Registered by Australia Post — publication No. NBP 0240

Australia's Top Selling Electronics Magazine

Electronics Australia

NOVEMBER 1985
Aust* $2.75
NZ $3.50

Exciting kits to build:

★ BUDGET HIFI LOUDSPEAKERS

★ ULTRASONIC COCKROACH REPELLER

SS TITANIC: The part played by wireless

Keep your hands free with this LOUDSPEAKING TELEPHONE ADAPTOR

NAD 2200 AMPLIFIER REVIEWED!

Here At Last!

PLAYMASTER SERIES 200 HI-FI MOSFET AMPLIFIER KIT.

It's a Breakthrough!!

The new Playmaster Series 200 has broken through the Price/Performance barrier! For features, performance or price you won't find a better commercial amplifier anywhere! Even the fancy names with their big price tags don't have features like this!

Features like electronic input switching. Circuitry which handles just about any input: magnetic cartridge, CD player, hi-fi VCR, cassette, tuner, etc, etc. PLUS plenty of headroom with a massive 100 watts per channel output power.

And with its unique design — it's amazingly simple to construct! All potentiometers, input/output connectors, etc are mounted directly onto the PCB. And don't forget — when you buy a DSE kit you get everything you need! Things like; solder-masked PCBs, factory-wound power transformer, step by step construction manual and, if all else fails: our exclusive 'Sorry Dick, it doesn't work' repair service.

Why so long coming?
Our R&D staff have been refining this kit ever since publication: we ensure our kits are "bug free" before release, so you don't have problems during construction. Who needs problems — especially with an expensive kit such as this?
All refinements to the original design have been checked out by Electronics Australia magazine.

All this PLUS . . .

Outstanding Specifications!

- 100W RMS/channel into 8 ohms
- Frequency response: 8Hz-20kHz (−0.3dB)
  2.8Hz-65kHz (−1dB)
- Hum — 100dB below full output
- Unconditional stability into any load
- RIAA equalisation within 0.3dB
- Distortion <0.01% max (typical 0.003% 20Hz- 20kHz)
- Sensitivity: Phono 2mV (80dB s/n)
  Line 300mV (90dB)
  CD 2V (94dB)

Cat K-3516

As described in EA. **$439**

DICK SMITH ELECTRONICS PTY LTD

B058

Volume 47, No. 11

Electronics Australia

November 1985

THIS MONTH'S COVER

This loudspeaking telephone adapter comes as a kit of parts and can be built for around $80. It offers high performance and is ideal for business and family use. Turn to page 50.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

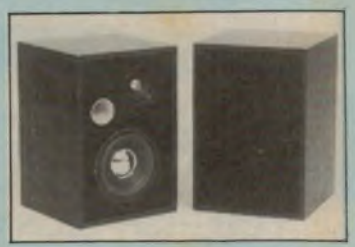
Cockroach repeller

Creeping cockroaches on the loose? Keep your thongs on and build the EA Ultrasonic Pest Repeller. It uses a proper piezo tweeter and operates beyond the range of human hearing.

HF Transceiver

Part 2 of the HF Amateur Transceiver has been held over until the December issue, due to lack of space.

Compact Loudspeakers



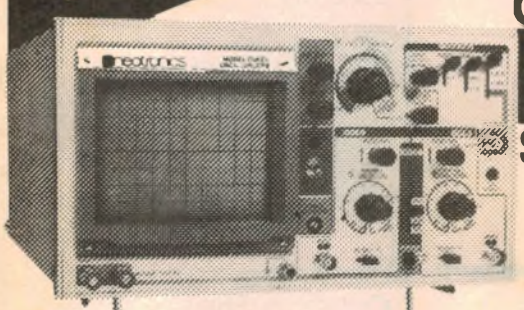
These compact 2-way loudspeakers are a cinch to build and cost just $229 for the pair. You can easily put them together in a couple of evenings.

NOW WITHIN YOUR SCOPE

OS-635
$835
$961 INCL. TAX

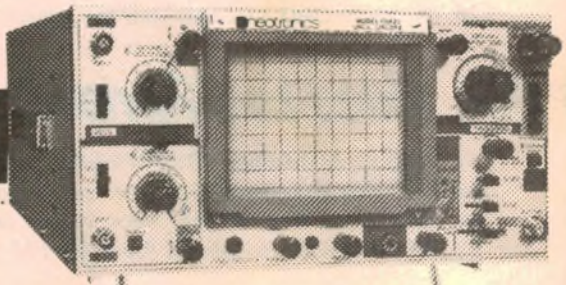
● Bandwidth 35MHz ● Rise time to 10 n sec. ● Sensitivity to 1mV/DIV ● 6KV acceleration ● Delayed sweep ● Trigger hold off ● Alt. trigger ● Single sweep

OS-620
$595
$682 INCL. TAX



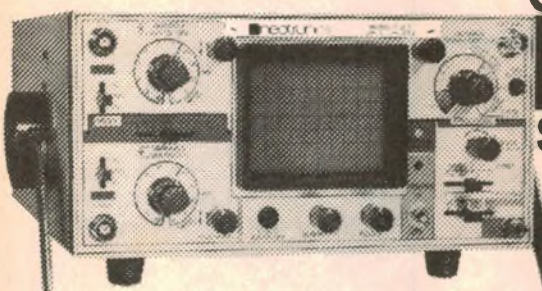
● Bandwidth 20MHz ● Rise time less than 17 n sec. ● 5mV/DIV sensitivity ● Channel A, channel B, dual, add, subtract ● Component tester ● X-Y mode ● TV video synch filter.

OS-645
$1285
$1475 INCL. TAX



● Top of the range ● 45 MHz bandwidth (usuable to 70MHz) ● Signal delay ● Trigger delay ● 15KV acceleration ● 5mV/DIV sensitivity (1mV at reduced bandwidth)

OS-615S
$785
$896 INCL. TAX



● Rechargeable battery operated 6 hrs. operation ● Bandwidth 15MHz ● 2mV/DIV sensitivity ● Dual channel ● 95cm rectangular screen ● Ideal for field work

Prices subject to change without notice.

PROBES INCLUDED IN PRICE

The rugged ones (UL and VDE approved). Pick your pick - pushbuttons or rotary selections.

DIGITAL MULTI-METERS

$78 incl. tax. $78 incl. tax.

neotronics

FOR HIGH TECHNOLOGY ELECTRONICS

37 Ryedale Road
West Ryde NSW 2114
Australia. Telex AA 73264
Phone (02) 807 4739

DELIVERED ANYWHERE IN AUSTRALIA FOR $7.50

Prices correct and goods expected in stock at time of going to press

BUY DIRECT AND SAVE

Phone on the Hotline (02) 807 4739
Avoid disappointment. Order your Scope or DMM by bankcard on the phone. Just call up, reverse the charges and we'll take your order. Shipping is only $7.50 anywhere in Australia - including packing and insurance.
Full 12 month warranty. Your Scope is fully guaranteed for a full year.

MEA002/FP

EDITOR
Leo Simpson
B. Bus. (NSWIT)

ASSISTANT EDITOR
Greg Swain, B.Sc. (Hons. Sydney)

EDITORIAL CONSULTANT
Neville Williams
F.I.R.E.E. (Aust.) (VK2XV)

TECHNICAL STAFF
John Clarke, B. E. (Elect. NSWIT)
Spencer Brown, B.E. (Elect. NSWIT) (VK2DDH)
Colin Dawson
Robert Flynn
Louise Upton, B.A. (Hons. Sydney)

ADVERTISING PRODUCTION
Danny Hooper

ART DIRECTOR
Brian Jones

SECRETARIAL
Carmel Triulcio

ADVERTISING MANAGER
Selwyn Sayers

MANAGING EDITOR
Jamieson Rowe

PUBLISHER
Michael Hannan

Editorial and Advertising Office: 140 Joynton Avenue (PO Box 227), Waterloo, NSW 2017. Phone: (02) 663 9999.
Telex: AA74488. Facsimile: 662 1007.
Representative: Ruth Stubbs.

Melbourne: 23rd Floor, 150 Lonsdale Street, Melbourne, Vic 3000. Phone (03) 662 1222.
Representative: John Oliver.

Adelaide: Admedia Group, 24 Kensington Road, Rose Park, SA 5067. Phone (08) 332 8144.
Representative: Steve Birbeck.

Brisbane: 25 Balaclava St, Woollangabba, Qld 4102. Phone (07) 391 8922.
Representative: Bernie Summers.

Perth: Tony Allen and Associates, 7 Fore St, Perth, WA 6000. Phone (09) 328 9833.
Representative: Jim Wells.

Distribution: Distributed by Gordon and Gotch Limited, Sydney.

Registered by Australia Post — publication No. NBP0240. ISSN 0313-0150

*Recommended and maximum price only.

Published by the Federal Publishing Company Pty Limited, under licence from Double Bay Newspapers Pty Limited, General Newspapers Pty Limited and Suburban Publications Pty Limited.

Editorial Viewpoint

by Leo Simpson

We should not compromise on electrical safety

Quite a few years ago now, *Electronics Australia* had a running campaign against two-pin mains sockets on the backs of hifi amplifiers. We were concerned at the danger they presented because it was so easy to touch the live pins when the plugs were partially inserted. Eventually the campaign was successful and it is now rare to see an amplifier with these two-pin mains sockets. Good.

Now it is clear that another campaign is warranted, on the issue of equipment approvals by the various State Energy Authorities. There is a tremendous amount of equipment imported into this country every year which is never checked to see if it conforms to our electrical standards. Some of this equipment is downright dangerous and should be banned from sale . . . but presently there is no sanction against it.

The problem is that there are several categories of electrical equipment which are not prescribed by the relevant State Acts: for example, domestic hifi equipment and personal computers and peripherals. This means, in effect, that it does not matter if an item of hifi gear conforms to our standards or not. It might be dangerous or it might not.

The relevant State Energy Authorities are well aware of the problem. If asked about the topic, they would be likely to reply, off the record, that they "don't know and don't want to know". If these items of equipment were prescribed and had to be checked, they would have a much greater backlog of equipment than is presently the case. They are seriously understaffed in this regard.

Well, it isn't good enough and the problem could become a lot worse. For example, a good portion of domestic hifi equipment is now marked as "double insulated". That means that none of this equipment has an earth wire in the power flex and so the insulation qualities of the power supply have to be a great deal better than for conventional earthed equipment. Who checks to see if it is up to par? No-one.

To give them their due, most major manufacturers, particularly those from Japan, lean over backwards to make sure their products conform to the electrical standards of most western countries, including Australia. That is why they have models specifically intended for Australia.

But you can't be so sure about equipment from other countries, such as Taiwan or Korea. The wiring in some of the cheaper domestic appliances such as clock radios, music systems and computer video monitors leaves a great deal to be desired: cords not anchored properly, substandard transformers, components with insufficient voltage ratings to suit Australian mains supplies and so on.

It is about time the State Energy Authorities moved on this problem. All this gear should be subjected to the same approval procedures as most domestic electrical appliances. This country may not make most of its electrical appliances anymore but that is no reason why we have to compromise on electrical safety.

We apologise for the latest rise in our cover price to $2.75. This is solely due to the great increase in the cost of our paper which comes from overseas under contracts written in US dollars.

News Highlights

Gigascale integration — anything is possible

Although we have not yet reached a billion components to a chip, the 30 or so US, Japanese and European companies which control 90% of the world semiconductor market believe that this is no pipe dream.

By 1986, the first integrated circuits (ICs) with lines of transistors a micron thick will have infiltrated the market. The second step (already being developed) is to shrink the lines to half a micron and crowd almost four times as many transistors onto the same quarter-inch-square chip. And, in less than 10 years, the quarter-micron chip will be reality.

One can't help but wonder about how many angels (or is it transistors) can dance on the head of a pin?

Shrinking chips into the submicron realm will certainly have an effect on the technology of chipmaking itself. Human beings could contaminate the manufacturing process, so their presence will be prohibited. The smallest speck of dust can destroy a computer chip at this level and even the white-suited, masked worker of today would be unsuitable in the manufacturing environment.

For this reason, etching microscopic circuits onto silicon wafers will have to be fully automated and existing air filter systems enormously upgraded. The cost will be phenomenal — as much as $US200 million per plant.

The second factor ushering in the computer is complexity. The task of building, testing and designing such chips is rapidly exceeding human capability.

The end product, however, is a chip with more computing power than a dozen of today's $US4 million super computers and at a fraction of the cost; perhaps a few hundred dollars.

The superchips will be just what researchers exploring artificial intelligence (AI) have been waiting for. The chips will give them the computer capacity they need to make products that are more exciting than anything available today.

Other uses for superchips might be in the car industry where better engine control would bring about lower emissions, lower fuel consumption and better performance. The Reagan administration's Star Wars defence system would also rely on the submicron semiconductor technology and this is one of the reasons that the Defence Department is a major supporter of the research.

For US manufacturers, the submicron era is an opportunity to regain profits and stature. The Japanese have been spending 20% of their revenue on capital projects, compared with about 16% for the largest US companies.

IBM releases the JX

IBM Australia has extended its personal computer line with the release of the JX model, a low-cost desktop machine with a wide range of features. Prices start at just over the $2000 mark for the base model which includes a colour monitor.

The JX personal computer now becomes IBM's low priced entry level machine. It is aimed squarely at the education and small business markets and is able to run over 100 IBM application packages. It has already been approved for use in the Victorian education system.

Originally designed for the Japanese market, the JX uses the same 8088 processor and disk operating systems as the IBM PC and XT models but has the Sony 3.5 inch disk drives instead of the older machines' 5.25 inch drives.

An optional expansion unit for the JX has a 5.25 inch drive. The 3.5 inch disks are formatted for 360KB which makes them fully compatible with any IBM 5.25 inch disk, although it does mean that their full capacity is not utilised.

While the operating system may not be new, the hardware of the JX certainly is. It features the first one megabit ROM to be used in a personal computer. This houses the BIOS (Basic Input/Output System) and Advanced Basic. As well, the JX employs five large gate arrays which have been used to replace a considerable number (180 according to IBM) of the conventional TTL chips for increased speed, reliability and miniaturisation.

Five different configurations of the JX are available. The JX1 education system, intended for use in cluster networks is supplied with 64K user memory, two cartridge slots and a colour monitor, and retails for $2115.

The JX2 starter system comes with 128K of user memory, two cartridge slots, one disk drive and the colour monitor, and sells for $2881.

The JX3 business system is a further upgrade with 256K of memory and two disk drives and sells for $3365. Fully optioned up, the JX3 comes with 512K of user memory and a clock/calendar.

Two keyboards are available, a compact unit and a full size office keyboard with separate cursor keys and numeric keypad. This has an improved layout to the much-maligned IBM PC keyboard but does not have the latter's refined key action.

Wide comb or narrow comb?

A robot which can shear a sheep every two minutes — and a system which will take the back-breaking effort out of the woolshed, allowing the shearer to work as skilled attendant, has been developed by a team of Adelaide scientists.

The private research and development program, supported by the Federal Government and the Australian Wool Corporation, is working to a timetable which will see the robot shearer in full commercial production by the mid 1990s.

The final production model will be a two arm unit which simultaneously shears both sides of an immobilised sheep cleanly and with minimum fuss.

The robot unit uses mainly off-the-shelf components and standard robotics, which will keep the price down.

The computer guided system uses highly accurate sensors fitted to the shearing heads to guide it smoothly across the surface of the sheep. It also relies on the Stockstill livestock immobiliser, to hold the sheep firmly during shearing.

Pitch and roll of the comb is controlled by capacitive sensors which measure the clearance between parts of the comb to the skin. However, the robot also responds to the electrical resistance between the comb and the skin, so that if the comb encounters blood or moisture on the skin surface, it lifts over it.

The system's basic software provides the robot with a background "map" of the sheep — warning it, for example, that it can expect horns around the head or wrinkles around the neck. But this is only the underlying data which determines the robot's method of approaching any one part of the sheep. This background picture is constantly updated with "signature" information on specific parts of the sheep being shorn, all of which is generated during the shearing process.

However, it is not a rigid pattern. It is a self seeking adaptive system. The computer looks at an unknown body and adapts the basic pattern as it goes.

Portable compact disc player

Matsushita has a new portable compact disc player, the Technics SL-XP7, billed as the world's smallest CD player.

The unit measures 126mm (W) x 31.9mm (H) x 126mm (D) and weighs 520 grams, making it small enough to fit in the palm of your hand. The photograph shows the slimline design and the large transparent window for disc visibility. For user convenience, the SL-XP7 can be powered by an optional AC adapter. Another accessory for portable use is a rechargeable battery built into a hard carrying case.

