . $35.00

FUNCTION GENERATOR WITH DIGITAL DISPLAY



EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.

See EA April, 1982

K 2505 . . . . . $85.00

ALTRONICS POWER SUPPLY

BASED ON EA LM 317K PROJECT
Every workshop, school and hobbyist should get one now!

* Overload and short circuit protected.
* Full voltage and current metering.
* 3-32 volt output at 1 AMP.
* Uses LM 317K variable regulator.
* Full instructions and every last part included.

VALUE PLUS!

K 3200 . . . . . $39.95

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1PF – 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

• • • EXCLUSIVE TO ALTRONICS • • •

Each kit now includes precision measured capacitors for accurate calibration of each range.

K 2520 . . . . . $45.00

DUAL TRACKING POWER SUPPLY

± 1.3 to ± 22V @ 2 AMPS + 5V @ 0.9 AMPS

Unit is fully protected against short circuits, overloads and thermal runaway. Pos and Neg supplies track within 1MV, voltage adjustable to within 10MV.

* Uses .25% linearity 10 turn pot.
* High sensitivity meter.

Essential for every school, workshop and lab.
Easy to build!

K 2507 . . . . . $86.00
See Electronics Australia March 1982

GREAT NEW MOSFET PA AMPLIFIER KIT FROM ETI 150 watts power output

See June '82

UNCONDITIONALLY STABLE - SOUND STUDIO SPECIFICATIONS

OUTPUT IMPEDANCE Selectable to low Z voice coil or 100V or 70V line out.
INPUTS 2 mic inputs HI or low Z with speech filter.
1 Aux. input.

* Low noise 5534 op amps used.
* Noble W/wound power resistors used in output stage for guaranteed stability.

*** * * ALTRONICS EXCLUSIVE * * ***
All due respects to ETI, but we felt the original case was lousey – So we've brought out ours utilising dur snazzy H 0400 Black Rack Cabinet.

It looks terrific!! And for this month only, it's the same price as the original version.

K 5035 . . . . . ONLY $239.00

GO ANYWHERE 240V PWR. KITS

See EA May and June 82. These great new inverter kits enable you to power 240V appliances for your car, caravan or boat. (From Standard 12V car battery.)

40 WATT

Suits small appliances, i.e. turntable, tape deck, shaver etc. Variable frequency adjustment enables accurate speed control of turntable motors.

IC Sockets Provided

K6700 . . . . . $55.00

300 WATT

Fully regulated and overload protected XTAL locked frequency.

* * * * *

NOW USING HIGH EFFICIENCY C-CORE TRANSFORMER

* * * * *

Use to power hi-fi, TV sets and for emergency lighting.

* Gold plating on both PCB edge and edge connector.
* Low age rate parallel resonant XTAL used.
* Sockets for all IC's.

K6750 . . . . . $199.50

$10 DELIVERY ANYWHERE IN AUSTRALIA!

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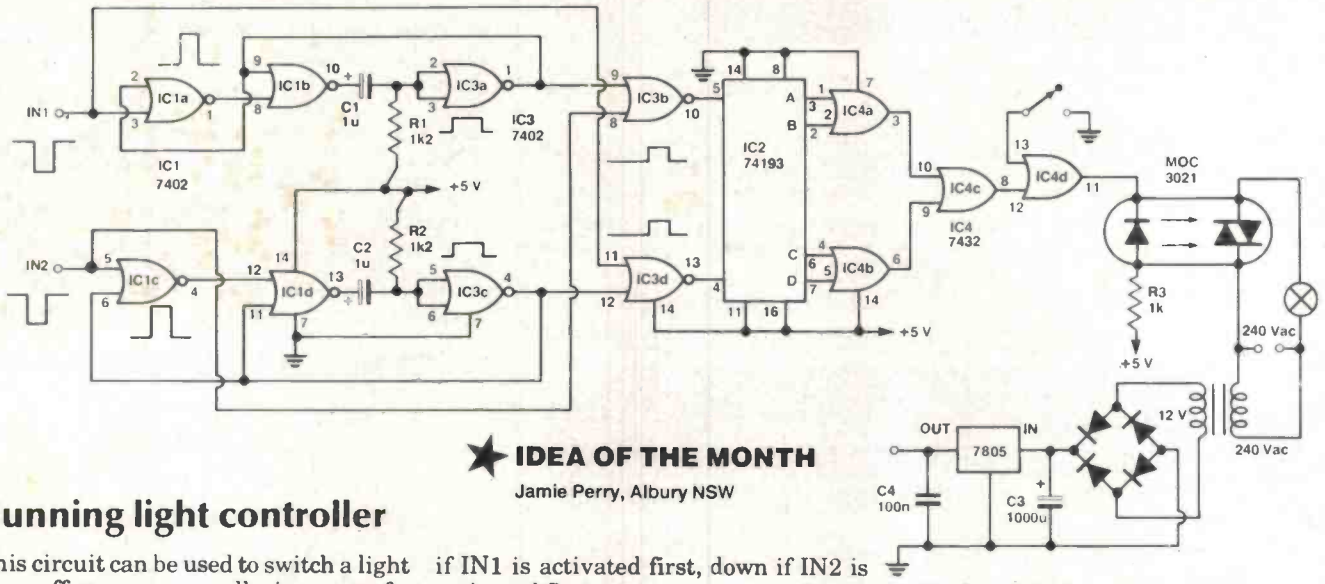
Nominate Jetservice Delivery with your order and we guarantee to deliver quicker than any other Australian supplier – it doesn't matter where you live – from Townsville in the North to Hobart – ALTRONICS delivers faster!

Ideas for Experimenters



★ IDEA OF THE MONTH

Jamie Perry, Albury NSW

Cunning light controller

This circuit can be used to switch a light on or off as a person walks in or out of a room. If two sensors are arranged either side of a doorway (infrared trip switches, like the ETI-570 from Jan. '82, for example) they can drive the two inputs to this circuit, IN1 and IN2. You could also use pressure mats, like those used with burglar alarms.

When IN1 is activated as you start to walk through the doorway (low-going pulse), IN2 is disenabled. The IN1 pulse is stretched such that the output of IC3a is still high when IN2 receives a pulse as you pass through the doorway. The two pulses are fed into an up/down counter, IC2, IN1 driving the UP inputs, IN2 the DOWN input. The counter will count up if IN1 is activated first, down if IN2 is activated first.

When IC2's outputs are all low, IC4 decodes this and switches off the light via the optocoupled triac. A switch is added on the final output gate, IC4d, so that you can manually control the light. Alternatively, pin 13 of IC4 could be driven from some other logic-level source for additional control of the light (from a sound, source, etc).

To set the time allowable to pass the two sensors, 0.8 x R1 x C1 gives the period. Note that R1 = R2, C1 = C2.

There should be not more than 15 people in the room as the counter resets after this count and the lights will go off unexpectedly.

By decoding the outputs of the counter and displaying the result, you could externally monitor how many people are in the room. Next step is to put these switches all over the house, connecting the counter outputs to your computer, and have your computer keep track of you!

The same circuit could be used to control an electrically-operated 'pet door'. You could put the sensors at a suitable height or in a suitable place and regulate what animals are allowed in or out, e.g: let in the cat, keep out the dog, let in the wombat but keep the baby out. (Now *that* will require some ingenuity! — Ed.)

'IDEA OF THE MONTH' CONTEST

Scope Laboratories, who manufacture and distribute soldering irons and accessory tools, have offered to sponsor a contest with a prize to be given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI. Each month we will be giving away a Scope Panavise pc board holder, model 333 — as described in News Digest, p.8, October '81 issue. Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, worth about $70, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.

Winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

"I agree to the above terms and grant Electronics Today International all rights to publish my idea in ETI Magazine or other publications produced by them. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright"*.

* Breach of copyright is now a criminal offence.

Title of idea .....

Signature .....

Name .....

Date .....

Address .....

..... Postcode .....

Cut out and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.**

MASSIVE BREAKTHROUGH!

CAR COMPUTER BELOW $200

COMPLETELY BUILT AND TESTED – NOT A KIT!!

MADE IN ENGLAND! – QUALITY!!

See Review ETI This issue Pgs 26-27.

SEE REVIEW OCTOBER EA PAGES: 26,27,28.

IDEAL RALLY COMPUTER!

CONTAINS EQUIVALENT OF THOUSANDS OF TRANSISTORS – USES MASSIVE CUSTOM LSI CHIP TO ACHIEVE LOW PRICE

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Never before has such a comprehensive car performance computer been offered at such a low price!! Once again miracle microprocessor technology has enabled us to pass enormous savings on to you!!
But don't let the low cost fool you. The "Voyager" car computer IS THE MOST COMPREHENSIVE PRODUCT THAT WE HAVE SEEN. No other car computer matches this one AT EVEN TWICE THE PRICE! You could buy a $20,000 Holden and not get a better car computer!!
Just check the features. We are sure that you will calculate that the "Voyager" represents outstanding value!

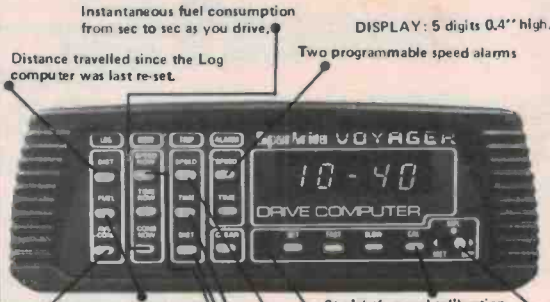
FEATURES

- INSTANT FUEL CONSUMPTION IN LITRES/100KM AND MPG!! (MOST OTHERS HAVE ONLY ONE OF THE ABOVE) JUST SWITCH FROM ONE TO THE OTHER AS YOU DRIVE ALONG.
- INSTANT SPEED, TIME AND OTHER FUEL DATA.
- VISUAL AND AUDIBLE EXCESS SPEED ALARM.

INSTALLATION

The "Voyager" comes complete with an unbelievable array of mounting configurations, on dash, under dash or stalk mount. ALL installation hardware is supplied (even a roll of insulation tape!) as well, of course, as the speed and fuel sensors. A lavishly illustrated installation manual is provided as well as a comprehensive operators manual. If you do not want to install the unit yourself we can do this for you for a guaranteed $39.50*. (A few exotic cars excluded!). A typically competent EA/ETI reader would do the job in 3-4 hours.
* Sydney metropolitan area only.

VOYAGER OPERATING FEATURES



Instantaneous fuel consumption from sec to sec as you drive.
DISPLAY: 5 digits 0.4" high.
Distance travelled since the Log computer was last re-set.
Two programmable speed alarms
Fuel used since the Log computer was last re-set.
Straightforward calibration.
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Average speed over the trip.
Instantaneous speed as you drive from sec to sec.
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Overall dimensions: 20cm x 7.1cm (9cm deep).
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Sat 8.30 to 12.00pm
Thurs night to 8.30pm

LOOK! More books!

Mail order coupon on page 99.

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BP93 **$6.56**
These may have a high degree of accuracy with quartz control or they may be quite simple designs, using only a few components. A number of specialist timer projects are car windscreen wiper delay unit, darkroom timer, metronome etc.

ELECTRONIC PROJECTS FOR CARS AND BOATS
BP94 **$6.56**
Fifteen fairly simple projects designed for use with 12 V electrical systems but in some cases can also be employed with 6 V and/or positive earth systems as well.

MODEL RAILWAY PROJECTS
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Projects include such things as controllers, signals and sound effects units. Construction stripboard layouts are provided for each project.

CB PROJECTS
BP96 **$6.56**
A number of useful designs include a speech processor, interference filters and a simple CB radio receiver. Stripboard layouts, wiring diagrams and notes on construction are provided.

POPULAR ELECTRONICS CIRCUITS — BOOK 2
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A companion for BP80, this book provides a wide range of designs for electronics enthusiasts who are capable of producing working projects from just a circuit diagram without the aid of detailed constructional information.

MINI-MATRIX BOARD PROJECTS
BP99 **$6.56**
This book provides a selection of 20 useful circuits which can all be built on a mini-matrix board which is just 24 holes by 10 copper strips in size. Simple and easy for those with not much experience in electronics.

MULTI-CIRCUIT BOARD PROJECTS
BP103 **$6.56**
All circuits are based on one specially designed pc board. Recommended to the less experienced hobbyist.

ELECTRONIC SCIENCE PROJECTS
BP104 **$7.52**
These projects range in complexity from a simple colour temperature meter to an infra-red laser. There is an electronic clock regulated by a resonating spring and an oscilloscope with a solid-state display. How to build them and use them is fully explained.

AERIAL PROJECTS
BP105 **$6.56**
Practical aerial designs including active, loop and ferrite which are relatively simple and inexpensive to build. The complex theory and mathematics of aerial design have been avoided.

MODERN OP-AMP CIRCUITS
BP106 **$6.56**
A collection of widely varying circuits and projects based on the op-amp ICs.

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING
BP110 **$6.56**
Helps you to overcome the problems of a circuit that doesn't work by indicating how and where to start looking for many of the common faults that can occur when building up a project.

circuit techniques and design

TTL COOKBOOK
21035P **$17.50**
A complete look at TTL logic circuits — what TTL is, how it works, and how to use it. Many kinds of practical TTL are included, such as digital counters, electronic stopwatches, digital voltmeters, etc.

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Learn how to construct filters of all kinds — highpass, lowpass, bandpass. The book is easy to understand — no advanced maths or obscure theory is used.

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continued on page 88

LETTERS

Dear Sir,

I am writing to advise you of a mistake on page 61 of the Ideas for Experimenters section of the July 1982 issue of ETI. You summarised a brief article I wrote for the SAMG newsletter but unfortunately printed the wrong circuit diagram with the text. For your information, the history is as follows.

J. Wilson's interlace modification in your June 1981 issue contained a mistake which prevented the modification working.

E. Clarke (SMAG newsletter, Oct/Nov 81), whom you also mentioned in your July 1982 issue, couldn't get that modification to work (because of your printing error) so he designed a modification to perform the same function using several packages.

I then wrote the article (SAMG newsletter Dec 81/Jan 82) which you saw, providing a correction of your misprint of June 1981. I provided no circuit because it was a simple modification which worked well.

The circuit diagram which you printed was for a modification I described in the same issue of SAMG newsletter, detailing how to get the PCG (ETI-681) joysticks to work with a CPU running at 4 MHz.

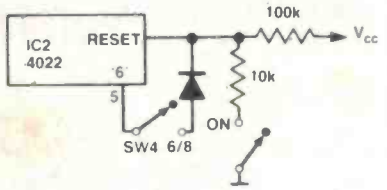
N.J. Phillis
Salisbury SA

Dear Sir,

I am interested in the percussion synthesiser and the sequencer projects which have appeared in ETI this year and, funds permitting, I hope to build them.

However it seems to me that there is a basic deficiency in the sequencer project (ETI June 82). At the bottom of page 67 you state, "For example, closing switches 1, 3 and 4 will generate a waltz rhythm". This seems to indicate a lack of understanding about waltzes and is a shortcoming in the circuit. As far as I know, waltzes are almost always in 3/4 time i.e: there are three beats to the bar (or six half beats).

Therefore, it is not possible to produce a waltz rhythm, or anything in 3/4 or 6/8 time since the sequencer always works on a sequence of eight beats. But this is easy to fix as the diagram below shows.



Only SW4, one diode and the 10k resistor are needed to modify the unit. Closing SW4 connects output '6' via the diode to the reset input. When the counter counts to '6' (i.e: on the seventh beat) a pulse is sent to the reset input, resetting the counter to zero, and the counter starts again. The 10k allows the ON switch to function without interfering with the reset action for 6/8.

This method is simple and doesn't require many parts. I have tried this out on a Proto Board and it seems to work without any problems. With this, or a similar modification, the unit will now be able to play waltzes.

If you had used a 4017 it would be possible to get a 5/8 beat as well. I am somewhat surprised at your apparent lack of knowledge, or misunderstanding of what is required.

All that aside, the project looks good.

Phil Denniss
Chippendale NSW

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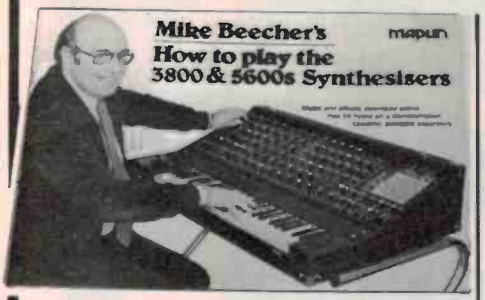

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As reviewed in Sept. EA page 107

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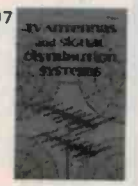

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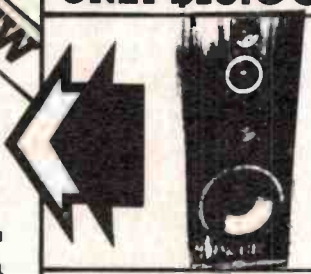

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This manual is ideal for beginners in electronics or as a handy guide for the more experienced.

LIMITED QUANTITY. **PLESSEY 12" WOOFER.**

This price can never be repeated.

90 watt handling, about 50w RMS
Foam rubber surround
beautiful white cone
Freq response to-3500 hz
SPL 92 db 1w/1mt
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CE2005
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PIONEER GUITAR SPEAKER

Far more watts for your dollar.

40 oz. Ferrite Magnet
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Total Flux 108,000 MAXWELL
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Net Weight 3,520 (124.2) gr (oz)

CE2380 **$49.50 ea.**

SUPER TWEETER

Available again for a limited period. Plessey HO16N17 Horn
Power 50 watts RMS
Freq resp 5K-40 KHZ
SPL 96 db 1w/1mt

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(Updated 8.30)

40 watts RMS handling.

CE2113 **$34.50.**

ALL PRINTED CIRCUIT BOARDS FOR ELECTRONICS AUSTRALIA AND ELECTRONICS TODAY KEPT IN STOCK IN BOTH STORES BACK TO 1975.

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here.

Series 5000 Graphic equaliser

Because the Series 5000 equipment is so phenomenally popular, this project will be widely stocked as a kit. Any supplier advertising Series 5000 equipment in the past will have this project in stock. If you're a mechanical masochist and really *have* to cut all 28 slots in the front panel by hand then we sincerely wish you all success. From experience, we know most hobbyists don't fit this category and will be seeking kits. At press time, we knew the following firms were to stock the project: Electronic Agencies and Jaycar in Sydney, Rod Irving Electronics in Melbourne and Altronics in Perth. These firms will be able to supply complete kits, right down to the last nut and bolt and featuring silk-screened front panels.

ETI-165 Tacho calibrator

So far as we are aware, only Rod Irving Electronics are stocking this project as a kit. Save yourself the trouble of hunting up all the components and contact them for a kit.

If you have some of the components on hand for this project and want to shop around for the rest then you should find most available almost anywhere. The BD266 Darlington used to drive the loop is not too common, but you should find it at David Reid and Jaycar in Sydney, or Magraths and Ellistronics in Melbourne, plus Data Parts in Shepparton (for Victorian country readers).

The EC.1001 case is manufactured by Sigea in Melbourne. If you cannot find a local supplier, they can be contacted at P.O. Box 49, Thornbury Vic. 3071.

The PL24/5VA Ferguson pc-mount transformer is available from Jaycar in Sydney and Rod Irving Electronics in Melbourne.

Printed circuit boards and Scotchcal front panels may be obtained from the suppliers listed in Shoparound in the August issue this year (page 70).

ETI-653 16 Channel computer output driver

Kits for this project will be stocked by Electronic Agencies in Sydney and Rod Irving Electronics in Melbourne as well as Dick Smith Electronics all over the country.

For those who have parts on hand, then pc boards can be obtained from the suppliers listed in Shoparound in the August issue this year (page 70).

Latest addition to the line of tools produced by Minitools is the 'Gravllo' engraving tool. Like all other Minitool tools it is powered from 12 Vdc. The engraving bit spins at 18 000 rpm and the whole unit weighs just 60 grams. Details from Minitool Australia, 134A Ayr St, Doncaster 3108. (03)850-9887.

For those wanting to make their own pc board, a print of the full-sized artwork can be obtained by sending a stamped, self-addressed A4-sized envelope to:

ETI-653 pc board artwork
ETI Magazine
15 Boundary St
Rushcutters Bay NSW 2011

Address missing

The fairies at the bottom of the darkroom had an insatiable appetite last month, and not content with chewing up leftover artwork, attacked page 64 and devoured the address on A.E.D.'s advertisement at the top of the page. If you want to find out more about the Little Big Board advertised there, contact A.E.D. at 130 Military Rd, Guildford NSW 2161. (02)681-4966. Tell them the fairies sent you. ●

JIL SX-200,
A BETTER SCANNING MONITOR RECEIVER.

Covers 26-88 MHZ & 108-180 MHZ & 380-514 MHZ

Monitors over 33,000 frequencies from 26 to 88 MHz, 108 to 180 MHz and 380 to 514 MHz. Bands included within this range are HF and UHF CB, 27 and 155 MHz MARINE, Australian LOW BAND, AIRCRAFT band, VHF SATELLITE band, 10 Mx, 6 Mx, 2 Mx and 70CMx AMATEUR BANDS, VHF High BAND as well as UHF two-way band.

Mechanically rugged the SX-200 uses high quality double-side Epoxy-Glass printed circuit boards throughout. Some of its other outstanding features include 3 MODE SQUELCH circuitry which allows the lockout of spurious and carrier only signals, extremely low spurious count, AM and FM detection on all bands, FINE TUNING control for off channel stations, 240 VAC on 12 Volt DC operation, Accurate QUARTZ CLOCK, Squelch operated OUTPUT for switching a tape recorder etc, 16 Memory channels, MEMORY BACKUP which lasts up to two years, high SENSITIVITY and SIGNAL-TO-NOISE ratio on all bands, CRYSTAL FILTER for excellent SELECTIVITY and easy servicability due to component layout as well as a 90 day warranty.

Its high quality and performance is testified by the fact that it is in use by a large number of State government and Federal bodies including most state and federal police departments.

Contact GFS, the Australian Distributors, or our interstate outlets for full technical specifications.

We also market a range of pocket scanning receivers and transceivers. Contact us for full details.

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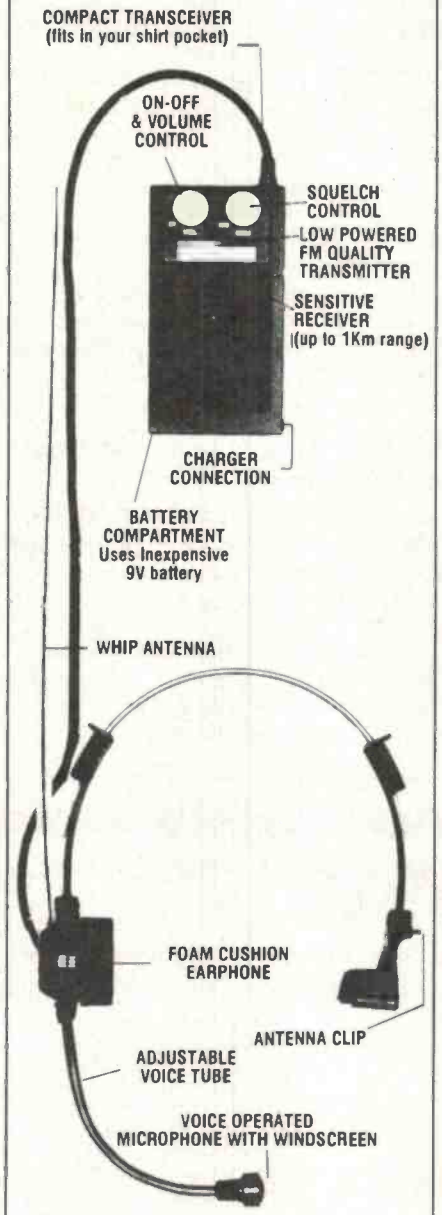

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SPECIAL PACKAGE DEAL
A65-450 AIM65 4K with FORTH. Normally $106.83 ..... **NOW $540.54**

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Amateur transponders for geostationary satellite?

Two geostationary amateur satellite transponders may become a reality by the end of 1985 if a proposal by the President of Cablesat General Corporation of Cocoa, Florida USA, is put into effect.

The President of Cablesat, Ray Kassis WA40HK, has proposed a 'no-strings' gift of two transponders to be carried aboard the 'Cablesat East' satellite to be orbited by the company in 1985.

The two 10 MHz-wide transponders will be part of a pair of 24-channel communication satellites and the value of the gift is estimated to be in the vicinity of US$20 million.

The transponders will operate in C-band, adjacent to an existing amateur microwave band. The overall proposal has been submitted to the FCC for action and, if approved, will give amateur radio the kind of communications only dreamed about in the past.

Ray Kassis would like to see formation of an amateur radio experimental network dubbed ARNET, with a proposed uplink frequency of 5.65-5.67 GHz and a downlink in the C-Band at or near 3.40-3.41 GHz.

It is estimated that amateurs using a 6 foot dish and 10 watts of power (or less) will provide sufficient voice communications performance over the transponders. According to Cablesat General, the transponders will use circulary polarised antennas to provide as large a 'footprint' on the earth's surface as is possible, unlike the other 23 transponders on each bird whose signals will be beamed to specific geographic areas.

With satellites at either end of the equatorial 'geostationary parking orbit', the Eastern bird will not only cover most of the continental USA and Canada, but will also serve Central and South America as well.

The Western bird will have similar Northern hemisphere coverage and will reach well out into the Pacific to include the Hawaiian Islands. It is not know if coverage will reach Australia.

Kassis has placed the operation of these transponders with the ARRL, but said that one of the things that he would personally like to see is some form of amateur radio emergency network, possibly one using either computer-based or packet radio technology.

He envisions a new era in amateur radio experimentation using the satellites, and hopes that this gift may add impetus toward getting new, technically-minded people into amateur radio, and possibly from there into careers in the sciences and technologies. (Westlink Report.)

Field day in the Blue Mountains

The Blue Mountains Amateur Radio Club will hold their annual field day on November 14 at Springwood High School, Chapman Parade, Springwood.

All the favourite field day events will be on for young and old: HF/VHF scramble, 'sniffer' transmitter hunts, the traditional 'fox' hunts, etc.

There will be a number of trade displays and that old favourite — the auction, where you can off-load all that junk you bought at another club's auction last year!

If you're taking your family, and they'd rather go sightseeing, there's the Norman Lindsay gallery and museum just down the road from the field day venue and plenty of other local sights.

Don't forget, November 14, at Springwood. The fun commences at 0900 (EADST).

Reading the RTTY, a breeze with Telereader

Those myriad of 'warble' signals heard all over the shortwave bands are a variety of radioteletype, morse and ASCII (computer) communications signals. With the Telereader model CWR-670E you can decipher them all.

The CWR-670E is a converter that attaches to the audio output of any receiver and will convert morse (CW), radioteletype (RTTY) and ASCII signals to a composite video output that can be viewed on a suitable monitor or TV set. A Centronics parallel printer interface is also provided if you want hard copy output from one of the standard computer printers.

ETI recently had the opportunity of using a Telereader CWR-670E and a companion video monitor, model TMC-9M. The Telereader can be set to demodulate morse ranging in speed from 4 wpm to 50 wpm. The RTTY demodulator can convert the IARU and US tone standards in three shift widths of 170 Hz, 425 Hz and 850 Hz. Reverse shift can be copied too. Maximum speed that can be accommodated is 110 baud.

The display memory gives you 14 lines of 75 characters per line on the video output, 16 lines of 36 characters per line on a printer. A useful CW practice function is provided so that you can plug in a key and display your efforts on the monitor or your TV set. In addition, a CRO output is provided giving a cross pattern for tuning purposes. Very handy. A mark-space LED indicator on the front panel is used in lieu of CRO tuning.

We connected the Telereader converter input to the AUX SPEAKER output of a Yaesu FRG-7 general coverage receiver, rigged up a hasty antenna ('random wire') and tuned around for some likely signals. Lo and behold!, we found plenty of interest — indecipherable message code a lot of it, but some intelligible news services could be found. The unit performed faultlessly on both CW and RTTY and would cleanly 'copy' signals that didn't even move the receiver's S-meter.

General operation is 'a breeze' and all controls function as you'd expect them to. If you want to explore a whole new world on shortwave, or get into amateur radio teletype etc, this looks a good place to start. Starting price is $447 for the model CWR-670E. Further details from Emtronics, 649 George St, Sydney NSW 2000. (02)211-0531.