The miniaturised laser pickup which has been developed by Matsushita is called "fine-focus one-beam". They say that previous single beam systems have suffered from crosstalk problems because the focus error signal and tracking error signal came from the same laser beam.

Matsushita believe that they have overcome this crosstalk problem by using a digital phase comparison system together with a digital noise canceller, digital phase limiter, and dropout protection circuits.

The engineers have also incorporated a friction-free four-wire suspension system to support the focus lens. A spring loaded mechanism is used to assure smooth movement of the laser pickup on its guide rail.

Amongst its other features are 15-step random access programmability which is performed by using a skip key to select tracks and a memory key to specify input. A Program Recall function can display program contents on a multi-function LCD when activated during programmed play.

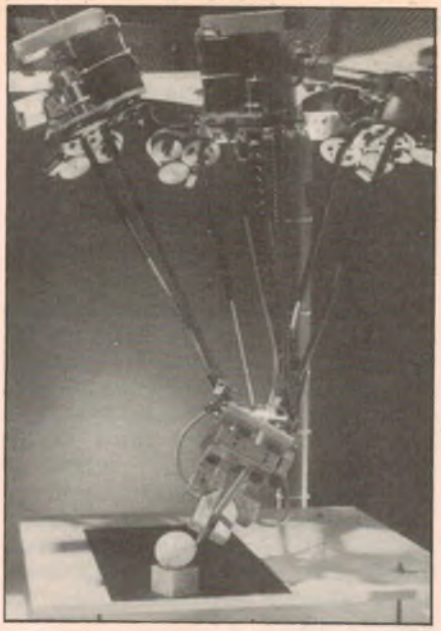
News Highlights

Unconventional robot

The Gadfly is a robot fitted with two 6-axis force sensors, which can be programmed to perform intricate tasks on irregular and delicate surfaces . . . writing on an egg for example.

The British invention is highly unconventional. Instead of the manipulator being housed at the end of a single arm, Gadfly adopts three pairs of telescopic legs that push on the corners of a triangular faceplate which holds its manipulator. Its main advantage is its rigidity and light weight.

The robot is being developed by researchers at GEC who plan to fit it with as many as 50 tactile sensors, in addition to vision sensors. Using advanced artificial intelligence software, they aim to make Gadfly faster, more accurate and more manoeuvrable than many of todays robots used for rapid assembly of small devices on production lines.



While Gadfly is not yet on the market, the company sells a wide range of other robots including Comparm and Ramp 2000 paint sprayers and the Little Giant "pick-and-place" robot, for transferring components from one place to another.

Two out of five bail out of fighter project

The European air-to-air fighters planned for the 1990s have lost the backing of France and Spain. Three countries remain to carry out the project, Britain, Italy and West Germany. It is planned that 650 aircraft will be built at a cost of $13.5 billion — a good percentage of which will be spent on avionics.

The fighters are planned to be control-configurable vehicles which makes for high manoeuvrability but at a price. They are unstable aerodynamically and will therefore require digital electronic actuation for their flight control surfaces. This technology has already been proved feasible in flight by British Aerospace Jaguar.

Aussie detector for space

The sophisticated detector system operating on the advanced technology telescope at Siding Springs is likely to be tested aboard the US space shuttle in March 1987.

It is planned to have the detector system, which has been developed by ANU scientists at the Mt Stromlo and Siding Springs Observatories, used in the far ultra-violet spectroscopic space telescope being developed under a tripartite agreement between Australia, NASA and the European Space Agency (ESA).

The respective bodies have seen the system in operation and its success is demonstrated by NASA's willingness to negotiate to reserve a position on the shuttle for the detector system, so that it can become space qualified as soon as possible.

To gain this space qualification the system must be used for astrophysical measurements while in space. The opportunity to do this will accelerate the development of space qualifying hardware being carried out by Australian companies and such bodies as the ANU.

It will also be of great benefit to the Australian space industry which can bring forward its time schedule for the acceptance of contracts for the construction of space qualifying hardware.

Business brief

Parameters in Sydney have moved to new premises at North Ryde. The new building is situated at Centrecourt, 25-27 Paul Street, North, North Ryde, 2113. Telephone: (02) 888 8777.

Computer competition winners

In the August 1985 issue of *Electronics Australia* we ran a competition in which the reader had to answer 10 questions to win her/himself a fabulous Dick Smith Electronics VZ-300 computer. The first prize in this competition has gone to Queensland reader Rosa Bradbury.

The following are the names and addresses of all five lucky winners.

1st prize: Rosa Bradbury, 26 Mountford Rd, New Farm, Brisbane, Qld, 4005.
2nd prize: David Kew, 33 Kendal Crescent, Wheeler Heights, NSW, 2098.
3rd price: Bruce Kitch, 7 Eurella Street, Kenmore, Qld, 4069.
4th price: Laurence Wong, 54 Brighton Street, Botany, NSW, 2019.
5th price: David Anthony Jones, 10 Borneo Barracks, Cabarlah, Qld, 4352.

Congratulations!

Machines with an eye for detail

In under one minute this new British inspection system can scan 650 components on a printed circuit board (PCB) and tell if any are absent or misplaced.

Replacing the previous lengthy, tedious, and often error-prone manual system, the new equipment works by memorising the image of a known good board and examining the differences, within defined limits, of each new board presented to it. The good board is scanned by a solid state TV camera in stepped areas and the image broken down into a number of pixels — tiny picture elements — their light values being stored in the machine's memory as a digital code.

If the board under test is the same as the good board, a series of identical pixel codes is produced. If the machine detects a faulty component it stops, and projects an image of the component as a highlighted area on a screen. The imaging system has one millimetre resolution allowing canted or misaligned components to be identified, while further development will enable it to check for the correct numerals on integrated circuits.

The system has already been used with great success at Computer Systems Engineering (CASE) in southern England where last year some 82,000 PCBs of 120 different types went through the company's production plant. Linked to an associated computer, the master data of up to 350 different boards and inspection sequences can be stored — although the equipment will stand alone as programming for each board takes only a few minutes.

NOW AVAILABLE!
50 Page wholesale price list
Please call in or write to:
P.O. Box 620, CLAYTON 3168
and simply supply a business card!

TRANSISTOR

	10-99	100+		10-99	100+
2SJ49	4.50	4.30	2SK134	4.50	4.30
PN2222A	.10	.08	PN2907A	.10	.08
PN3463	.15	.13	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.16	.14
PN4356	.16	.14	MPSA42	.23	.20
MPSA43	.23	.20	MPSA55	.15	.14
MPSA56	.15	.14	MPSA92	.22	.20
MPSA93	.22	.20	SC1410	.85	.75
BU126	1.50	1.25	BUX80	2.50	2.20
BU208	2.50	2.20	2SD350	2.50	2.20

Plus 30% tax where applicable

COMPUTER RIBBONS
To suit CP80, BX80, DP80 etc.

	3-24	25-99	100+
C22036	7.00	6.50	6.00

Plus 20% tax where applicable

PRINTER PAPER
60gsm 2000 Sheets 11 x 9½"

1-3	4-9	10+
29.00	25.00	23.00

Plus 20% tax where applicable

ADD ON DISK DRIVE FOR 6502 SYSTEM (APPLE* COMPATIBLE)

1-9	10-24	25+
$150	$140	$130

(*Apple is a registered trademark)

IBM ADD ON HARD DISK

- 10 Mbyte
- Seagate hard disk
- Hard disk controller by Xebec

Cat. X20010 $1295

Plus 20% tax where applicable

MITSUBISHI DISK DRIVES

		1-9	10+	25+
4851	5¼"	$160	$150	$140
4853	5¼"	$220	$205	$175
4854	5¼"	$250	$220	$195
2896	8"	$475	$430	$400

Plus 20% tax where applicable

CARD EDGE CONNECTORS

Edge Connectors to Disk Drives Etc.

	10-24	25-99	100+
P12060 10 Way Card Edge Con	2.95	2.50	2.10
P12062 20 Way Card Edge Con	3.25	2.75	1.95
P12064 26 Way Card Edge Con	3.55	2.95	2.20
P12066 34 Way Card Edge Con	3.95	3.50	2.30
P12068 40 Way Card Edge Con	4.50	3.90	3.50
P12070 50 Way Card Edge Con	5.50	4.50	3.90

Plus 20% Sales Tax where applicable

UNPROTECTED STRIP HEADERS

Dual in Line 2.54mm

	1-9	10+
P12240 10 Way Unprot Header	1.25	1.10
P12246 16 Way Unprot Header	1.35	1.20
P12250 20 Way Unprot Header	1.45	1.25
P12256 26 Way Unprot Header	1.50	1.40
P12260 30 Way Unprot Header	1.75	1.65
P12264 34 Way Unprot Header	1.95	1.75
P12270 40 Way Unprot Header	2.25	1.95
P12275 50 Way Unprot Header	2.75	2.50
P12280 60 Way Unprot Header	2.95	2.75

Plus 20% Sales Tax where applicable

R.A HEADERS

	1-9	10+
P12241 R.A. 10Way Unprot Head	1.45	1.30
P12247 R.A. 16Way Unprot Head	1.55	1.40
P12251 R.A. 20Way Unprot Head	1.65	1.45
P12257 R.A. 26Way Unprot Head	1.70	1.50
P12261 R.A. 30Way Unprot Head	1.95	1.85
P12265 R.A. 34Way Unprot Head	2.15	1.95
P12271 R.A. 40Way Unprot Head	2.45	2.15
P12276 R.A. 50Way Unprot Head	2.95	2.70
P12281 R.A. 60Way Unprot Head	3.15	2.95

Plus 20% Sales Tax where applicable

RITRON II

Swivel base monitor in stylish case.

	1-9	10+	50+
Green Cat. X14506	$145	$135	$115
Amber Cat. X14508	$150	$140	$120

Plus 20% tax where applicable

MONITORS

Cat No.		1-3	4+
X14500	Ritron 1 Green	$130	$125
X14502	Ritron 1 Amber	$135	$130

BACK IN STOCK

Plus 20% tax where applicable

CERAMICS 50V PERIOD

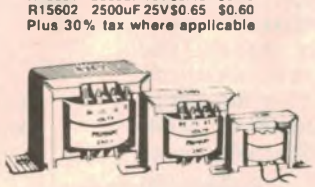
	100+	500+
1pF - 2.2nF	$2.20	$2.00
3.3nF - 10nF	$2.50	$2.20
22nF - 47nF	$2.90	$2.70
100nF	$7.00	$6.50
220nF	$9.50	$8.50
330nF	$12.00	$11.00

Plus 30% tax where applicable

ELECTROLYTIC SINGLE ENDED PCB MOUNT

Cat. No.	Descr	10+	100+
R15405	0.47uF 63V	$0.07	$0.06
R15415	1uF 63V	$0.07	$0.06
R15422	2.2uF 25V	$0.07	$0.06
R15424	2.2uF 50V	$0.06	$0.05
R15425	2.2uF 63V	$0.07	$0.06
R15432	3.3uF 25V	$0.07	$0.06
R15435	3.3uF 63V	$0.07	$0.06
R15442	4.7uF 25V	$0.07	$0.06
R15443	4.7uF 35V	$0.08	$0.07
R15445	4.7uF 63V	$0.07	$0.06
R15461	10uF 16V	$0.07	$0.06
R15462	10uF 25V	$0.07	$0.06
R15463	10uF 35V	$0.07	$0.06
R15465	10uF 63V	$0.07	$0.06
R15481	22uF 16V	$0.07	$0.06
R15482	22uF 25V	$0.30	$0.25
R15483	22uF 35V	$0.08	$0.07
R15484	22uF 50V	$0.09	$0.08
R15502	25uF 25V	$0.07	$0.06
R15505	25uF 63V	$0.10	$0.08
R15512	33uF 25V	$0.08	$0.07
R15521	47uF 16V	$0.09	$0.08
R15522	47uF 25V	$0.09	$0.08
R15525	47uF 63V	$0.10	$0.09
R15531	100uF 16V	$0.10	$0.09
R15532	100uF 25V	$0.08	$0.07
R15533	100uF 35V	$0.15	$0.12
R15535	100uF 63V	$0.24	$0.22
R15541	220uF 16V	$0.09	$0.08
R15542	220uF 25V	$0.14	$0.12
R15543	220uF 35V	$0.25	$0.23
R15545	220uF 63V	$0.26	$0.24
R15552	330uF 25V	$0.15	$0.13
R15555	330uF 63V	$0.34	$0.30
R15561	470uF 16V	$0.16	$0.13
R15562	470uF 25V	$0.23	$0.20
R15563	470uF 35V	$0.30	$0.28
R15564	470uF 50V	$0.00	$0.00
R15565	470uF 63V	$0.44	$0.39
R15581	1000uF 16V	$0.25	$0.22
R15582	1000uF 25V	$0.35	$0.30
R15583	1000uF 35V	$0.45	$0.40
R15591	2200uF 16V	$0.45	$0.40
R15592	2200uF 25V	$0.65	$0.60
R15593	2200uF 35V	$1.20	$0.91
R15601	2500uF 16V	$0.45	$0.40
R15602	2500uF 25V	$0.65	$0.60

Plus 30% tax where applicable



TRANSFORMERS

Cat No.		1-99	100+	1000+
M12851	2851	2.50	2.25	1.90
240V 12-6V CT 150mA				
M12155	2155	4.80	4.10	3.70
240V 6-15V 1A tapped				
M12156	2156	6.35	6.15	5.95
240V 6-15V 2A tapped				
M16672	6672	6.35	6.15	5.95
240V 15-30V 1A tapped				

Plus 20% tax where applicable

75OHM COAX CABLE

Cat No.	100M	500M	1000M
W11222 3C2V	18.00	17.00	16.00
W11224 5C2V	27.00	25.00	24.00

(5C2V WHITE OR BLACK)

100M ROLLS

LINE LOSS PER 100' (33M 200MHz)

W11222 6.2dB (Approx)

W11224 3.9dB (Approx)

Plus 20% tax where applicable

RESISTORS

¼ WATT E12 CARBON BULK
PACKED $5.25/1000
TAPED AND BOXED $5.25/1000
$5.00/1000 10K LOTS
¼ METAL FILM TAPED AND BOXED
$12.00/1000 $11.00/1000/10K LOT
SUPPLY E24 VALUE
Plus 30% tax where applicable

VERBATIM DATA LIFE DISKETTES

	10-99	100+	500+
SS/DD MD525-01	2.50	2.35	2.25
DS/DD MD550-01	3.20	2.50	2.40

XIDEX DISKETTES

SS/DD	2.50	2.50	2.25
DS/DD	3.40	3.05	2.85

Plus 20% tax where applicable

HORN SPEAKERS

Cat No.		1-99	100+
C12010	5" Plastic 8W Max	4.80	4.70
C12015	5" Metal 8W Max	4.70	4.30
C12012	12V Siren	8.50	8.00

Plus 20% tax where applicable

MONOLITHIC .1uF 50V

10+	100+	1000+
$0.09	$0.07	$0.06

Plus 20% tax where applicable

GREY FLAT RIBBON CABLE

			PER 100 FT ROLL			
Cat No.	Desc.	Per Mtr	1-3	4-9	10-99	100+
W12614	14 Way	1.29	19.50	18.50	18.00	14.00
W12616	16 Way	1.90	21.50	19.50	19.00	16.00
W12620	20 Way	2.20	29.50	28.00	26.50	20.00
W12625	25 Way	2.50	32.50	29.00	28.50	25.00
W12626	26 Way	2.60	34.00	32.00	29.00	26.00
W12634	34 Way	2.80	44.00	42.00	39.00	34.00
W12636	36 Way	3.00	49.00	47.00	42.50	36.00
W12640	40 Way	3.20	55.00	52.50	49.50	40.00
W12650	50 Way	3.75	62.00	59.50	58.50	50.00

EX STOCK

LARGER QUANTITIES NEGOTIABLE

Plus 20% tax where applicable

CRYSTALS

Cat No.	Frequency	Can	10+	100+	500+	1000+
Y11000	1MHz	HC33	5.50	4.75	4.50	4.00
Y11005	2MHz	HC33	2.25	1.95	1.85	1.70
Y11008	2.4576MHz	HC33	2.25	1.95	1.85	1.70
Y11015	3.57954MHz	HC18	1.20	.90	.65	.60
Y11020	4.00MHz	HC18	1.30	.90	.75	.60
Y11022	4.194304MHz	HC18	1.40	.90	.75	.60
Y11025	4.75MHz	HC18	1.40	.90	.75	.60
Y11026	4.9152MHz	HC18	1.40	.90	.75	.60
Y11042	6.144MHz	HC18	1.40	.90	.75	.60
Y11050	8.00MHz	HC18	1.40	.90	.75	.60
Y11055	8.867238MHz	HC18	1.40	.90	.75	.60
Y11070	12.00MHz	HC18	1.40	.90	.75	.60
Y11072	14.318MHz	HC18	1.40	.90	.75	.60
Y11080	16.00MHz	HC18	1.40	.90	.75	.60
Y11085	18.432MHz	HC18	1.40	.90	.75	.60
Y11090	20.00MHz	HC18	1.40	.90	.75	.60

FULL RANGE OF CRYSTALS AVAILABLE ON INDENT

Plus 20% tax where applicable

POLYESTER 100V "GREENCAP" TYPE

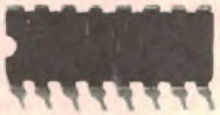
Cat No.		1-99	100+	1000+
R15131	.001uF	0.06	0.04	.036
R15137	.0012uF	0.06	0.04	.036
R15138	.0015uF	0.06	0.04	.036
R15140	.0022uF	0.06	0.04	.036
R15142	.0033uF	0.06	0.04	.036
R15143	.0039uF	0.06	0.04	.036
R15145	.0047uF	0.06	0.04	.036
R15146	.0056uF	0.06	0.04	.036
R15147	.0082uF	0.06	0.04	.036
R15148	.01uF	0.07	0.05	.045
R15150	.015uF	0.07	0.05	.045
R15152	.022uF	0.07	0.05	.045
R15154	.033uF	0.07	0.05	.048
R15155	.039uF	0.07	0.05	.045
R15156	.047uF	0.08	0.06	.055
R15157	.056uF	0.08	0.06	.055
R15158	.068uF	0.08	0.06	.055
R15159	.082uF	0.08	0.07	.055
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

Plus 30% tax where applicable

COMPUTER CONNECTORS

Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	1.30	1.20	1.00
P10901	DB25 Socket	1.40	1.30	1.20
P12210	Centronics Solder	3.50	3.15	2.50
P12200	Centronics Crimp	6.00	5.50	5.00
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Socket	1.40	1.30	1.00
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Socket	1.40	1.30	1.00
P10902	DB25 Cover	.80	.65	.55

Plus 20% tax where applicable



MEMORY

"Check for the latest memory prices!"

	10-99	100+	1000+	10K+
4164-15P	$2.00	$1.50	$1.30	$1.10
41256	$7.00	$6.00	$5.50	$5.00
6116P-3	$3.00	$2.90	$1.80	$1.50
2716	$4.90	$4.50	$4.25	$4.00
27128	$7.00	$6.00	$5.00	$4.00
2532	$7.50	$6.50	$6.40	$6.30
2732	$6.50	$6.10	$5.90	$5.50
27256	$29.00	$27.00	$22.00	19.00
6264	$9.00	$7.50	$6.00	$5.50

Plus 20% tax where applicable

IC's GALORE!

	1-9	10+	100+	250+
8035	3.90	3.70	3.50	3.00
8085	4.00	3.90	3.50	3.00
8088	19.00	18.00	15.00	14.00
8155	3.90	3.75	3.50	3.00
8156	3.50	3.30	2.90	2.50
8212	1.90	1.70	1.50	1.00
8224	2.40	2.00	1.90	1.50
8226	1.90	1.70	1.50	1.00
8237A	35.00	31.00		
8253	3.90	3.70	3.50	3.00
8255	4.00	3.50	2.90	2.00
8257	3.90	3.50	3.00	2.50
8259	3.90	3.50	3.30	2.70
8237A	35.00	31.00		
8279	3.90	3.50	3.30	2.70

Plus 20% tax where applicable

LOW PROFILE IC SOCKETS
How cheap can they go ??

	10+	100+	1000+	10K
8 Pin	.08	.07	.06	.05
14 Pin	.10	.09	.08	.07
16 Pin	.11	.10	.09	.08
18 Pin	.12	.11	.10	.09
20 Pin	.13	.12	.11	.10
22 Pin	.14	.13	.12	.11
24 Pin	.15	.14	.13	.12
28 Pin	.19	.17	.15	.14
40 Pin	.25	.24	.22	.20

Plus 20% tax where applicable

VOLTAGE REGULATORS

	10+	100+	1000+
7805uC	.45	.44	.43
7805KC	1.50	1.40	1.20
7812uC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75
78H12	7.00	6.00	5.90
78HGKC	7.50	6.50	6.00
79HGKC	16.50	16.00	14.00
78P05	11.50	11.00	10.50
78P12	14.00	13.50	13.00

Plus 20% tax where applicable

BRIDGES

	10+	100+	1000+	10K+
6A 400V	1.00	0.80	0.75	0.69
W02	0.24	0.23	0.20	0.18
W04	0.25	0.24	0.21	0.19

Plus 20% tax where applicable

IDC SOCKETS

	1-9	10+	100+
P12100 10 Pin Socket	1.95	1.75	1.25
P12101 16 Pin Socket	2.25	2.05	1.65
P12102 20 Pin Socket	2.45	2.25	1.90
P12104 26 Pin Socket	2.65	2.45	2.00
P12106 34 Pin Socket	2.75	2.55	2.15
P12108 40 Pin Socket	2.95	2.75	2.25
P12110 50 Pin Socket	3.50	2.95	2.50

Plus 20% Sales Tax where applicable

IDC CONNECTORS

	1-99	100+
P12114 14 Pin Dip Plug	0.60	0.50
P12116 16 Pin Dip Plug	0.65	0.55

Plus 20% tax where applicable

Ritronics Wholesale have an extensive range, excellent "in stock" availability and excellent prices! We're confident that you will find us more than satisfactory in your pursuit of the latest electronic products and components at very competitive prices.
Please feel free to ring Peter Jones or Graeme Jarry for competitive quotes on all your components, and computer peripheral needs.

MINIATURE BUZZER

5-15V White or black
Cat. A15062 10-99 100+
0.90 0.80
Plus 20% tax where applicable

74F SERIES

Full range of Fairchild "Fast" series in stock!

	1-9	10-99	100+	1000+
74F00	0.64	0.60	0.56	PLEASE
74F02	0.64	0.60	0.56	PHONE
74F04	0.64	0.60	0.56	
74F08	0.64	0.60	0.56	
74F10	0.64	0.60	0.56	
74F109	0.88	0.83	0.77	
74F11	0.64	0.60	0.56	
74F112	1.30	1.22	1.13	
74F113	1.30	1.22	1.13	
74F114	1.30	1.22	1.13	
74F138	1.50	1.41	1.32	
74F139	1.50	1.41	1.32	
74F148	1.39	1.31	1.22	
74F151	1.50	1.41	1.32	
74F153	1.50	1.41	1.32	
74F157	1.50	1.41	1.32	
74F158	1.50	1.41	1.32	
74F160	3.34	3.14	2.93	
74F163	3.34	3.14	2.93	
74F164	1.88	1.77	1.65	
74F168	3.68	3.45	3.22	
74F169	3.68	3.45	3.22	
74F174	1.73	1.62	1.51	
74F175	2.34	2.20	2.04	
74F181	4.08	3.83	3.57	
74F189	7.15	6.69	6.26	
74F190	3.36	3.15	2.94	
74F191	3.36	3.15	2.94	
74F192	4.72	4.43	4.13	
74F193	4.72	4.43	4.13	
74F20	0.64	0.60	0.56	
74F219	6.78	6.36	5.94	
74F240	2.98	2.79	2.60	
74F241	2.43	2.28	2.13	
74F243	3.70	3.47	3.23	
74F244	2.98	2.79	2.60	
74F245	7.00	6.56	6.12	
74F251	1.64	1.54	1.43	
74F253	1.44	1.35	1.26	
74F257	1.60	1.50	1.40	
74F258	1.63	1.53	1.43	
74F280	1.34	1.26	1.18	
74F283	1.81	1.75	1.59	
74F299	6.94	6.51	6.08	
74F32	0.64	0.60	0.56	
74F322	5.80	5.43	5.07	
74F323	7.66	7.19	6.70	
74F350	3.00	2.81	2.62	
74F352	1.63	1.53	1.43	
74F353	1.63	1.53	1.43	
74F373	3.36	3.15	2.94	
74F374	3.36	3.15	2.94	
74F378	2.04	1.92	1.79	
74F379	2.14	2.01	1.87	
74F381	5.00	4.69	4.37	
74F382	5.20	4.82	4.55	
74F384	11.23	10.53	9.83	
74F385	9.82	9.21	8.60	
74F398	3.82	4.82	4.55	
74F399	2.33	2.19	2.04	
74F521	3.56	3.34	3.12	
74F524	10.69	10.02	9.35	
74F533	3.36	3.20	2.90	
74F534	3.36	3.20	2.90	
74F537	5.02	4.70	4.39	
74F538	5.02	4.70	4.39	
74F539	5.02	4.70	4.39	
74F543	7.06	6.62	6.17	
74F544	6.94	6.51	6.08	
74F545	5.39	5.05	4.72	
74F547	5.17	4.84	4.52	
74F548	4.47	4.19	3.91	
74F568	3.94	3.70	3.45	
74F569	3.94	3.70	3.45	
74F582	9.87	9.25	8.64	
74F583	7.33	6.87	6.42	
74F588	5.69	5.34	4.98	
74F64	0.60	0.57	0.53	
74F675	1.22	1.14	1.06	
74F74	0.64	0.60	0.56	
74F86	0.88	0.81	0.76	

Plus 20% tax where applicable

ECONOMY TOGGLE SWITCHES

Unbelievable Value!

	10-99	100+
S11010 (SPDT)	0.70	0.60
S11020 (DPDT)	0.90	0.80

Plus 20% Sales Tax where applicable

NEW SWITCHES

Right angle P.C.B. mounting

	10-99	100+
SPDT Cat. S11040	1.00	.95
DPDT Cat. S11042	1.20	1.00

Plus 20% Sales Tax where applicable

QUALITY MOMENTARY (RED BODY)

	10-99	100+
SPDT Cat. S11050	1.00	.90

Plus 20% Sales Tax where applicable

ENCLOSED ROTARY SWITCHES AT SPECIAL PRICES!!

		1-9	10+	100+
S13021	SW ROT 1P 12Pos	1.00	.80	.70
S13022	SW ROT 2P 6Pos	1.00	.80	.70
S13033	SW ROT 4P 3Pos	1.00	.80	.70
S13035	SW ROT 3P 4Pos	1.00	.80	.70

Plus 20% Sales Tax where applicable

CANNON TYPE ADUIO CONNECTORS

We've sold 1000's because of their great value!

	1-9	10+
3 Pin Line male Cat. P10960	1.80	1.60
3 Pin Chas male Cat. P10962	1.90	1.70
3 Pin line female Cat. P10964	2.50	2.20
3 Pin Chas FMle Cat. P10966	2.90	2.50

Plus 20% Sales Tax where applicable

10W P.A. SPEAKERS TWIN CONE

1-9	10+	100+	300+
$5.00	$4.75	$4.50	$4.00

Plus 20% tax where applicable

YU-FONG YFE-1030C

Features:
- Large 3½ digit display. (½ inch high)
- Autopolarity, "-" display for Negative input.
- High over-load protection for all ranges.
- Over-load display highest figure "1" or "-1" alone glows.
- Power consumption 20mW approx.

Cat. Q126030

1-99	100+
43.95	34.00

Plus 20% Sales tax where applicable

AXIAL ELECTROLYTICS (DOUBLE ENDED)

Cat. No.	Description	10+	100+
R15705	0.47uF 63V	$0.12	$0.10
R15715	1uF 63V	$0.12	$0.10
R15725	2.2uF 63V	$0.12	$0.10
R15742	4.7uF 25V	$0.11	$0.09
R15745	4.7uF 63V	$0.11	$0.09
R15761	10uF 16V	$0.12	$0.10
R15762	10uF 25V	$0.13	$0.12
R15765	10uF 63V	$0.15	$0.14
R15792	22uF 25V	$0.13	$0.12
R15794	22uF 50V	$0.17	$0.15
R15812	25uF 25V	$0.13	$0.12
R15815	25uF 63V	$0.17	$0.15
R15831	47uF 16V	$0.16	$0.13
R15832	47uF 25V	$0.16	$0.13
R15835	47uF 63V	$0.22	$0.19
R15841	100uF 16V	$0.18	$0.16
R15842	100uF 25V	$0.18	$0.16
R15845	100uF 63V	$0.27	$0.24
R15851	220uF 16V	$0.17	$0.15
R15852	220uF 25V	$0.21	$0.18
R15855	220uF 63V	$0.50	$0.46
R15871	470uF 16V	$0.27	$0.24
R15872	470uF 25V	$0.29	$0.27
R15873	470uF 35V	$0.75	$0.70
R15875	470uF 63V	$0.75	$0.70
R15885	1000uF 63V	$0.60	$0.58
R15891	1000uF 16V	$0.39	$0.35
R15892	1000uF 25V	$0.45	$0.40
R15893	1000uF 35V	$0.70	$0.65
R15894	1000uF 50V	$0.00	$0.00
R15903	2200uF 35V	$1.20	$1.10
R15904	2500uF 50V	$1.30	$1.20
R15911	2500uF 16V	$0.59	$0.50
R15912	2500uF 25V	$0.95	$0.90
R15913	2500uF 35V	$1.10	$1.00
R15914	2500uF 50V	$1.30	$1.20
R15932	4700uF 25V	$1.90	$1.80
R15933	4700uF 35V	$2.40	$2.15

Plus 30% tax where applicable

TANTALUM CAPACITORS

Cat. No.	Description	10+	100+
R16124	4.7uF 16V	$0.24	$0.18
R16125	10uF 16V	$0.25	$0.23
R16126	15uF 16V	$0.38	$0.36
R16128	22uF 16V	$0.42	$0.40
R16132	47uF 16V	$1.55	$1.20
R16134	68uF 16V	$1.80	$1.50
R16220	4.7uF 16V	$0.35	$0.33
R16224	10uF 16V	$0.38	$0.37
R16228	22uF 16V	$1.20	$1.00
R16300	0.1uF 16V	$0.13	$0.12
R16302	0.15uF 16V	$0.13	$0.12
R16304	0.22uF 16V	$0.15	$0.12
R16306	0.33uF 16V	$0.15	$0.14
R16308	0.47uF 16V	$0.15	$0.14
R16310	0.68uF 16V	$0.16	$0.15
R16311	0.82uF 16V	$0.18	$0.15
R16312	1uF 16V	$0.15	$0.12
R16314	1.5uF 16V	$0.24	$0.20
R16316	2.2uF 16V	$0.24	$0.23
R16318	3.3uF 16V	$0.29	$0.27
R16320	4.7uF 16V	$0.35	$0.33

30% Sales tax where applicable

FANS

		1-9	10+	100+
Cat. T12461	240V 4½"	10.50	10.00	8.00
Cat. T12465	240V 3½"	10.50	10.00	9.00
Cat. T12463	115V 4½"	10.50	10.00	8.00
Cat. T12467	115V 3½"	10.50	10.00	9.00

(Fan guards to suit also available)
Plus 20% tax where applicable

LEDS 5mm STANDARD

	10+	100+	1000+
Red	$0.10	$0.09	$0.08
Green	$0.15	$0.10	$0.09
Yellow	$0.15	$0.10	$0.09

Plus 20% tax where applicable

RCA INSULATING SOCKETS

Cat No.	Desc.	1-99	100+
P10232	2 Way	0.25	0.21
P10234	4 Way	0.45	0.40
P10236	6 Way	0.75	0.60

Plus 30% tax where applicable

RCA CHASSIS MOUNT METAL

Cat No.	1-99	100+
P10231	0.16	0.13

Plus 30% tax where applicable

TELEPHONE CABLE

		1-9	10+
W11302	2 Pair	24.00	23.00
W11303	3 Pair	36.00	34.00
W11310	10 Pair	120.00	115.00

Per 200m Roll
20% Sales tax where applicable

DIP SWITCHES

	10+	100+	1000+
S13402 2 Way	.70	.65	.60
S13404 4 Way	.80	.75	.70
S13405 5 Way	.90	.85	.80
S13407 7 Way	1.10	1.00	.95
S13408 8 Way	1.20	1.10	1.00

20% Sales tax where applicable

SEALED LEAD ACID BATTERY 12V 1.2 AH

S15029	1-9	10-99	100+
	12.50	11.00	10.50

Plus 20% tax where applicable

NICADS

Cat No.		1-99	100+	250+
S15020	AA	1.60	1.50	1.40
S15021	C 1.8AH	3.25	2.90	2.80
S15022	D 4.0AH	5.90	5.50	5.20

Plus 20% tax where applicable

DIODES

Cat No.	Desc.	10+	100+	1000+	100K+
Z10135	IN4148	0.03	0.02	0.015	.013
Z10105	IN4002	0.04	0.03	0.03	.025
Z10107	IN4004	0.05	0.04	0.03	.025
Z10110	IN4007	0.10	0.06	0.05	.040
Z10115	IN5404	0.18	0.14	0.09	0.08
Z10119	IN5408	0.20	0.16	0.10	0.09

Plus 20% tax where applicable

PANEL METERS

		1-9	10+	100+
Q10500	MU45 0-1mA	6.95	6.75	6.50
Q10502	MU45 50-0-50uA	6.95	6.75	6.50
Q10504	MU45 0-100uA	6.95	6.75	6.50
Q10505	MU45 0-50uA	6.95	6.75	6.50
Q10510	MU45 0-5A	6.95	6.75	6.50
Q10518	MU45 0-1A	6.95	6.75	6.50
Q10520	MU45 0-20V	6.95	6.75	6.50
Q10535	MU45 VU	7.95	7.75	7.50
Q10530	MU52E 0-1mA	9.95	8.35	
Q10533	MU52E 0-5mA	9.95	8.35	
Q10538	MU65 0-50uA	9.35	8.95	8.75
Q10540	MU65 0-1mA	9.35	8.95	8.75
Q10550	MU65 0-100uA	9.35	8.95	8.75
Q10560	MU65 0-20v	9.35	8.95	8.75

Plus 20% tax where applicable

RITRONICS WHOLESALE

Incorporated in Victoria Pty. Ltd.