LOOK AT THESE

A COMPLETE SHORTWAVE LISTENERS RIG

Telereader Model CWR-670E

$447

This receiving converter takes audio output from your receiver and converts morse (CW), radio teletype (RTTY) and ASCII (computer) signals into text for display on a VDU. Converts almost any speed morse and all the standard RTTY and ASCII speeds and frequency shifts. Simple to use.

Video Display Unit TMC-9M

$185 incl. tax

This compact display unit has a 210 mm diameter screen, an all-metal cabinet and two 75 ohm SO239 input sockets to take standard 1 V composite video.

FRG-7700 **$499**

The shortwave listeners dream; High Quality, medium price, general coverage communications receiver.

THE INTELLIGENT RECEIVER IS YOURS, FOR DX IN THE 1980's

NRD-515 $1595

This new receiver is full of performance advantages including general coverage, all modes of operation, PLL digital VFO for digital tuning, 96-channel frequency memory (option), direct mixer, passband tuning, etc.

MARC NR82F1 12 BAND COMMUNICATIONS RECEIVER

$310

Features:
- ★ 12 bands LW/MW/4-SW/5-VHF/VHF with digital frequency
- ★ 3 way power AC/Battery/Car Battery
- ★ Frequency coverage 145 KHz to 479 MHz
- ★ 8 Microvolt sensitivity on VHF bands
- ★ Controls for squelch, RF gain, BFO antenna adjustment narrow/wide sensitivity, bass, treble, and direct taping facilities.

THE DRAKE R7A **$2145**

Offers performance and versatility for those who demand the ultimate. ★ Continuous no compromise 0 to 30MHz frequency coverage ★ Full passband tuning (PBT) NEW! Noise Blanker Supplied as standard ★ State-of-the-Art features.

8510/8510P DOT MATRIX PRINTER

8510 8510P

This compact desk top dot matrix serial impact printer is ideal for hard copying CRT displays, and for data communications and peripheral minicomputer terminals. Features include variable fonts, dot graphics, 4-copy capability, print speed of 100 characters per second, 136 characters per line.

Dot Matrix Printer DP-8480

★ Low cost ★ Excellent printing quality ★ Logical Seeking carriage control for faster throughput ★ Graphics printing capability ★ Self-Diagnostic capability ★ 96 ASCII character set plus block graphics characters ★ Long life print head.

KGN-12N DISPLAY MONITOR

Designed to fit Telereader equipment and computers with composite video output, the 12" (31 cm) CRT displays up to 2000 characters, using an implosion proof green phosphor. Dependable 14 transistor circuitry with DC restoration for raster prevention.

ALL NEW EMTRON 470

Introducing the latest in UHF CB ★ 6CH ★ hand held ★ smallest on the market ★ 1W output ★ repeater offset. Complete with CH 20 XTL, rechargeable nicad batteries and car adapter. XTL's for other channels and carry case available.

$299

Compact Sized Terminal Printer DP-8240

$349 incl. tax

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EMTRONICS Sydney's Radio Communications Centre

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16K EPROM CARD-S 100 BUSS

$89.50 KIT

BLANK PC BOARD $49

USES 2708's

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450 NS 2708'S ARE $5.90EA. WITH PURCHASE OF KIT

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32K S-100 EPROM CARD

NEW!

$99.95

KIT
USES 2716's
Blank PC Board — $59
ASSEMBLED & TESTED
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SPECIAL: 2716 EPROM's (450 NS) Are $5.90 EA. With Above Kit.

KIT FEATURES

1. Uses +5V only 2716 (2Kx8) EPROM's
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks.
5. Cromemco extended or Northstar bank select
6. On board wait state circuitry if needed
7. Any or all EPROM locations can be disabled
8. Double sided PC board, soldermasked, silk-screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

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- 16K Dynamic Ram Board
- Fully Expandable to 64K
- Assembled, tested and guaranteed
- S100 Compatible

16K Dynamic RAM Board assembled and tested. Special $269 plus tax (4mHz) $299 plus tax (4mHz) This must be the best offer available on quality tested dynamic RAM boards.

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16K STATIC RAM KIT-S 100 BUSS

KIT $179
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KIT FEATURES

1. Addressable as four separate 4K Blocks
2. ON BOARD BANK SELECT circuitry (Cromemco Standard) Allows up to 512K on line
3. Uses 2114 (450NS) 4K Static Rams
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6. All address and data lines fully buffered
7. Kit includes ALL parts and sockets
8. PHANTOM is jumpered to PIN 67
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10. Blank PC Board can be populated as any multiple of 4K

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16K STATIC RAM SS-50 BUSS

PRICE CUT!

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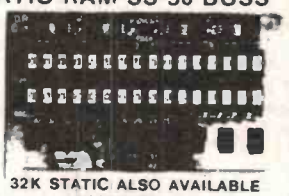

FOR SWTPC 6800 BUSS!

32K STATIC ALSO AVAILABLE

KIT FEATURES

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board Solder mask and silk screened layout Gold fingers
5. All Parts and Sockets included
6. Low Power Under 1.5 Amps Typical

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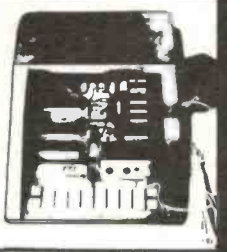

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Colour capability, operates from optional 9 V plugpack. 1K memory expandable to 3K on-board, single-board construction, cassette interface, audio output, simple to program (uses Chip-8)
Expansion projects coming up include ASCII keyboard, light pen, games software, etc.
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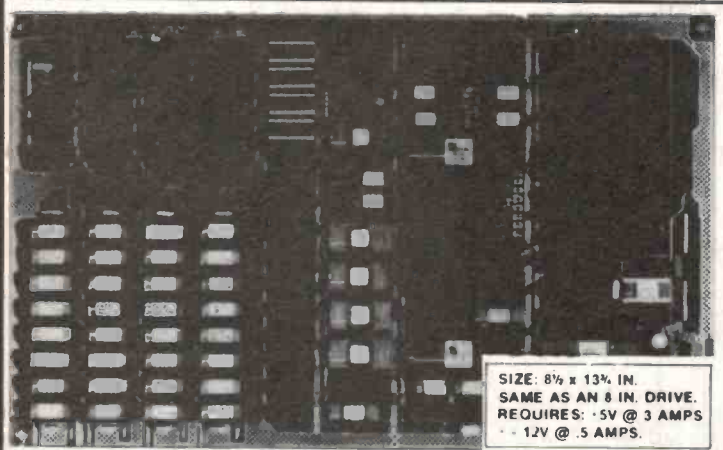
Write for list of other power supplies. Tax free prices also available.



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Also available: Blank PCB's with Roms $275 + Tax.
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THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure; and you have a total Business System for about 1/3 the cost you might expect to pay.

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 int. Price for all parts and connectors: **$49**

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: **$21**

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: **$15**

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

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PLEASE WRITE OR RING FOR THE BEST POSSIBLE PRICES ON DISC DRIVES, PRINTERS AND OTHER COMPUTER COMPONENTS.

Open systems local area networks

In a major step towards true open systems interconnection and networking between equipment supplied by different manufacturers, a number of companies recently announced their support for a set of local area network standards.

The companies are: Intel, ICL, Siemens, Nixdorf, CII-Honeywell/Bull, Fujitsu, DEC, Three Rivers Corp, Mitel Corp, Logica-VTS, Olteco/Olivetti, L.M. Ericsson, Ungerman-Bass Inc, 3-COM Corp, Hewlett Packard, Xerox, Information Technology Ltd, Network Technology Ltd, Computer Technology Ltd and Office Technology Ltd.

All these companies support the ISO transport protocol Class 4 (ISODPSC16N699) for the transport layer which is international standardisation of prior ECMA work. (ECMA '72 revised.) For the lower layers they will support the new ECMA standard for the physical and data link layers (No. 80, 81, 82) for CSMA/CD local area networks. The standardisation of these three protocols will represent a major step to intervendor networking and benefit both users and manufacturers of computing equipment.

At the physical and data link layer these ECMA standards are largely compatible with Ethernet in all major areas. The interfacing of such local area networks with the public networks would typically be achieved through X.25. It will be possible to integrate X.25 virtual services into such local area networks.

The development of these standards and continuing work within the ECMA community to define standards for networking is seen as a precursor to international standardisation.

These proposals from ECMA to ISO are submitted for consideration as input to international standards as are inputs from other national and international standards bodies. These companies are also working in close conjunction with their national and trade associations.

Tandy's new TRS-80 Model 16 microcomputer

At the heart of the Model 16 is an MC68000 microprocessor, a 16/32-bit CPU. The Model 16's second microprocessor, a Z-80A, handles I/O functions. This dual processor design permits the Model 16 to operate as a Model II and use existing Model II software.

The Model 16 is capable of 512K internal RAM memory storage and 2.5M of disk memory using two all-new built-in 'thin line' double-sided 203 mm disk drives. Additional external disk storage to over 33M may also be added via TRS-80 hard disks.

The Model 16 is equipped with two RS232C serial interface ports and a parallel interface port. One of its serial ports is capable of bi-synchronous communications to IBM and other mainframes.

Digital psychiatrist interviews you on the couch

Dreamcards, a Melbourne software supplier, has released a new program called 'Psychotec' that turns the personal computer into a tame psychiatrist.

Written for the new 'Microbee' computer (but with full conversion instructions for any other 16K BASIC system), the program allows a dialogue between operator and computer in the style of a psychiatric interview.

The program is supplied as a booklet which contains a full expanded listing, detailed instructions for conversion to other BASICS and a complete and easily understood description of the program logic, to allow it to be modified as desired. The detailed analysis in the program booklet allows the reader to readily comprehend how BASIC routines can be used to process and understand the English language for all sorts of applications.

Available from Dreamcards, 8 Highland Court, North Eltham Vic. 3095, the program is $20 and a cassette dump (Microbee format) is $5 extra. Send SSAE to Dreamcards for further information.

It's so noisy I can't hear myself think

You'll know what I mean if you work in a noisy office and sometimes you feel that you just can't think straight . . . around corners maybe.

Well, Magmedia believe that they have the answer to your problems with their acoustic sound enclosures which have a thick acrylic lid and a base covered with acoustic carpet. Magmedia claim that their acoustic sound enclosures will effectively reduce noise levels, improving the environment in your office.

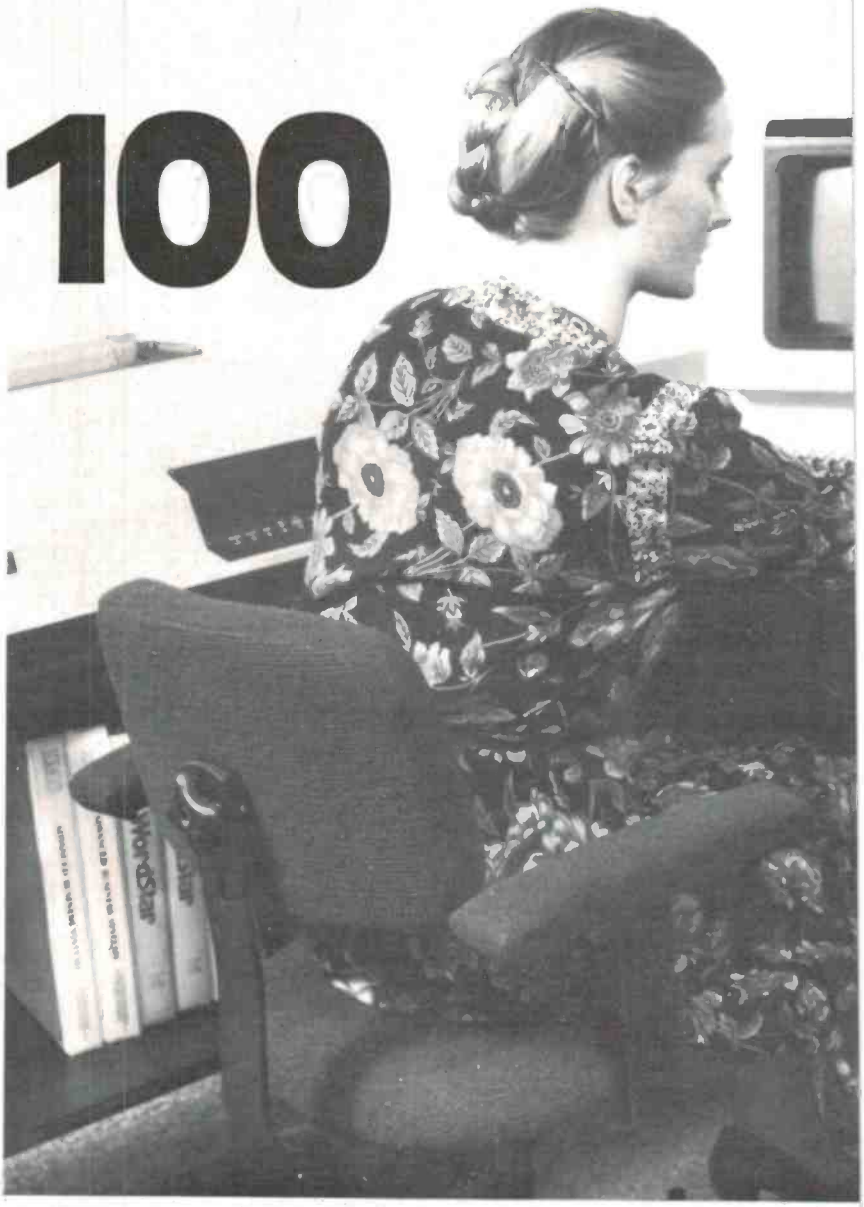
If you want to find out more contact Magmedia at 100 Park St, South Melbourne Vic. 3205. (03)699-9688.

Intel and TI share project

Intel Corporation and Texas Instruments are exchanging masks and process information for the manufacture of an NMOS combination codec/filter IC designed for the telecommunications market. The 'combo' codec/filter is called the 2913/2914.

Late in 1981, TI and Intel agreed in principle to jointly manufacture and market the 2913/2914. TI will source the Intel-designed NMOS combos and Intel will have the option of sourcing TI's future pin-compatible CMOS combo devices. Both versions incorporate a PCM and transmit/receive filter on chip.

Meet the MPU-100



SME Systems know computers, we've been building them for years. And we know what the discerning computer buyer wants most of all — a Z80 system that will provide him flexibility, performance and reliability.

Flexibility to be configured to perform simple single user tasks, and capable of configuration for multi-terminals, color graphics, word processing, business accounting, process control and scientific work.

The MPU-100, the flagship of the SME Unicorn series, is designed around the industry standard S100 bus, with an advanced vertical motherboard system giving it the highest reliability and lowest profile of any commensurate system.

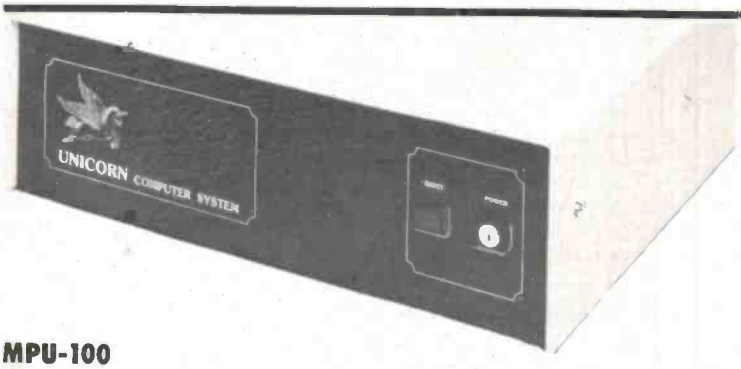
It is CP/M based, and its attractively housed system looks equally well rack mounted or on the desk top.

The economically priced system can be configured with the basic MPU-100, its natural partner the DDU-8 2 Mbyte twin disk drive unit, terminal and printer.

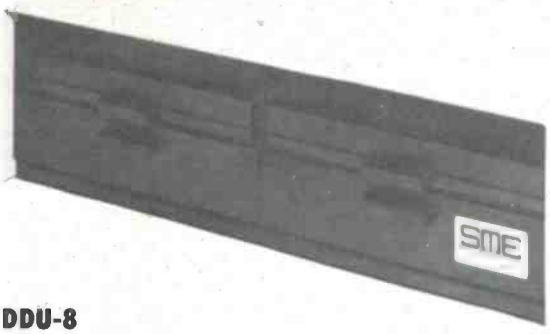
Addition of the SME Dartbauds will allow a further 6 terminals or modems to be added, and a further card will allow it to handle up to 50 Mbytes of hard storage.

Other configurations could include one or more HDU-1001 10Mbyte Hard Drive/1 Mbyte floppy subsystems, or the revolutionary 16/Mbyte Lark fixed/removable hard drive units.

Like the hundreds of SME systems already installed around Australia, the Unicorn series is built



MPU-100



DDU-8

The microcomputer for people performance, durability and

to stand up to everything that business, commerce, industry, and nature can put it to, and to continue operating without missing a beat.

Its modular construction allows for the easy addition of further function boards as they are required.

A wide range of interface cards such as Color graphics & CMOS RAM, make the MPU-100 one of the most versatile systems available today.

SME SYSTEMS build for strength, speed and reliability. All units can be bench mounted or fit comfortably in standard 19" rack configuration.

Also available from SME Systems are a range of full size and mini card cages, Eprom erasers, wire wrap cards, video control, Color Graphics, CMOS RAM, Serial and parallel I/O cards.
All systems designed and manufactured in Australia and fully backed with installation and service support.

The expandable MPU-100

This rugged, low profile system, has vertical 10-slot motherboard minimises transmission line defects. Core CPU is the versatile Z80, 4 Mhz, SBC 800, the enhanced FDC-II floppy disk controller card, and the DRC-II state-of-the-art 64/256K dynamic RAM card.

The highly reliable DDU-8

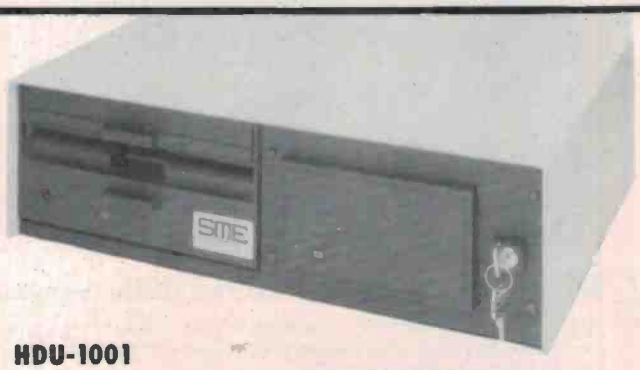
A low profile double/sided dual 8" disk drive unit with 2 Mbyte storage, door locking, internal fan and power supply. The perfect partner for the MPU-100.

The hard to fool HDU-1001

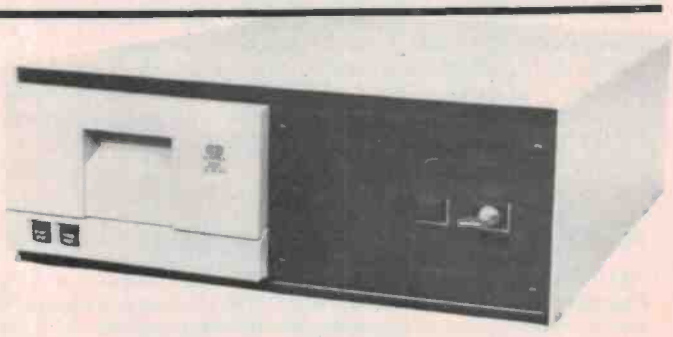
Incorporates a 10 Mbyte mini-Winchester hard drive, and 1 Mbyte 8" floppy. Its DTC510 internal controller uses Bit Slice technology to achieve high data throughput, extensive error detection and correction. On board memory provides data buffering.

Backing up is a Lark

The 16 Mbyte Lark Hard drive system fulfills the dream of data base owners. 8 Mbytes are on fixed disk, and 8 Mbytes on removable sealed cartridge — providing the ability to back up a full 8 Mbytes in 2 minutes. With its built-in back up and other features the Lark is less subject to failure than old style cartridge drives.



HDU-1001



LARK

who want permanence, quality

SME SYSTEMS

SME Systems, 22 Queen Street, Mitcham, Vic. 3132.
Phone: (03) 874 3666. Telex 37213.

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Computerland contract to sell Sirius microcomputer

Barson Computers has won the contract with Computerland Australia for sale of the newly released Sirius 16-bit microcomputer through Computerland's national chain of fifteen stores.

Worth an estimated $3 million in Sirius sales over the next twelve months, the contract was signed on August 3 in Computerland's new premises at 364 Sussex Street, Sydney by Computerland's managing director Loma Hoess and Julian Barson, managing director of Barson Computers.

Retailing for $5295 plus tax, the Sirius offers the user a 16-bit processor, 128K RAM, 1.2 Mbytes of floppy disk storage and an ultra-high resolution display. It has been designed for the small business and has a large library of applications software.

Amber phosphor screens

The latest advance in the reduction of VDU operator eye strain is the adoption of amber or yellow VDU screens. This trend has accelerated dramatically in Europe in recent years.

Tubes with this phosphor are now being manufactured in Australia by Thomas Electronics in a variety of types including 9", 12" and 15" sizes.

A number of anti-glare treatments are also available. Tubes are manufactured to customer specifications, so that existing VDU's can be fitted with amber screens.

Very high resolution CRTS for applications such as Word Processors and Phototypesetting are included in the range.

For more information contact Thomas Electronics of Australia Pty Ltd, 12 Larkin St, Riverwood NSW 2210.

AED releases new Superaed

AED Microcomputer Products announce the release of a new extended version of the Superaed CP/M extension package. The new package offers an extension of the features of the old version and a much greater flexibility to the user who wishes to modify the package for alternative or additional hardware.

AED are also making available a configure program called Supercon, similar in principal to that offered with Wordstar.

The new Superaed improvements are: keys default to issue any code or string of codes, keys can be dynamically defined as strings, configurability of all hardware drivers, extended and improved monitor features, status line and control and configurability of desired options.

Enquiries to AED Microcomputer Products, 130 Military Rd, Guildford NSW 2161. (02)681-4966.

Microcomputer grant from Digital

Digital Equipment Australia Pty Ltd has given an equipment grant valued at $70 000 to the Queensland Institute of Technology.

Digital are seeking to enhance teaching and research in microelectronics and computing. To achieve this they have established a Special Equipment Grant Program with the intention of installing microelectronics research equipment in selected centres throughout Australia.

QIT was awarded the grant ahead of keen competition from Universities and Colleges specialising in microcomputing, based on its excellent submission which Digital believed was an ideal application of microcomputer technology.

Some of the equipment will be located in QIT's Microprocessor Development Centre which is being established by QIT and several large Queensland industrial organisations. The aim of the Centre is to provide the latest microprocessor facilities for firms in the state. In particular, expertise will be provided to implement the latest technologies in industrial processes.

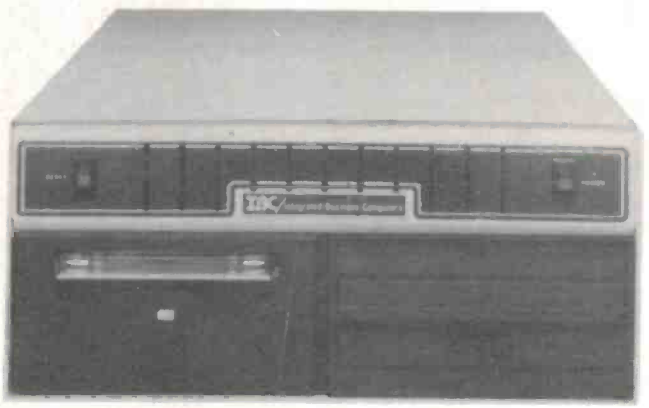
Single chip IBM 3274/3276 compatible coax receiver transmitter

Standard Microsystems Corporation recently introduced the COM 9004 IBM 3274/3276 Compatible Coax Receiver/Transmitter. It is the first commercially available single chip metal-oxide-semiconductor/very-large-scale-integrated (MOS/VLSI) circuit IBM compatible receiver/transmitter, claim Standard Microsystems.

The COM 9004 is designed to allow simple implementation of high speed serial data communications. It is a serial encoder/decoder for interfacing any standard parallel microprocessor data buss to a bi-phase serial line. Besides the double buffered serial to parallel and parallel to serial converters, the COM 9004 provides a Manchester II bi-phase encoder and decoder, parity detection and generation, and internal diagnostics for testing both itself and the line driver/line receiver circuitry.

It detects and generates line quiesce, code violation, sync, parity, and mini-code violation sequences specified by IBM.

For more information contact Total Electronics, 9 Harker St, Burwood Vic. 3125.



IBC Super Cadet cache disk memory

IBC recently introduced a cache disk memory for the Super Cadet computer system. The memory consists of 256K of 150 ns, 64K RAM chips on a 102 mm square pc board.

IBC claim that with overlayed operating systems such as OASIS the cache disk offers the user a substantial increase in system performance, making it four times faster than its nearest competitor. Using block transfer, the 6 MHz, Z-80B can transfer a typical 5K overlay into the main system memory in less than 18 ms. Using the cache disk to store all program overlays, frees the disk drive to do only transactional data I/O, thereby increasing the throughput performance enormously.

Western Digital single chip floppy controller

The WD279X series of floppy disk controllers combine the standard feature of Western Digital Corporation's WD179X series, with a digital data separator, phase lock loop and write precompensation circuitry, often the hardest design problem to overcome.

Powered from a single 5 V supply, the WD279X is capable of single and double density operation and is software compatible with the industry standard controller interface. Up to four 5¼" and 8" floppy disk drives may be accommodated and the WD279X will also allow for double sided operation.

For more information contact Daneva Australia, 66 Bay Rd, Sandringham Vic. 3191. (03) 598-5622.

Q.T. Computer Systems have moved

Q.T. Computer Systems, a manufacturer of microcomputer systems and products, has moved to new, larger premises at 41 Sydney Street, Marrickville NSW 2204. (02)519-2680.

They now provide a ground floor showroom for over-the-counter retail sales and the factory area includes a service department for warranty and after sales service.

CP/M capability for Apple III

The Apple III personal computer will now run CP/M-based application programs with the introduction of the Apple Softcard III System.

The Apple Softcard III System was developed by Microsoft Corporation and is now being distributed exclusively by Apple Computer.

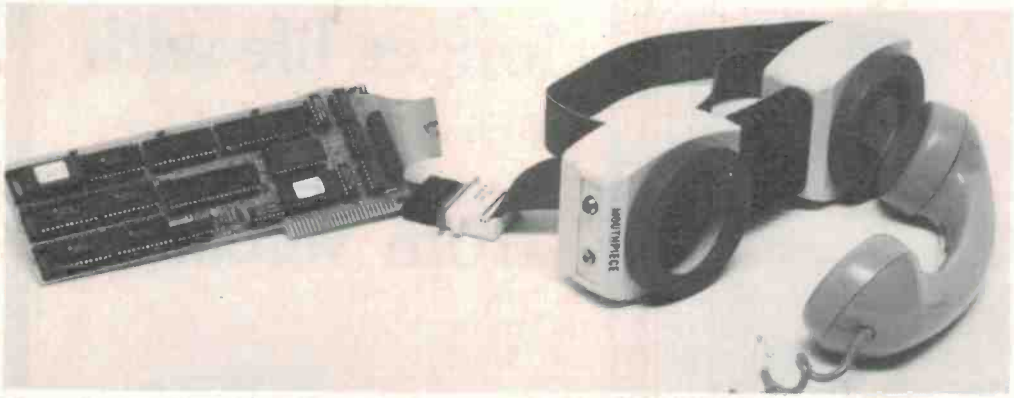
The system augments the Apple III sophisticated operating system (SOS) to bring dual-processor capabilities to Apple users. The Apple III product marketing manager states, "The range and variety of programs compatible with these two operating systems makes the Apple III an enormously flexible computer for business, science, industry, and education."

A major feature of the system is that it supports the Apple 5M mass storage system, Profile. Both SOS and CP/M files can be stored on Profile.

No hardware or software modifications of any kind are required to install the system circuit board, which plugs into any of the Apple III's peripheral card slots. Operation of the Apple III is not affected when not in the Z80 mode.