56 Renver Road, CLAYTON, 3168, VICTORIA, AUSTRALIA. Phone (03) 543 2166 (3 lines) Telex: AA151938

Minimum account order is $50, minimum cash sale is $25. Minimum post/pack $3.00. Minimum account post/pack $5.00. Comet Road Freight, bulky items and/or over 10Kg is extra.
Bankcard, Visa and Mastercard welcome.

Letters to the editor

Microelectronics in Australia

The microelectronic industry in Australia is at a point where it needs encouragement for continued growth. Resources available in Australia are limited so that the industry must work in a co-ordinated and efficient manner. At present —

(1) those wishing to use microelectronics in their products for the first time are often unsure as to who can assist them.

(2) there is no single record that lists facilities available in Australia, be it fabrication, computer and design service or expertise in a given area. In fact, some documents produced in recent times contain noticeable errors and omissions.

(3) educational establishments are often spending their limited resources on writing CAD software only to discover they are duplicating work already undertaken elsewhere.

(4) there are no agreed sets of design rules for many of the microelectronic processes.

To help resolve these and other difficulties it is intended to compile an "Australian Directory of Microelectronic Facilities and Services" which will improve communication and co-operation in the industry. To this end I am seeking the assistance of educational, industrial and government establishments to compile such a directory. It is intended that the volume be widely circulated and available for a nominal charge to cover production costs.

A series of simple questionnaires have been produced and cover the following areas: (a) printed circuit board; (b) hybrid thick/thin film; (c) silicon semi-custom; (d) full silicon custom; (e) special custom service.

For the venture to be successful in both stimulating the microelectronics industry and assisting the transfer of this technology to other industries, the questionnaire should be completed by all organisations in Australia who offer services or facilities in one or more of the above five areas.

I would therefore, be grateful if you could publish this letter advising organisations of this venture so that, should they wish to be included in the directory, then they can contact me to receive a set of questionnaires. No charge is made for being involved in the directory. However, some organisations may wish to sponsor the directory and donations in excess of $100 will be acknowledged in the directory.

M. R. Haskard, Principal Lecturer,
School of Electronic Engineering.
SA Institute of Technology,
PO Box 1, Ingle Farm, SA 5098.

HACBSS, AUSSAT, but not B-MAC

I refer to your article entitled *HACBSS, AUSSAT and B-MAC*, which appeared in the September 1985 issue of your magazine.

Whilst Mr Williams is to be commended for his collection of technical facts related to Aussat television reception, the article fails to address the most important issue — the cost to the end user.

Until recently, the estimated cost of a complete HACBSS Home Television Reception System, was $1000. This estimate rose to $1500 and now rests at $2500, although industry sources indicate that $3500 is more likely to be the final cost.

Primarily, the increase in cost has been due to the decision taken by the Government to adopt B-MAC technology — proprietary technology monopolised, apparently with Government approval, by Plessey Australia. The effect of the adoption of B-MAC (instead of the previously recommended PAL/SCPC system) is that those people already paying for a television service that they don't receive have been singled out to pay an extra $1000 each.

Is there not some confusion over the aim of HACBSS? Surely the aim was to provide those people living in remote areas, and not serviced adequately by terrestrial television services, with an economical method of obtaining television reception.

Residents confronted with this predicament may not consider $2500, or worse $3500, economical at all. Certainly those residents living in "Remote Communities" which utilise the Telecom maintained Intelsat Earth Stations and community terrestrial translators should have no cause for concern. Their service will continue uninterrupted as B-MAC decoders and the necessary 12Ghz hardware is installed. However, in spite of the technical advantages of B-MAC, the "Remote Community" transmission will be PAL to maintain compatibility with domestic television receivers!

How many of those residents of Australia who don't live in remote communities serviced by Telecom can afford $2500 extra for the privilege of watching television. Can you?

Final food for thought. As reported in the *Australian* newspaper on Wednesday, August 21, it appears that a market survey commissioned by Plessey Australia showed that 68% of people questioned about the cost of Aussat HACBSS equipment rejected the proposal of having to pay over $2300 for such a system.

To this end Plessey is reported to have applied for a Government Grant of $25 million to help reduce the cost of their HACBSS system. Good money after bad?

Garry Crapp,
Dick Smith Electronics,
North Ryde, NSW.

Novice amateur radio course

Do you know of a young person between the age of 12 and 17 who wants to get into amateur radio? A number of amateur radio operators from Sydney are planning a 10 or 12 day live-in Novice Amateur Radio course during the 1986 May school holidays.

The camp will involve five or six amateurs as lecturers and supervisors. There will be places for about 24 students. The camp will be held near Sydney and will include both theory and practical electronics, regulations and Morse code. Other activities may include swimming, bushwalking and sports.

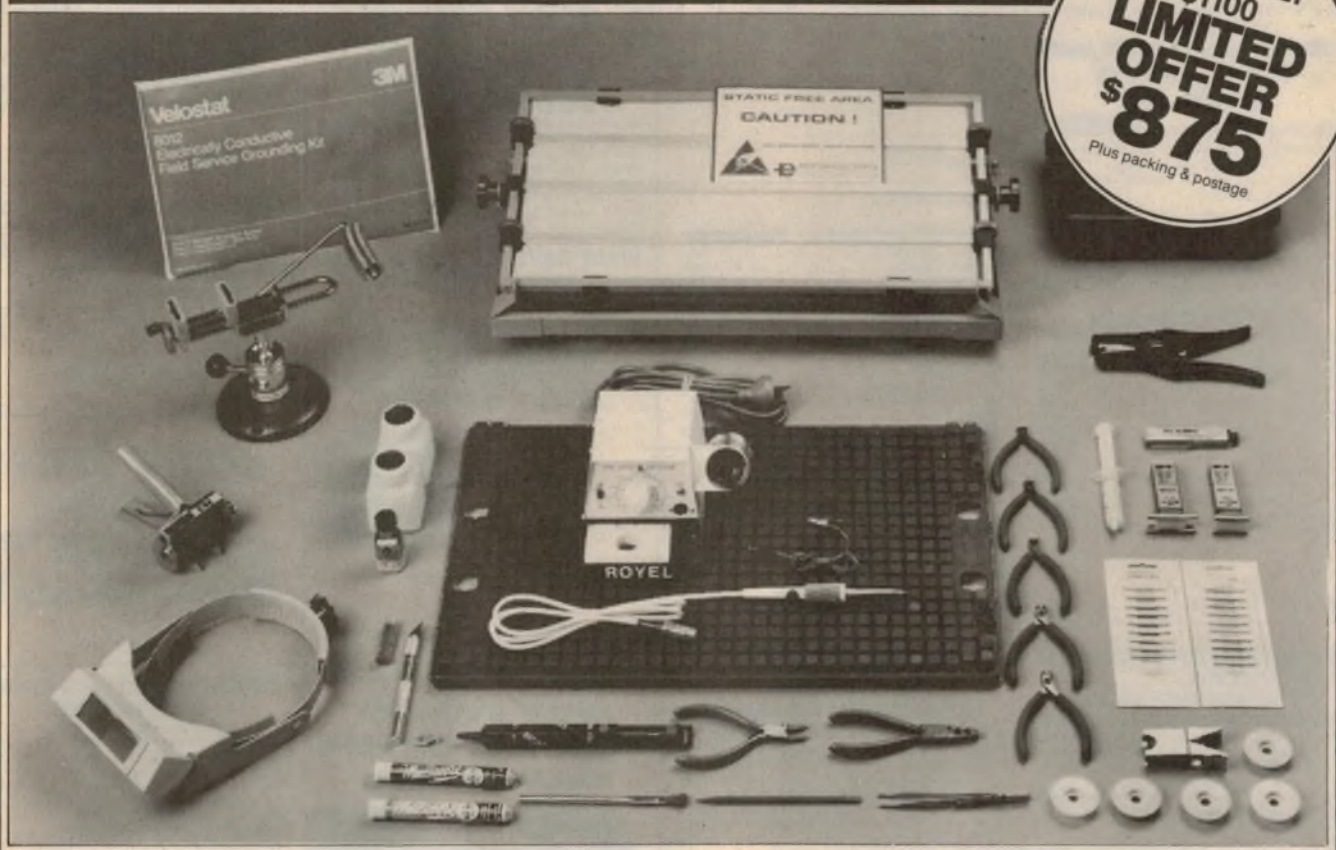
It is anticipated that a full amateur station will be set up, including AMTOR, packet radio and satellites. This will give the students some on-air experience.

Interested students and amateurs should contact Peter O'Connell, VK2JJJ at 3A Algernon St, Oatley, NSW 2223, enclose a stamped SAE.

Peter O'Connell, VK2JJJ,
Oatley, NSW.

ROYEL HI-TECH KIT

NORMALLY $1100
LIMITED OFFER
$875
Plus packing & postage



EVERYTHING YOU NEED FOR ELECTRONICS ASSEMBLY & REPAIR

The "Royel" Hi-Tech Kit comprises the best high quality precision-made tools from Australia and around the world. Royston Electronics supply advanced-technology equipment to the Australian Armed Forces, computer companies, aviation and police departments, hospitals and electronics manufacturers.

This very comprehensive, professional kit has been compiled after extensive world-wide industry experience.

First release is a special offer for a limited period only.

OFFER CLOSES DECEMBER 16, 1985

Phone for your nearest distributor:

ROYSTON ELECTRONICS

VIC:	(03) 543 5122	**SA:**	(08) 212 5999
NSW:	(02) 709 5293	**WA:**	(09) 381 5500
QLD:	(07) 277 4311	**TAS:**	(002) 34 2233

Kit Items Include:

- ☐ Royel ECT soldering station.
- ☐ P.C. assembly jig.
- ☐ Static dissipative work mat.
- ☐ Complete set of soldering tips.
- ☐ Ball clamp work holder vice.
- ☐ Solvent saver dispensers.
- ☐ I/C inserters and extractors.
- ☐ Head band magnifocuser.
- ☐ Solder packs and solder wick fine braid.
- ☐ Tweezers, probe and cutting knife.
- ☐ Swiss precision cutters and pliers.
- ☐ Component protection devices.
- ☐ Anti-stat desolder pump.
- ☐ Field service grounding kit.
- ☐ Heat sinks and transfer compound.

MHL 3396

JAYCAR - UNIQUE PRODUCTS

VIFA SPEAKER SENSATION

European Style 2-way Speaker Kit Sensational NEW design by Dave Tillbrook

SEE AEM JULY

Tweeter DZ5TG 8 ohm Cat. CT-2020

$49.95 ea $99.90 pair

Woofer PZ1WO 8 ohm Cat. CW-2132

$135 ea $270 pair

Crossover Network

(Not a kit now - but factory built for precision)

Cat. CX-2630

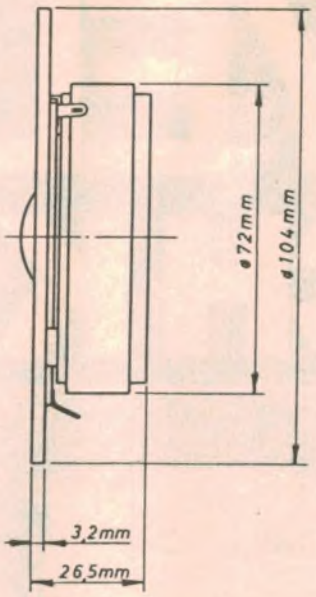
$49.95 ea $99.90 pair

Total price $469.80

Package Deal price **$450**

(Price increase due to factory cost increases and Australian $ devaluation)

Speaker cabinets for this system: Check with your store for details!



We estimate that you will be able to build the cabinets for around $50 - $90 (depending on finish). This means that you can end up with a superior 100 watt speaker system for under $500!!!

UNBELIEVABLE!! Technical Data - Woofer

Nominal Impedance	8 ohms
Frequency Range	26 - 4000Hz
Free Air Resonance	33Hz
Operating Power	2.5W
Sensitivity (1W @ 1m)	92dB
Nominal Power	60 watts
Voice Coil Diameter	40mm
Voice Coil Height	12mm
Air Gap Height	6mm
Voice Coil Resistance	5.8 ohms
Effective Diaphragm Area	222cm²
Moving Mass	20 grams
Thiele/Small Parameters	
Qm - 2.4	
Qe - 0.41	
Qt - 0.35	
Vas - 80.1	
Weight	1.65kg

Technical Data - Tweeter

Nominal Impedance	6 ohms
Frequency Range	2 - 24kHz
Free Air Resonance	1500Hz
Operating Power	3.2 watts
Sensitivity (1W @ 1m)	90dB
Nominal Power	90 watts
Voice Coil Diameter	25mm
Voice Coil Height	1.6mm
Air Gap Height	2.0mm
Voice Coil Resistance	4.7 ohms
Effective Diaphragm Area	7cm²
Moving Mass	0.3 grams
Weight	0.53kg

AA NICADS

RECHARGEABLE BATTERIES

AA size, 1.2V - 450mA. Charges at 45-50mA (14-16 hours). Will outlast well over 1000 recharge cycles with average use

Cat. SB-2452

1-9 $2.50
10-24 $2.20
25-99 $2.00
100 up $1.80 each

AT LAST! A low cost 10 Amp Digital Multimeter with transistor test facility

Digital multimeters are very popular these days but good quality ones with 10 amp scales generally cost well over $100. We think that is too expensive so we've decided to do something about it.

Jaycar is pleased to announce a direct import digital multimeter with sensational specifications at an unheard of price!

Check the specs:

DC VOLT	0.1mV - 1000V
AC VOLT	0.1mV - 700V
DC CURRENT	1uA - 10A
AC CURRENT	1uA - 10A
RESISTANCE	0.1 - 20 Mohm
CONTINUITY	less than 30 ohm @ 1mA
hFE TEST	0-1000 10uA 2.8V NPN/PNP
DIODE TEST	1mv

Basic accuracy of Volts, Current & resistance is between 0.5 - 1.2% depending on range.

DIMENSIONS 170(H) x 90(W) x 35(D)mm

FEATURES

- ★ 0.5" high digits
- ★ High quality probe set supplied!
- ★ Vinyl carry case supplied!
- ★ Built in tilting bail!
- ★ LED & buzzer continuity test!
- ★ Precision thin film resistors used for long term accuracy!
- ★ CMOS logic. 1000-2000 hours battery life!
- ★ Single function range switch
- ★ Complete with battery, spare fuse (2AG) and instruction manual
- ★ Protected ON/OFF switch!
- ★ Auto polarity
- ★ Protected
- ★ Floating decimal point

Cat. QM-1530

$89.95

AT LAST! A low cost 10 Amp Digital Multimeter/ Transistor Tester & Capacitance Meter!

Jaycar is proud to announce a genuine low cost high performance combination Multimeter/Capacitance meter for the enthusiast! This unit is all the most commonly needed test gear rolled into one!

Similar units are on the market to sell from around $150 to over $200. Why pay more when you can get a Jaycar direct import for less?