The Apple Softcard III System includes a plug-in Z80 microprocessor card, CP/M software, and four manuals which describe card installation and use of the software. The system also provides microsoft basic. The system requires a 128K Apple III personal computer with a suitable video display device.

Print-out



Apple at Australian Computer Exhibition

The powerful networking capabilities of the Apple II personal computer was demonstrated at the 9th Australian Computer Exhibition held in August at Hobart.

The networking was achieved by linking the Apple II through the use of Omninet, a shared access network, which allows any station to transfer data without the need for a master network controller or a mass of wires.

Also on display was a new terminal emulator, known as 'Netcomm', which allows the Apple 'to talk' to IBM, ICL, Burroughs and other major mainframes.

Using one of the internal expansion slots, 'Netcomm' communication card can be connected to an external modem or acoustic coupler via RS232-C convention, or directly to an onboard auto dial and answer modem which is designed in Australia, and is expected to be released by October this year.

In order to free the Apple processor from the often complex task of monitoring the various communication conventions, it was decided to built 'Netcomm' around a Z80 processor. This enables the communications protocol to be maintained in the background so the Apple processor is free to transfer information from or to disk, to printers or other peripherals while on-line to a host mainframe or mini.

Ortex announces MicroAda compiler

A local computer systems manufacturer, Ortex Australia Pty Ltd, has announced the availability of a MicroAda compiler for its range of Pascal System 1 minicomputers.

Ada is a new block structured high-level language that has been developed by the US Department of Defense to be used for all its internal software development.

MicroAda implements a subset of the full Ada language, including packages and separate compilation, tasks, and exceptions. Generics, representation specifications, and the more complex exception handling features are not yet included, though Ortex intends to support the full language within twelve months.

For more information contact Ortex Australia Pty Ltd, P.O. Box 732, Fyshwick ACT 2609. (062)80-5283.

Three new Texas Instruments microcomputer modules

Three microcomputer modules, an analogue-input, counter/timer and interface module were recently announced by Texas Instruments as the latest additions to TI's TM990 family of single-board microcomputers.

The TM990/315 is a low-level analogue-input module that enables TM990 boards to handle inputs from such devices as thermocouples and strain gauges. The module, which fits directly into the TM990 system bus, is available in versions with either 8 or 16 electrically isolated, differential inputs. For applications requiring more than 16 inputs, the system can be expanded with additional modules to include up to 128 channels. An on-board programmable amplifier provides auto-zeroing and six gain settings for an input sensitivity of 10, 20, 50, 200, or 500 millivolts (full scale).

Capable of withstanding common-mode voltages as high as 250 volts, the TMS990/315 has a sample time of six milliseconds per channel and a relative accuracy of ±5 microvolts at 24°C.

The TM990/315 operates from a +5 and +12 V power supply (±3%) and draws approximately 1.3 A (typical).

Another new module, the TM990/317, is a counter/timer module that can serve as a pulse counter, programmable timer, and waveform generator. The TM990/317 offers four TTL software-gateable counter inputs with programmable debounce filters and five independent 16-bit counters with a 5 MHz counting rate.

The counters have both up/down and BCD/binary counting capability. Each counter has five outputs, and two of the counters have alarm comparators.

The TM990/317 requires a 5 V (±3%) power supply and has a 0.9 A current requirement (typical).

The third new board is the TM990/309, an interface module designed for use with TI's 6MT Series of input/output industrial modules. By providing an interface between the TM990 bus and 6MT modules, the TM990/309 enables microcomputers such as the TM990/101 to input status from and control the high voltage/current loads found in industrial-control applications.

For applications involving more than 32 I/O points the TM990/309 requires a 5TI-5500 I/O expander which allows the TM990/309 to supply power to as many as twelve full 6MT bases.

All inquiries to Texas Instruments, 9 Byfield Rd, Nth Ryde NSW 2113. (02)887-1122.

Elmeasco Instruments to distribute disks for Intel systems

Elmeasco Instruments has announced a range of Winchester disks for use with Intel microcomputer development systems.

The disks are designed and manufactured by Data Management Labs of San Jose, California, which recently appointed Elmeasco its Australian distributor.

Improved performance, capacity and reliability are the major reasons behind using Winchester disk technology in conjunction with microcomputer development systems, says Elmeasco's computer products manager, Daryl Black.

Most importantly all Intel software runs without modification. The DML controller emulates standard Intel controllers. As far as ISIS-II is concerned an Intel 710, 720 or 740 is attached to the system and as a result all existing software, including custom I/O drivers, will operate.

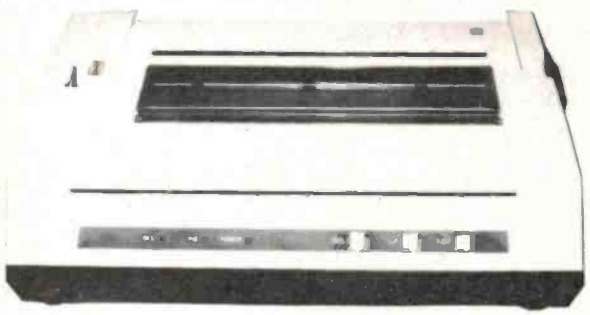
There are two basic DML Winchester disks. The model 1010 offers 6 Mbytes of storage and is priced at $8000, while the model 1040 has 26 Mbytes and is priced at approximately $11 000. Each can be used with an optional floppy disk for program load and backup.

For further information contact Daryl Black, Elmeasco Instruments, 15 McDonald St, Mortlake NSW 2137. (02)736-2888.

C. Itoh PRINTERS

FROM ROD IRVING ELECTRONICS

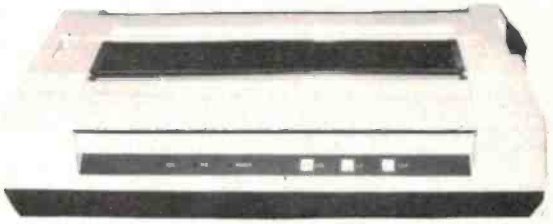
SPECIAL OFFER NOVEMBER ONLY



Pro/Writer Printer 8510

Print Features: Number of columns—136 col. max. Print Speed—120 CPS. Print Direction—Single-directional and Bidirectional, Switch Selectable. Throughput Speed—From 44 to 152 lpm. Character spacing (max. number of columns per line)—Pica 10 CPI (80), Double Width 5 CPI (40), Compressed Font 17 CPI (136), Double Width 8.5 CPI (68), Elite 12 CPI (96), Double Width 6 CPI (48), Proportional Double Width Proportional. Line Spacing—Variable to 1/144". Print Width—203 mm (8") max.
Forms Type: Fan Fold Roll or Cut Sheet: Width—113 mm to 254 mm (4.5" to 10.0"). Total Thickness—0.06 to 0.28 mm (0.002" to 0.011"). Number of Copies—Original + 3 copies nominal.
Form Feed: Method—Tractor or Friction. Form Loading—Either rear or top.
Interface—Serial: Method—EIA RS232-C and 20mA (40 & 60mA switchable option) Current Loop Serial Interface. Baud Rate (BPS)—110, 300, 600, 1200, 2400, 4800, 9600. Transmitting Method—Half Duplex. Synchronization—Asynchronous.
Interface—Parallel: Method—TTL compatible, 7-bit, parallel Interface. Control Signals—ACK, BUSY, SELECT, DATA STB, INPUT PRIME FAULT, INPUT BUSY, PAPER EMPTY. Instruction Codes—(ASCII): CR, LF, VT, FF, CAN, SO, SI, DEL, DC1, DC2, DC3, DC4, GS, RS, US, FS, EM; GRAPHIC SYMBOLS: BIT GRAPHICS.
Error Detection: (1) Parity (VRC)—Odd, Even, No-parity. Switch selectable. (2) Framing Error—Stop bit check. (3) Overrun Error—Error is detected when data are received before the previous data have been processed.
Physical dimensions: 398 mm W x 120 mm H x 285 mm D (15.7" W x 4.7" H x 11.2" D).
Weight: 8.5 kg (18 lbs., 12 oz.)

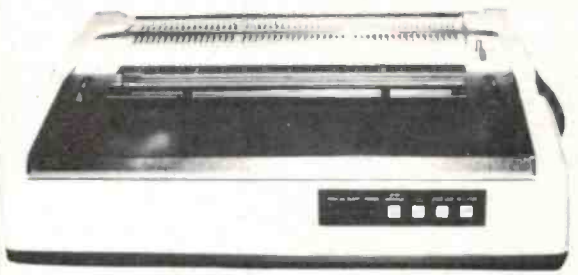
P* $759 ($725 ex)
S $845 ($775 ex)**



Model 1550

The Model 1550 is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.
The character format is a dot matrix of 7(H) x 9)(V). or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 136 characters can be printed per line at 10 CPI.
Its main features are: • Compact desk-top dot matrix printer • 136-column print • Light-weight • Low power-consumption • High-quality print • Bit Image graphics • Graphic Symbols • Prints in six different languages • High reliability • Low cost.

P* $1225 ($1050 ex)
S $1275 ($1195 ex)**



F-10 Printmaster Daisy Wheel Printer

Print Speed: 40 CPS. **Print Method:** Static Print Impact. **Number of Printable Columns:** 136, 163, Variable. **Character Spacing:** 1/120 Inch (minimum). **Line Spacing:** 1/48. **Return Time:** 900 msec. **Line Feed Time** 40 msec. **Paper Width:** 406 mm (maximum). **Print Characters:** 96. **Printwheel:** Industry Standard 96 Character Wheel. **Interface:** Industry Standard 8-bit Parallel, RS232-C Compatible, X-ON, X-OFF, 12-bit Qume and Diablo Compatible. **Dimensions:** 574 mm W x 405 mm d x 153.5 mm H (22.5" W x 15.9" D x 6" H). **Weight:** 14 kg (30.8 lbs.) with cover and power supply. **Noise:** Less than 65 Db (1M from Platen, A Scale).

P* $1600 ($1450 ex) * Parallel Interface ** Serial Interface
S $1750 ($1510 ex)**

Extra Special Microline 80
$499 incl. tax $435 tax exempt

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TO ORDER: Heavy items sent Comet Freight on Mail Order Phone 481-1436. Wholesale Customers Phone: 489-7099. Mail Orders to RITRONICS WHOLESALE, P.O. Box 235, Northcote 3070.
Minimum P&P $2. Add extra for heavy items, registration and certified mail.
Prices and specifications subject to change without notice.

Turn to Page 72 for our Big Board Specials

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Expiry Date.....
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Signature.....

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VDU monitors

A range of high and medium resolution monitors aimed at OEM users is now available from Thomas Electronics.

The basic 12" monochrome monitor is priced at under $A100 FOB Japan. This unit features a 15 MHz bandwidth, 1000 lines resolution, adjustable screen tilt metal frame, and is available with either a white or green phosphor tube incorporating an etched anti-glare screen.

The full monochrome range consists of frame or cabinet versions with 5", 9", 12" and 15" tube sizes, with P4 (white phosphor) or P31 (green phosphor) as standard. Band widths are up to 50 MHz with resolutions in 800 — 1800 lines.

The colour monitors are in sizes of 12", 14" and 20", RGB phosphor tubes with either delta or in-line gun types. Included are both open frame and cabinet types of monitors with band widths up to 35 MHz and display formats from 2000 characters to 4000 characters.

The monitor range is complemented by video RAMs to provide a CRT controller for colour data systems and two types of switching power supplies for operation on 90 — 264 Vac 50/60 Hz.

For more information contact Thomas Electronics of Australia Pty Ltd, 12 Larkin St, Riverwood NSW 2210.

Tandy's new pocket computer

Tandy Electronics has introduced a new handheld portable computer, Model PC-2, which is now available for $319.95.

Among the features of the 27 x 195 x 86 mm computer are its capability for internal expansion with plug-in RAM and/or ROM modules, and for external expansion through a 60-pin I/O buss connector.

The PC-2 features a 16K (ROM) extended BASIC language interpreter with ability to process words and messages. The CPU is a high-speed 18-bit custom CMOS microprocessor. The built in memory includes 16K of ROM and 2640 bytes of user memory.

Club Call

MEGS, the Sydney Microcomputer Enthusiast's Group, now meet at St Andrews Presbyterian Church Hall, 37 Anderson St, Chatswood (changed from WIA hall, Atchison St, Crows Nest). Meeting date is still the third Monday of the month, time: from 7 to 10 pm. The church hall is just behind Wallaceway and is conveniently near the railway station and buses.

It's quite likely that many of you have the incorrect address of the venue for the **North and Western Suburbs Computer Users Group** meetings. So please note that the correct address is Maribyrnong Primary School, Warrs Road (off Raleigh Road), Maribyrnong. Meetings are held every second Thursday from 7.30 pm to 10 pm and you can contact Mr. David Coupe on 370-9590.

A new club which formed in July is the **Pocket Computer Users Club.** If you have an interest in pocket computers, whatever the brand, you will develop a better understanding of them through the club. The meetings are held on the first Wednesday of each month at 7.30 pm at the 'Woodstock' Community Centre, Church St, Burwood. Interested people can contact the President, George Antonijevic, at home on 683-4296.

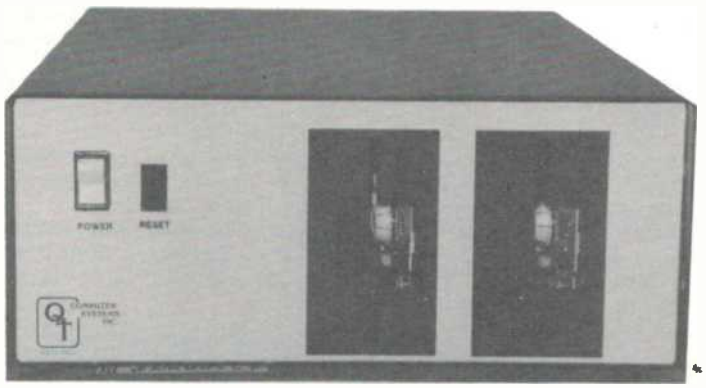
The SA branch of the **Commodore/Vic Computer Users Association** is a functioning user group, established so that enthusiasts can meet and discuss all aspects of computing. The club meets monthly and if you want to find out when and where write to Mr. Eddie Hann, the secretary, at 13 Miranda Rd, Paralowie SA 5108.

Apple-Q, the Brisbane User Group, has been in operation for almost a year. User Group days are held every third Sunday of the month (December excluded) at the Hooper Education Centre, Kuran Street, Wavell Heights. The Centre is open from 8.30 am until 4.30 pm and members are encouraged to bring their Apple along. Barbecue facilities are available for members staying all day. Those interested in becoming members of Apple-Q should forward $18 subscription fee to the Secretary, Apple-Q, the Brisbane User Group, P.O. Box 721, South Brisbane Qld 4101. Apple-Q is affiliated with the International Apple Core.

The Blue Mountains Computer Club is still going strong and meets on the second and last Friday of each month at the Springwood Civic Centre. Meetings start at 7.30 pm.

Attention!

OEM's • Independent Software Vendors • System Designers Programming Consultants and Teachers



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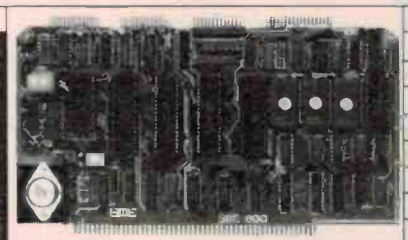
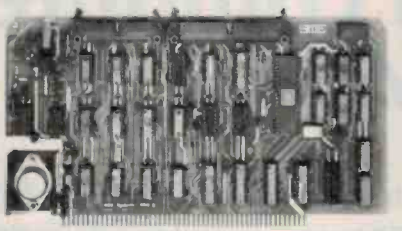
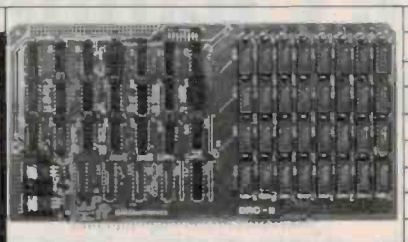


SBC-800



FDC-II



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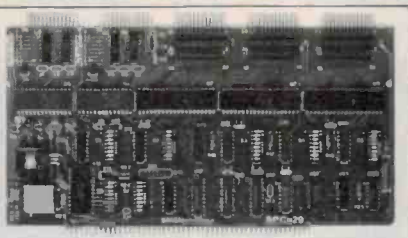
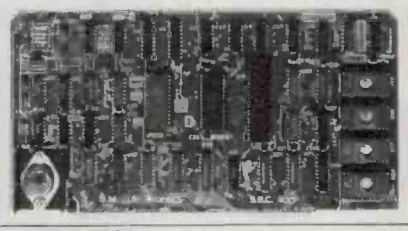
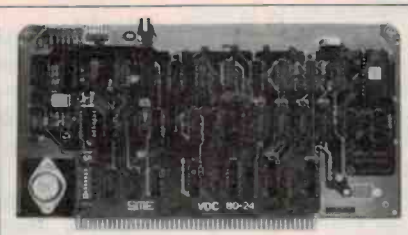


SPC-29

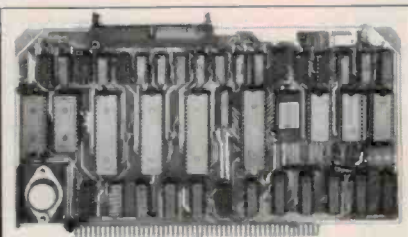


SBC-400

CRC-48



VDC-8024



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PEN 220

Project 653

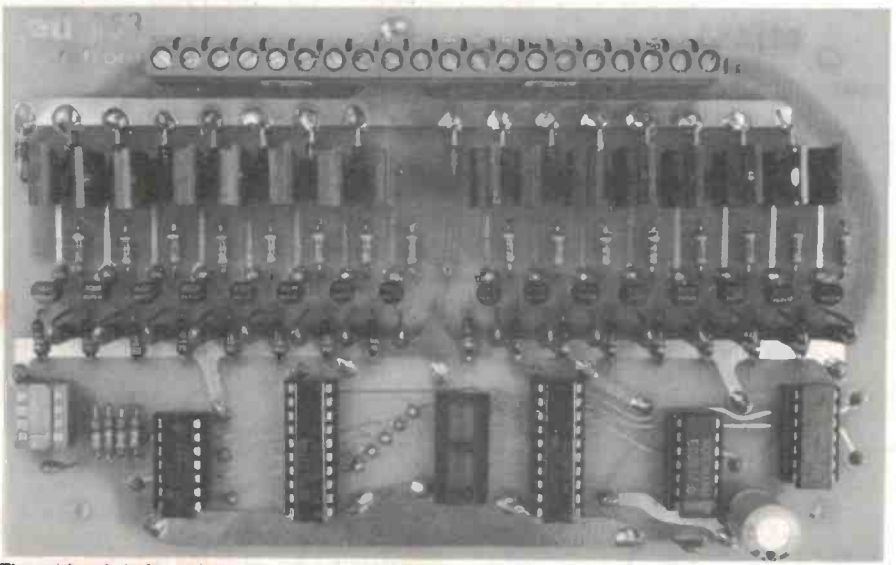
16 Channel computer output driver

With this project hooked up to your computer you can drive relays, motors, lamps, solenoids, or whatever, under software control. Do something useful with your computer!

Geoff Nicholls

A PERSONAL COMPUTER need not necessarily be used for playing games, learning programming or producing computer club newsletters. With this project, you can put it to some *practical* use. Just what that is I'll have to leave to your imagination and ingenuity!

Two independent groups of eight outputs are provided. Each of the 16 output driver circuits is configured to run from a 12 V supply, although higher supply voltages may be used. Each can be configured to sink up to 3 A. Simple address selection for the board is provided by an on-board DIP switch. It's a pretty straightforward project and you can vary things to suit your application(s).



The project is built on a board measuring 103 x 165 mm.

Component options

The component values shown in the circuit diagram are for output currents of up to 2 A. If other load currents are desired, then a few components need changing in order to reduce power dissipation in the output transistors.

For currents of less than 1 A, the TIP31Bs (Q17-32) may be replaced by BD139s — which have the distinct advantage of costing considerably less than TIP31Bs. However, note that BD139s have a different pinout such that the metal face on BD139s is on the opposite side of the package to the TIP31Bs.

The base current drive to the output devices is determined by R17 and R32 and may be optimised for different loads. The table here (Table 1) summarises component values for various output currents.

If the total output current is expected to exceed 20 A for more than a few minutes, then it is advisable to make the following changes:

(a) Use a terminal strip capable of passing half of the total load current through each terminal OR solder the power ground directly to the pc board ground plane.

(b) Solder several lengths of tinned copper wire to the heavy power ground track on the pc board.

Intermittent use over 20 A should not require these changes. The power dissipation calculations for transistors Q17 to Q32 were based on data for RCA-manufactured TIP31Bs. The prototype transistors developed a collector-emitter voltage of 0.65 V at 2 A, which does not necessitate heatsinking the transistors. If high current loads are to be used, measure Vce and Ic and calculate P = Vce x Ic.

The TIP31B can dissipate 2 W at 25°C ambient without heatsinking. Continuous use at high currents may require a small flag heatsink on each TIP31B.

TABLE 1. Component variations

OUTPUT CURRENT amps	Q17 to Q32	R17 to R32	R1 to R16	+5 V SUPPLY CURRENT (max.)
3	TIP31B	15R/1W	330R	3.4 A
2	TIP31B	18R/1 W	470R	2.8 A
1	TIP31B	22R/½ W	470R	2.3 A
<1	BD139	33R/½ W	470R	1.6 A

Construction

The entire electronics for this project is mounted on a double-sided pc board. During the early design phase, it was found that a single-sided pc board would require an unacceptably huge number of links. To keep the cost down, through-hole plating was not specified for this board and connections between top and bottom side tracks are made with links of 22 swg tinned copper wire, of which there are a total of 61. IC sockets were installed on the prototype, but these are not essential.

Commence construction by giving the pc board a good inspection, looking for broken tracks and undrilled holes. Make sure the tracks are clean and bright so that soldering is easily carried out. Insert all the links first. These are identified on the component overlay diagram by a •. Note that a large star is next to a '62nd' link more or less in the

centre of the board. This is the optional 0 V link — see the text under the heading 'Power supplies'.

Next, solder diodes D1 to D17 in place. Note that the cathodes of these diodes are soldered on the *component* side of the board. Solder resistors R1 through T16, then R33 through R48 in place next. Mount and solder the BC639 transistors, Q1 to Q16, in place next. All the 1 W resistors, R17 through R32, stand up on end and these may be soldered in place after the transistors. Follow with the remaining four resistors and the three capacitors. Now you can mount and solder in the output devices, Q17 to Q32. Watch orientation.

Now mount DSW1, but take care you put it round the right way. The ON position of the switches should be adjacent to the edge of the board. If you're using IC sockets, put these on next. If not, solder the ICs in place. Note that ICs 1, 2 and 5 are CMOS types, so take precautions in handling and soldering them in place. Only handle them by the ends of their cases after discharging yourself against an earthed metal object. Solder the supply pins first. A 16-pin DIL IC socket is used for the input connections and this can be mounted now. Last of all, mount and solder in the output terminal strip or strips. We used one 12-way and one 8-way strip as we could not obtain a single 20-way strip.

Having completed the construction, go over the board very carefully, looking for missed links and components, bad joints or mis-oriented semiconductors. Fix any faults and, if you're satisfied all is well, the best way to test the board is to hook it up and try it out!

Power supplies

The logic power supply of +5 V should be supplied from the host computer Vcc rail through the DIL socket pins 15 and 16. The computer's ground (0 V) should be connected to pin 9.

The +5 V power to the driver circuits should not come from the host computer unless it has the capability to supply at least an extra 3 A. In any case, heavy wire should be used (at least 24 x 0.2 mm hookup wire) for the power connections to the terminal strip to minimise voltage drop.

The optional 0 V link (marked with a star) should only be used for light loads. Normally, the connection between 0 V logic and power should be at the power supply.

The output drivers' power supply is shown as +12 V, but other voltages may be used, up to about 70 V. The PIV rating of diodes D1 to D16 should not be exceeded, however (best use 400 V diodes here, at least).

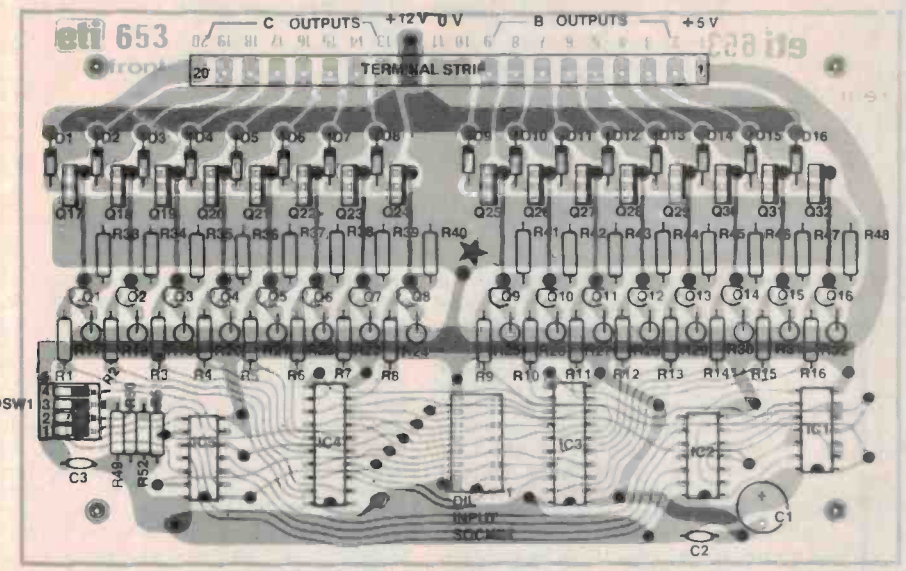
Hooking it up

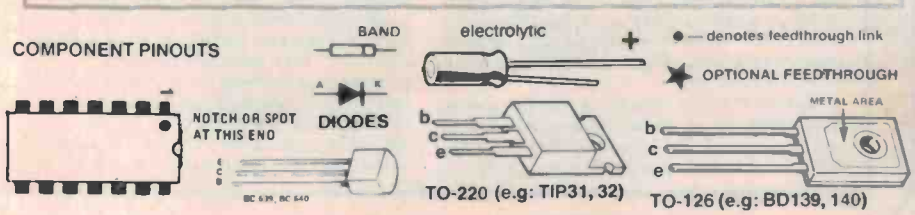
The ETI-653 has been designed to allow up to eight boards to be connected to a computer through a single ribbon cable. In order to do this a special strobe signal must be supplied by the computer whenever any of the ETI-653 boards are being selected. This will probably require a small hardware circuit, unless your computer is favoured by the famous Murphy! If there is sufficient interest we may publish a general purpose interface board, but until then you will have to work out for yourself how to connect a particular computer from the following guidelines. (For background information, refer to ETI August '82, *Turtle Interfacing Fundamentals.)*

I will assume that the computer has an I/O scheme with eight I/O address lines — AD0 to AD7. The ETI-653 inputs A0 to A3 are then connected to the lowest four I/O address lines of the computer. i.e: AD0 to AD3. Each ETI-653 board is then set up at a different address via the DIL switches, DSW1, 2 and 3. This means that the ETI-653s will occupy 16 consecutive I/O ports. Now for the hard part!

The STROBE input (A4) must have a positive or negative going edge (see the How it Works) that occurs when an I/O WRITE to the ETI-653s is taking place. In order to fully decode the I/O port address space, the other I/O address lines (AD4 to AD7) must be gated with the I/O control signals to produce the STROBE signal. In order to get the STROBE transition timing correct, a signal such as WRP (write pulse) should also be gated in the STROBE logic. This allows the data buss to settle before the latches are locked.

The ribbon cable requires a buffered driver for each wire carrying logic signals, especially if multiple ETI-653s or long cable runs are envisaged. ▶





PARTS LIST — ETI-653

Resistors ..... all ½ W, 5% unless noted
R1-16,33-48 ..... 470R
R17-32 ..... 18R, 1 W
R49-52 ..... 10k

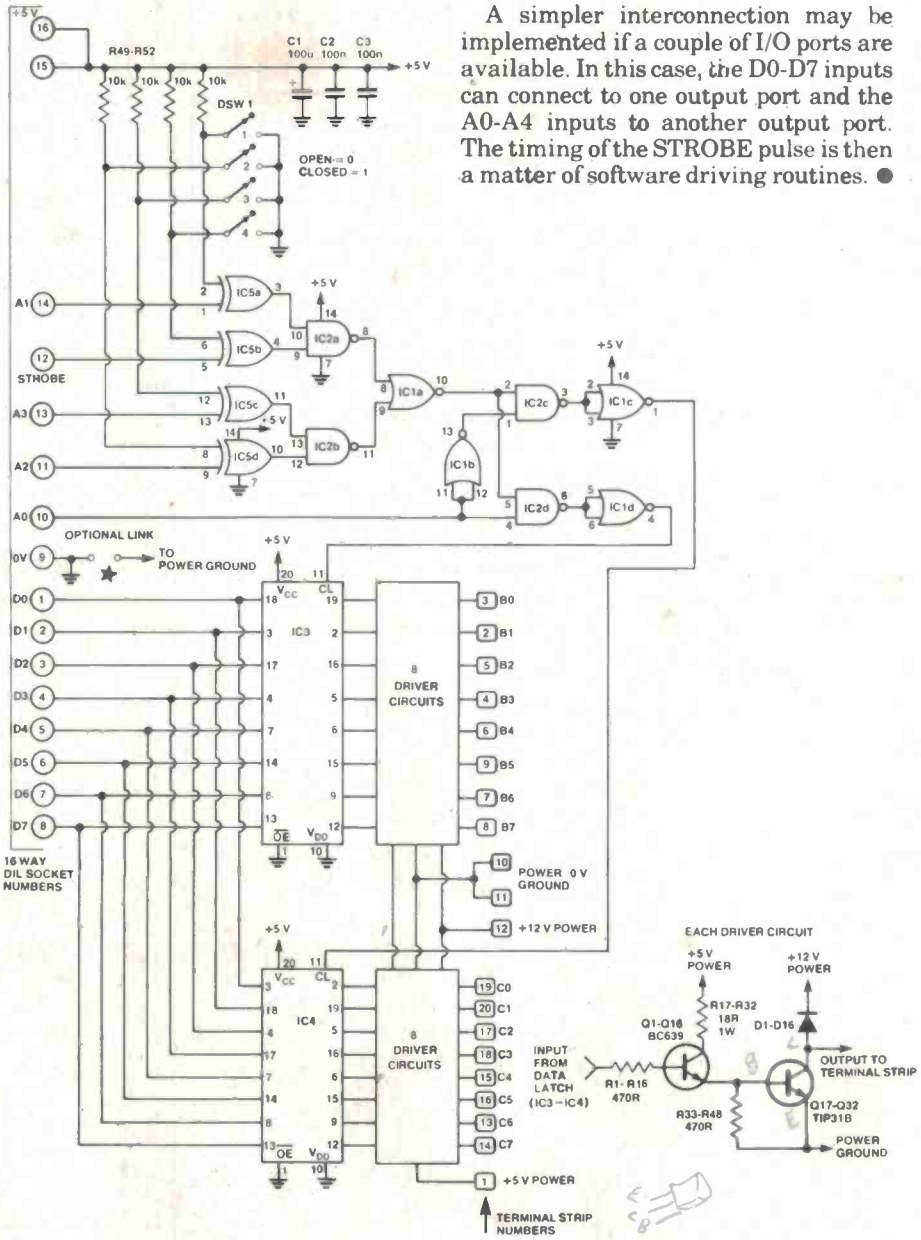
Capacitors
C1 ..... 100u/16 V RB electro.
C2,C3 ..... 100n blue chip ceramic

Semiconductors
D1-D16 ..... 1N4002, 1N4004 etc
IC1 ..... 74C02
IC2 ..... 74C00
IC3,4 ..... 74LS374
IC5 ..... 74C86
Q1-16 ..... BC639
Q17-32 ..... TIP31B, BD139 (see text)

Miscellaneous
ETI-653 pc board; DSW1 — 4-way DIP switch; 16-pin DIL socket; IC sockets (optional) — 3 x 14-pin, 2 x 20-pin; 2 x 16-pin DIP headers; 1 x 12-way and 1 x 8-way pc mount terminal strips or 1 x 20-way type; suitable length 16-way ribbon cable; 22 swg tinned copper wire, etc.

Price estimate
$40 — $45

Project 653



A simpler interconnection may be implemented if a couple of I/O ports are available. In this case, the D0-D7 inputs can connect to one output port and the A0-A4 inputs to another output port. The timing of the STROBE pulse is then a matter of software driving routines. ●

HOW IT WORKS — ETI-653

First of all, note that the component values shown on the circuit diagram are for the 2 A output version. Other output current versions are possible, as explained in the text, but basic circuit operation is the same.

The host processor connects to the ETI-653 board via the 16-pin DIL socket. IC5 compares the logic levels present on the DIL socket pins 14 (A1), 11 (A2), 13 (A3) and 12 (STROBE) to the settings of DSW1, 2, 3 and 4 respectively. When a match is found, pin 10 of IC1 goes high. The STROBE input should receive a pulse edge timed to coincide with a valid data buss (pins 1 to 8 of the DIL socket) and a valid address (pins 11, 13, 14). Note that either a positive-going or a negative-going edge of the strobe pulse may be used, according to whether the setting of DSW4 is closed or open, respectively.

The A0 input on pin 10 of the DIL socket determines which of the two on-board latches are being addressed. When pin 10 is low, IC4 is selected ('B outputs active'), if high, then IC3 ('C outputs active').

Each driver circuit buffers one of the 16 latch outputs and provides an open collector current sink of up to 3 A (see the text on 'Component options').

To simplify the description of the driver circuits, consider the one comprising R1, Q1, R17, R33, Q17 and D1. Diode D1 is a flywheel diode and protects transistor Q17 from excess back emf voltage when turning off inductive loads, such as a solenoid. When the latch output is low, Q1 is held off via R1 and Q17 is held off by R33. Resistor R33 speeds up the turn-off time of Q17 by providing a path to remove stored charge in the base-emitter junction.

When the latch output is high, about 5 mA of current flows into the base of Q1, thus turning it on. R17 sets the base current of Q17 and is chosen according to the output current requirement. Transistor Q17 must be saturated in order to reduce power dissipation and up to 300 mA of base current may be required for 3 A loads (see component options in main text).

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SPECTROL 43P ACTUAL SIZE

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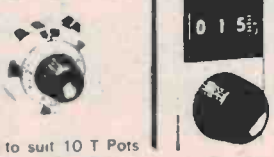

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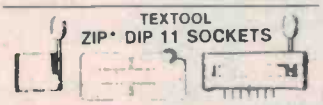
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST

TEXTOOL ZIP* DIP 11 SOCKETS



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DB 25C	1 pc Grey Hood	2.40	2.20	2.00
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DC 37P	37 PIN MALE	7.90	7.50	7.10
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HS3 — 150mm	5.80	5.40	4.90	3.80	2.90	2.70
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PASCAL
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For people with little or no programming experience, this book gives lots of examples that clearly explain proper usage of language features. Discusses top-down programming, debugging, self-documentation etc.

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INTERMEDIATE PROGRAMMING FOR THE TRS-80 MODEL I
21809P **$14.95**
Step-by-step instructions for the TRS-80 user who wants to progress from BASIC to machine and assembly language programming with the TRS-80 Model I system. A complete how-to guide with numerous examples.

continued on page 98

BLACK JACK

W.F. Kreykes, St Albans Vic.

Bill Kreykes has come up with an absolutely amazing program here that really shows what CHIP 8 is capable of if you're prepared to work at it. Even if you're not a card player, this one's a ripper.

Traditional Black Jack is played with four decks, though casinos generally now play with six decks (but you can't fit that on the '660, yet). This program plays traditional Black Jack with four decks. The '660 is always the banker with an opening balance of $1500. Players A and B (George and Bill in this program) start with $750.

Whenever a decreasing line appears above a player's name the banker is looking for a reply. When asked to place bets, enter the amount you desire — maximum $45, minimum $2. When asking for a yes/ for a reply. Once the line has disappeared your turn is no answer, only press any key from 0 to 9 for a YES reply, no response is required for a NO reply.

The banker is very impatient and will not wait all day terminated, except when placing bets which are above or below minimum or maximum.

A simple check can be maintained on the program with regards to any sceptical participant who may doubt the payment of winnings. Every time the bank balance is displayed the three amounts shown should add up to $3000.

The game is automatically re-started if the bank's balance falls below $200 or a player tries to bet money he has not got (no room for an IOU).

The bank shuffles the four decks of cards at the start of each game and then signals another shuffle to take place at the 186th card. However, the cards will not be shuffled until the next round is about to start. The bank can be forced to shuffle the deck before this time by each player not placing a bet at the start of the round.

House Rules

- The bank cannot sit on less than 17; players — no minimum.
- Insurance is offered if the bank's first card is an ace. The maximum amount of insurance is half of your bet. If the bank does get Black Jack, he/she will play quadruple.
- Players' cards equal to bank — bets returned.
- Players' cards less than bank — bets lose.
- Players' cards greater than bank — bank pays.
- Bank plays Black Jack three times.
- Bank plays 5 under 22 double.
- Splits on any pair, but can only be done on first hand.
- Doubles on 9, 10 or 11 then only one more card dealt.
- Bank's first card an ace: if Black Jack, insurance pays four times; if not Black Jack, insurance loses.

A complete explanation of how the program is constructed and how it works will have to be left for another issue, unfortunately.

```
0600  290a 6d17 aee0 2860 6c22 aeef 29f6 ae4d
0610  6d1d 6c18 29f8 ad9b 6c18 6d24 29f8 6c00
0620  6d23 ae74 dcd7 7c0c dcd7 7c1d dcd7 7c0c
0630  dcd7 7cce ae31 3c06 1624 ae44 6c00 6d2b
0640  dcd5 6c24 dcd5 6001 6105 6200 6300 296c
0650  6000 6107 6205 2928 295e 2864 3000 1668
0660  62fe 8214 3f01 1d6a 2a0c 2864 166e 6901
0670  80b0 af10 28ce af22 28f4 276e 275a 6d1d
0680  3600 168e 6c02 277e 2880 2920 2b42 2760
0690  277e 2880 2920 275a 6700 6a00 6801 6921
06A0  2b58 682a 6703 2b58 af10 f065 90b0 1c6e
06B0  2b42 6818 2778 285c 2b5e 400b 27e4 2b42
06C0  6705 2b66 285c 6901 2b6e 276e 2d26 6801
06D0  28f2 6c02 2870 6c0e 680d 2870 682a 2d26
06E0  6601 2b42 2d26 2764 2870 6c37 6836 2870
06F0  2d26 6705 2b42 285c 2b66 2774 2a96 af1c

0700  f065 400b 1c42 170c 2b42 2aea 6110 81e5
0710  3f00 1708 276a 2cca 2cca 2760 2cca 2cca
0720  2b42 285c 2774 28dc 40bb 1d32 40aa 1c6a
0730  29ce 2738 00FF 165a 6a00 6818 af1c fa1e
0740  f065 4000 18f2 2a42 173c ada5 6c12 6d0d
0750  29f6 aed8 6d0c dcd8 00ee ae4d 29ee 1a04
0760  6d1d 6601 6c2b 6703 00ee 6c02 6d1d 6700
0770  6600 00ee 6d06 6c06 6901 6705 00ee ab44
0780  6410 3600 6435 6515 d451 74f8 d451 74f8
0790  d451 6302 60ff 7001 e0a1 17ba 4009 17a4
07A0  1796 73ff ae67 f318 d451 7401 4418 00ee
07B0  443d 00ee 3300 1794 17a8 f518 73ff 4900
07C0  17a2 3300 17d6 8e00 29cc 4100 17d4 7e0a
07D0  71ff 17ca 80e0 28ca 29ce 6f50 7fff 3f00
07E0  17dc 17a4 6600 6702 2834 6c1A 3600 6c39
07F0  6d17 277e 77fe 28c0 6100 4000 180e 70ff

0800  9010 180e 7101 9010 180e 00ff 17fe 8300
0810  8e30 7702 28c0 8305 3f00 1828 29cc 2842
0820  2a0c 28c8 2844 17e8 28e2 2920 7703 6601
0830  3708 17ee aec0 183a ade4 6c0d 6d0d 29f8
0840  1750 2834 adcb 6c0b 6d0d 29f8 add5 29f6
0850  80e0 19ce 28ba 19c2 2968 1d06 6d00 aea7
0860  6c00 19f6 285c 7cfe ae3a 29f6 af28 1932
0870  28c0 4000 00ee 2b42 2a8c 7701 7c0c 00ee
0880  28c0 4000 18e0 6e2d 81e0 8105 3f00 189c
0890  29ce 275a 2844 2a0c 2844 18b2 6e02 81e0
08A0  71ff 8105 3f01 18e0 29ce 275a 28b6 2a0c
08B0  28b6 28c8 167c adc1 1846 af19 f333 00ee
08C0  af22 f71e f065 00ee 6000 af22 f71e f055
08D0  00ee af16 f033 af17 f165 00ee af0e 18c2
08E0  28c0 28d2 af2c f155 af32 f155 af38 f155
08F0  00ee af1c 6000 6100 f155 f155 18ee aefe
0900  ff55 00ee aefe ff65 00ee 601c a66c 18ce
0910  3600 191a 292c 297a 1928 2962 297a 195e
0920  3600 195a 292c 298c af2e f355 af2e 6c09

0930  6d2b f565 4000 194c f029 2946 f129 2946
0940  f229 2946 f329 dcd5 7c05 00ee 3100 193c
0950  3200 1940 3300 1944 00ee 2962 298c af34
0960  f355 af34 6c2d 1930 af28 2978 af28 f355
0970  00ee af28 298a 196c f565 29a2 8410 8354
0980  28ba af19 f065 8404 19c2 f565 29a2 8410
0990  8355 3f00 1854 4400 1d56 74ff 7364 28ba
09A0  19c2 4000 19ac 710a 70ff 19a2 4200 19b6
09B0  730a 72ff 19ac 4400 00ee 750a 74ff 19b6
09C0  00ff af17 f433 af18 f365 00ee 28c0 28d2
09D0  4000 19de f029 dcd5 7c04 29e4 19e8 4100
09E0  00ee 7c02 f129 dcd5 7cfe 00ee ae8e 6c0b
09F0  6d0d 29fa 29fa 29fa 29fa c51f f500 6f01
0A00  ff18 6505 dcd5 7c08 f51e 00ee 6302 6107
0A10  6210 f215 f207 f200 f318 3200 1a14 71ff
0A20  3100 1a10 00ee 4bba 290a af3a fb1e f065
0A30  7b01 6110 8015 3f00 1a34 7010 af1c fa1e
0A40  f055 2a48 7a01 00ee f818 4921 1a52 ae2f
0A50  d89b 7903 6109 8105 3f01 1a68 7803 f029
0A60  d895 7805 8e04 1a88 7802 400a ae89 400e
0A70  ae7f 400c ae6b 400d ae7a 300b 1a82 ae6f
0A80  7e01 d895 7e0a 7806 79fd 00ee 28dc 6921
0A90  6d24 2a48 6900 6818 6a00 6e00 2a3c 00ff
0AA0  2a26 4e16 7ef6 4e15 1b8e 4901 1b2c 2b2c
0AB0  af1c f165 4563 1ac4 4701 1ac4 4704 1ac4
0AC0  9010 1b9e 4e09 1bde 4e0a 1bde 4e0b 1bde
0AD0  84c0 2bda 8c40 6d24 1adc 2aea 4064 1738
0AE0  277e 3302 1ada 2738 1bda 2850 2a26 6400
0AF0  6e00 6500 af1c 4405 1b80 f065 400b 7501

0B00  4000 1b2c 610b 8105 3f01 1b10 8e04 1b12
0B10  7e0a 6115 81e5 3f01 1b1e 7401 1af6 3500
0B20  1b26 2b2c 1c06 7ef6 75ff 1b12 2850 80e0
0B30  1b62 ae16 19ee 2838 2904 1ad0 274a 2904
0B40  1ac4 6f25 ff15 ff07 3f00 1b46 00ee 6921
0B50  af1c f065 2a48 1b62 28c0 4000 00ee 2a26
0B60  2b42 af0e 18cc 6800 6909 1b70 6900 6818
0B70  28dc 1a48 2d3e ad8c 19f6 2d3e aeb6 19f8
0B80  4901 1b88 2bd8 2904 60aa ae84 1b92 60bb
0B90  ae49 dcd5 2b62 2a0c 1d44 ae84 1d3a 28fe
0BA0  274a 277e 3300 1b3c 2904 2850 7cff 88c0
0BB0  2b4e 7804 7c0d 6d1d 29cc 28c0 7701 28ca
0BC0  28e2 2920 2b4e 274a 2904 2738 2b42 7cff
0BD0  88c0 7c01 6563 1a8c 28fe adfd 183a 28fe
0BE0  2838 277e 3300 1b36 2904 6d1d 29cc 28e4
0BF0  28c0 8004 28ca 29ce 2920 2904 2aea 2b42

0C00  28fe 2838 1c20 4901 1c28 2bd8 2b32 2a0c
0C10  28e0 2968 2904 2850 6d1d 29cc 28c8 2b32
0C20  2738 2904 6064 00ee 28fe 2c36 2a0c 2904
0C30  2850 6000 2b62 aea7 6c08 6d0f 29f6 ae20
0C40  19f6 28fe 4e15 2b7a 3e15 2b74 2a0c 6600
0C50  6702 6c1A 2cae 6601 6705 6c39 2cae 4e15
```

WORD 60

Another game for two players (George and Bill, still) from Bill Kreykes. The computer throws up groups of letters randomly and each player has to write down (on a notepad) as many words as possible within 60 seconds, at which time the letters disappear from the screen.

After the letters disappear, the players compare lists. Matched words are cancelled out. You score points for the words left. Any words spelled incorrectly or that contain a letter that was not displayed have points deducted. Plurals are acceptable, e.g: dog, dogs.

Scoring

Three letters ..... 1 point
Four letters ..... 2 points
Five letters ..... 4 points
Six letters ..... 7 points
Seven letters .... 10 points

The words ENTER SCORES will appear on the screen which is a prompt to record each player's score, be it plus or minus. The player on the left enters his/her score first.

To enter scores, press A for add, D for deduct, followed by the number of points. Do this for each player (remember, left player first).

At this stage a high-pitched tone will be heard. During the time the tone is on, if an error has been made in entering the score, you can correct it by pressing E and re-entering the correct score (wipe out the old ones first).

When the scores have been entered the game will automatically restart, showing the updated scores. A player with a negative score will not have the score displayed until he or she again reaches or passes zero.

The first player to attain a score over 99 is declared the winner of the round.

Names

The data from 0957 to 0979 contains the names George and Bill. This can be changed to suit individual needs. However, the data underlined must remain similar to what is shown or be replaced by zeros. This area is used to display the scores to be added or deducted.

```
0C60  2b7a 3e15 2b74 2904 170c ae84 1d34 29ec
0C70  adb4 fc65 af0e fc55 fc55 6b00 c71f 6ae6
0C80  8a74 3f00 1c7c 28dc 617e 8105 3f01 1c7c
0C90  fb00 ff18 af3a fb1e f055 7b01 7010 2b62
0CA0  3bc6 1c7c 6016 290c 29ec 6b00 166e 28e0
0CB0  6d17 29d0 3e15 1968 00ff 28e0 2910 28c0
0CC0  8004 8004 28e2 2910 1972 28e0 af13 f065
0CD0  8100 28c0 4000 187a 28dc 28fe 9010 1d04
0CE0  41bb 1858 8105 3f00 1d50 2d1a 2b42 40aa
0CF0  1cfa 30bb 1cfe 2972 2910 2972 2910 2972

0D00  2910 2d1a 2910 2904 6d24 40bb 1d38 40aa
0D10  1b9a 29ce 2904 29cc 187a 6d0e 285e 7cfe
0D20  29f8 7c02 1d2a 6c00 6d03 aee0 3600 aeef
0D30  19f6 ae49 dcd5 1732 ae49 dcd5 1d14 aec0
0D40  6c00 19f0 6e15 30bb 1c24 3901 1738 00ee
0D50  2968 2b42 1d06 6c09 3600 6c2d ae20 29f8
0D60  2a0c 2a0c 2a0c 00e0 1600 6d0a 285e adc1
0D70  29f8 7c02 ae44 dcd5 7c08 6102 6200 6300
0D80  293c 1d60 00ff 00ff 00ff 00ff 8e8a 8a8a
0D90  eeee a8ae a2ee ee88 ce82 eeae aaee aaaa
0DA0  96d5 b595 96ee 8aee 28e8 8b89 8989 e9b8
0DB0  2038 0838 020c 0709 0e03 060b 040d 0805
0DC0  0a89 d9a9 8989 2434 2c24 248b daab 8a8a
0DD0  a294 8894 a23d 151d 15bd dc08 8808 c87c
0DE0  507c 147c 1c12 1212 1cf4 9494 94f7 be92
0DF0  9e92 be8e 888c 88ee e080 e020 e0e7 9496

0E00  94e7 7454 7454 570e 0808 080e efa9 efaa
0E10  a970 4848 4870 aeaa ea4a 4ea0 a0a0 a0e0
0E20  f555 7555 f777 4272 1272 7645 6545 767f
0E30  5d7f 7f7f 7f7f 7f7f 5d7f f755 7755 f540
0E40  4040 4074 7c50 7c14 7cf3 5171 55f7 5476
0E50  54f7 7724 2721 270e 0a0e 0808 8e88 8c88
0E60  eeee a8ee a2ae e080 c080 e038 1010 5070
0E70  5070 5050 f0f0 f0f0 f0f0 f090 90b0 f848
0E80  5060 5048 fe00 4410 44b8 a8a8 a8b8 97d4
0E90  b694 9744 4454 546c 3925 2525 39dd 1191
0EA0  11dd 2040 8040 20f7 5577 55f5 4a6a 5b4a
0EB0  4a40 8000 8040 eeaa ee8a 8aae a8ee 424e
0EC0  a5b5 ada4 a5d5 15d5 55dd ee2a ee4a 2a97
0ED0  d4b4 9497 7040 6040 7088 0830 2020 0020
0EE0  ee88 8ca8 eeef a9af aae9 7744 4654 7779
0EF0  2939 2979 2121 2121 3900 0000 00c0  --

0F00  stores V0 to VF                       --
0F10   cards          --   work area        --
0F20  top cards  -- bets   -- bank bal.     --
0F30  george bal.-- bill bal.  XXXXXXXXXXXXXX
      XXXX  Storage of 4 decks of cards XXXXX
```

```
0600  0910 6001 620B 630A 26E6 6005 6307 26E6
0610  6000 630A 26E6 6006 6307 26E6 6004 6308
0620  26E6 6A00 6B00 00E0 A6D1 6C00 6D16 DCD2
0630  7D0B DCD1 7C08 3C40 162C A957 6D24 270C
0640  271C 3500 16D0 2752 26FA 6C00 6D00 C007
0650  4006 164E 4007 164E A7EE FC1E F01E F065
0660  A97A FD1E F055 7D01 7C06 3D07 164E 6007
0670  26E2 276E 6D1A 6F01 663C 2730 FF18 6E2E
0680  FE15 FE07 4605 2756 3E00 1682 2730 76FF
0690  3600 167A FC18 276E 26FA 26E0 2708 276E
06A0  6C00 279E 6C1C 27CE 8890 6C22 279E 6C39
06B0  27CE 6E0E 60AA F015 F007 FE00 EEA1 16A0
06C0  FE18 3000 16B8 8A84 8B94 FC00 FC18 1626
06D0  6FFF FF15 FF07 FF00 FF18 3F35 16D4 1622
06E0  6000 6200 6300 6100 2920 7101 3108 16E8
06F0  7201 7301 330B 16E6 00EE 6C18 6D19 A8DC
0700  DCD7 7C06 DCD7 00EE A8E8 6D1A 6C00 6305
0710  DCD5 F31E 7C08 3C38 1710 00EE 6500 6D2B
0720  86A0 27BA 6C08 2732 86B0 27BA 6C2A 1732
0730  6C1C A981 F633 F265 4002 00EE F029 3000
0740  2748 F129 2748 F229 DCD5 3D24 7C01 7C04
0750  00EE 6004 1758 6005 6103 275E 6104 620C
0760  6300 2920 7201 7301 3304 1762 00EE 6300
0770  6C00 6D00 A97A F31E F065 A818 F01E DCD9
0780  7C12 7301 4307 00EE 3304 1774 6D0B 6C08
0790  1774 6100 3C00 7104 6215 6301 1762 6D2B
07A0  F70A 470A 17B2 370D 17A0 6000 2792 A90B
07B0  1748 6001 2792 A8E3 1748 6C9C 8C64 3F01
07C0  00EE 7501 6C64 8C64 3F00 75FF 00EE 6D24
07D0  F00A 6100 4000 17DE 710A 70FF 17D4 F60A
07E0  8614 8960 370D 1732 8995 8965 1732 38AB
07F0  4070 451B 70AB 66BB 122F 1223 A32B 665E
0800  8196 0900 5578 451B 89B3 6791 4D9B 9167
0810  4D89 9167 9B4D 894D 8282 8282 FE10 1010
0820  1000 8142 2418 1824 4281 F088 8484 8484
0830  8488 F082 C2C2 A292 8A86 8682 8282 8282
0840  92AA C682 C6AA 9282 8282 8282 C66C 3810
0850  F884 8488 F088 8484 F884 8484 F880 8080
0860  8080 8080 80FC 8080 80F0 8080 80FC 8080
0870  80F0 8080 8080 FE02 0408 1020 4080 FE10
0880  1010 1010 1010 1010 F884 8484 F8A0 9088
0890  8488 90A0 C0A0 9088 8478 8480 8080 8E84
08A0  8478 8484 8484 8484 8478 8484 84FC 8484
08B0  8484 FC84 8484 8484 8484 8478 8480 8080
08C0  8080 8478 8480 8078 0404 8478 8484 8484
08D0  8494 8C7E 0808 0808 0888 9060 3F3F 3F3F
08E0  3F3F 3F20 20F8 2020 E98D CB89 E977 2426
08F0  2427 7848 7850 4877 4474 1477 334A 4B4A
0900  32DD 51D9 905D C000 C040 C000 00F8 0000
0910  F839 AF96 BFEF F82C 5F62 2FF8 205F 62D4
0920  A981 F255 0928 00EE F809 BEF8 81AE EE72
0930  FA07 BEF0 FA07 5E1E F0FA 1FFE FEFE FE5E
0940  F80C 7C00 BDF8 80F4 AF9D 7C00 BD8F 2EF4
0950  ADED 9F5D 63E2 D4F7 84B6 94F7 7754 5755
0960  74BD A1AD 25BD C000 8000 C001 0000 0001
0970  E4A4 E4A4 E488 8888 88EE  --   --   --
0980   --   --
```

SKEET SHOOT

Peter Collins, Springvale South Vic.

Undoubtedly, dedicated games players have seen skeet shoot in a games arcade where a missile (skeet) is fired at random across a screen and you have to predict where it is going to be and fire ahead of it so that you shoot the skeet. What you are doing, in fact, is judging the speed of the skeet and the speed of your shot so that they meet at a prejudged point.

This version draws a 'T' channel on screen. Your shot is at the bottom of the T vertical and the skeet flies across the T horizontal. Simple? Sure is, but not so simple to hit the skeet!