DC VOLT	0.1mV - 1000V
AC VOLT	0.1mV - 700V
DC CURRENT	1uA - 10A (20A max 30 secs)
AC CURRENT	1uA - 10A (20A max 30 secs)
RESISTANCE	0.1 - 20M ohms
CAPACITANCE	1pF - 20uF (2%)
CONTINUITY	less than 30 ohms @ 1mA
hFE TEST	0-1000, 10uA 2.8V
DIODE TEST	1mA (Buzzer & LED)

FEATURES:

- ★ 0.5" high digits
- ★ High quality probes supplied!
- ★ LED and Buzzer continuity test
- ★ Precision thin film resistors for long term stability
- ★ CMOS logic. 1000 - 2000 hours battery life!
- ★ Meter protection. Fused
- ★ Complete with battery, quality probes, spare fuse
- ★ Floating decimal point
- ★ Auto polarity
- ★ Impact resistant case

$129.00

Cat. QM-1540

AN ECONOMICAL MAINS FILTER

250V AC @ 3A

250V AC @ 3A - insertion loss line to line 20dB 0.8 30MHz. Line to ground 30dB 0.7 - 30MHz. Ideal fo computers, amps etc. Quick connect lugs. D.O.T approved.

Cat. MS-4002

ONLY $22.50

ULTRASONIC PEST REPELLER

We were staggered by the price increases on the pest repeller we used to sell, so we found a new one at a more realistic price. Will repel mice, blowflies, birds, spiders, bats, rats, cockroaches, flies, moths and fleas. It's cosmetically appealing and is supplied with a 240 volt power adaptor. We are so sure this product works we will give you a 14 day money back guarantee (less postage costs). Power consumption only 1½ watts.

WHAT HAVE YOU GOT TO LOSE EXCEPT THE BUGS!

Cat. YS-5510

MOZZIE SPECIAL
NORMALLY $55
NOVEMBER SPECIAL
ONLY $45.00

These are sophisticated mixers that have excellent specifications. SEE PAGE 86 of our 1985 CATALOGUE for full features and specs.

STEREO AUDIO MIXER

Cat. AM-4200

ONLY $125.00

PRO-QUALITY CONSOLE

Cat. AM-4202

ONLY $399.00

Squeaky Clean Mains Filter

- Two fantastic low cost models. MS-4010 will supply up to 4 appliances. Each 240V socket is isolated from the other, i.e. interference from disc drives is de-coupled from the CPU power supply etc. It will supply up to 4 outlets with a total load of 6 amps (unswitched).

Cat. MS-4010

ONLY $125.00

Single 10 amp line socket type filter.

(Unswitched)

Cat. MS-4012

ONLY $34.95

Meet Roger Harrison & Dave Tillbrook!

You can meet Roger Harrison and Dave Tillbrook from Australian Electronics Monthly at our York St. store on the 3rd Saturday in November (16th) from 10.30 - 12 noon.

BE THERE!

JOIN THE JAYCAR COMPACT DISC CLUB

DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, focal length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce. (We doubt whether 20 years continuous use would wear out the German made flexible arms for example). Spare fluoro tubes are available either from us or electrical outlets. If you have trouble with fine PCB work or component identification but still want both hands free, this is for you. We thoroughly recommend this quality Australian made product.

Technical Information

Illumination: **22W Fluorescent**
Weight: **8.16kg**
Lateral Extension: **254mm**
Vertical Extension: **254mm**
Fixing: **Heavy table base (grey) with two chrome plated flexible arms.**
Lens: **(see text)**

Cat. SL-2700

ONLY $169

NOTE: **This is the GENUINE 'Maggylamp' - don't fall for cheap substitutes.**

AT LOW, LOW PRICES FOR YOU

IDC DIP PLUGS
IDC plug with cover

14 pin Cat. PI-6549
1-9 $1.75 - 10 plus $1.65
16 pin Cat. PI-6550
1-9 $1.90 - 10 plus $1.80
24 pin Cat. PI-6555
1-9 $3.20 - 10 plus $3.00
40 pin Cat. PI-6558
1-9 $3.95 - 10 plus $3.75

Edge Connector Disc Drives
IDC with strain relief

34 way Cat. PI-6560
1-9 $8.50 - 10 plus $8.00
50 way Cat. PI-6562
1-9 $10.50 - 10 plus $9.50

'D' type Subminiature IDC with strain relief

FDE9P 9 pin male Cat. PP-0802
1-9 $6.50 - 10 plus $5.95
FDE9S 9 pin female Cat. PS-0805
1-9 $6.50 - 10 plus $5.95
FDA15P 15 pin male Cat. PP-0821
1-9 $8.50 - 10 plus $8.00
FDA15S 15 pin female Cat. PS-0825
1-9 $8.95 - 10 plus $8.50
FDB25P 25 pin male Cat. PP-0842
1-9 $9.95 - 10 plus $9.50
FDP25S 25 pin female Cat. PS-0846
1-9 $9.95 - 10 plus $9.50

IEEE - 488 CENTRONICS

57-30360F 36 way IDC line plug Cat. PP-0892
1-9 $12.50 - 10 plus $11.50
(Solder type socket and plug also available)

Headers - line IDC Sockets
PCB protected header with latch

16 way Cat. PP-0945
1-9 $3.50 - 10 plus $3.25
26 way Cat. PP-0947
1-9 $3.95 - 10 plus $3.60
34 way Cat. PP-0948
1-9 $4.95 - 10 plus $4.50
50 way Cat. PP-0950
1-9 $6.50 - 10 plus $6.00

PCB protected header with latch right angle

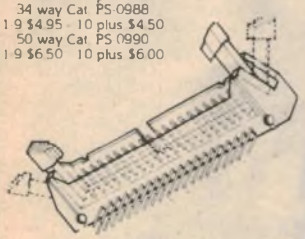
16 way Cat. PP-0965
1-9 $3.50 - 10 plus $3.25
26 way Cat. PP-0967
1-9 $3.95 - 10 plus $3.60
34 way Cat. PP-0968
1-9 $4.95 - 10 plus $4.50
50 way Cat. PP-0970
1-9 $6.50 - 10 plus $6.00

PCB economical unprotected header right angle

16 way Cat. PP-0992
1-9 $2.25 - 10 plus $2.00
26 way Cat. PP-0993
1-9 $2.95 - 10 plus $2.70
34 way Cat. PP-0994
1-9 $2.95 - 10 plus $2.80
50 way Cat. PP-0996
1-9 $3.95 - 10 plus $3.75

IDC line socket with strain relief

16 way Cat. PS-0985
1-9 $3.50 - 10 plus $3.20
26 way Cat. PS-0987
1-9 $3.95 - 10 plus $3.60
34 way Cat. PS-0988
1-9 $4.95 - 10 plus $4.50
50 way Cat. PS-0990
1-9 $6.50 - 10 plus $6.00



JAYCAR - No.1 FOR INSULATION DISPLACEMENT

NOTE! NOTE! We also carry a VERY large range of D-sub in right angle PCB and standard solder as well as any computer interface connector (not to mention power or audio) connector you are ever likely to need.

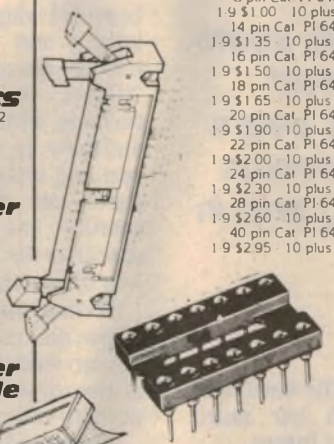
Machine pin IC sockets

By popular demand

(See our catalogue for standard production tin, gold and wire wrap sockets)

Screw M/C pin gold insert

8 pin Cat. PI-6452
1-9 $1.00 - 10 plus 90¢
14 pin Cat. PI-6454
1-9 $1.35 - 10 plus $1.25
16 pin Cat. PI-6456
1-9 $1.50 - 10 plus $1.35
18 pin Cat. PI-6458
1-9 $1.65 - 10 plus $1.50
20 pin Cat. PI-6460
1-9 $1.90 - 10 plus $1.80
22 pin Cat. PI-6462
1-9 $2.00 - 10 plus $1.85
24 pin Cat. PI-6464
1-9 $2.30 - 10 plus $2.00
28 pin Cat. PI-6466
1-9 $2.60 - 10 plus $2.40
40 pin Cat. PI-6468
1-9 $2.95 - 10 plus $2.75



GREAT NEW PRODUCTS

RS-232 Connector Products
RS-232 Mini Patch Box

★ Patch in to non-standard RS-232
★ DB25 male to female connection
★ Do-it-yourself 25 tinned ends on short leads to do your own patch
★ Instructions supplied
Cat. PA-0880

ONLY $25.95

'GENDER BENDERS'

★ Got a connector problem? With our Gender Benders you can change sex without pain.
★ Overcome non mating RS-232 cables with a Gender Bender adaptor plug!
★ All 25 pins wired straight thru

Male-toMale
Cat. PA-0882
ONLY $19.95

Female-to-Female
Cat. PA-0884
ONLY $19.95

AVTEK MULTIMODEMS

State-of-the-art multimodem - has the following data standards CCITT V.21 & V.23, BELL 103 & 202 - Data rates 300, 600 & 1200 BPS. Backward channel 75 BPS in conjunction with 1200 BPS. Computer interface CCITT V.24 (RS232C) - Power requirements 240V AC 3 watts. Talk to the world with this fine Multimodem.
Cat. XC-4820

AUTO ANSWER VERSION
Cat. XC-4822

INCLUDES PHONE

$265 **$299**

61 Note Wedge Front Keyboards

★ Actuators only, no contacts
★ Made in Italy - quality
★ Ideal for organ builders
★ Gold rod, contacts available but you can make your own easily

Normally $95.00
This month $60.00!!
A FEW ONLY
Cat. HM-3011
HURRY!!!

FM TRANSMITTER MODULE

FEATURES
★ Ultra low noise output (−60dB or better attainable with suitable tuner)
★ Excellent frequency stability
★ NOT a kit - ready for immediate use
★ Connections required: (A) Power supply or battery (B) Antenna (C) Audio input
★ Full instructions supplied
★ Suits any application where a stable low noise FM link is required

SPECIFICATIONS
- Frequency 88 - 108MHz
- Useable range - 50 metres
- Supply - 6 to 9V @ 20mA
- Input sensitivity - adjustable - max. 30mV
- Pre-emphasis - 50us standard
- Dimensions 90 x 22 x 15mm (approx)

Cat. DT-5450

ONLY $59.95

Sheet Metal Bending The Panbrake

Handles up to 16 gauge metal up to 445mm wide. Make your own chassis, boxes, brackets etc. Unique slotted upper clamping bar allows complex corner bends etc.
Cat. TM-3020

ONLY $99.50

Standard Mic Inserts

Replacement electrets for tape recorders etc. Includes data sheet and application notes. Operates from a single 1.5V battery. 10mm diameter. 50Hz-15kHz
Cat. AM-4010

ONLY $1.95 ea

Jaycar ELECTRONICS

Incorporating ELECTRONIC AGENCIES

NUMBER 1 FOR KITS

MAIL ORDER HOTLINE (02) 747 1888

N.S.W. SHOWROOMS
SYDNEY: 117 York Street. Tel. (02) 267 1614
CARLINGFORD: Cnr. Carlingford & Pennant Hills Road. Tel. (02) 872 4444
CONCORD: 115-117 Parramatta Road. Tel. (02) 745 3077
HURSTVILLE: 121 Forest Road. Tel. (02) 570 7000
GORE HILL: 188-192 Pacific Highway (Cnr. Bellevue Avenue) Tel. (02) 439 4799

QUEENSLAND: **BURANDA:** 144 Logan Road. Tel. (07) 393 0777
MAIL ORDERS: P.O. Box 185, CONCORD 2137
HEAD OFFICE: 115-117 Parramatta Road, CONCORD 2137
Tel: (02) 747 2022 Telex: 72293

SHOP HOURS
Carlingford, Hurstville
Mon-Fri: 9am - 5.30pm, Thurs 8.30pm, Sat 12pm
Sydney
Mon-Fri: 8.30am - 5.30pm, Thurs 8.30pm, Sat 12pm
Concord & Gore Hill
Mon-Fri: 9am - 5.30pm, Sat 12pm

POST & PACKING

$5 - $9.99	$2.00
$10 - $24.99	$3.75
$25 - $49.99	$4.50
$50 - $99.99	$6.50
$100 - $198	$8.00
Over $199	$10.00

COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY $13.50

BANKCARD MasterCard VISA

MAIL ORDER VIA YOUR PHONE

CDQ SOS de MGY

SS TITANIC

The wireless story

The recent news that the Titanic has been discovered lying on the floor of the Atlantic some 4000 metres below the surface has sparked interest in the disaster which occurred 73 years ago. Radio played a big part, both in the events leading up to the collision with the iceberg and in the subsequent rescue of the survivors.

by PETER JENSEN (VK2AQJ)*

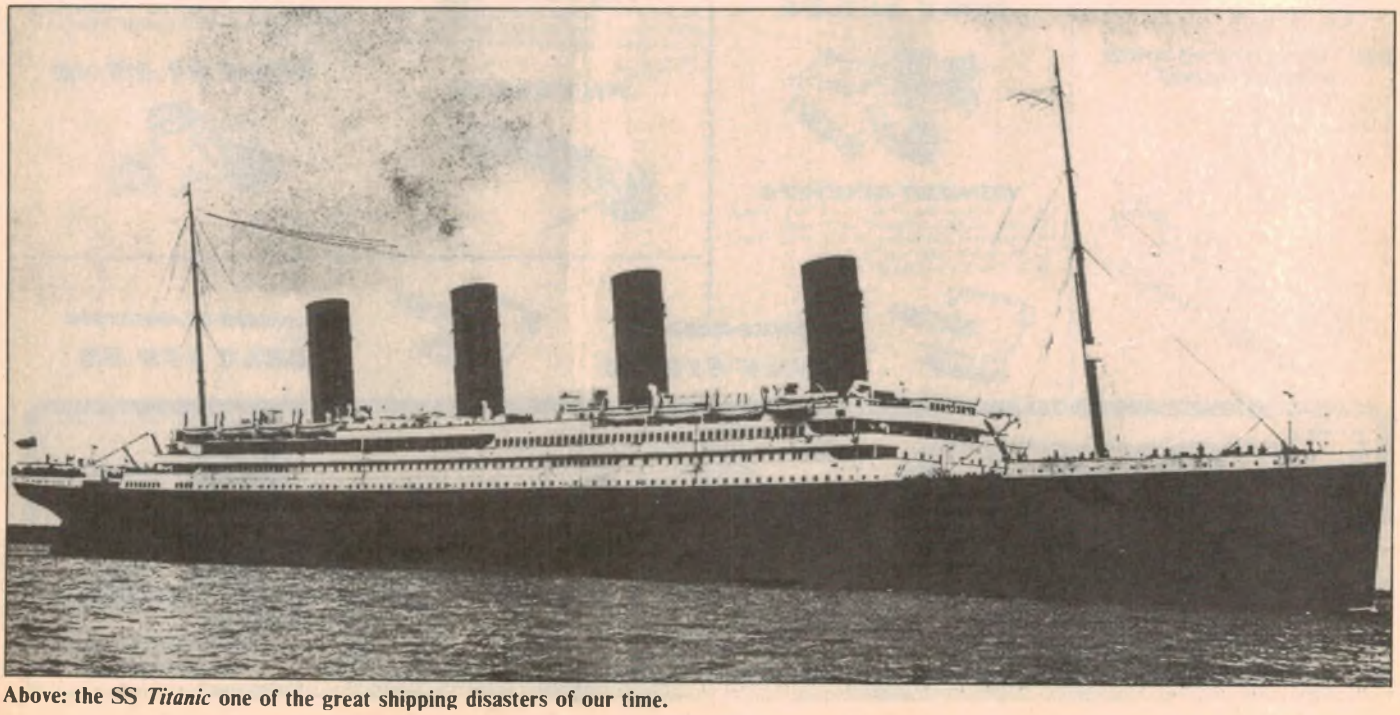
In 1912, just over 70 years ago, one sunny morning in April, the biggest and most luxurious ship in the world set sail from the Port of Southampton. It was a great occasion for all those who sailed on her and for those who watched her heading down Southampton water out to the open sea: for this was her maiden voyage. This ship represented all the wealth, happiness and aspirations of a world that had not known the horrors of a World War, and with her sailed universal hopes for a bright future.

But just as the western world was about to encounter the disaster of 1914. so too, was this ship to sail to a disaster which still strikes a sympathetic chord in the hardened heart of 1985: This was the "Titanic", the unsinkable.