PRESS KEY 5 TO FIRE

The score is displayed on the lower left of the screen — you get 5 points per hit and the number of shots left is displayed on the lower right — you start off with 20 shots. (Best effort from the ETI staff was 65!)

```
0600  6400 6501 A720 D451 7401 343F 1606 643E
0610  6504 D451 74FF 3420 1612 D451 7501 352F
0620  161A D451 74FF 341D 1622 D451 75FF 3504
0630  162A D451 74FF 3400 1632 D451 75FF 3501
0640  163A 6401 6700 6814 26E0 26EA 6B00 6C02
0650  A722 DBC2 691E 6A2C A724 D9A2 4800 165E
0660  6E00 6680 6D05 EDA1 6600 3680 268C A722
0670  DBC2 8B44 DBC2 3F00 1694 4E00 165C A724
0680  D9A2 4A02 16C6 7AFF D9A2 166E 6E01 6D08
0690  FD18 00EE A722 DBC2 A724 3F01 D9A2 A724
06A0  D9A2 6506 6D02 FD18 6D03 FD15 FD07 3D00
06B0  16AC 75FF 3500 16A4 26E0 7705 26E0  6EA
06C0  78FF 26EA 164C 3F01 D9A2 7901 D9A2 493F
06D0  16D4 166E 3F01 D9A2 26EA 78FF 26EA 1654
06E0  A710 F733 6300 26F4 00EE A710 F833 6332
06F0  26F4 00EE 6D2B F265 F029 D3D5 7305 F129
0700  D3D5 7305 F229 D3D5 00EE
0720  8000 3030 C0C0
```

BLOCK PUZZLE

David Poole, Kenthurst NSW

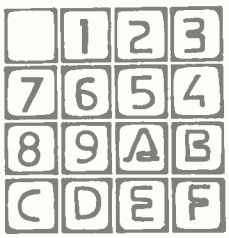
This is a simulation of the traditional block puzzles everyone used to play at school under the desk while the teacher's back was turned. Block puzzles consist of a matrix of interlocking tablets, usually in a square of 4 x 4 or 5 x 5, with one tablet missing allowing you to shuffle the tablets or blocks. Each block has a numeral or letter and the object is to arrange them in order: 1 2 3 4 in the first row, 6 7 8 9 in the second row etc, leaving the blank in one corner. There are various other arrangements, but you get the idea.

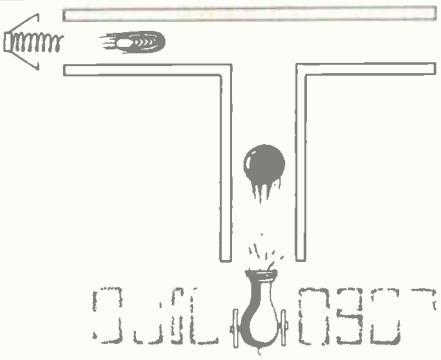
This version displays 16 white blocks on the screen in a 4 x 4 matrix with a numeral or letter in 15, one being blank. You get the numerals 1 to 9 and letters A to F. You can move the blank by pressing the keys as follows:

UP	press KEY 2
DOWN	press KEY 8
LEFT	press KEY 6
RIGHT	press KEY 4

When you start the program, the block puzzle is written on the screen and the computer randomly shuffles all the blocks. When it stops, you can start moving the blank. This game is guaranteed to take longer to play than it is to key in!

```
0600  6A12 6B01 6110 6200 6000 A6B0 D127 F029
0610  3000 DAB5 7108 7A08 3130 1624 6110 7208
0620  6A12 7B08 A700 F01E F055 7001 3010 160A
0630  6A12 6B01 6C00 62FF C006 7002 2652 72FF
0640  3200 1638 6E00 00FF F00A 2652 7E01 00FF
0650  1648 84A0 65B0 86C0 3002 1664 4501 1664
0660  75F8 76FC 3008 1670 4519 1670 7508 7604
0678  3006 167C 4412 167C 74F8 76FF 3004 1688
0680  442A 1688 7408 7601 A700 F61E F065 8100
0690  6000 A700 F61E F055 A700 FC1E 8010 F055
06A0  F129 D455 DAB5 8A40 8B50 8C60 00EE EE5E
06B0  FEFE FEFE FEFE FEFE
```





METEOR STORM

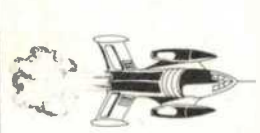
Adrian Ollerenshaw, O'Sullivan Beach SA.

Dodge the meteors! Here you are, hurtling through space and dirty great meteors bear down on you — what to do, duck out of the way or shoot them down? Well, that depends on the position in which you find yourself. Getting hit means your ship is destroyed. Blasting meteors wins you points. Here's how to control your ship:

MOVE UP	press KEY 0
MOVE DOWN	press KEY 1
TO FIRE	press KEY F

When the game starts, your ship appears on the centre left of the screen. Meteors rush at you from the right hand side of the screen. You can only afford to lose three ships in crashes, at which point the game ends. If you successfully destroy 20 or more meteors you get another ship. The score is displayed at the end of the game (i.e: after three crashes). Note that, after firing, you can direct you missile by moving your ship up and down.

To start a new game, simply press any key.



```
0600  6900 6803 6A06 6B0E 630A 6410 6E00 6700
0610  6120 A732 DAB5 6600 E6A1 16B6 6601 E6A1
0620  16D6 660F 3701 162C 2680 1630 E6A1 26F6
0630  A732 DAB5 6F00 DAB5 3F01 163E 16FE 4E01
0640  2658 4701 2680 3E01 164C 1616 6C39 CD19
0650  A736 DCD7 6E01 1616 C207 4201 1664 4205
0660  1678 1658 A736 DCD7 7D01 7CFC 3C01 1674
0670  6E00 00EE DCD7 00EE A736 DCD7 7DFF 166A
0680  A744 D341 6F00 7301 3340 1692 6700 630A
0690  00EE D341 3F01 00EE 00E0 7901 A732 DAB5
06A0  A73E DCD5 6E00 6700 630A F118 3914 16B2
06B0  7801 00E0 1746 3701 16C4 A744 D341 74FF
06C0  D341 16C6 74FF A732 DAB5 7BFF 6F00 DAB5
06D0  3F01 161C 16FE 3701 16E4 A744 D341 7401
06E0  D341 16E6 7401 A732 DAB5 6F00 7B01 DAB5
06F0  3F01 1622 16FE A744 D341 6701 00EE 00E0
0700  A73D DAB7 F118 00E0 78FF 3800 1604 A754
0710  F933 F265 6A15 6B0F F029 272C F129 272C
0720  F229 272C FA18 F10A 00E0 1600 DAB5 7A04
0730  00EE 38E0 70E0 386C FEAA FE6C 3882 4428
0740  0028 4482 8000 A732 DAB5 6F00 630A 6E00
0750  6700 00EE
```

SPACE INVADERS MK III

Peter Collins has modified the original '660 Invaders (Feb. '82, p.116) to give it a few interesting twists.

You get a 'tank' or 'ship' at the base of the screen and a single 'invader' ship moves from left to right across the top of the screen. However, in this version, you can move your tank, rather than firing at angles. The following keys are used:

MOVE LEFT	KEY 4
MOVE RIGHT	KEY 6
FIRE	KEY 5

It looks simple, doesn't it? However, the invader slows down and speeds up in order to avoid your shot! Very cunning!

You can't move while shooting. Note that your tank 'wraps around' the screen if you move off-screen on either side.

You start off with an arsenal of 20 shots and score 10 for each hit. The score is displayed at lower left, shots to go at lower right.

You can hit the invader more than once as it progresses across the screen by chasing after it and firing at the appropriate moment.

Get after it!

(Alright all you CHIP 8 hackers — this one is ripe for 'colouring up', adding sound effects etc. How about it? Don't forget, we pay for programs published — Ed.)

```
0600  A68C 6B00 6C05 DBC3 641E 6523 6700 6814
0610  268C 269A A688 D454 4800 1618 6E00 6680
0620  3F01 D454 6D04 EDA1 74FF 6D06 EDA1 7401
0630  6D05 EDA1 6600 3680 2676 A68C DBC3 CD01
0640  8BD4 DBC3 3F00 165E 4E00 1614 2682 A68F
0650  D9A1 4A00 1668 7AFF D9A1 2682 163A 2690
0660  770A 2690 A68F D9A1 267C D9A1 6D03 FD18
0670  269A 78FF 1612 6E01 6D08 FD18 8940 8A50
0680  00EE A688 D454 00EE 1038 7C54 60F0 6010
0690  A6F8 F733 6300 26A4 00EE A6F8 F833 6332
06A0  26A4 00EE 6D2B F265 F029 D3D5 7305 F129
06B0  D3D5 7305 F229 D3D5 00EE
```

sirius 1

A third generation computer, from the designer of the 6502 Processor.

$4950 + TAX

TECHNICAL SPECIFICATIONS:

CPU:	8088, 5 MHz
Memory	128k (64k dynamic RAM chips) internally expandable to 512 kbytes; external module to expand to 1 Mbyte
Keyboard	95 keys inc. 7 prog. function keys, numeric pad, cursor control, editing, screen & loudspeaker control, all software re-definable.
Screen	80 char x 25 lines; hi-res graphics, 800 x 400 bit-mapped, user-definable character sets.
Disk drives	2 x 5¼in single-sided, high density, 600 kbytes per unit.
Ports	1 Centronics/IEEE-488 printer port, 1 RS232 printer port, 1 RS232 communications port.
System Software	CP/M-86 and MSDOS
Languages	Basic 86; Graphics & character set packages. Assembler, Fortran, Cobol, Pascal, PL-I, Extended business basic compiler, various applications software.

software price list

The Sirius comes complete with CP/MI-86, MS-DOS & M Basic

CBASIC (Digital Research)	$440	SELECT (Select)	$550
Report Manager (Image)	$330	SuperCalc (Sorcim)	$330
Time Manager (Image) (a)	$225	Pascal/M (Sorcim)	$550
Personnel Manager (Image) (a)	$225	Basic Interpreter (Microsoft)	$440
Project Manager (Image) (a)	$225	Basic Compiler Diskette	$550
Level II COBOL with Forms 2 (Microfocus)	$1125	COBOL (Microsoft)	$880
WordStar (MicroPro)	$550	Multiplan (Microsoft)	$330
WordStar with MailMerge (MicroPro)	$775	Pascal (Microsoft)	$660
WordStar with SpellStar (MicroPro)	$880	Fortran (Microsoft)	$550
WordStar with MailMerge and SpellStar (MicroPro)	$1125	Real Estate Package (Sample printout available)	$1500
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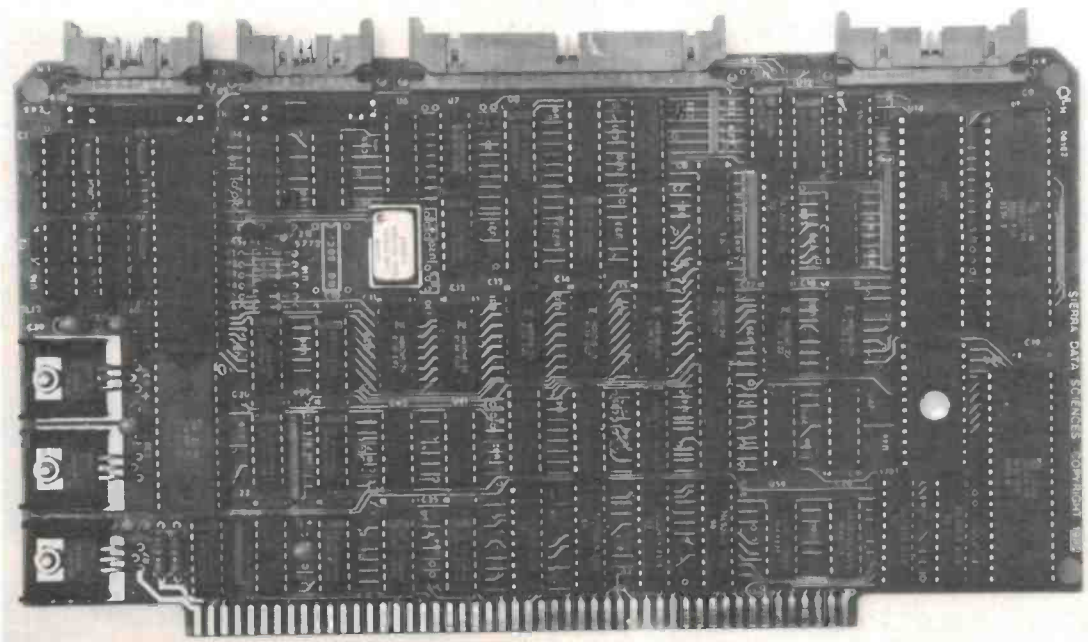

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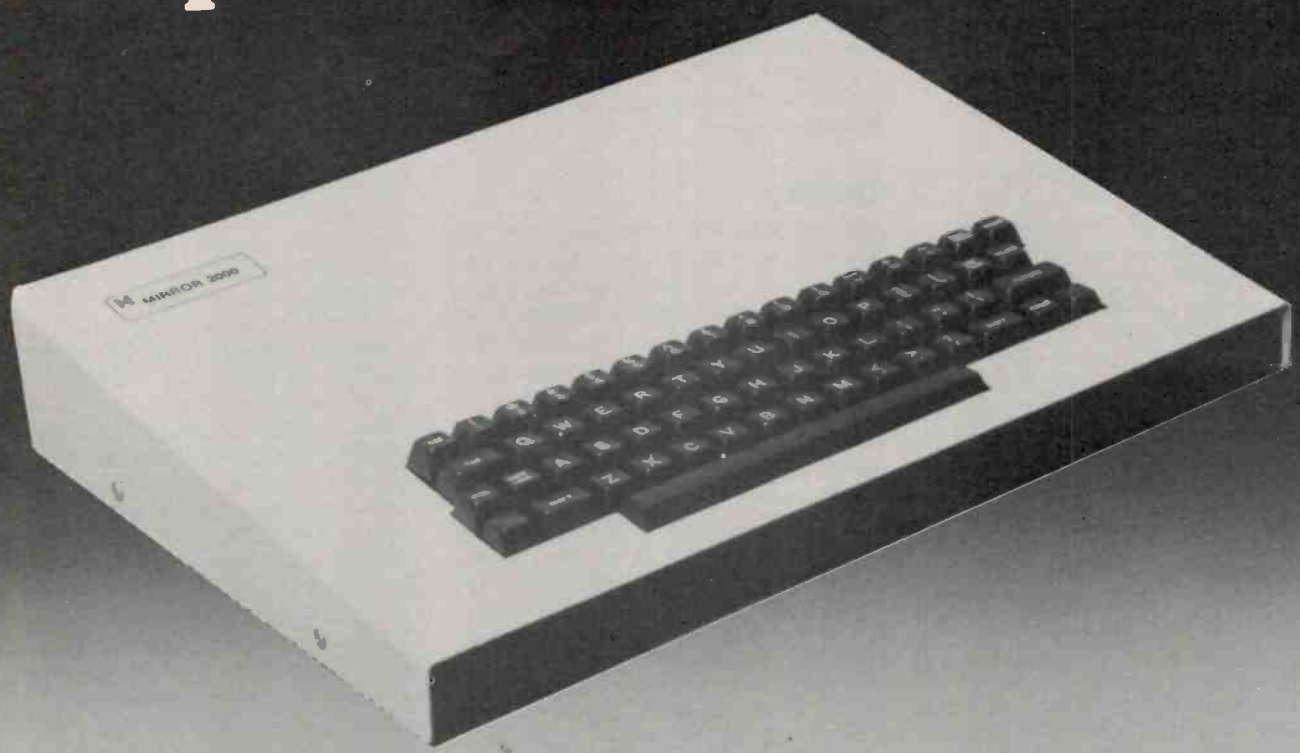
Native technology — the Mirror Systems 2000 computer



Here is a locally designed and manufactured personal computer with some unusual features not seen elsewhere.

Jonathan Scott

THE MIRROR SYSTEMS model 2000 is a 6502-based personal computer which boasts a number of interesting features in its design which set it apart from the run-of-the-mill type machines. The most significant difference is that it has software-driven graphics. 'What?', I hear you say. This means that the processor itself is sending the data out to the TV monitor for display. In the Mirror 2000, a timer interrupts the processor using its NMI (Non-Maskable Interrupt) line at the required moments, and it outputs the bits to the screen.

The first benefit the makers boast is a low parts count. This should lead to low cost and high reliability. Indeed, the parts count is low for such a computer. The board itself sells for $379, while the works (tested working board, 8K RAM, power supply, enclosure, basic ROMs and speaker) comes in at $599 + $10 p&p from the manufacturers. Considering what is offering these days, we rather expected the bare board to be around the $250 mark, in view of its low parts count and unextraordinary hardware. We might add that while the single 380 by 270 mm pc board is of the plain tinned and plated-through hole type, the keyboard, which occupies about 30% of the area, is a neat and very nice-feeling design.

The next benefit of software-implemented video control is extreme flexibility in the display system. In this the Mirror is unequalled in home machines. The makers promise a colour output board (the basic unit is B&W only) which, when it arrives, will give superb capabilities. As is, it starts with a video format of 24 lines of 44 characters each in a 5 x 7 matrix. This can be user-programmed to 32 lines, though we did not try this to see how it appeared. As the character generator is soft, it is an elementary (machine level) job to produce whatever character setup you desire — e.g: a full 7 x 12 dot matrix character set with descenders, as found on the high level type of machine. We received an example program which allows you to build a characterset like using lego bricks. This is really not the type of job one would want to do himself, so we feel that such software should be available, and no doubt will be if the machine finds a large market. The other luxury item in the flexible video line is smooth scrolling. This is actually supported at BASIC level, by one of the extension commands, which we will discuss later. In a single command the screen scrolling may be slowed or hastened, giving either a brisk or a visually pleasing movement of lines on ▶

the screen, as the user desires. The character generators may be exchanged, turned off and on or modified as you go, since their location is also changeable. In fact we were most pleased by the number of factors which were not only designed in such a way as to allow them to be changed at the whim of the user, but also pointed out in the manual supplied with the system. The programmer of the Mirror has not fallen into the trap of keeping things you might want to change to himself, or keeping them where you cannot get at them.

Graphics

The graphics part of the operation is just as variable. It starts out as a 248 pixel wide by 128 pixel high operation. In actual fact this is implemented as if there were 31 *very* high characters on the screen, though this fact is substantially transparent to the BASIC user. This occupies the top half of the screen, which is rather disconcerting at first, as the bottom is blank. We feel the unit should have possibly been organised to default a lower screen of text, given that the upper half is all that is required for graphics. This brings us to another quibble of this machine, namely the memory. In these days of plummeting memory prices and comprehensive memory-burning programs ('Adventure' and so on in the games sphere and 'relaxation' programs in the technical) the Mirror is rather small. Sporting space for sixteen 2114 ICs (8K) on the pc board, further memory has to be outboard. The manufacturers intend these boards to be available in the future. The graphics can of course be changed to fill the whole screen, 256 x 256 pixels, but there goes 8K, a lot of memory for this beast. (That's in B&W too!)

The colour board which we mentioned earlier promises to give very good colour capability indeed, when and if it arrives. Slated for release 'when demand becomes sufficient', it will allocate three bits per pixel, giving eight colours, but each of these eight choices can be programmed to one of 4096 different colours, presumably constructed by choosing one of 16 levels of intensity for each of the prime colours. This, if it lives up to expectations, represents very fine and powerful games-type or diagramatic graphics indeed.

BASIC

The basic BASIC is Synertek 8K, but the Mirror has an extension set consisting of ten graphics associated commands, two printer (RS232) commands and a sound port command. The graphics commands allow clearing of the screen, setting and reading of pixels, setting graphics, video or no output to the screen, (the turnoff facility being used for speed), adjusting scrolling speed, moving the cursor for print and input statements, drawing lines and circles and 'filling in' shapes on the graphics platen. These commands seem very comprehensive and well worked out, easing the job of drawing immensely, but there is one quibble that we have regarding the circle command. The length of arc which is drawn, i.e: the fraction of a whole circle, is specified in terms of the number of pixels of circumference to be filled in, rather than in terms of the angle subtended by the required arc.

We were particularly pleased with the 'PAINT' command, which does the filling. This merely turns all the pixels within an enclosed shape to the specified state. We rather expected it to fail on re-entrant shapes, such as a boomerang placed horizontally, but it did not fall into this trap. After a while we thought of some commands which it would have been nice to add if you are going to the trouble of extending the BASIC, but which were not included. In fact, it is a strong selling point of the MicroBee that it has a very extended BASIC which is clearly influenced by the design philosophies of Hewlett Packard computers with which the author has worked. The idea of extending BASIC is a good one, and few of the computers we have seen even bother. Once having gone to the trouble of interfacing to the core routines however, the more extensions, the classier a machine results. We would be pleased and not surprised *if* popularity of Mirror 2000's saw the availability of a ROM or program to extend further.

The printer commands are simply 'LPRINT' and 'LLIST' which print or list to the RS232 interface — nothing surprising, but useful utilities. The sound command is a little unusual, by virtue of the method of sound output. The Mirror clocks an 8-bit shift register out to the speaker. The 'PLAY' command accepts as its parameters a duration number (16 bits, in decimal integer form) and a value representing the eight bits to be loaded and clocked out. Frequencies between 1.9 kHz and 7.5 kHz may be generated. The lower limit is rather painful, compared to other machines as tones which sound pleasant are generally below 1 kHz.

The Mirror 2000 exposed! All enquiries about this computer should be directed to Mirror Systems, P.O. Box 186, Belmont Vic. 3216.

There is a possibility which we did not explore, that tones of lower frequency could be generated at machine level using single cycles of the shift register. This might have been supported by the BASIC level command. Also the units of the duration parameter are not mentioned, one of the few flaws of the manual supplied. (They turn out to be a shade more than 1 ms, as might be expected.)

The editor

The system also has an on-screen editor. This is a very neat system, being of the popular type where control keys move a cursor over the screen and allow characters over which the cursor passes to be fed into the input line where resides the normal input cursor. This allows lines previously listed to be copied in with additions, concatenations (stringing things together) or deletions as required. More powerful editors are not found on domestic type machines in general, and most do not have editors as standard anyway. The keys are easy to recall, and we experienced no problems whatsoever with this system. Very laudable.

Monitor

A monitor is included, which supports inspection, modification, execution and saving/loading of machine level blocks. This is a fairly standard setup, which we will not dwell on. Suffice to say that it is fine for a quick check of machine language routines which are small, but a more comprehensive system would be needed if one was to want to do any significant amount of programming at the 6502 native level.

Cassette interface

The cassette interface for recording and recalling programs is fairly standard, except that it does have the facility to load a particular program identified by a number at the time of saving. A 'LOAD' command will not load another program if it is set to load number 4, say. So if you lose the location on the tape of number 4, the tape need only be played end to end while a 'LOAD 4' is in effect, and the Mirror will wait and grab that one from the others. Of course, it can be set to load the first it comes to, if you forget the number.

Expansion

Finally to the matter of expansion. At this time, the Mirror appears not to be supported by any expansion boards which can be immediately plugged in to give more memory, a disk drive, etc. The board is provided with a very complete 40 pin expansion socket with buffered address and data lines, clock and control lines. This is clearly designed with expansion in mind, so the possibility is there, but we feel that the lack of boards on the market is rather a failure. A 20-pin RCA type keyboard connection is also provided, for external input of keystroke data. We would like to see the promised colour board *and* more memory, and perhaps some interface board to make an extant disk drive, such as the Apple-type drives, immediately compatible. These will be available if the Mirror becomes popular, and will be purchased even if they are not so cheap, but the initial unit is rather costly for the parts used, and it seems to us that the price will hinder the deserved popularity of this machine. ●

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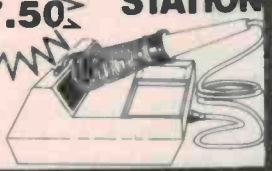

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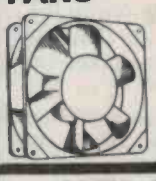

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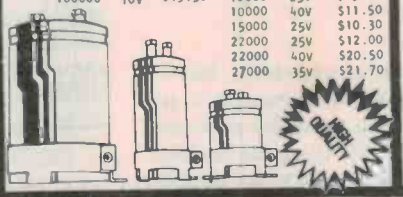

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The pocket programmer's friend

A utility package for the Sharp and Tandy pocket computers. The program assumes that the user has access to a bigger system and likes to program it in machine code.

Tom Moffat

PEOPLE HAVE TRADITIONALLY used the decimal number system, based on ten, because it matches the number of fingers they have to count on. Computers demand binary since their internal registers can only exist in two states. Then there's hexidecimal, a more convenient way of expressing binary, using sixteen states. Anyone who can count hexidecimal on his fingers should forget about computers and join the nearest circus.

The first three routines convert numbers from one system to another. In the pocket computer all the routines are called up in the 'defined' mode, by hitting 'SHIFT' and then the appropriate letter, 'B', 'D', 'H', 'Z' or 'X'.

B, D and H specify the number system being converted from. The computer will respond with 'CONVERT TO:' and you again enter B, D or H.

Program 'B' (convert from binary)

You enter either 8 or 16 bits, 8 bits at a time, as 1's and 0's. If an 8 bit number, enter '0' for byte 1 and then the 8 bits for byte 0. After a (somewhat lengthy) pause the computer will beep and then deliver the decimal or hexidecimal equivalent. For another numer hit 'SHIFT B' again.

Program 'D' (convert from decimal)

As the program is limited to sixteen bits the highest decimal number you can enter is 65 535 which represents all 16 bits high. Enter the number in the normal way, and wait for the result as above.

Program 'H' (convert from hexidecimal)

The pocket computer doesn't split strings, so you must do it yourself. Enter four hex digits separately, such as "0- ENTER -2- ENTER -A- ENTER -B- ENTER" for '02AB'. The conversion will appear in due course, after a beep.

Program 'Z'

This is not a number converter, but it's probably the most useful routine of all. Without going into machine code programming too deeply, it can be said that it's sometimes necessary to execute certain program steps 'out of order', usually conditional on the result of some test. If you're at some memory address and want to jump to another address, the actual instruction doesn't usually say *where* to jump; it only says how far and in what direction.

In this program you enter the 'FROM' and 'TO' addresses (in four digit hexidecimal, as in program 'H'), and the computer responds with '00xx' where 'xx' are the hex digits to be used in the actual instruction. Microprocessors limit the jump distance (called the 'offset' or the 'displacement') to between −128 and +127 bytes.

Any attempt to calculate further than this on the pocket computer will result in an 'OUT OF RANGE' message, and usually much swearing on the part of the programmer.

Program 'X'

This does the opposite of program 'Z' and is handy for working out how other people wrote their programs. You supply the current address and the offset, and the computer tells you the address to be branched to.

When running the above routines you will notice they are painfully slow, but this is the price of heavy number crunching in the pocket computer. They will allow you to work independently of your bigger system; for instance at the office, when you're supposed to be doing something else (be sure to disable the BEEP statements in this case).