Just five days later, due to a series of inexcusable errors, this grand and beautiful ship was to collide with an iceberg and within a hideously short period, plunge to the depths of the Atlantic two and half miles below, carrying with her over 1500 passengers and crew. In 1985, amidst the horrors of real and imaginary happenings, and the death and destruction that the 20th century has brought, it is hard to conceive the impact that this calamity was to produce in 1912.

Perhaps only the dropping of a nuclear device on a modern city could produce a similar reaction to that which occurred at that time following the release of the news to the public.

The repercussions of the sinking of the "Titanic" were to be felt on both sides of the Atlantic and have, in addition, a particular significance to the radio amateurs of the present day. "Titanic" carried the Marconi wireless equipment and it was universally acknowledged that the loss of life would have been far



Above: the SS *Titanic* one of the great shipping disasters of our time.

greater if it had not been available and operated with significant bravery by the Marconi trained operators.

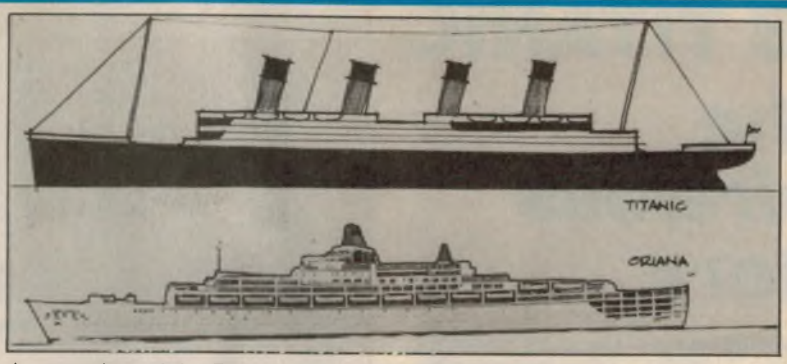
The story of the "Titanic" is, in outline, at least, known to many people. The story of how the wireless was used is far less well known. This aspect should be of interest because, despite the immense changes in technology that have occurred in 70 years, much of what happened to the people aboard the "Titanic" could easily be repeated today in any number of different but similar situations. Human nature, unlike the wireless, seems to have changed very little over the same period.

Firstly, to describe the wireless apparatus that the "Titanic" carried: even though it was only just over 15 years from the first demonstration of wireless communication by Marconi, the apparatus that the "Titanic" carried was by no means unsophisticated or unreliable. The transmitter certainly operated by means of a spark but this was not the low power, high voltage spark generated by an an induction coil that Marconi had used originally. On the contrary it was a strapping, youthful, crackling five kilowatt spark dancing across the points of a rotary disk discharger. This device was designed to produce what was known as a "heavily damped" spark.

When a spark is struck normally the oscillations that accompany it gradually die away until they approach zero volts. However, with a heavily damped spark, after the first few cycles of oscillation, an instant return to zero volts was achieved by a number of different techniques such as high velocity air to blow the spark out, a series of heat absorbing plates between which a series of sparks jumped, and the final system involving the disk discharger. It is interesting to note that the disk discharger was the forerunner of the last and most sophisticated form of spark device invented by Marconi.

This consisted of a rotary plate driven by a motor at high speed with two other smaller rotary plates set at right angles to the face of the disk, also driven at speed, between the faces of which danced an extremely short lived spark. This produced an oscillation very nearly comparable with the continuous wave produced by an electric arc or later, when valves had been invented, from a power triode.

Due to the noise output from the spark apparatus it was generally housed in a separate transmitter room away from the receiver and CW key. In the case of the "Titanic" the apparatus was powered by a motor generator fed from the 110V DC ship's lighting system. In an emergency, the transmitter could be switched over to utilise an oil driven engine, erected on the boat deck, and in addition a battery of accumulators was available as an ultimate standby.



A comparison of the *Titanic* with a modern ship, the *Oriana*.

Comparative Statistics TITANIC AND ORIANA

	TITANIC	ORIANA
Tonnage (Imperial)	46,328	41,900
Length overall	882 feet (268.8 metres)	803 feet (245.6 metres)
Breadth	92 feet (28 metres)	97 feet (29.5 metres)
Number of Passenger Decks	7	11
Number of Passengers and Crew	2206 1500 Drowned 706 Saved	2440

In common with all spark detecting apparatus of the early days the receiving apparatus was of extreme simplicity without any form of amplification of the radio frequency energy received. The "Titanic" appears to have been equipped with the Marconi magnetic detector which operated on the application of magnetic hysteresis and was driven by clockwork. The detector is illustrated. This type of detector was highly reliable and not as sensitive to vibration as other forms of detector like the Galena or Carborundum detectors which were available at the same time. However, the "Maggie" as it was called was somewhat less sensitive than these other forms of detector.

The accompanying photograph shows the senior operator of the Marconi apparatus sitting at the operating table. In front of him are a receiving set and against the wall is a large induction coil which no doubt served as a part of an emergency radio apparatus of considerably lower power than the main transmitting set.

The receiver and transmitter were capable of operation on wave lengths between 300 and 2500 metres. In frequency terms this would be between one megahertz and 120kHz. Because of the simplicity of the apparatus used, selectivity was almost irrelevant. The result of this was that interference and jamming were inevitable between the various users of the radio frequency spectrum. Again, in spite of the simplicity of the apparatus and in spite of problems of mutual interference, the ranges obtained were very considerable.

During the daytime it appears that the "Titanic" was able to receive over distances of between 250 and 400 miles and at night time occasionally was able to span a distance of some 2000 miles. As the ship was of substantial size, it was able to carry a most substantial antenna system. This consisted of a twin-T antenna supported on masts 200 feet high and set some 600 feet apart at each end of the ship. An earth connection to the wireless apparatus was provided by means of an insulated cable clamped to the vessel's hull below water line. The general arrangement of the transmitter and receiver equipment used on the "Titanic" is of the sort illustrated in the accompanying diagram.

Shore-based communication was provided by two stations at this time, one located in Ireland at Clifden and the other at the American end at Glace Bay in Nova Scotia. These land base stations employed enormous transmitting equipment having powers in the order of three and four hundred kilowatts. Indeed the transmitting apparatus and antennas, together with the power stations, resulted in buildings and equipment which resembled modern power generating stations in scale. The antenna, or aerial, as it was then known, consisted of a series of parallel strands running away from the factory-type building to a distance of approximately one mile and

SS TITANIC
The wireless story

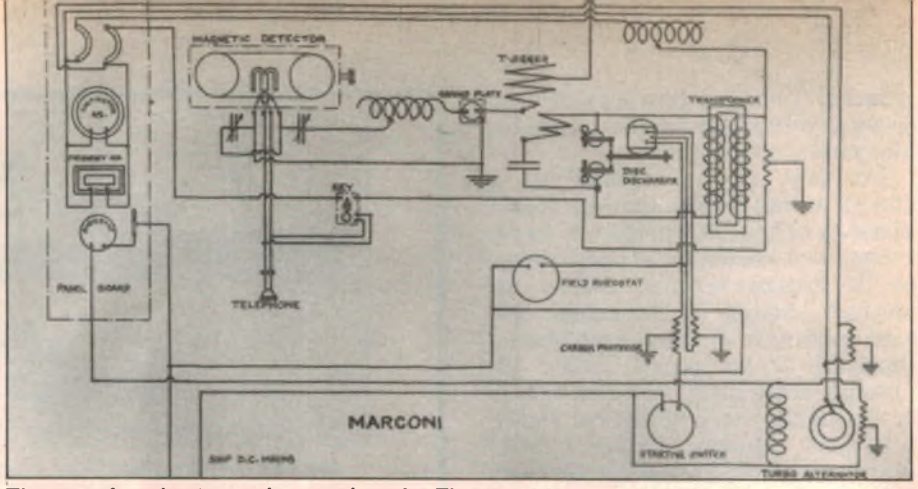
represented one of the early forms of high gain antenna, again invented by Marconi.

With this immense and powerful apparatus it was possible for ships on the run from Europe and the United Kingdom to America to maintain contact with either east or west shore station for the duration of the cross-Atlantic trip.

Quite apart from the problem of mutual interference due to the broad-banded character of the receiving and transmitting gear, at this period there was intense rivalry between the major manufacturers and suppliers of wireless apparatus. This produced a situation where lack of co-operation, except perhaps in an emergency, was the norm. Indeed, outright mutual abuse was extremely common as efforts to transmit messages were interrupted by interference and jamming from other stations.

This problem and the attitude that it produced amongst wireless operators of that day was to contribute to problems that the "Titanic" experienced. In addition, as the ship was on its maiden voyage and had sailed to the accompaniment of intense publicity and jubilation, it was to generate and receive an enormous number of communications up to the time that disaster struck. One further technical problem occurred with the wireless and this was to significantly contribute to the later difficulties.

Late on the day of departure from Southampton the wireless operators discovered that their transmitter was not operating correctly. Initially, the Senior operator, Philips, believed that one of the main capacitors (condensors as they were then known) was defective and as a result they were removed from the transmitter for examination. However, this did not prove to be the cause of the fault and the two operators, after nearly six hours of work, traced the problem to the leads of the transformer secondary which had shorted out to the iron casing of the transformer, accordingly shorting out most of the current being generated. After carrying out repairs involving insulating tape, the transmitter was finally made operational and the two operators were left to deal with the backlog of messages for transmission and reception that had occurred during the previous six hours. Prior to the fault developing with the transmitting apparatus, the French liner "Touraine" had been in communication with the "Titanic" and its messages had warned of ice encountered. Further messages were received in the following two days and at 7.30pm on the 14th a message was picked up as transmitted from the "Californian" to the "Antillian". This message said "6.30pm apparent ships time. Latitude 42°3′ north, Longitude 42°9′ west, three large bergs five miles to the southward of us".



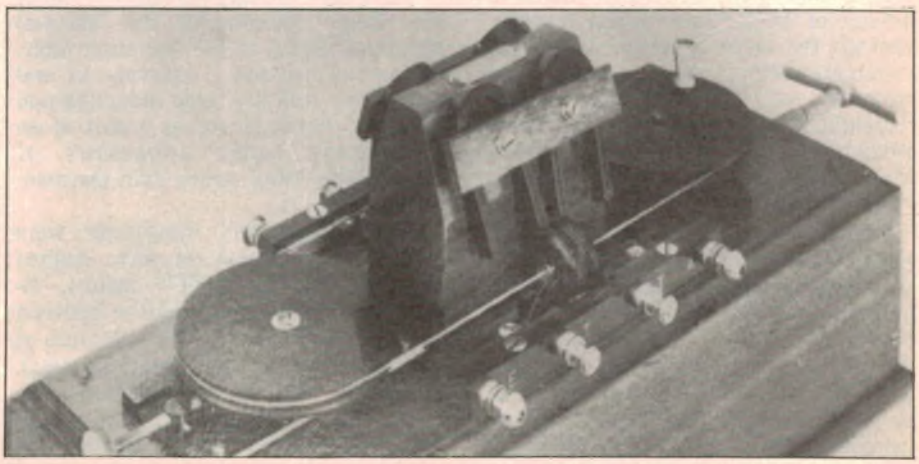
The type of receiver/transmitter used on the *Titanic*, a Marconi.

Apart from receiving such messages relating to the safety of the ship the two wireless operators were inundated with congratulatory messages being received and messages sent by the passengers. Later, on the evening of the 14th at about 9.40pm, contact was made with the Nova Scotia station at Cape Race and following this a larger number of messages were transmitted and received, the work appearing to have been cleared at about 11.30pm. At this stage it appears that the ship was running at the highest speed it had ever obtained, some 22½ knots.

Just after 11.40pm the fatal iceberg loomed out of the haze and darkness and in spite of orders from the bridge to reverse engines and bring the ship "hard a starboard" it was too late. With a barely perceptible jar and with an ominous but not very loud rumbling noise, the "Titanic" struck. The damage caused was immense. A spur of ice, below water line, was to tear a jagged rent along the side of the ship for nearly three hundred feet and it was this length that was to seal the ship's fate. As a result of the extent of the tear through the steel hull, water was able to penetrate into six of the watertight compartments provided as a safety measure. It was the flooding of this large number of compartments that was to prove fatal for, due to the number, the ships pumps were unable to combat the sheer volume of water pouring in.

Also, and in comparison with modern ships, the compartments of the "Titanic" were not really wateright since they did not seal against the underside of A-deck. As water filled each compartment it was able to spill over into the next compartment. Once it became apparent that the pumps could not keep pace with the quantity of water entering the six forward compartments, the "Titanic's" sinking was inevitable.

In the wireless cabin at around about midnight the operators had changed over. The younger operator, Bride, had taken over the key and his senior, Philips, was getting ready to turn in when the Captain suddenly appeared at the



The 'Maggie' or magnetic detector.

Dollar Devaluation? Not at Sheridans!!

Electronics Galore! 1001 Stupendous Bargains!

RS232C Connector Sets

25 way RS232 connector sets at massive savings. Complete set with plug, socket and hood. Grab them now at a fraction of the normal price.

only $4.95 complete set

Resettable Counters.

ALL NEW

Brand new stock! These counters operate on 12V DC. 50mA at up to 10cps.

only $10

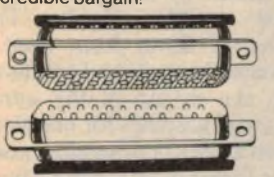
DIP Switch sale

Top quality .1" DIL type DIP switches going out at tiny prices.

10 way . . 5 for $6.00
5 pole . . . 5 for $4.75
3 way . . . 5 for $3.75

I.D.C type D-Submini Connectors

Perfect for the latest 'flat cable' I.D.C. connection cables. 25 way plug and socket. What an incredible bargain!



only $12.00 THE PAIR

Save 66% on Philips & Sprague Electros

LAST FEW!!

Philips and Sprague at crazy prices. All brand new unused stock.

10,000uF/40V. $6.00
22,000uF/10V. $4.00
47,000uF/10V. $5.00
100,000uF/10V . . . $6.50

300V/150A Stud Rectifiers below Wholesale!!

Astounding savings. 300V forward voltage only. All brand new stock. Very limited stocks. Be quick.

only $7.50
5 for $32.50

"Sizzling Chips" Specials

Top brands

3764 (4164) Dyn. RAM	$2.50
2732 4K x 8 EPROM	$4.50
2764 8K x 8 EPROM 250ns	$5.50
27128 16K x 8 EPROM 250ns	$19.00
2114 1K x 4 Static RAM	$1.50 10 $1.30 each
6116P3 2048 x 8 Static RAM	$5.50
8085 CPU	$7.50
8212 Display Driver	$3.40
8255 P.P.I. for 808-8085	$4.80
Z80 PIO	$5.00
MC1458 D.I.L. Dual Op-amp	70c
MC1458 Can type Dual Op-amp	60c
CA3086 Transistor array	75c
74121 Multistable Multivibrator	50c
4013 Dual type flip-flop	50c
MC1488 RS232 Driver	$1.00
MC1489 RS232 Receiver	$1.00
2532 EPROM	$7.00
7442 BCD to DEC/DEC-Driver	$1.00
4001A Dual 3 input NOR gate	10 for $1.25
4020A 14 bit binary counter	10 for $2.25
4020B Ditto ceramic package	$1.80

Telephone Plugs and Sockets

Plug $2.25

Socket $3.50

Relays at the Right Price

Type HH62. 24V AC or DC operation. Plug or solder type. 2 pole changeover. Contacts handle 8A/30V DC or 10A/240V AC.

Type HH54. 24V AC or DC. Solder type. 4 pole changeover contacts. Contacts handle 3A/30V DC or 240V AC.

only $2.00
10 for $18.00

Triacs and SCRs at massive savings.

We have limited stocks of top quality Teccor brand SCRs and Triacs at massively reduced prices. Order now to avoid disappointment.