TELETYPE	POCKET COMPUTER
:,	;
USING 'XXX'	USING "###"
*	*
LT	<
GT	>
PWR	^

Program Listing

```
10: 'B'GOSUB 640
20: INPUT 'ENTER BYTE 1: ';,U
30: INPUT 'ENTER BYTE 0: ';,V
40: R=10:S=2
50: IF U LET X=U:GOSUB 600:U=256Y
60: X=V:GOSUB 600:T=U+Y
70: IF Q$='H' LET X=T:GOTO 300
80: BEEP 1:GOSUB 650:END
100: 'D'GOSUB 640:INPUT 'ENTER DECIMAL: ';,V
110: IF Q$='H' LET X=V:GOTO 300
120: R=2:S=10
130: X= INT (V/256):IF X=0 THEN 150
140: GOSUB 600:T=Y
150: X=V:GOSUB 600:U=Y:BEEP 1
160: USING 'XXXXXXXX';PRINT 'BINARY';,T;,U
170: END
200: 'H'GOSUB 640
210: A=10:B=11:C=12:D=13:E=14:F=15
220: INPUT 'ENTER HEX= ',G,H,I,J
230: V=((16G+H) . 16+I) . 16+J
240: IF Q$='B' THEN 120
250: IF Q$='A'RETURN
260: T=V:BEEP 1:GOSUB 650
270: END
300: A$='0':B$='1':C$='2':D$='3'
301: E$='4':F$='5':G$='6':H$='7'
302: I$='8':J$='9':K$='A':L$='B'
303: M$='C':N$='D':O$='E':P$='F'
310: X=X/4096:Q= INT X
320: X=(X-Q) . 16:R= INT X
330: X=(X-R) . 16:S= INT X
340: X=(X-S) . 16:T= INT (X+.5)
350: Q=Q+1:R=R+1:S=S+1:T=T+1:BEEP 1
360: PRINT 'HEX= ';,A$(Q);,A$(R);,A$(S);,A$(T)
370: END
400: 'Z'Q$='A':PAUSE 'FROM...'
410: GOSUB 210:K=V+2
420: PAUSE 'TO...'
430: GOSUB 220:L=V
440: M=L-K:IF (M LT -128)+(M GT 127)PAUSE
     'OUT OF RANGE.';GOTO 400
450: IF M LT 0 LET M=M+256
460: X=M:GOTO 300
500: 'X'Q$='A':PAUSE 'CURRENT ADDRESS...'
510: GOSUB 210:K=V+2
520: PAUSE 'OFFSET VALUE...'
530: GOSUB 220:L=V
540: IF L GT 127 LET L=L-256
550: M=K+L:X=M:GOTO 300
600: Y=0:FOR W=0 TO 7
610: Z= INT (X/R)
620: Y=Y+(X-RZ) . S PWR W:X=Z
630: NEXT W:RETURN
640: CLEAR:INPUT 'CONVERT TO: ';,Q$:RETURN
650: USING 'XXXXX';PRINT 'DECIMAL=';,T:RETURN
```

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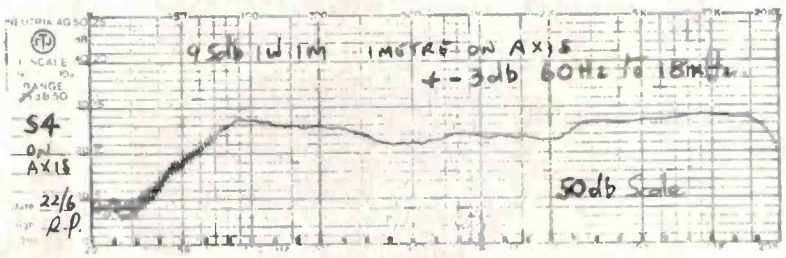

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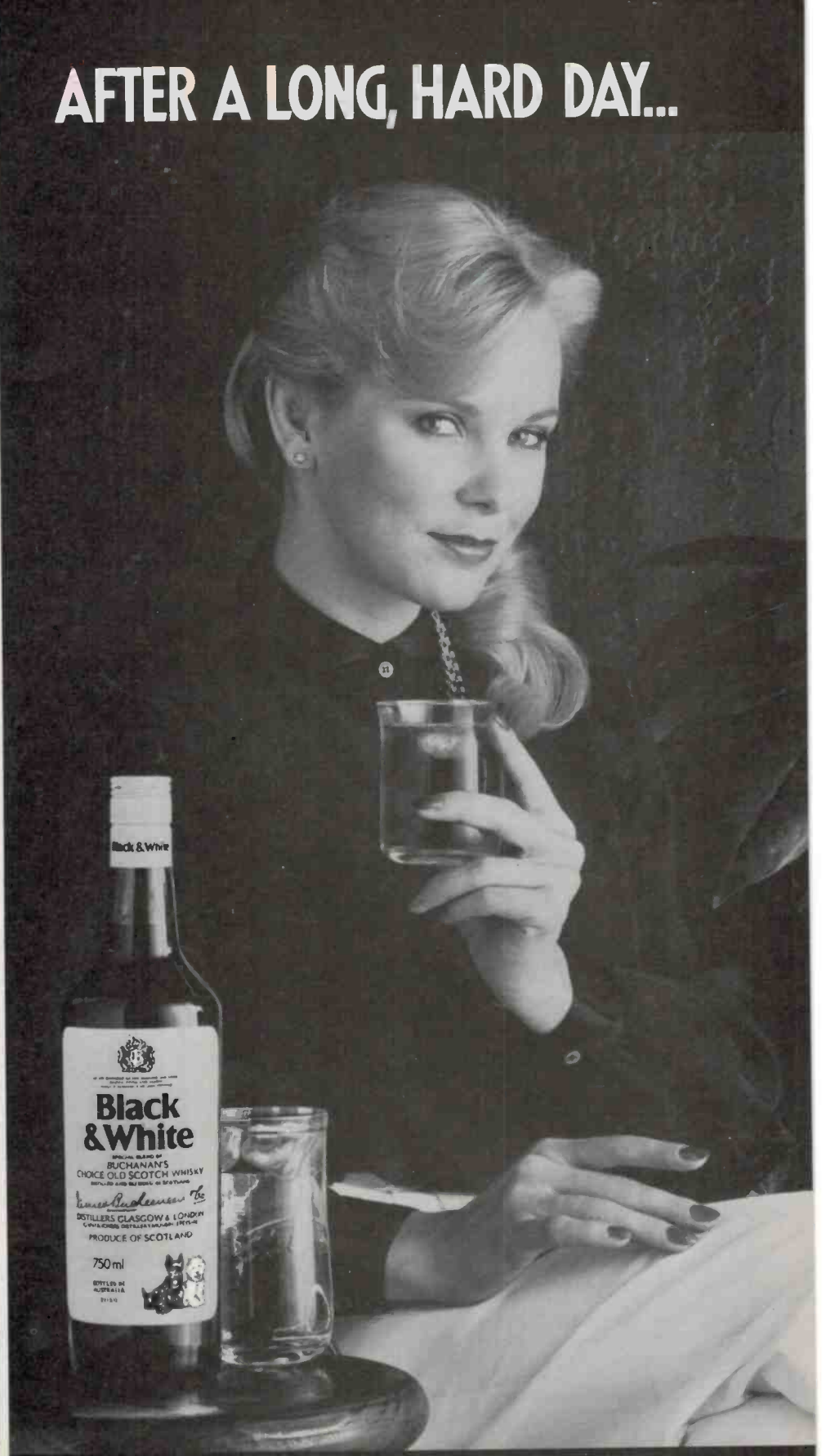

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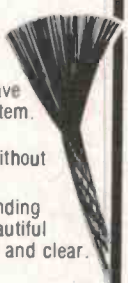

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ELECTRONIC LIFESTYLE

Grand Hi-Fi Contest winners!

Our Grand Hi-Fi Contest, run over the July and August issues, was a great success, thanks to the many, many readers who tackled the dozen twisty questions with gusto and ingenuity. Here are the answers:

1) The Gregorian Calendar was adopted by Roman Catholic countries in 1582 but it wasn't until 1752 that Britain followed suit. The discrepancy between the prevailing Julian calendar and the Gregorian calendar was then 11 days. The 1751 Act required that "the Natural Day next immediately following the second Day of September (1752) shall be called, reckoned and accounted to be the fourteenth Day of September . . ."

Thus there **were** no dates between the 3rd and 13th of September 1752 hence no significant discoveries were made.

2) Three hours after Bell filed his telephone apparatus patent, Elisha Gray filed a caveat with the US Patent Office claiming that he was working on a similar device.

3) In 1857 Leon Scott (known also as Leon Scott de Martinville and in another reference as Edouard Leon-Scott) developed his 'phonautograph' which employed a hog bristle to trace sound vibrations on carbon-blacked paper.

4) Hollerith's first punched cards were 6⅝" by 3¼" — the same size as the then US dollar bill. His adoption of that size enabled him to use existing bill handling equipment.

5) Unlikely though it may seem, the circuit shown in this question was an early heterodyne radio receiver. The dc energised arc, C1, L3/4 forms a local oscillator. (After Fessenden.)

6) A 'Rheotome' was essentially a device for continuously interrupting the flow of current in an electrical circuit. In 1854 Lenz used such a device for measuring voltage waveforms of ac generators. Bell used another during his pioneering work on the multiple telegraph.

7) Nathaniel Hawthorne in 'House of Seven Gables' wrote "Is it a fact — or have I dreamt it — that, by means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time?"

8) In 1792 leaders of the French Revolutionary Convention introduced a decimal calendar. Whilst still retaining 12 months a year each month consisted of three weeks, each of ten days. Each day was divided into ten hours, each hour into 100 minutes and each minute into 100 seconds. The remaining days were inserted as holidays (the Sansculottides) at the end of each year. The decimal day survived from 1793 until 1795 but the decimal calendar continued until January 1st 1806 when Napolean changed back to the Gregorian system.

9) Our illustration is of Augustus de Morgan. Together with George Boole, de Morgan developed theorems used to simplify expressions of logical variables using what became known as 'Boolean algebra' notation.

10) This question, concerning the discovery of the thermoelectric effect by people other than T.J. Seebeck has proved slightly controversial. James Cumming and Jean-Philibert Dessaignes were the people we had in mind. Several contestants have provided evidence that whilst literature credits Cumming and Dessaigne with independent and/or anticipated discovery the extent of their work is in some doubt. Nevertheless as these are the only two people named who could be considered in the context of the question we feel that it is fair to retain those as the correct answers.

11) In 1843 Alexander Bain received British Patent 9745 for his automatic electrochemical recording telegraph.

12) Babbage's signalling lamp (using occultting solar lights) was used by the Russians during the Seige of Sebastopol.

First prize goes to Mr. G.M. Stallman of Graceville in Queensland. No doubt you'll enjoy your system compiled from equipment supplied by Audio Engineers, Concept Audio, Communications Power Inc, National Technics, TDK, Marantz, Pioneer, Vanfi, Audioson, Convoy and Maurice Chapman.

Second prize goes to A.G. Wood of Sydney NSW. We guess you'll be pleased with the Sharp VZ2000 portable hi-fi plus Allsop accessories, TDK tape and Sennheiser headphones from R.H. Cunningham.

Consolation prizes, in order, went to W. Pantelejenko of Plenty Vic; Wayne Thompson of Croydon Vic; Peter Farleigh of Peakhurst NSW; T. Krysiak of Mt Hawthorn WA; Peter Kelly of Leonay NSW and Michael Reich of Turner ACT. The consolation prizes comprised items donated by Communications Power Inc (Allsop accessories), R.H. Cunningham (Sennheiser headphones), TDK (cassette tapes) and Maurice Chapman (Audio-Technica cartridges).

The six runners-up were Roy Preece and Chris Davies of Carlton Vic; Ray Johnson of Stanmore NSW; R.C. Neale of Killara NSW; B.F. Pollett of Cheltenham Vic. and Fred Inman of Cottonvale Qld. Fred Inman deserves special mention as he received a runner-up prize for the most imaginative entry sent in. To question 3, he said "Tom Tom the Piper's Son used a diaphragm and hog bristle to develop a (sex aid)!" To question 4 he said Hollerith's cards were 5'8" by 3' to "simulate the height and width of his mother in law for more precise punching practice." The circuit in question 5 Fred said was "a lightning powered ear wax dislodger with 110 V (light duty) battery charger." For question 8, he said "DeciBelgium" introduced decimal time in "Dec. 1010." Instead of telling us the picture in question 9 was that of de Morgan, he said it was "W.C. Shop — he invented the shop counter." Having provided everyone with such a good laugh we thought it was worth **something.**

Thank you to all the firms who donated prizes and thank you to all the enthusiastic contest entrants. We're sincerely glad you enjoyed the challenge of another of our famous twisty questions contests and hope you search the magazine keenly for more (. . . like the one on page 27, this issue).

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Total Trackability Index (TTI): 91.7 minimum

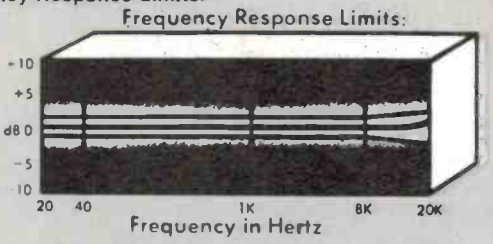
Vertical Tone Arm Resonance: Less than 5dB rise at 14Hz In SME Series III Tone Arm (without SME damper)

Channel Balance: Within 1.5dB

Channel Separation: 1kHz: 25dB or greater
10kHz: 18dB or greater

Output Voltage (Typical): 3.2mV RMS at 1kHz at 5cm/sec peak velocity

Frequency Response Limits:



Recommended Load: 47 kohms in parallel with 250pF (includes tone arm wiring, connecting cables, and preamplifier input) Capacitive loading from 100pF to 400pF will cause negligible change from the recommended 250pF loading

Resistance (Typical): 815 ohms, dc

Inductance (Typical): 330mH at 1kHz

Cartridge Weight: 6.6 grams

Replacement Stylus: V15V: VN5HE, Nudé Hyperelliptical tip, 5 x 38μ (.0002 x .0015 in) Black serial numbers
V15V-G: VN5G, Nude Spherical tip, 15μ (.0006 in) Red serial numbers

Optional 78 RPM Stylus: VN578E, Biradial (Elliptical) tip, 13 x 63μ (.0005 x .0025 in)

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LIFESTYLE NEWS

Akai VS-2 video cassette recorder

The Akai VS-2 features full function wireless remote control and an interactive monitor system.

The interactive monitor system is a microcomputer based system that allows any TV screen to display VS-2 operating instructions, making operating an error-free process. The screen displays the unattended recording schedule and prompts for data input, updating or simple confirmation.

The VS-2 permits unattended recording of up to nine individual programmes on any combination of 16 different preset channels over a four week period.

Granitic gramophone rocks on

A hi-fi gramophone with radically new technology has been put on the market by a small English electronics firm, Elite Townshend. Cranfield Institute of Technology's Unit for Precision Engineering designed the 'Rock' gramophone, but not without their share of problems.

It's called the Rock gramophone because it's filled with artificial granite to damp unwanted resonances and weighs 16 kg. It incorporates technology that Jack Dinsdale, a senior lecturer at Cranfield, developed. But the Rock cannot incorporate a special bearing that Dinsdale designed and patented because the patent rights were sold to another company — which has never exploited them.

The damping material, called Granitan, was developed at Cranfield. It is as stiff as cast iron but is ten times better for damping spurious vibrations which can colour the sound from the pickup cartridge. Seven kilogrammes of Granitan are poured into the Rock's chassis during manufacture.

Another Cranfield invention damps vibrations in the pickup arm. A paddle on the arm has to move through oil in a thin trough mounted over the record. This kills off all vibrations of audible frequency.

Have you seen the Michell Gyrodec?

Backed by the experience of many years of building high quality turntables such as the 'Reference' and 'Focus One', John Michell has now come up with a new design called the 'Gyrodec'.

The Michell Gyrodec represents the British interpretation of turntable state-of-the-art. Its detailed engineering is aimed at maximising isolation of the groove/stylus interface, to extract maximum information with minimum distortion. The Gyrodec is therefore equipped with a very specialised mat and clamping system, with a critically-aligned sub-chassis suspension to give exceptional independence of environmental vibration. The suspension is factory adjusted and arms of different weights are compensated by the use of specially weighted mounting plates, pre-drilled for accurate geometrical alignment for a wide range of popular models.

There is also provision for mounting a second arm should this be required.

Short and long term rotational stability is ensured by the use of a very powerful low-voltage synchronous motor driving the massive peripherally-weighted platter via a resilient round-section belt.

The Gyrodec is therefore extremely simple to install and operate and needs no special procedure for setting up, other than correct assembly, to give best possible performance.

The Gyrodec is manufactured from aluminium, brass and clear acrylic.

Full information can be obtained from specialist retailers or Audio 2000, P.O. Box 107, Brookvale NSW 2100. (02)939-2159.

Ampex awarded $10M in magnetic tape contracts

Ampex Corporation USA recently announced that the General Services Administration has awarded the company two contracts valued at $10 million to provide recording tape in support of all facets of US Government's magnetic tape requirements.

According to Stanley W. Faught, Vice President and General Manager of the Ampex Magnetic Tape Division, a $7.4 million contract award is for precision instrumentation recording tape, which will be used in a variety of government-sponsored scientific research programmes, including the space shuttle and other deep space missions. It marks the eleventh consecutive year Ampex has provided the GSA with instrumentation tape under the Federal Supply Schedule.

The other contract is a multiple $2.6 million award to supply the GSA with broadcast video, video cassettes, audio cassettes, open reel audio and mastering tapes.

Meridian M10 speaker system

Audio 2000 has the new Meridian M10 speaker system, the latest in the range of inter-active speakers by Boothroyd-Stuart. The other models in the family of inter-active speakers are the M2 and M3.

The family of inter-active speakers is dedicated to the idea of optimum dispersion for good stereo imaging using purpose-designed amplification for each drive unit, in conjunction with electronic cross-over (dividing) networks with precisely tailored characteristics, said the hi-fi experts at Audio 2000. A Meridian 101 preamplifier is planned to meet the demands of the new speaker system.

The Boothroyd-Stuart team, who developed the Meridian equipment, were presented with a British Design Council Award. The award was for design excellence of Meridan high fidelity products and was presented by HRH The Duke of Edinburgh.

The award winning system was made up of the modular components from which a range of hi-fi systems are assembled providing output power from 35 W/channel to 100 W.

Meridan products can be obtained from Audio 2000, P.O. Box 107, Brookvale NSW. (02)939-2159.

A revolutionary way to grow younger.

Let's face it, every car interior gets old. But it needn't show. The Kitten System has created Revive All, the facelift that comes in a bottle.

Revive All will dramatically improve the appearance and feel of vinyl or leather upholstery, the dashboard, inside doors, roof linings, tyres, rubber bumper strips and vinyl tops.

Now this isn't just an extravagant claim. Revive All penetrates surfaces with a special silicone film to restore original beauty.

And if you use it regularly, Revive All will preserve against cracking and decay caused by natural elements.

If you have an interior that needs cleaning, we recommend Kitten Interior Cleaner or Kitten Upholstery Cleaner before using Revive All.

Otherwise, for your car's good health, use Revive All regularly and help your car grow young.

THE KITTEN SYSTEM.

KIW 311/2

THE CREAM OF CAR CARE.

Product Audio File

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With its ultimate in precision British engineering and logical design Michell's **GYRODEC** sets the highest ever standards in disc sound quality, far surpassing existing performance levels to give breathtakingly clear sound, fresh as the dawn.

Never before has the space, scale and power of musical performances been so thrillingly brought to life. **GYRODEC** moves closer to the ideals of mechanical neutrality and environmental isolation than ever before, requires no critical fine tuning or setting up to yield its uniquely accurate sound, and has provision for mounting a second pickup arm.

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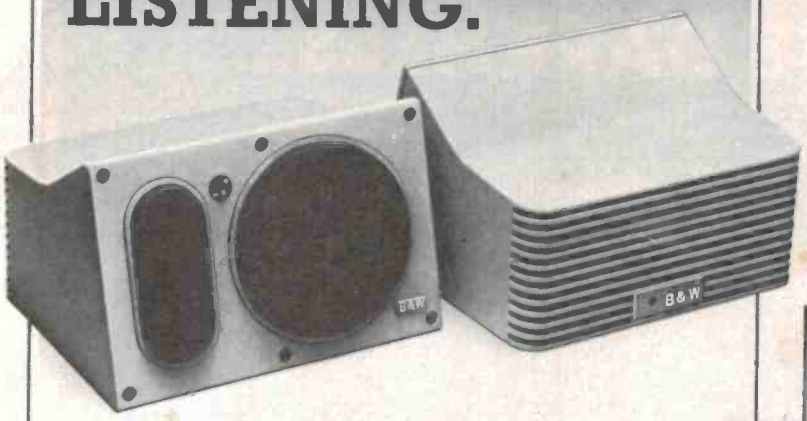

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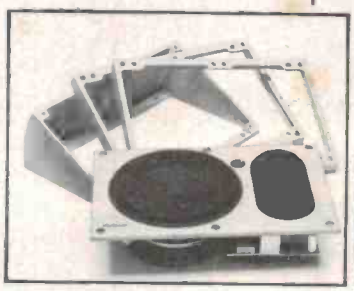

For further information contact
Convoy Sydney,
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Telephone (02) 698 7300

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$399

Incorporating many of the design and performance features of our most advanced unit, the Systemdek III, this completely new concept in a budget turntable provides the opportunity for audiophiles to experience the immense benefits that an advanced signal source is able to achieve.

An improved suspension system isolates the specially designed glass platter from the base and its surroundings to provide a level of performance unheard of in this price bracket. And compared with its competitors, the Systemdek II offers a two speed option, simpler alignment procedures, levelling feet and easier arm fitting.

If you are serious about your hi-fi and interested in 'acoustic value for money', then the Systemdek II is worthy of your attention.

See your Systemdek dealer today and discover the true meaning of value for money . . . Systemdek II.

Arm & cartridge not included
Record clamp optional extra

For further information contact
Convoy Sydney, 400 Botany Rd., Alexandria 2015. Telephone (02) 698 7300

LIFESTYLE NEWS

Enjoy hi-fi while you drive

Concord's latest model in Australia, the HPL-130, an AM/FM radio cassette unit, is a no-compromise 'top-of-the-line' enthusiast-oriented product, say Concord.

Featuring quartz digital synthesised AM/FM tuning and Concord's exclusive signal processor circuitry, the HPL-130 has a four gang front end and 25 watts per channel amplifier section.

The front end offers ten station memory presets, local and distance switching, FM muting and hi-blend sensitivity control and digital frequency display.

The cassette deck has metal and standard tape compatibility, a Sen Alloy tape head, Dolby noise reduction, power off tape eject, automatic repeat play function, extremely low wow and flutter and a precision speed control.

For further information contact Mr. Martin McMurray, General Manager Sonic International, 4 Clarendon St, Artarmon NSW 2064. (02)439-8900.

Digital discs first in Japan

Japanese audio makers, Pioneer and Trio-Kenwood, have said that they will be marketing digital audio disc players in Japan by the end of this year. Sony and eight Sony Philips licensees in Japan also said they will bring their players to the market this year.

Pioneer and Trio-Kenwood make a digital audio disc player under license from Sony and N.V. Philips, which jointly developed the laser-style system.

Software is supplied by a Sony-CBS joint venture, Polygram, Denon and Toshiba-EMI.

Pioneer has set a dollar equivalent retail tag of US$761 and Trio-Kenwood, which developed its player jointly with Toshiba, has set a price of US$923. Its model can program up to 99 selections compared with the Pioneer model's 16 selection capability.

Tape motion analyser

Bell and Howell's tape motion analyser, TMA 3000, is a microprocessor controlled test instrument. It is IRIG compatible to 240 IPS for measurement of tape recorder tape dynamics including flutter, TBE and skew.

There are nine reference frequencies and interface options are available. For further information contact Fred Liackman at Bell and Howell on (02)660-5366.

Electronic hand clapping

A British patent application has been filed for a circuit that synthesises the sound of human hand clapping. It enables a pop group to play musical instruments live on stage, while backed with the sound of rhythmic hand clapping.

According to the inventor, David Simmons, there is an easy way to imitate the sound of several people clapping in unison. He says it is only necessary to generate a background crashing noise overlaid with the sound of one or two short individual clapping sounds.

The background crashing is produced by amplifying an electronic noise of random frequency and random amplitude. By a happy coincidence, many electrical components, such as resistors and transistors, produce just this kind of noise at low levels. So all that is necessary is to boost the noise in a powerful amplifier.

The single hand clap is synthesised by generating an audio signal which sweeps down in pitch. A tone of 1.6 kHz is rapidly switched on and then allowed to fall to around 200 Hz in 7 ms. When a train of these sweep pulses is superimposed on background crashing, the combined sound is like a hand clapping in time with the music.

The rhythmic pulses are generated by a timing circuit, but the inventor suggests that this should not be too accurate or the sound would be unnatural! Very few people clap in strict tempo. It is also possible to trigger the claps by an audio sensor that responds to sudden sounds. So if the sensor is placed alongside the drummer's kit, the electronic claps will follow the rhythmic beat of the drums—a great morale-booster when playing in empty halls. □

Nakamichi ZX-7 cassette deck

The ZX-7 is a cassette deck designed for the serious tape recordist, offering extensive manual calibration control for achieving optimum performance with any tape.

Record head azimuth alignment control, record/playback level and bias can be manually adjusted to optimum levels for the characteristics of any tape. Calibration is carried out in a three step process, azimuth, level then bias. Through careful adjustment a frequency response of 20-21 kHz ± 3 db (ZX/metal tape) can be achieved.

The ZX-7 employs Nakamichi's asymmetrical, diffused resonance, dual capstan transport. However, instead of a CMOS logic circuit, transport control is now handled by an NMOS 4-bit microprocessor which improves the overall performance of the system.

Once recording level and left/right channel balance have been set, automatic fade-in and fade-out of the recording level is possible with the master fader control. It allows either a two second or six second fade, 'up' or 'down'.

The same Dolby B-C noise reduction processor ICs are used in all Nakamichi decks. As the S/N ratio of the Dolby processor IC is 74 dB (Dolby C encoding mode), the total dynamic range of the Dolby circuit can reach 100 dB.

The ZX-7 record head, playback head and erase head are arranged in a completely discrete configuration. Also incorporated is a system for precise alignment of the record head azimuth.

Other features include a remote control unit RM-200 (optional), MPX filter switch, dc power output for blackbox series and record/playback timer operation.

Sanyo personal audio system

Sanyo has now introduced its M-G30 personal audio system which has stereo listening from radio or cassette through lightweight headphones.

It has an AM/FM stereo tuner with LED stereo indicator. The M-G30 operates on batteries or ac with an optional adaptor. The cassette takes both metal and normal tapes with auto stop at the end of the tape.

This 'personal audio system' has all the features of a large cassette with the added bonus that you can take the M-G30 anywhere as the accessories include shoulder strap, carrying case and stereo headphones for private listening.

The Sanyo M-G30 is available at a suggested retail price of $111.00.

For further information contact Mr. W. Fabiszewski, Sanyo Australia Pty Ltd, 225 Miller Street, North Sydney NSW 2060. (02) 436-1122.

Review of the Quad electrostatic loudspeakers, model ESL-63

Once upon a time, Peter Walker of Quad Electroacoustics, made an electrostatic loudspeaker. The fame of this speaker spread throughout the lands. This product was held in such reverence it was the standard by which all others were compared. Two score and some years later a new standard was established . . . by others. But, knowing such a day would come, Peter Walker had spent nigh on two score years developing a better product. But will it establish an even 'newer' standard? Perhaps . . .

Louis Challis

THIS REVIEW theoretically started at a party in 1979 which the Australian Importer for Quad loudspeakers arranged to welcome Ross Walker, the son of the Managing Director of Quad Electroacoustics Ltd, during a brief visit to Australia.

I sat opposite him at the table and asked the ubiquitous question "when are you going to release the new Quad loudspeakers?" and received the nonchalant answer, ". . . in a little while!", which told me that they were seriously working on the project. His next response was that they would not release a new loudspeaker unless it was a significant improvement on the (then) current Quad electrostatic loudspeaker. Knowing the calibre of the company and its products, I accepted this statement as a matter of fact and the discussion moved on to more mundane matters.

It was only a few weeks later that Peter Walker, Managing Director of Quad Electroacoustics Ltd, demonstrated his new prototype ESL-63 to a packed meeting of the Audio Engineering Society in London. The news of that momentous gathering was not lost on the rest of the technical world and the technical journals literally 'hummed' for almost a year with all sorts of possible and tentative guesses as to when the production version would be released.

It took until June 1981 to solve the not inconsiderable manufacturing problems and the speaker was released with a blaze of publicity. We had to wait a further 14 months to get hold of a privately owned pair of the new speakers.

You might well ask what is so special about Quad electrostatic speakers. The answer, to me, is quite simple as I already own a pair of the original Quad loudspeakers which are used in conjunction with an Audio-Pro B2-50 sub-woofer. The Quad's performance is still regarded as outstanding some 26 years after their original release. But, because of their size and shape, I have been hard pressed to find the right location in my living room to place these speakers and the addition of the Audio-Pro sub-woofer has only compounded the problem. The sub-woofer proved to be an essential addition as the lower effective frequency for the Quads was a mere 60-70 hertz, which is just not good enough for the high quality records and tapes now available. Even with the sub-woofer added to the system the major limitation still becomes the maximum undistorted output level from the Quads which at one metre tends to be between 90-95 decibels, depending on the weather. No, it is not that I may be under the weather, but rather that under the influence of high humidity there is always a likelihood of ionisation particularly under high drive conditions when the speakers have to produce peak signal levels. Fortunately the original Quads used a selenium rectifier stack for the high voltage supply and this tended to be relatively immune to such problems (except on the occasion when the speakers were left running and one rectifier stack failed completely. Both the smell and the cost of repair proved to be unacceptable).

The Editor and I knew that the magazine's readers would be just as interested as we were to see how well the new Quads performed. Equally important, Peter Walker has been working on the design of these speakers since 1963 and a 19-year gestation period is a remarkably long one for any piece of electo-acoustic equipment.

The original Quad electrostatic speaker.

Dramatic change

The ESL-63 loudspeakers present a dramatic change in visual impact when compared with the original Quad electrostatics. Whilst the original Quads are ungainly, and many would say ugly, the ESL-63s are visually attractive and not out of keeping with either a modern architectural internal decor or even a room of antique furniture. They are, I believe, as attractive as the old Quads were unattractive. The reasons for this are not hard to see.

Firstly, the older Quads featured either a black or bronze expanded

aluminium protection grill overlying a swept-back rectangular shaped panel with wooden sides and with two small wooden legs at the front and one at the rear.

The new Quads, by contrast, feature an attractive wooden top and bottom to the main cabinet structure. The lower one rests on top of a molded black plastic pedestal which extends beyond the back of the unit. This pedestal incorporates the power supply rectifiers, delay lines and protection circuits, which form an integral part of each speaker unit. The face of the unit is covered by a seamless stocking of open weave brown terylene cloth. This provides necessary and important protection for the lightly framed electrostatic elements located behind. These elements have a number of important differences when compared with the original Quads. Firstly as the illustration shows, the design incorporates a series of concentric elements with annular electrodes, to which the signal components are individually fed by means of sequential delay lines. This is done in order to reproduce a sound pressure response which is theoretically (but not practically) an exact replica of the sound signal that would be produced by an ideal point source located approximately 300 mm behind the plane of the diaphragm.

The aim of such a configuration is to produce an homogeneous, or equivalent, point sound source with a linear phase response and a frequency response that is as smooth as possible both on- and off-axis.

Obviously such a structure behaves like a true dipole and Quad have introduced the acronym FRED (full range electrostatic doublet) to describe the system. Such a system has a number of positive and unquestioned benefits. Firstly, that it offers benefits in terms of the speaker placement within a typical living room. Secondly, the stereo imaging effect is substantially better than that provided by most conventional loudspeakers and thirdly, if the frequency response is right it should be able to more closely reproduce the original sound, with a subjective realism superior to that achieved by more conventional loudspeakers with which you and I are now very familiar.

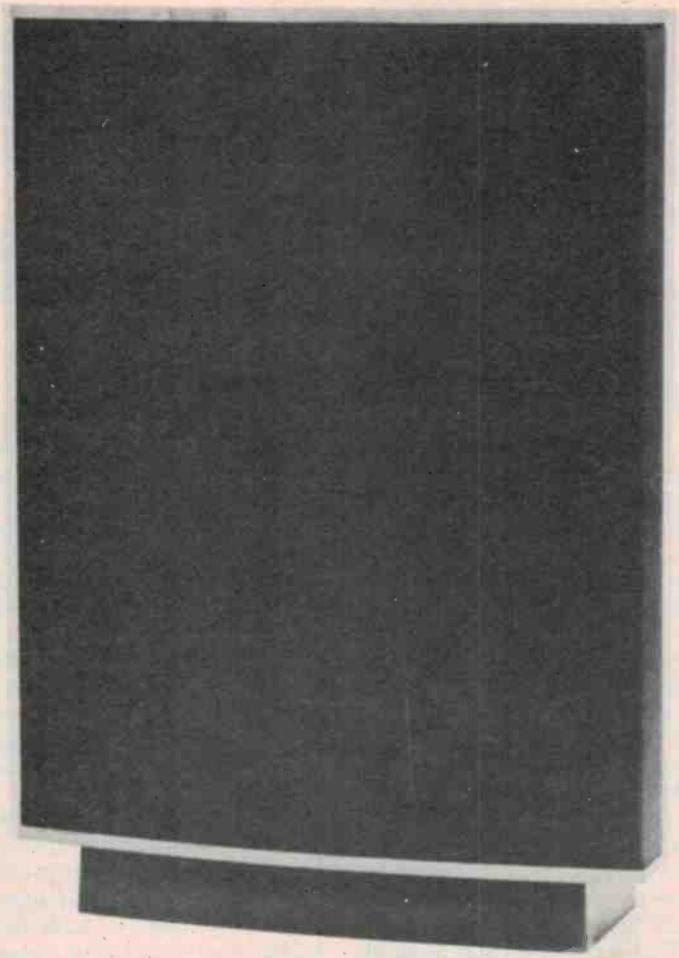
To the test!

Obviously, I was itching to get the speakers into our anechoic room to see how they would perform, for after all the good things written by overseas (subjective) reviewers, it was time to put the speakers fully to the test.

The first set of parameters that we evaluated was the measurement of the frequency response both on- and off-axis. The results were, as you can see from the graphs, particularly commendable with a flatter frequency response over the range 40 Hz to 8 kHz than I would have expected. What was particularly noticeable was the sharpness of the resonant response at 45 Hz (where the damping is obviously too low) and the degree of nonuniformity which is so noticeable in the range 5 kHz to 20 kHz. The off-axis response however, is still excellent, only dropping by approximately 2 dB in the midband, by 5 dB at 8 kHz, by 6 dB at 13 kHz and 10 dB at 17 kHz. I wondered about the sharpness of the low frequency resonance, and the bottom end would obviously behave somewhat differently when presented with a reflective floor surface and a reflective rear wall surface, but more about that later.

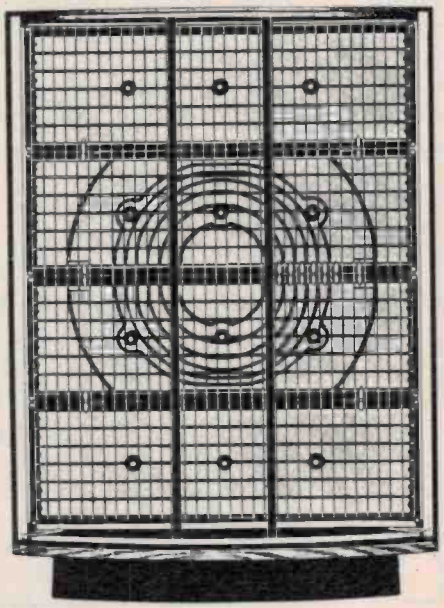
Our next investigations were the assessment of the phase response, the results of which took me by surprise. Our first response displayed a series of cyclical variations that were periodic with increasing frequency and which did not go away even after we had correctly aligned the microphone with the true centre axis of the loudspeaker in the anechoic room.

It took me some time to realise that if one is 'off-axis' or the delay line tappings are not perfect, then there must be a series of competing signal components from each of the annular sections of the radiating diaphragm array which can produce small interference patterns. This is totally inaudible, primarily of academic interest and most upsetting



The new Quad Model ESL-63 electrostatic loudspeaker — more attractive than its predecessor.

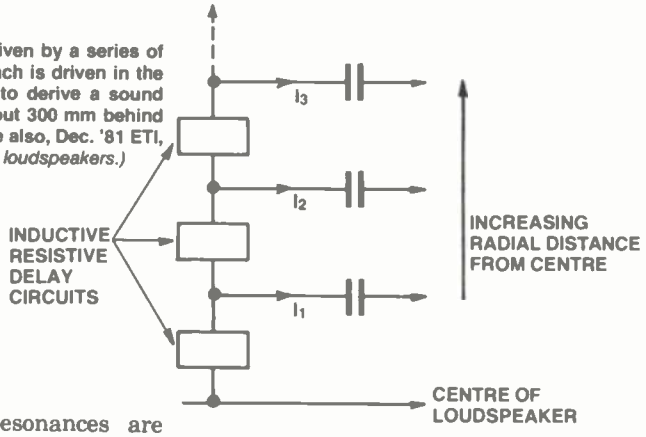
Inside the Quad ESL-63 showing the concentric annular electrodes.



for reviewers who wonder where they might have gone wrong! The phase response of the Quad is nonetheless excellent, varying by less than ±90° from 20 Hz to 20 kHz. That response has only been bettered by very few other speakers in my experience of speaker testing.

The impedance curve is interesting as it features a modest rise from a minimum of 4 ohms at 10 Hz up to a 24 ohm peak at 100 Hz. This drops away again to 6 ohms at 10 kHz with a rise again to 15 ohms at 20 kHz. This impedance curve is slightly load sensitive, but irrespective of the load would not cause problems for any normal amplifier. The manufacturers do however warn that amplifiers without internal short circuit protection should not be used to drive this speaker. The reason for this, as we subsequently discovered, is that when overdriven, the speaker's protection circuit applies a voltage limiter, in the form of a thyristor, which is connected across the input terminals and which only resets when the dangerous signal is removed. (Sounds like a job for the ETI-494 speaker protector, published last month! — Ed.)

The most interesting tests of the Quad ESL-63 were firstly the conventional tone burst tests, performed at the standard frequencies and also at 40 Hz, and secondly, the decay response spectra. The latter is one of the most revealing tests and has enabled us to correlate some aspects of the objective response with the subjective response. The tone burst tests revealed that the ESL-63 has a relatively sharp Q in its response at 40 Hz. The decay response test revealed significant decay resonances at 3.5 kHz, 6 kHz, 8 kHz, 13 kHz and 17 kHz. Other resonances are observable in the region above 18 kHz but are generally of little concern.



The annular electrodes are driven by a series of delay line elements so that each is driven in the approximately correct phase to derive a sound source that appears to be about 300 mm behind the plane of the elements. (See also, Dec. '81 ETI, *Inside Quad's latest electrostatic loudspeakers.*)

The smooth response below 3.5 kHz subsequently proved to be important as I had expected to find significant mid-band resonances. The original Quad electrostatic speakers and, albeit, most electrostatic speakers that I have so far examined, have exhibited such resonances. They provide some of the 'characteristic sound' or colouration that electrostatic speakers possess and which I feel is often mistaken for an attribute even when it is not.

The last of the objective tests that we performed was the distortion level at 10 volts input, the value specified by the manufacturer for continuous sinewave excitation. Here we found the distortion levels much lower than those produced by the previous model Quads and generally *amongst the lowest levels we have yet seen from any loudspeakers operating at comparable acoustical output.* We endeavoured to perform a transient evaluation of distortion but had less success than we did utilising our conventional technique because the transient levels were lower than we could reliably measure.

On listening

The subjective evaluation of the ESL-63s proved to be more pleasurable than I had expected, as I had already been told the stereo imaging and spatial abilities proved to be truly outstanding. Listening to a series of the best of the Telarc records and the Sheffield Track Record (Lab 20) I heard things that I had never heard before, and most of it from the record (just a little however was not on the record). The transient performance was superb on most of the orchestral material and the bass was, if anything, better than I had expected. Even the Ultragroove record "The Digital Fox", UG9001, sounded like a real organ although at the bottom end of the spectrum the last 20 Hz were a little muted.

I raised each of the speakers 300 mm above the floor and this made a difference to the bottom end, cleaning up the 30-to-50 Hz performance considerably and providing the order of performance that I have grown used to hearing from my Audio Pro sub-woofer and from my B&W 801s. ▶

LOUDSPEAKER DATA SHEET

MEASURED PERFORMANCE OF :
Quad Electrostatic Model ESL63
SERIAL NO.: 8552

FREQUENCY RESPONSE: 35Hz - 20kHz

CROSSOVER FREQUENCIES:

SENSITIVITY: 11.5 VRMS - 16.5 Watts (nominal into 8)
(for 90dB average at 2m)

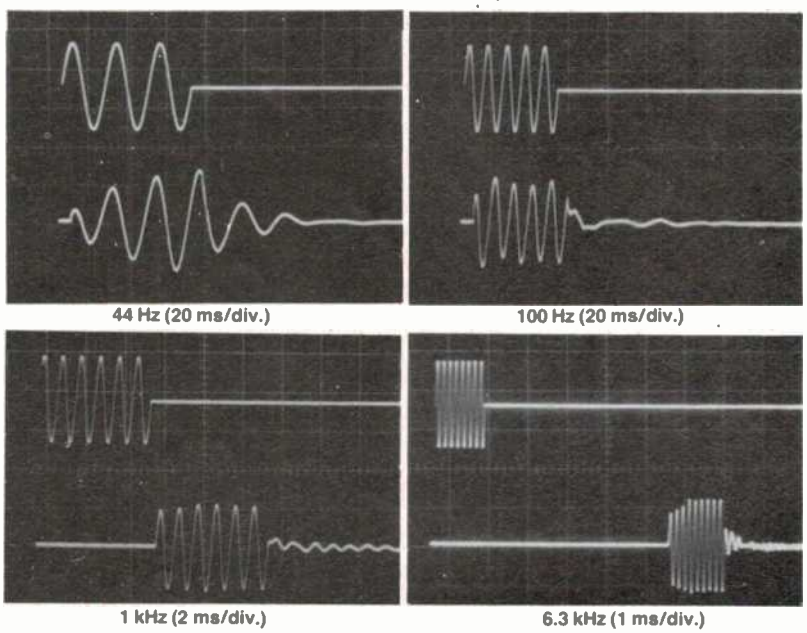
HARMONIC DISTORTION:

(at 10V input as specified)	S.P.L.	83dB 100Hz	88.5dB 1kHz	89dB 6.3kHz	
	2nd	-63.7	-72.0	-72.1	db
	3rd	-46.5	-77.3	-65.2	dB
	4th	-68.0	-78.6	-76.1	dB
	5th	-56.4	-77.6	--	dB
	THD	0.5%	0.034%	0.06%	

INPUT IMPEDANCE:

	100Hz	23 ohms
	1kHz	8.3"
	6.3kHz	5.8"
L.F. Minimum at	10Hz	4.0"
H.F. " "	10kHz	5.4"

Tone-burst response of Quad ESL-63 electrostatic loudspeakers.



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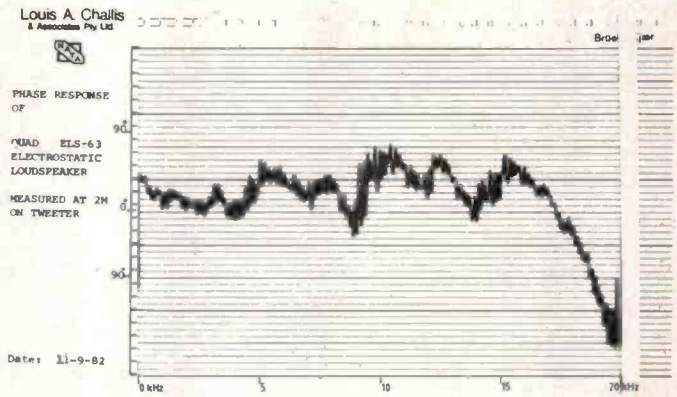

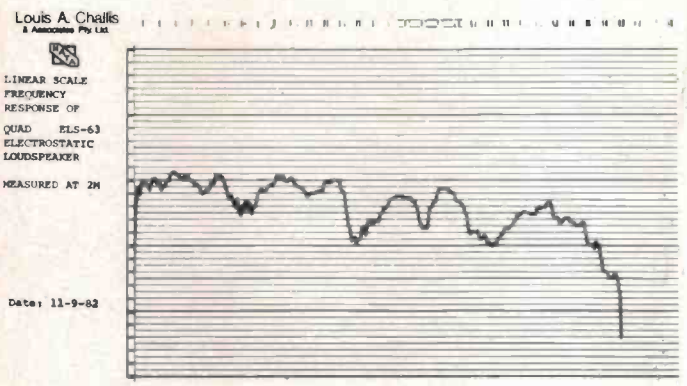

This was confirmed with the Swedish (Svenska) Hi-Fi Institute Test Record which revealed traces of mid-band colouration from the speakers which I had not previously detected in my A-B testing procedure. This was confirmed in part with white noise signals where the signal was not as 'neutral' as I would like.

On most pre-recorded voice material the fidelity of realism of these speakers proved to be absolutely superb and this performance has not been equalled or bettered by any speaker that I have yet tested. It is clear that Peter Walker's ideas are right, even if they have not achieved true perfection.

I continued listening to these speakers for over six hours of unquestioned pleasure and although I often find such work a chore, on this occasion I found it to be both technically and musically rewarding. I was then convinced that the Quad ESL-63 loudspeakers are unquestionably a dramatic leap forward in speaker technology.

The concept of the concentric elements fed by delay lines is a good one, although the fully developed concept requires extremely precise matching of the component values if true perfection is to be achieved. (The units tested approach this but didn't quite achieve it.)

The achievement of a better damped decay response is another feature which if attained, will further improve these speakers. If any further improvements are to be investigated, it is in this area that the research should be directed.

These speakers are exceptional in many ways with only one of them being ingenuity and another most certainly being perseverance.

At a recommended retail price of $4800 a pair, I think there will be plenty of people who will buy them solely because of their 'price', without really appreciating their finer technical attributes. ●

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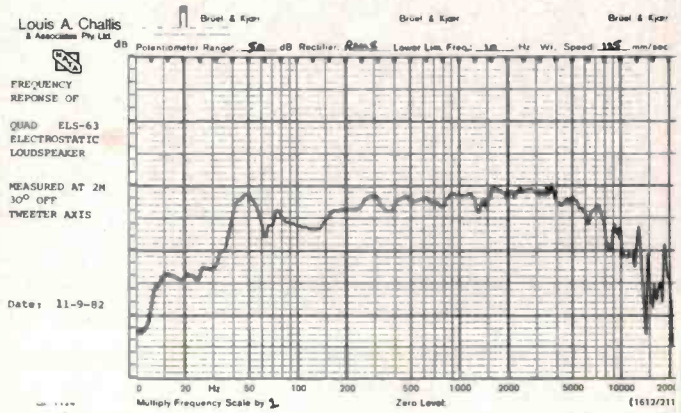

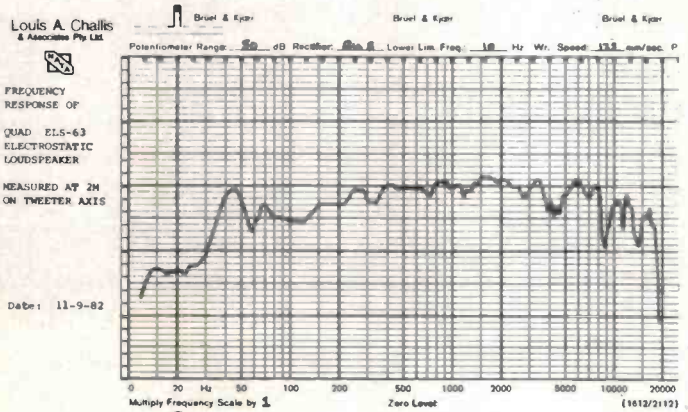

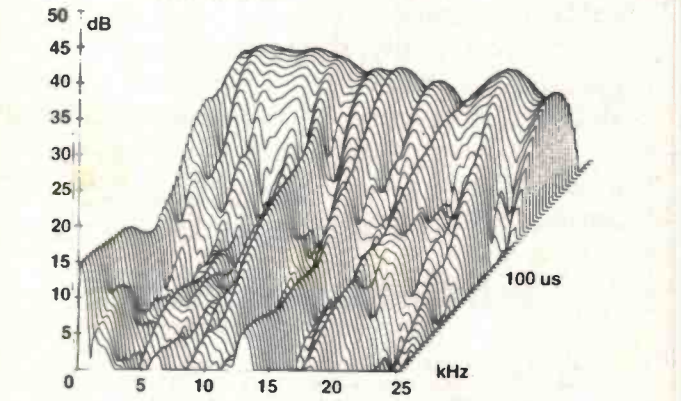

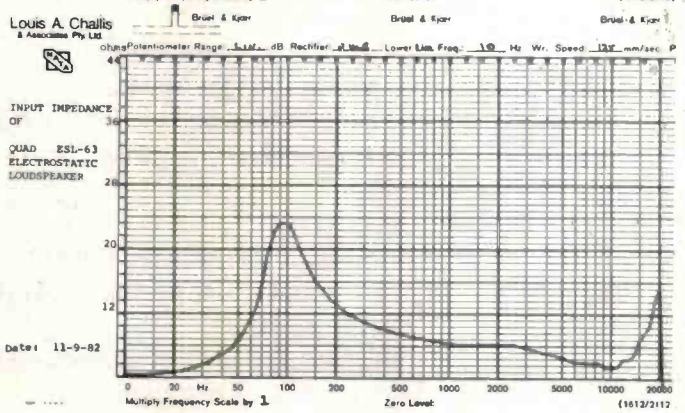

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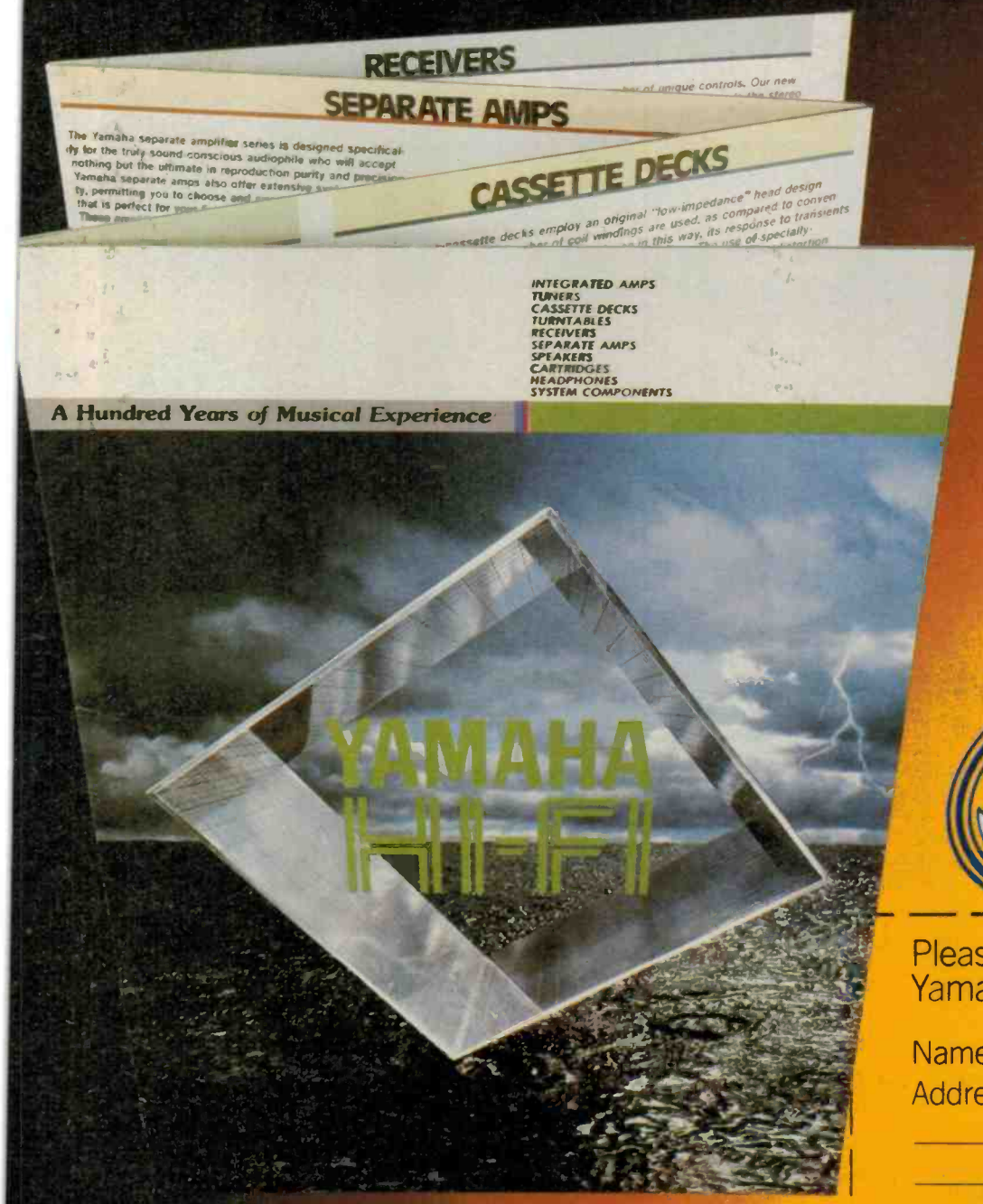

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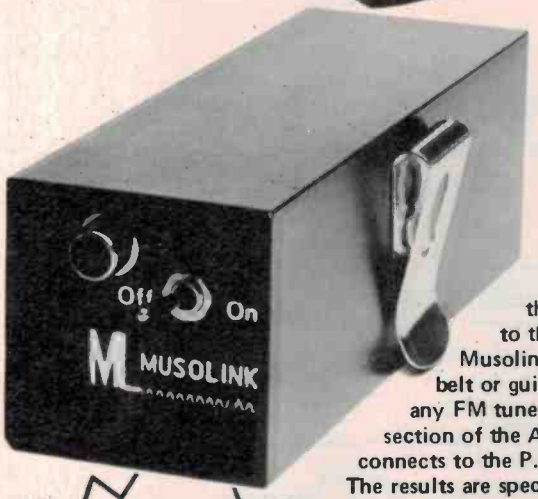

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Audio amplifiers using nested differentiating feedback loops

Part 2 — The basic idea

Edward M. Cherry
Associate Professor
Department of Electrical Engineering
Monash University

Here we get to see how this technique is applied to an amplifier and the effect it has on performance under differing conditions.

LAST MONTH we saw that, for a feedback amplifier to be stable, the separation between the forward-path gain and the demanded gain in graphs such as Figure 3 should not decrease towards zero at a rate exceeding 20 dB/decade. If an amplifier uses conventional resistive feedback, this stability criterion requires that the forward path must have just one dominant pole $1/\tau_\mu$, usually achieved in practice by suitable lag compensation. All the poles associated with transit time effects in transistors must be at substantially higher frequencies than $1/\tau_X$, the frequency of intersection of the curves of forward-path gain and demanded gain. Thus, available transistor types ultimately force the choice of $1/\tau_X$, and hence set a limit to the reduction of distortion that can be achieved by feedback because the return difference $F(\omega)$ at angular frequency ω in Equation 7 cannot exceed

$$F(\omega) \leq 1/\omega\tau_X \,. \qquad (8)$$

There is, however, another solution to the stability problem. If the forward-path gain has two dominant poles, so that its gain falls at 40 dB/decade, the rate of closure between the graphs of forward-path gain and demanded gain would still be 20 dB/decade provided the demanded gain itself were to fall at 20 dB/decade. In essentials, this requires that the usual frequency-independent resistive feedback factor β should be replaced by something having a frequency dependence of the form $\omega\tau_F$ (remember that the demanded gain is the reciprocal of the feedback factor). Mathematicians tell us that a linearly rising frequency response corresponds to differentiation with respect to time and, in hardware terms, a capacitive feedback network will perform just this action.

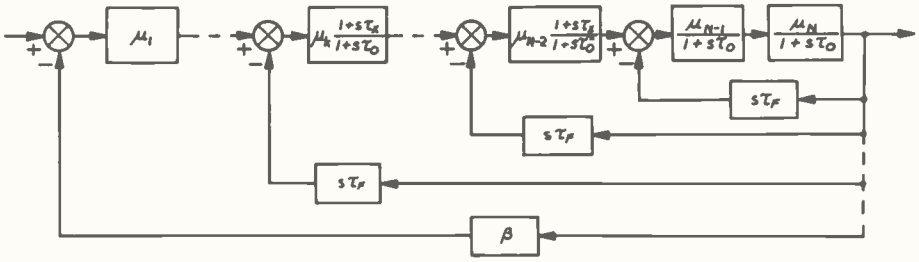

Figure 5. **Block diagram of an NDFL amplifier.**

Figure 5 shows the outline of an amplifier incorporating nested differentiating feedback loops.

Notice first that the forward path has been separated into a number of stages, whose mid-frequency gains are μ_1 to μ_N respectively. The variable s is what mathematicians call complex frequency; for sinusoidal signals its magnitude is equal to the angular frequency ω of the sinusoid. Factors of the form $(1 + s\tau_X)$ represent a frequency response that rises proportional to frequency above the frequency $1/\tau_X$ — that is, they represent a zero. Similarly, factors of the form $1/(1 + s\tau_0)$ represent a frequency response that falls inversely proportional to frequency above the frequency $1/\tau_0$ — that is, they represent a pole. Thus, the stages in Figure 5 have special frequency responses: all stages except the first have a pole at $1/\tau_0$, and all except the first and last two have a zero at $1/\tau_X$.

Notice also that there are differentiating feedback networks, each denoted by $s\tau_F$, linking the output back to various points in the forward path. The resulting feedback loops are arranged one inside another, like a nest of Chinese boxes — hence the name nested differentiating feedback loops.

The amplifier is completed by an overall resistive feedback network β.