Q6025H TRIAC 600V 25A 1/2" stud gated triac $3.50
Q4025H TRIAC 400V 25A 1/2" stud gated triac $3.00
Q4015H SCR 400V 15A 1/2" stud non-sensitive gate $2.00
Q4020L SCR 400V 20A TO220 non-sensitive gate $1.50
T106D1 SCR 200V 4A TO220 sensitive gate $1.00
Q4001L4 TRIAC 400V 1.6A TO220 $1.25

BARGAIN PACKS

1 Fuse Pack. 50 assorted 3AG & 2AG glass fuses in both fast acting and slow blow. All useful types. Normally 25c each. Our special price only: **$6**

2 Disk Ceramic Pack. 60 assorted values. From 10pf to .1uF. 100V to 630V. What astounding value. **$3**

3 Polyester Capacitor Pack. 60 assorted types from .001uF to .22uF 100V. **$6**

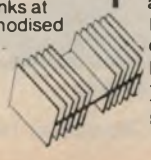
4 1% Resistor Pack. High grade Takman 1/4 watt types. 300 mixed types that would normally cost around $22.00. **$12**

5 Monolithic Cap Pack. Now here's value. Mini Bypass caps manufactured by Emcon USA. 50 assorted types from 12pF to 270pF 100V. In radial and axial types. Worth at least $15.00. **$7**

Heatsinks

Philips 40D3CB heatsinks at bargain prices. Black anodised finish. **5 for $13.50**

only $3.00



Save a fortune on semis

Enquire for Prices on Larger Quantities

A14A Glass diodes 100V 1A **10 for $1.00**

IN914 (IN4148) Diodes **100 for $2.50**

BC548 Transistors **10 for $1.40**

BC549 Transistors **10 for 90c**

BC559 Transistors **10 for 90c**

TIP29B Transistors **10 for $3.50**

BC557 Transistors **10 for 90c**

BC332 Transistors **10 for 90c**

BC109/BC337 Transistors **10 of each (20) $3.00**

Crystal 6MHz **$2.50 each**

Crystal 32.768 Clock Xtal **1.25**

Crystal 4433.619KHz Colorburst **2.00**

Handheld Telephone

only $9.95

We are offering these for component value only

A mine of useful parts. Originally produced for Plessey. Contains miniature speaker, electret microphone, ICs, caps, superb keypad, LED, Xtal etc.

Turntable Motors $2.00

5 FOR $7.50 P&P $6.00

240VAC/50Hz Garrard motors complete with 3 speed spindle. Keep your turntable rotating reliably!

20W/8 ohm Horn Speaker

Super efficient reentrant horn speaker. Weather resistant plastic frame.

only $22.00

SHERIDAN ELECTRONICS

DEPT EA5 164-166 Redfern Street, Redfern NSW 2016
Phone (02) 699 5922
699 6912
Mail Orders to: DEPT. EA5
PO Box 229 Redfern NSW 2016

Mail Charges:

$5.00-$9.99	$3.50
$10.00-$24.99	$4.00
$25.00-$49.99	$6.00
$50.00-$99.99	$7.00
$100.00 or over	$8.00

Trading Hours:
Mon-Fri 9am-5.30pm
Thurs 9am-7pm
★Saturday 9.30am-1pm
(until further notice)

Note: We accept both Bankcard and American Express. However we cannot give quantity discounts on Credit Card purchases or account orders. Minimum for account orders is $50.00
Minimum order is $10.00
exclusive of postage and packing

Large and overweight items sent skyroad freight

SS TITANIC
The wireless story

doorway. He said "We've struck an iceberg and I'm having an inspection made to tell what it has done to us. You had better get ready to send out a call for assistance, but don't send it until I tell you".

The Captain returned to the bridge and the two operators were left to discuss this announcement. About 10 minutes later the Captain reappeared briefly and said "Send the call for assistance". When Philips asked him what sort of assistance call he should send. The Captain replied "The regular international signal. Just that." Immediately Philips turned to the operating key and sent out the general distress call CQD six times followed by the "Titanic's" call sign MGY and the vessel's approximate position. Then he sent "Have struck an iceberg. We are badly damaged. Titanic position 41°44′ north 50°20′ west." This call was received by several ships and also by Cape Race.

A little later the Captain returned and asked "What are you sending?" to which Philips replied CQD. Bride suggested "Send SOS, its the new call," and laughing grimly he added "It may be your last chance to send it." When the Captain had gone back to the bridge Philips started to send out the revised distress call. "CQD CQD SOS SOS CQD SOS, come at once we have struck a berg. CQD OM position 41°46′ north 50°14′ west CQD SOS." The message was initially received by the German ship "Frankfurt" and shortly afterwards the Cunard liner "Carpathia" also replied.

It appeared that "Carpathia" was the nearest ship of those who had responded and was lying some 58 miles to the southeast. Presently a message came from the Captain of the Cunard line ship indicating that he had turned to assist the "Titanic" and was making all possible speed. The two operators continued to send distress messages and at about 1.30am the Captain returned to the cabin to tell them that the engine room was flooding and that the ship's power supply might not last much longer. This news was passed to the "Carpathia" and the senior operator, Philips, continued to send messages to ships in the area until some time later the Captain appeared to say that they should abandon ship as their duty was done. Captain Smith said: "You can do no more, abandon your cabin, now. It's every man for himself and you look out for yourselves. I release you."

However, rather than rushing away the two wireless officers obtained some candles in preparation for the loss of power but in the event they were not necessary. The generators did not finally fail until very shortly before the ship's final plunge and accordingly it was possible to continue sending messages until very shortly before the end. During the last awful 15 minutes, Senior Operator Philips continued to send messages despite the progressively weaker and weaker signal. In addition the two operators maintained their "procès verbal" which was the maritime version of a log.

Finally, when it was quite obvious that the ship was very close to its final moments, the two men ran out of the radio cabin and to the strains of the ship's band playing "rag time", Bride scrambled up the steeply sloping deck around the back of the wireless cabin and finally plunged into the frigidly cold Atlantic. His senior, Philips, ran down the boat deck in the other direction and was never seen again. As Bride struggled in the water he could hear the band still playing and as the ship's angle increased

The wireless operating room of the *Titanic*.

Senior Wireless Operator Philips of the Marconi Company.

prior to its final disappearance he heard the music change to the hymn "Autumn".

Together with Senior Operator Philips, there died in the icy water of the Atlantic Ocean that night over 1500 passengers and crew. Wireless operator Bride was one of the fortunate few who lived to tell of seeing the lighted port-holes of this grand ship blinking briefly as they slid beneath the waves. Perhaps those that went down with the ship were the lucky ones. For those that survived for a while, struggling in the water, the end was far slower in coming and far more agonising.

As one survivor reported: "Within the area described, which was as far as my eyes could reach, there arose to the sky the most horrible sounds ever heard by mortal man except by those of us who survived this terrible tragedy. The agonising cries of death from over a thousand throats, the wails and groans of the suffering, the shrieks of the terror stricken, the awful gaspings for breath of those in the last throes of drowning, none of us will ever forget to our dying days."

If this was not bad enough, the aftermath represents perhaps one of wireless communication's blackest episodes. The following day it was discovered that a ship, the Leyland Line "Californian", had lain, stopped in the ice, not more than 10 miles from where the "Titanic" had gone down. Ironically the same ship had, through its wireless operator, Mr Cyril Evans, issued an "ice" warning to the "Titanic" the previous day. However his low power signal had represented jamming of the "Titanic's" communications with Cape Race and he had been abruptly asked to cease transmission so that it would not be interrupted.

The "Californian" had aboard a single radio operator. When he went off watch in the late evening, the "Californian" lay inert and entirely deaf to the pleas for help coming from the "Titanic". Much of the blame for the loss of life was inevitably placed upon the Master of the "Californian" and his radio operator who was blamed for failing to keep watch in the face of an apparent emergency. Very easy to lay the blame after such an event. To be charitable, it is easier to understand and forgive the actions of those aboard the "Californian" in a period when disasters and immense loss of life seem far more a common occurrence despite great technological sophistication of radio and other electronic apparatus.

However, significantly after this dreadful disaster and the subsequent discovery of the "Californian's" close proximity, international agreements were reached as to safety procedures for ships at sea. In particular, a single frequency of 500 kilohertz (600 metres) was defined for emergency purposes. Further, all ships at sea were required to maintain a 24 hours a day watch upon this frequency. Despite the failure of wireless in the case of the "Californian" there is no doubt that, in other respects, it is the factor that saw those that survived in the lifeboats rescued from the fate that attended so many others.

It is clear that the safety of the remaining passengers lay directly to the credit of wireless and in particular to the Marconi company, the apparatus of which was to be found on most ships of that period. The British Postmaster General was to say at that time: "Those who had been saved had been saved through one man — Mr Marconi."

This rather poetic statement to some extent diminished the position of the real heroes of that freezing night who were evidently Senior Wireless Operator Philips and his assistant Bride, who were to use their spark wireless to the very end.

References:

"The Maiden Voyage", Geoffrey Marcus 1968.

"Syntony and Spark — the Origins of Radio", Hugh G. J. Aitken 1976.

"An Elementary Manual of Radio-telegraphy and Radiotelephony", J. A. Fleming 1916.

"Manual of Wireless Telegraphy (Radio) for the Use of Naval Electricians", Commander SS Robinson 1913.

"Vintage Radio", Morgan E. McMahon 1973.

"Guglielmo Marconi — 1874-1937", Keith Geddes HMSO 1974.

"Handbook for Wireless Telegraph Operators", HMSO 1916.

ALL THOSE BITS AND PIECES YOU'RE ALWAYS LOOKING FOR . . .

HOBBYIST'S BARGAINZA

TOP TOOLS!

DSE Desoldering Tool

Wow! A fully self contained 240V 30W desoldering station. And it's at a DSE bargain price! It's simple and clean to operate and features quality components and rugged construction. Ideal for home, workshop, lab, etc. Don't miss this incredible value! $69
Cat T-1340

Mini Drivers

This really is a miniature screwdriver! Ideal for small jobs like the magnetic cartridge in your turntable, jewellery etc. Yes they are that small! **L-30mm, D-1.6mm, H-25mm × 7mm**

Cat T-4010 ... **FLAT BLADE ... 50c** ~~85¢~~
Cat T-4020 ... **PHILIPS ... 50¢** ~~75¢~~

Pearl Catch

For reaching into awkward places. 3 pronged tweezer with syringe action. A must for small nuts, washers etc. Great for serviceman, jewellers, hobbyists, etc. Cat T-4660 $3.95

TV Alignment Kit

~~$3.50~~

A versatile four general purpose tools to cover all shapes & sizes of cores. They are made from tough plastic. Cat T-4540 $2.99

Heatsink Clip Set

Spring loaded, plier grip clips for heat sensitive components and leads. Cat T-2620 ~~$3.25~~ $2.99

ETCHING KIT

Incredible value: a pack consisting of Ferric Chloride, Dalo PC pen, resin (flux), a sample of PC board plus instructions — at less than the price of the etchant and pen on their own! And the Ferric comes in handy 500ml bottle. H-5650 $8.95

BEST BOOKS!

Transistor Spec. Manual

Tells you how to read specifications then gives you specifications in detail Cat B-4508 ~~$12.50~~ $9.95

Transistor Equivalents

This reference book enables the user to find substitutes for approximately 9,500 European, American and Japanese transistors. ~~$6.85~~ $5.95

Australian Amateur Callbook

~~$6.45~~ $5.95

Compiled by the WIA from official DOC lits, together with registed SWL's and Papua New Guinea amateurs. Cat B-2322

Foreign Radio 1985 Callbook

WERE ~~$32.50~~
NOW $29.50 each
Cat B-2185

US Radio Amateur Callbook 1985

World Radio Handbook

The most thorough and complete listing of internation radio and television stations. Cat B-2085 ~~$32.50~~ $19.95

KITS KITS KITS KITS KITS

Beat Triggered Strobe

A beat triggered strobe that comes complete with case, reflector, PCB, everything! It's so simple to build and has adjustable sensitivity. Cat K-3153 $59

Want AM Stereo?

Don't throw out your old tuner . . . build an AM stereo decoder instead. Save $$$$ and get the latest sound. Get the lastest without spending a motza! Full fitting instructions included. Cat K-3415 $39.95

Deluxe Car Alarm

Cheap insurance for your vehicle! Cat K-3252 $64.95

Brake Lamp Flasher

You've seen those snazzy lamps that mount on the parcel shelf and flash when you brake? A great idea for road safety, too: you cannot avoid the flashing! Now you can build your own with this simple kit — and save $$$ on the commercial units. Flashes the lamp three times before holding on. Uses our A-8520 Rear Window Brake Lamps (at extra cost!)
Cat K-3245

$14.95

COMING SOON! 4 Channel Mixer to Build

Yes: a deluxe four channel mixer — ideal for bands, pa, churches & groups, etc. Coming next month — don't miss out on this one. Easy to build — and you'll save
Cat K-3036

1GHz Frequency Counter

Great value for a superb 8 digit counter with an enormous range of up to 1GHz! A professional device at an affordable price. The robust, functional design make this unit ideal for the lab, technician, workshop or professional hobbyist. The large bright display and logical layout allow the job to be done quickly and efficiently. Cat Q-1315 $499

Trio CS1021 20 MHz Dual Trace CRO

Famous brand TRIO — fantastic DSE value. Top quality CRO for all general service work — and for the serious hobbyist. And even better value: we throw in two sets of top quality probes. Amazing value — call in for a test drive.
Cat Q-1255 $799

Shortwave Antenna Kit

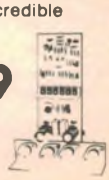
Get the best reception from your receiver with this high quality short wave antenna
Cat K-3490 $16.95

Two Great Mosfet Amps

Wow! Now you can have a 60W or 100W Mosfet module amp at a fraction of the cost of a commercially produced unit. These high performance general purpose amp kits are intended for use in a variety of applications and offer performance, reliability and versatility at an incredible price.

60 Watt Mosfet
Cat K-3441 $49

100 Watt Mosfet
Cat K-3443 $69



Hand-Held RC Oscillator

~~$89.50~~
Cat Q-1220

A really worthwhile addition to your test gear: a hand-held oscillator that's small enough to take anywhere. About the same size as a digital multimeter, it gives you 23 ranges of sine & square waves (switchable) between 20Hz and 1.5kHz, plus a x100 range: 46 settings in all. Continuously variable amplitude and a -20dB attenuator built in gives total control. And you can sync the signal if you wish. Output is standard 600 ohms.
Complete with clip test leads.
$79.50

AMATEUR BARGAINS

2m Choice:

At last! Total control, total flexibility in a hand-held! That's the new FT-209 series of 2 metre transceivers from Yaesu.
Your choice of transceiver/battery combination to give the power — and the features — that you want!

FT-209R (lower power version) Cat D-3502 — **Limited Stock** $439

FT-209RH (High Power version) Cat D-3503 — $449

FNB-3 10.8V/ 425mAh NiCad.

$65

Similar package to above, but containing a 10.8 volt NiCad Battery. Includes provision for charging without removal from hand-held. Instant removal & connection. Cat D-3506 $59

FNB-4 12V/ 500Ah NiCad

Slightly larger to above pack, gives full 12 volts for when highest power is essential (up to 5W out on the FT-209RH!). Also includes charging provision. Cat D-3507 $79

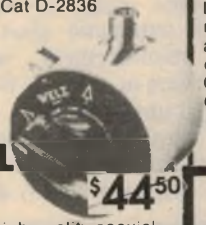
$89

Air Band VHF Radio & AM/FM!*

Operates from 4 penlight batteries (supplied), with telescopic whip antenna for aircraft band and internal ferrite rod for broadcast band.