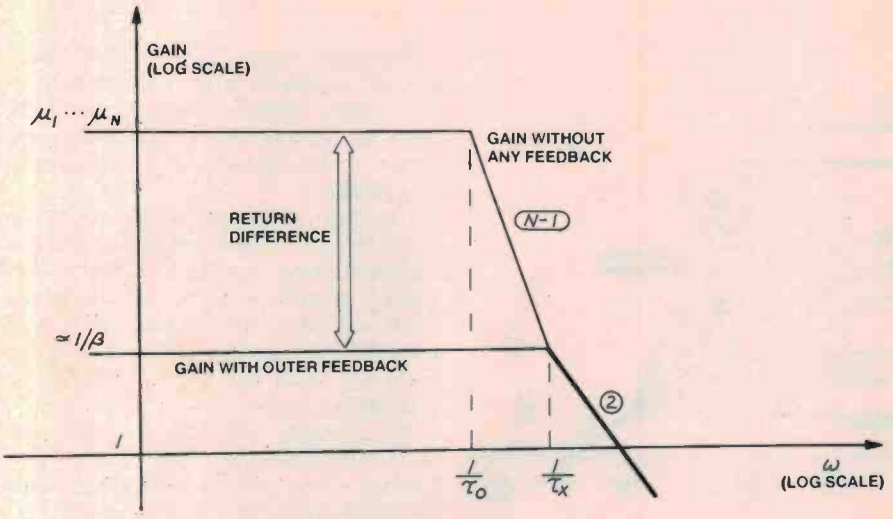

Figure 6. Logarithmic plots of gain versus frequency for Figure 5.

If we removed all the feedback from Figure 5, the forward-path gain would be shown in Figure 6: constant up to the frequency $1/\tau_0$, then falling at an (N-1)-pole rate (20(N-1) dB/decade) up to $1/\tau_X$, and finally levelling off somewhat to a two-pole rate (40 dB/decade).

If we now applied just the overall resistive feedback β, the return difference would be as shown in Figure 6. Distortion would be reduced by a constant large amount, approximately $\mu_1 \mu_2 \ldots \mu_N \beta$, at all frequencies up to $1/\tau_0$. Choosing $1/\tau_0$ to correspond to 20 kHz would virtually eliminate audible-frequency distortion. *But the amplifier would be unusable because of oscillation.*

The rate of closure of the forward-path gain and demanded gain curves breaks the rule of 20 dB/decade. Let us see how inclusion of the nested differentiating feedback loops solves the problem.

Figure 7 shows just the last two stages and the inner differentiating feedback factor. This 'clump' is a feedback amplifier in its own right, and Figure 7 shows its forward-path gain (that is, the gain of the last two stages without any feedback), the demanded gain, and the resulting closed-loop gain. Although the forward-path gain falls at a two-pole rate (40 dB/decade), the demanded gain falls at a one-pole rate (20 dB/decade), and their rate of closure is 20 dB/decade. By itself, this 'clump' is stable.

Figure 8 shows what happens when we add the antepenultimate stage and another differentiating feedback factor.

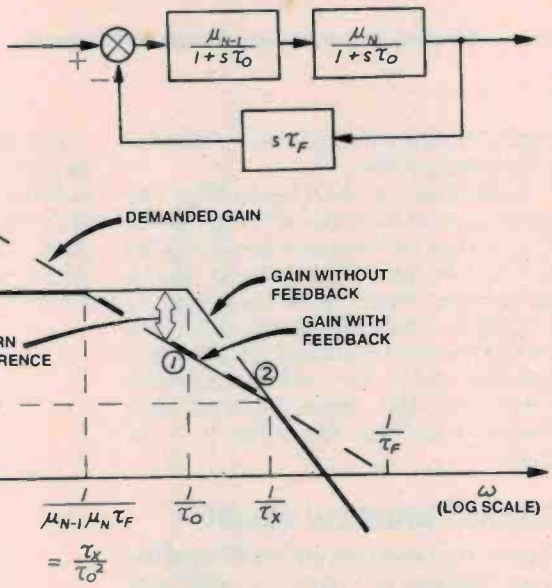

Figure 7. The inner loop of Figure 5.

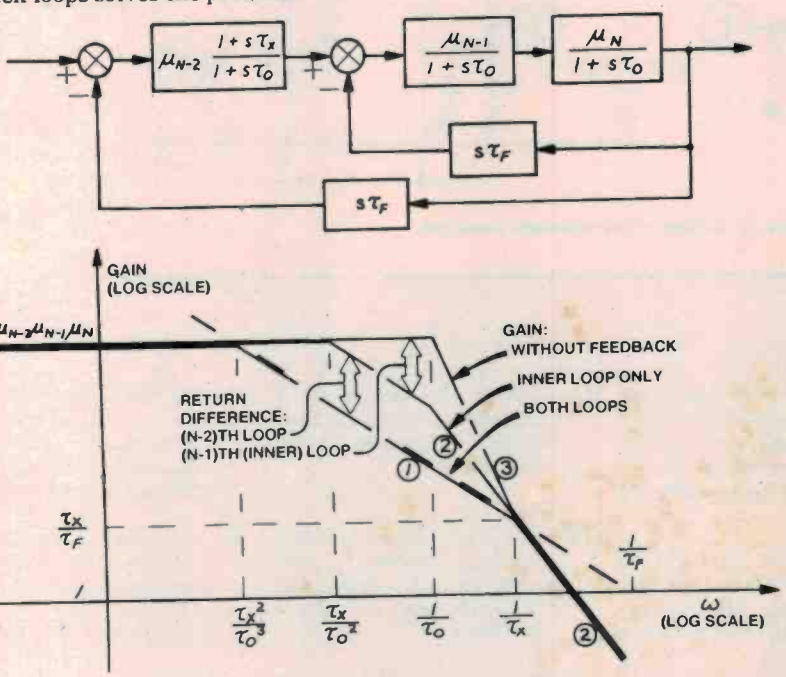

Figure 8. The (N-2)th loop of Figure 5.

Again this 'clump' can be considered as a feedback amplifier in its own right. Provided we choose

$$\mu_{N-2} = \tau_0/\tau_X$$

the various gains line up as shown. The forward-path gain is the combined gain of stage (N-2) and stages (N-1) and N with their local feedback, and this is the middle solid curve in Figure 8. The demanded gain is the dashed curve passing through $1/\tau_F$. Once again the forward-path gain and demanded gain close at 20 dB/decade, so the stability criterion is satisfied for this larger 'clump'.

And so it goes on. We can add more stages and differentiating feedback factors, and each time the curves line up as required for stability provided we choose

$$\mu_1 \mu_{N-1} \mu_N \beta = (\tau_0/\tau_X)^2, \quad (9)$$

$$_F = \mu_1 \beta \tau_X, \quad (10)$$

$$\mu_k = \tau_0/\tau_X \text{ for } 2 \leq k \leq N-2. \quad (11)$$

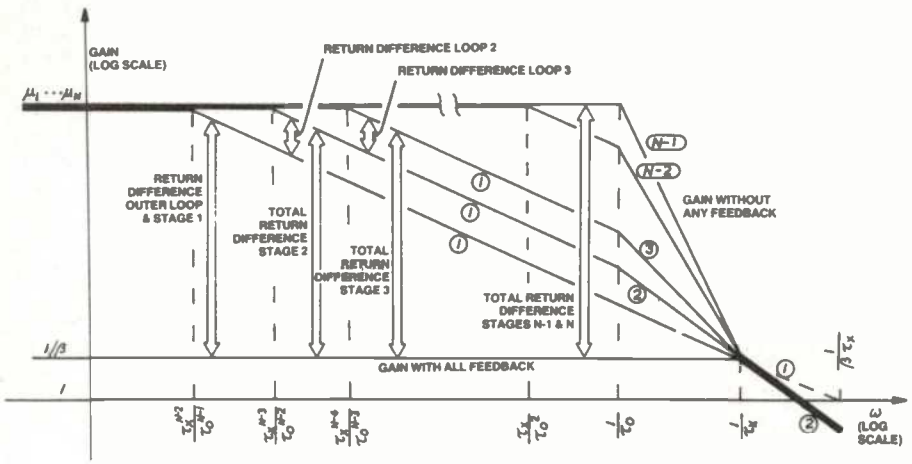

Figure 9. **Complete plots of gain versus frequency for Figure 5.**

Figure 9 shows the gain curves for the complete amplifier.

In designing an NDFL amplifier, the starting point is to choose the frequency $1/\tau_X$ so that the various transistor poles are sure to lie at substantially higher frequencies. Next choose the frequency $1/\tau_0$ up to which the return difference should remain constant; 20 kHz is a suitable value for audio amplifiers. After this, the circuit more or less designs itself via Equations 9 — 11 above.

Outline practical circuit

Figure 10 shows how an amplifier of the basic topology of Figure 2 can be modified to include two NDFLs. Interested readers should refer to references 14 — 16 for more details.

Notice first that the lag compensating capacitor, C, in the penultimate stage of Figure 2 has been removed in Figure 10. In its place are two capacitors (C) linking the output back to various points in the forward path. These capacitors are the feedback networks of the nested differentiating feedback loops.

The output stage has been changed to include a modified form of Thiele's load-stabilising network. Some form of LRC filter is required to locate one of the poles correctly, and with the circuit shown we get double value from the components (see references 17, 18).

The input stage itself is unchanged, but an inexpensive small capacitor in the overall feedback network β can be used to correct the group delay and improve the reproduction of transient waveforms.

Another essential addition is an amplifying stage between the two nested differentiating feedback factors. This rather peculiar circuit (which dates back to Rush in 1964) seems largely to have been forgotten. It uses one n-p-n transistor and one p-n-p to provide a well-defined gain (19).

As already suggested, once the demanded gain $1/\beta$ and the critical frequency $1/\tau_X$ are chosen, the circuit almost designs itself. The equations are:

$$\frac{R_{F1}}{R_{F1} + R_{F2}} = \beta\,, \qquad (12)$$

$$R\,C = \beta\tau_X\,, \qquad (13)$$

$$R_Y\,C_Y = \tau_X\,, \qquad (14)$$

$$\tau_L = (\sqrt{3} - 1)\tau_X\,. \qquad (15)$$

All stage gains and poles and zeros automatically look after themselves.

continued on page 129 ▶

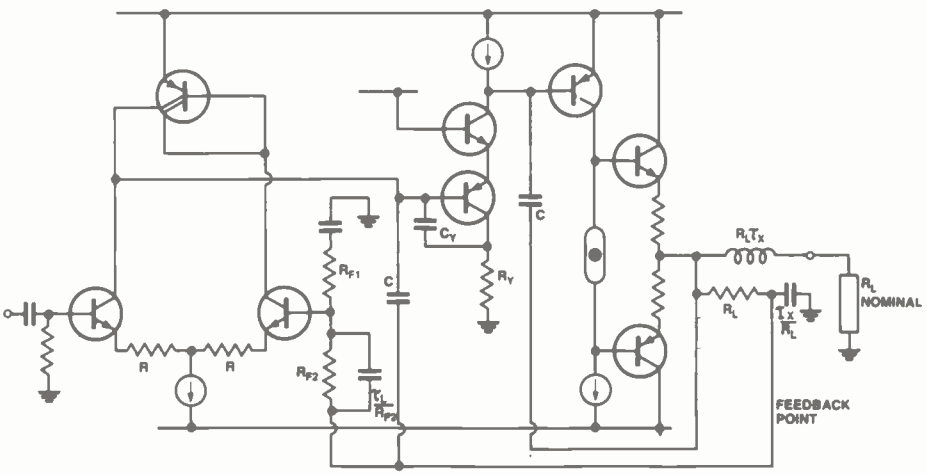

Figure 10. **Outline circuit for an NDFL amplifier.**

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18. A.N. Thiele, *Air cored inductors for audio*, Proc. IREE (Aust), vol 36, pp 329-333, Oct 1975.

19. C.J. Rush, *New technique for designing fast-rise transistor pulse amplifiers*, Rev Sci Instr, vol 35, pp 149-156, Feb 1964.

20. IEC Publication 269.3, *Part III — Amplifiers: Clause 22.6 "High-frequency intermodulation distortion"*. (Proposal dated June 1981)

21. R.R. Cordell, *A fully in-band multitone test for transient intermodulation distortion*, J. Audio Eng Soc, vol 25, pp 578-586, Sept 1981.

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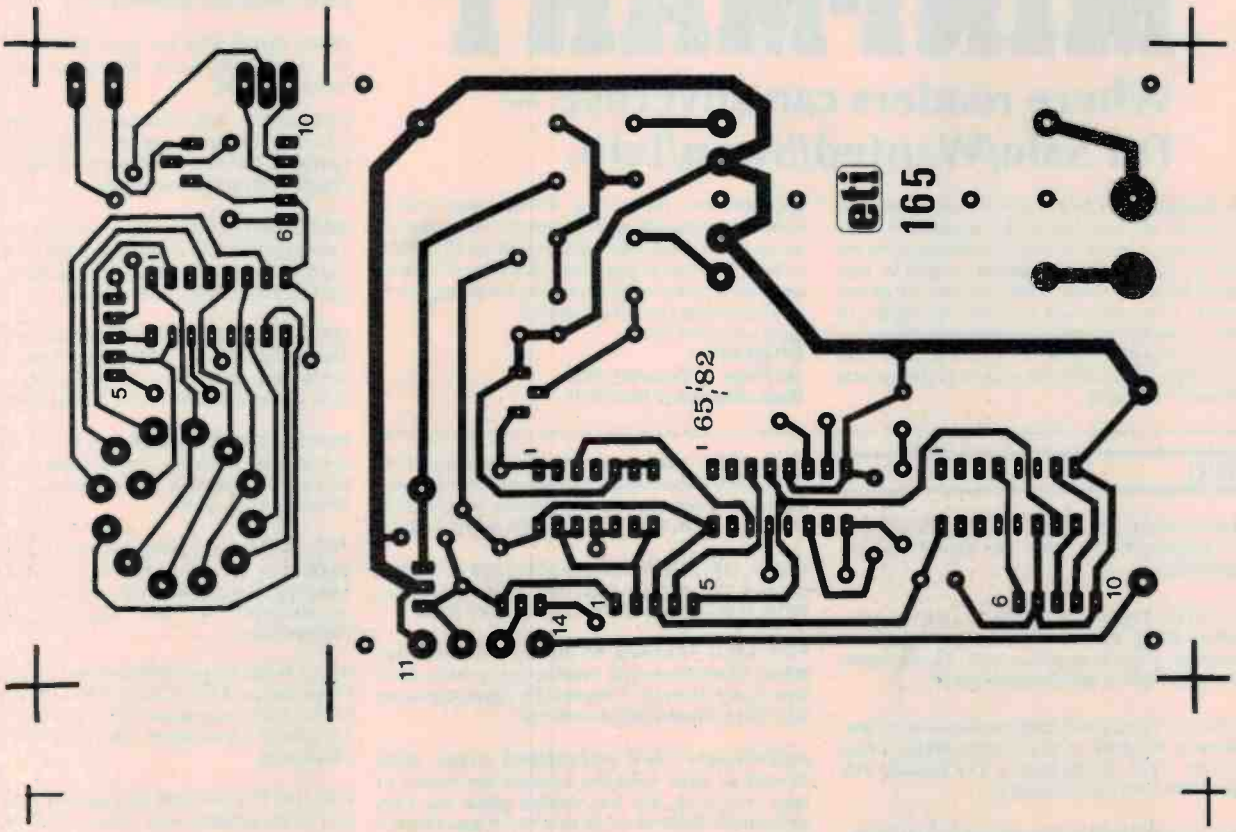

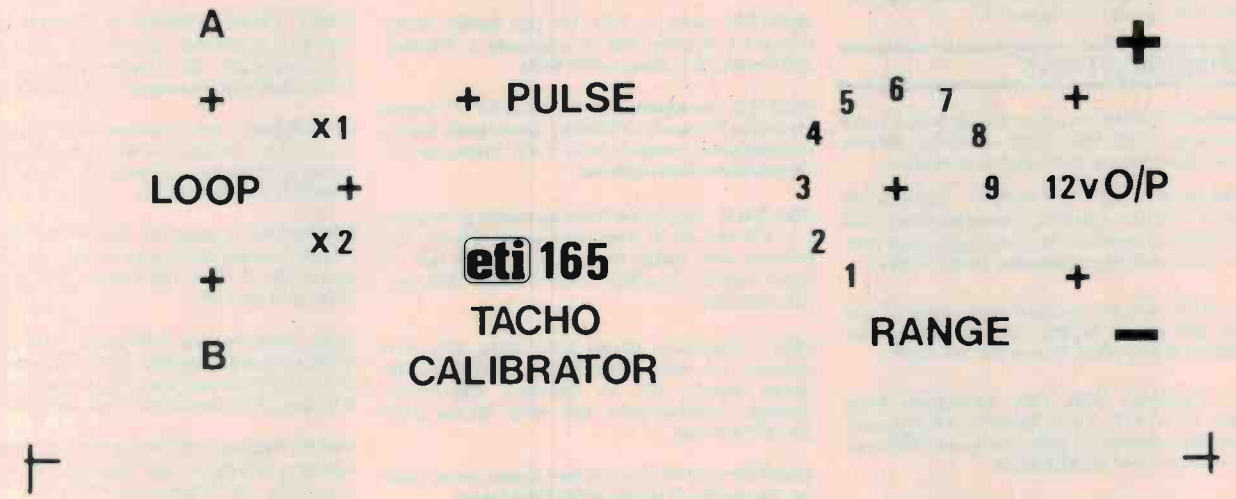

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URGENT: SYM-1, BASIC, 4K RAM, keyboard and case, DG640VDU, $400 ono. Will separate if absolutely necessary. Clive Conway, 80 Third Ave, Joslin SA 5070. Phone (08)42-3995 ah.

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TRS-80 OWNERS: Add 16K extra memory inside keyboard for $20. No technical knowledge required. Complete instructions $6. G. Wain, 3 Malakoff St, Nth Caulfield Vic. 3161. (03)509-6703.

SELL: S-100 frame, motherboard, 12 sockets and power supply $150. Boards: 280 CPU $80. 8K RAM $120. ASCII keyboard $70. Cassette I/F $40. All offers considered. Jennifer Hudson (002) 30-6338 bh.

FOR SALE: 2 MPI B52 disk drives, power supply and case, all $800 ono. Phone John (02)36-6170 ah.

SYM-1: SWAP 8K BASIC on EPROMS for RAE-1, resident assembler editor on tape with full documentation. M. Cvetanovski, 10 Caroona Close, Adamstown Heights NSW 2289.

DREAM 6800: 16K Dreamsoft board, synthesiser, 20 mA loop, joystick, video/VHF outputs, 20 cassettes of software, "Dreamer" all issues, Horwood case, $220. (054)42-4756.

SOFTWARE to swap for System-80 and TRS-80. Please forward SSAE plus listing and I will do the same. Mr. A. Tito, 103 Lauren St, Urangan Qld 4658. (071)28-9527.

SELL S100 boards. 16K static RAM, $140. 16K EPROM board complete with microworld BASIC, $140. Fully documented. Guaranteed. C. Franks, P.O. Box 4345, Darwin NT 5794. (089)81-2541.

SHARP POCKET COMPUTER PC1211 and printer/cassette interface plus manual/programs, $190 ono. John, 15 Robinson St, O'Connor ACT 2601. (062)72-3711.

FOR SALE: Micro-Ace computer with 2K. Complete with leads, power supply, TV adaptor and manual. Sell for $150. Phone (075)32-5098. Gold Coast.

MICRO-ACE 4K ROM, 16K RAM, leads, adaptor, manual and programs book. $150. Phone (02)639-3115 ah.

WANTED: Any hardware information about WANG 2200B computer and peripherals. Phil Sutherland VK6ZPS, P.O. Box 177, Nedlands WA 6009. Phone (09)386-4859 bh.

FOR SALE: ETI-660 colour computer in metal case with 3K RAM and some programs. Also 16K RAM, 4K + 8K ROMs to suit ZX80 computer with manuals and other books. No reasonable offers refused. (03)762-3058.

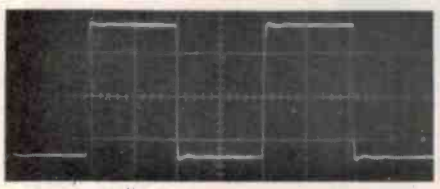
...nested differentiating feedback loops

Figure 11(a) shows the 5 kHz square-wave response of Figure 10 as built from:

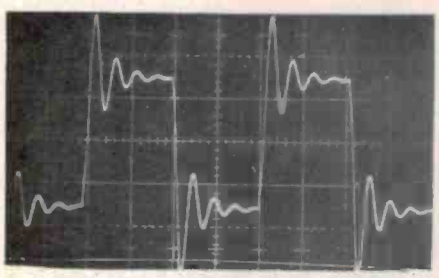
5%-tolerance resistors,
20%-tolerance capacitors,
unselected production transistors.

Evidently the circuit is 'designable'; Equations 12 — 15 really do predict component values for good transient response.

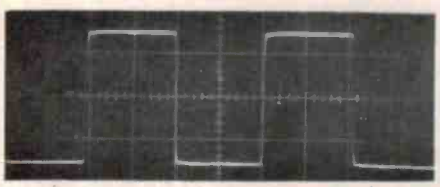
A nice feature of the modified Thiele circuit in Figure 10 is that, when the load is made capacitive (a well-known source of high-frequency oscillation in amplifiers), the voltage waveform at the FEEDBACK POINT is the waveform the amplifier would have delivered into its nominal resistance load. Figures 11(b) and (c) illustrate this; the violent ringing in Figure 11(b) is simply an LC resonance between the filter inductor and the load capacitance, and is in no way indicative of approaching instability.



(a) 8 ohm resistance load.



(b) 8 ohm and 2 uF parallel load



(c) waveform at feedback point for (b)

Figure 11. 5 kHz square-wave response of Figure 10.

Figure 12 shows details of the 1 kHz sinusoidal response under overdrive conditions. Note the quick, clean recovery.

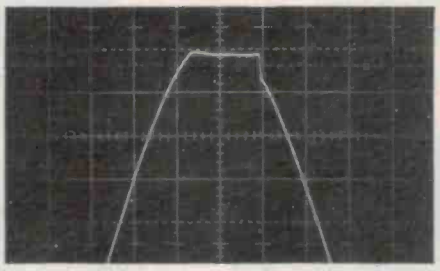


Figure 12. Detail of output waveform from Figure 10 under overdrive.

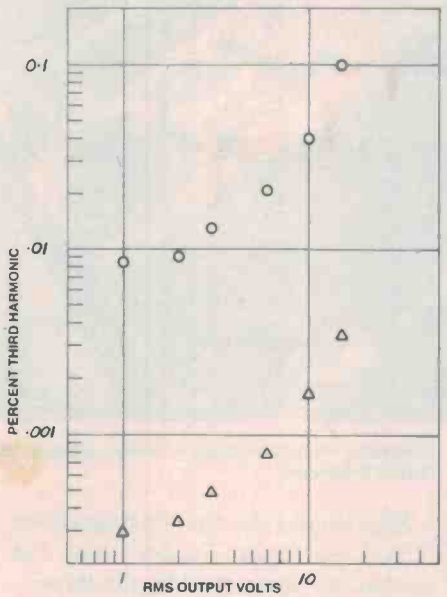
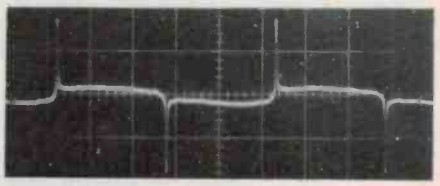


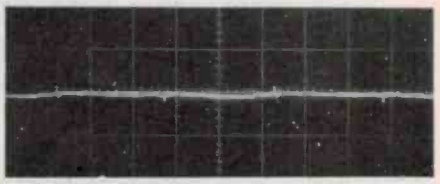
Figure 13. 1 kHz third harmonic distortion
o — Figure 2 (conventional amplifier);
△ — Figure 10 (NDFL amplifier)

An amplifier has been built in which the circuit can be switched from Figure 2 to Figure 10, to illustrate the improvement in performance of adding two NDFLs. Figure 13 compares the measured third-harmonic distortions of 1 kHz. Notice how the distortion of Figure 10 drops away to below three parts per million at small signal amplitudes. Such behaviour is more typical of class-A amplifiers than class-B amplifiers, and may account for the clean sound of NDFL amplifiers.

Crossover distortion associated with incorrect bias of the output stage is one of the most audibly annoying forms of distortion. Audio amplifiers based on Figure 2 sometimes have a type of crossover distortion that does not show up in normal measurements. Correct biasing of the output stage relies on close tracking of the thermally-compensated biasing device and the power transistors. At best the biasing device can be thermally bonded to the power transistor cases. More usually it is bonded to the heatsink, but there is no way it can simultaneously sense the actual junction temperatures of all the power transistors. Under rapidly-fluctuating dynamic signal conditions, the junction temperatures may be wildly different from each other and from the case or heatsink temperatures, and therefore the biasing may be wrong.



(a) Figure 2 (conventional amplifier)



(b) Figure 10 (NDFL amplifier)

Figure 14. 2 kHz crossover distortion when bias is set wrongly

Figure 14 compares the static crossover distortion of Figures 2 and 10 when the bias is deliberately set 0.5 V too low. Dynamic mistracking of the biasing circuit should not introduce audible crossover distortion in an NDFL amplifier.

One final point. The NDFL technique maximises the return difference (and hence minimises distortion components) at frequencies up to $1/\tau_0$. Above this frequency the return difference falls away rapidly, and distortion rises. Choosing $1/\tau_0$ to correspond to 20 kHz minimises audible-frequency distortion, but does not minimise ultrasonic distortion.

For example, a common specification for audio power amplifiers is their THD at 20 kHz. The harmonics of 20 kHz lie at 40 kHz, 60 kHz, 80 kHz, and so on. All are ultrasonic (and hence inaudible) and the NDFL technique does not minimise them. A measurement of THD at 20 kHz may therefore give a quite misleading indication of an NDFL amplifier's audible performance. Valid objective tests include the SMPTE and CCIF tests for two-tone intermodulation distortion, the proposed IEC test for TIM (20), Cordell's proposed three-tone test for TIM (21) and the proposed test for input-output intermodulation distortion IOD (9). The distinguishing feature of all these tests is that they measure the distortion at audible frequencies. ●

Followers of that legendary British comedy team, The Goons, will recognise this. Apologies to fans of Kraftwerk.

DREGS

THE HUMBLE MAIL BAG is a wondrously flexible product. And I don't mean in the purely physical sense, I mean in application. (This tale is specially dedicated to all our readers who have the misfortune of finding themselves guests of Her Gracious Majesty's Corrective Services establishments.) The humble mail bag has often been a target for abuse, ridicule — even satire. Yes, even satire. Well, it was mentioned in passing during The Goon Show's "Tales of Old Dartmoor". Wallace Greenslade introduces a scene with:

"The prisoners were busy at their tasks . . . mail bag sewing, warder bashing . . ."

But I think it was Ronald Biggs (alias, 'The Great Train Robber') who catapulted the lowly mail bag to fame — or maybe infamy.

Enough reverie. We recently had occasion to employ a mail bag in a hastily contrived scientific measuring machine. Our sister magazine, Sonics, was right on deadline and desperately needed to verify some figures quoted in an article. The figures related to tensile strength of guitar strings and the tension required to produce a given note for a certain length of string. But there was some confusion in the use of units. A little physics and mathematics gave result which, while seemingly correct, didn't feel right. Only one way to find out — get a guitar string and measure it!

Buried beneath the pile of half-edited articles, half-read magazines and half-completed projects on Roger Harrison's desk was a packet of guitar strings. One was selected for the destructive test and suspended at one end from a nail (the only one we could find was in ETI's lab and bent like a pretzel) hammered into the transom of Collyn Rivers' office door. To the lower end of the string we clamped a small vise (to avoid kinking the string, thus lowering its tensile strength). Suspended from the vise was — the mail bag! Into the mail bag we put more and more Sonics magazines, increasing the number until the string broke (at about E above high C, I believe). It took a total of 55 of the Sonics 1982 Yearbook (approx. 25 kg). This proved a little low, but we were in the right ballpark, because the string was kinked at the vise. Everything then fell into place with the figures in the article.

Taking another string, we clamped the vise to it a measured distance down from the nail and, using a smaller mail bag, added the calculated number of Sonics mags to produce the right tension for a given note. It worked! Much to the rest of the staff's amazement — but we knew it would work all the time!

I wonder if what we did is "... an approved use of a mail bag"?

(Why Sonics magazines? Well, it seemed appropriate after all, and we needed a way of increasing the weight about half a kilogram at a time — and that's the weight of the 1982 Sonics Yearbook. Anyway, our office scales stop at 11 kg.)

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