$29.50 Cat D-2836

- **Receives both AM/FM on VHF band.**



COAXIAL SWITCH

$44.50

At last! A really high quality coaxial switch suitable for all HF, VHF & UHF (900MHz) uses. Made by Welz in Japan. Cat D-5208 $39.50

Amateur Radio and Electronics Study Guide Cat B-2319 ~~$12.95~~ $9.95

Linear Amplifier

Don't pay $120 or more! This amp does a better job and will cost you less. This is an all mode, high efficiency linear amplifier for 2 metres. 30 watts output with only 3 watts in. 13.8 volt DC supply makes it perfect for mobile use. Dual time constant for SSB or FM operation. Reverse polarity protection too. Works great with our FT290R and FT208R or any 2M transceiver with up to 3 watts out. The best value in Australia!. Cat D-2546 ~~$95~~ $89

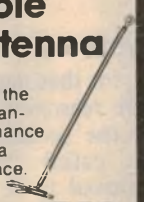
MW/FM/SW 6 BAND

The economic receiver with the deluxe features. Like 6 bands covering standard AM & FM broadcast PLUS 4 shortwave bands: 2.3 - 4.1MHz, 4 - 7.5Mhz, 7.5 - 15MHz. And a protective 'soft feel' carry case. Slide switches and controls. And best of all, it comes **complete** with quality stereo headphones - at **no extra charge!** $69 Cat D-2835

Regency HX-2000 Hand Held Scanner

At last! A hand-held, go-anywhere scanner that doesn't sacrifice any of the performance of the 'fixed' type. In fact, it does better than many other scanners: up to 525 MHz including aircraft band! **and** it gives you 20 memory channels! **NiCad Batteries included!** Cat D-2815 $475

Helical Dipole Scanner Antenna



Designed by a scanner expert especially to suit the bandwidth of today's scanners, it features performance approximately equal to a quarter wave in free space. Cat D-4432
Get the most from your scanner $57.50

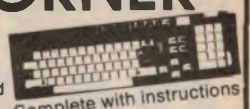
115V Stepdown Transformer

Input 240V AC and secondary voltage 115V AC @60VA with 7% regulation The unit is fully encased and has fuse protection for the output. Heavy duty carrying handle and socket outlet. Weight 2.9kg. Cat M-1156

NOW ONLY $59
WAS $67.50

BARGAIN CORNER

Digitran Keyboard



Get a load of this one: famous US brand keyboard and the manufacturer had to quit the stock. His loss is your gain. Not just a keyboard -the best keyboard we've ever seen. 98 keys (yes, 98!)but that's not all! Also includes decoder board with speaker and buzzer. What a bargain! Cat J-1008
Complete with instructions
$39.95

Computer Flash Innards

A complete "computer flash" insides, ready to build into a case, use as a strobe, etc etc. As used in photographic kiosks - manufacturer's rejects but most work perfectly. And if they don't the fix is pretty easy (circuit supplied). Cat J-1002 $9.95 ~~$14.95~~

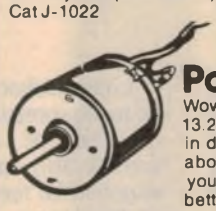
PCB with relays

Top value. Brand new computer spare parts pcb's with dozens of resistors, capacitors, etc PLUS six ultra high quality heavy duty relays. About $9.50 value: Look at our price. Cat J-1007 $1.99 ~~$9.50~~

Philips 2-way Crossover

More bargain buying! How much would a quality crossover normally cost? $15 or $20?? Look again. Philips made, ideal for most hi fi use - and they're so simple to fit (goes inside your speaker box). Cat J-1022 $7.50

and that's not all! Buy one . . . get one FREE! Perfect for stereo



Power Plant!

Wow! Quality Matsushita brand (ie National Panasonic) 13.2 volt DC motors. With 2.5mm shaft, they're 45mm in diammeter and ideal for those larger projects. Talk about torque — you can't stop these beauties with your fingers. You won't find better value! Cat J-1018 $1.95

100 transistors for under ten bucks!

Value: transistors less than 10 cents each. Quality, branded small signal transistors (data available) in a handy pack so you'll have some around. Cat J-1037 $9.90 pack

The Big Guns

The incredible Molon reluctance synchronous 230 volt motors. Heavy duty cast-iron outer casting, they're quality manufactured in the USA. With an 8mm shaft they're ready for the big jobs. Cat J-1016 $14.95

TARZAN FAN

Wow! This is an unprecedented price — stocks are limited so hurry! Genuine Tarzan 17cm Rotary Fans from the USA. The highest quality at this ridiculous price! Cat J-1009 $29.95

Micro Switches

99¢

Quality microswitches with positive switching action! These are ideal wherever a limited switching movement is required. Don't miss this great deal! SPDT, 5A 12V or 3A 250V rating. Cat J-1004 79¢

Scotchlock

Genuine 3M Scotchlock brand connectors type UG. They're the ones used by Telecom! Now at a BARGAIN price! Cat J-1020 $1.99
PACK OF 10 ONLY

Looking for your nearest Dick Smith Electronics store?

There's an insert in this issue with all store addresses listed . . . and don't miss the bargains while you're there!

DICK SMITH ELECTRONICS

Making speakers understood Pt.2:

PA loudspeakers must be designed for the job

Part one of this article was devoted mainly to a discussion of microphones and the necessity for people to use them intelligently. In this second article, we concentrate more on the equipment itself, with particular emphasis on the other end of the chain: the choice and placement of the loudspeakers.

by NEVILLE WILLIAMS

It was pointed out in the last issue that, to minimise problems with acoustic feedback, the microphone(s) should normally have a cardioid or unidirectional response pattern and be positioned so that they favour the wanted sound and ignore, as far as possible, sound propagated from the loudspeakers.

Ideally, the loudspeaker systems should also exhibit directional properties, so that they project most of their output towards the audience, and as little as possible back to the microphone(s) or into unoccupied areas of the building.

The point behind this last remark is that sound projected needlessly into a lofty ceiling or roof area, or even against a high, flat back wall, may produce reflections and echoes that can aggravate acoustic feedback and seriously prejudice intelligibility.

Unfortunately, it is difficult, in practice, to produce a loudspeaker system which combines anything like optimum directional properties with smooth frequency response, adequate power handling capacity and manageable dimensions — especially given the constraints of a small local church or hall.

To be sure, ordinary cone loudspeakers do normally project frequencies above about 5kHz as a forward beam but, at the vital middle and lower frequencies, the sound energy tends to diverge widely, so that it can no longer be directed selectively towards the audience. This is of little consequence for home hifi listening but it can pose a real problem in the context of public address.

Loudspeaker systems for PA work can be made somewhat more directional with the aid of short metal flares, or considerably more so by the use of exponential metal horns — but normally at the expense of both sound quality and appearance. In general, flared and horn loudspeakers are acceptable for announcements at sports meetings, &c, but not for situations where something more is required than mere intelligible speech.

Line source systems

For indoor use or, for that matter, for outdoor events where reasonable sound quality is essential, the so-called "line source" (sometimes called "column" configuration) has proved to be a very practical approach.

Basically, it involves mounting a number of identical cone loudspeakers — typically four or more — in a vertical array and feeding them so that their cones operate in phase.

(Ideally, the top and bottom loudspeakers should receive somewhat less drive than those in between but this is a refinement rather than a necessity.)

The line source configuration does not significantly modify the horizontal propagation pattern and the mid- and low-range sound still diverges to left and right, much as from a single loudspeaker. However, in the vertical plane, sound pressure waves from the multiple in-phase cones tend to cancel in terms of upward and downward propagation but to add straight ahead. The end result is a somewhat flattened, fan-shaped beam, as illustrated in Fig. 1, (a) being a plan view and (b) a side elevation.

This makes it possible to position and incline a line-source array so that it will project a large proportion of the sound in a fan-shaped segment, from slightly above, out over the audience. In effect, the sound can be directed broadly to where it is most needed, and minimised in the roof and upper wall areas where it can cause the undesirable reflections and echoes mentioned earlier.

The potential advantage is such that line source systems have become a virtually automatic choice for indoor speech reinforcement, with ordinary loudspeakers in ordinary boxes a poor — and often unsatisfactory — second.

In large scale professional installations, line source systems may involve anything up to a dozen high-

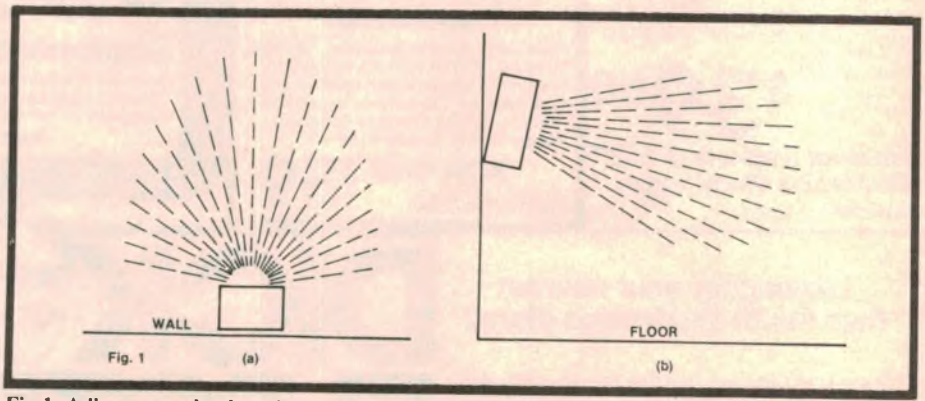


Fig.1: A line source loudspeaker system has much the same horizontal coverage as a single driver (a) but is more directional in the vertical plane (b), resulting in a fan-shaped beam, which can be directed towards the audience.

power general purpose drivers, often with an adjacent array of tweeters to reinforce the high frequencies and even non-directional sub-woofers to boost the low-end bass. In this article, however, we concern ourselves mainly with simpler arrays, more likely to interest non-professional readers.

For modest local installations, a system comprising four identical general-purpose round or oval loudspeakers is a convenient and frequent choice (Fig. 2). They can provide a quite effective line source system and can very conveniently be wired in series-parallel, as per Fig.2a, to present the same nominal impedance to the amplifier as that of a single driver.

Enclosure problems

Figs.1 & 2 both assume that the drivers are mounted in a tall, narrow enclosure and this is normally the case except where the array can somehow be accommodated within the structure of the building — an interesting possibility to which we will refer again later.

Where, as normal, one or more separate loudspeaker enclosures have to be mounted in a prominent, unobstructed position, facing the audience, it usually becomes imperative to keep them as neat and compact as possible so that they can be detailed to blend in with the rest of the furnishings.

This requirement invokes the kind of problem discussed at some length in the June 1985 issue ("Baffles, Boxes, Boffles and Vents"): that of conserving the low frequency response from typical loudspeakers without having to resort to an unacceptably large enclosure.

With a line source system, the problem becomes more demanding than ever: that of conserving the low frequency response, assuming a mandatory very small enclosure and the need to accommodate at least four drivers, and four times the active cone area! While one might hesitate to say "impossible", it would nevertheless not be too far from the truth for the average installation.

With rare exceptions, one has to abandon domestic hifi ideals (flat down to 40Hz) and the associated purist calculations to do with driver parameters, enclosure volume, port size, &c. It becomes, rather, a matter of bending the basics in an effort to arrive at a compromise that will hopefully be acceptable to the ears and eyes of the audience: a loudspeaker array that provides reasonably good sound, without being visually obnoxious!

Choice of drivers

In the contest between performance and dimensions, one can usually forget about 30cm (12-inch) drivers, despite their popularity for domestic hifi. An enclosure large enough merely to contain a vertical stack of four or more 30cm loudspeakers would inevitably dominate a modest auditorium; this, without any extra internal volume to help reduce air loading on the four large cones.

26cm drivers are only marginally more practical and, for most local churches and modest auditoria, a column of four wide-range 20cm (8-inch) diameter drivers probably represents the upper limit.

In fact, four wide-range 15cm (6-inch) drivers will usually provide all the level that is required, particularly if two such arrays are used — one to either side of the pulpit, rostrum or stage, as the case may be.

As distinct from the cheaper general purpose models, what we have described as "wide-range" drivers are likely to have tweeter cones, or curvilinear main cones to maintain treble response, and long-travel, lower-resonance suspension as a potential contribution to better bass. In practice, the sound quality obtainable from an array of such drivers would normally be considered excellent by the average audience.

As implied by Fig.2b, oval drivers (eg. 22x15cm or 17x13cm) are also a possibility but they are less readily available in a suitable wide-range or heavy-duty form.

By opting for smaller drivers, the enclosure can be substantially reduced in size so that, overall, the exercise becomes one of finding suitably compact, husky wide-range drivers and mounting them in a line source enclosure no smaller in internal volume than it strictly has to be.

The "bottom line" is how well the combination will work out at the bass end!

Sealed, vented or what?

Rarely, in practice, will an enclosure "built down to a size" be large enough to function acceptably as either a reflex or a fully sealed system but a design which we published back in December '66 comes close enough to provide some guidance as to minimum figures:

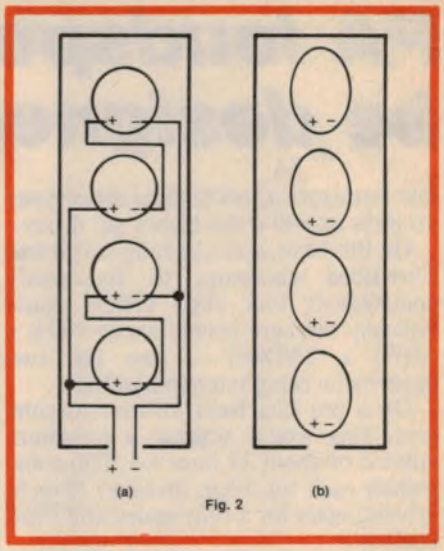


Fig.2: A typical, modest line source loudspeaker system can use four identical, good quality round or oval loudspeakers. If connected in series-parallel, as in (a), the net impedance will be the same as that of a single unit, typically 8 ohms.

"Loudspeakers for the Stereo PA System".

The twin systems described in that article involved a pair of Magnavox 6WR (15cm) drivers, plus an 8.5cm sealed tweeter, in each of two identical enclosures measuring 45(H) x 26(W) x 22(D)cm overall, each enclosure being fully sealed and substantially filled (and damped) with a roll of bonded acetate fibre.

Depending on requirements, the enclosures could be placed one on top of the other to form a 4-speaker line source array, or else arranged as a stereo pair, one on each side of the stage. Either way, the overall performance was surprisingly good and we used them for years for small scale speech and music reinforcement.

The significance of the design is that, in terms of bass response, it suggests an absolute minimum internal volume, for a sealed system, of just over 19 litres or 1150 cubic inches with a pair of typical

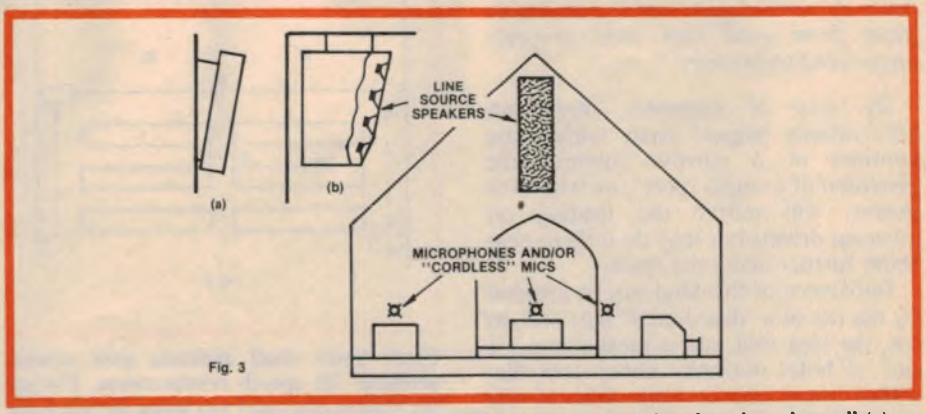


Fig.3: In a building with a high ceiling, a single line source system bracketed to the wall (a) or hung from the ceiling (b) can provide good coverage and relative freedom from acoustic feedback.

PA loudspeakers must be designed for the job

low resonance 15cm (6-inch) drivers; say 10 litres or 600 cubic inches per driver.

On this basis, a single, fully sealed and fibre-filled enclosure to reasonably complement four such drivers could typically measure overall about 90(H) x 26(W) x 22(D)cm — the last two dimensions being interchangeable.

On a pro rata basis, relative to cone area, this would suggest a minimum volume of about 17 litres (or 1000 cubic inches) each for 20cm diameter (8-inch) drivers, again for a fully sealed and filled enclosure.

In each instance, the enclosure would be considerably larger than necessary to merely accommodate the drivers, providing a powerful incentive to make it smaller. However, any substantial reduction in the already skimped dimensions would be certain to raise both the frequency and the "Q" of the main system resonance, possibly to the point where "one note bass" would be evident or, worse still, an unpleasant "tubby" quality.

Relieving back pressure

Faced with the need to use a too-small enclosure and the prospect of "tubby" sound, one has little option but to abandon the sealed or conventional reflex concepts and to curtail the system resonance by simply providing some form of relief for the excessive back loading.

One idea was mentioned last month, in a letter to "Forum" from a reader interested in public address equipment. I quote:

"For example, I was told that, when building a cabinet for a column of loudspeakers (for indoor public address) always to omit one loudspeaker to allow free movement of air. The cabinets I made up worked quite well but obviously more from good luck than properly engineered technology."

By way of comment, my own observations suggest that, within the confines of a narrow column, the provision of a single "port", by whatever means, will relieve the loading on adjacent drivers but may do little to help those further along the stack.

Imbalance of this kind can be avoided by the use of a "distributed" port and, to me, the idea that makes most sense is a line of holes (typically about 1cm dia) drilled along one or both sides of the front baffle. They can offer pressure relief, plus a degree of acoustic resistance, without significantly complicating or weakening the structure.

How many holes and how much internal filling or padding is best determined by observation and/or by monitoring the bass end impedance curve with the aid of an audio generator and millivoltmeter. The ultimate aim is to achieve a bass response which, if not extended, is at least free of resonant thump and/or low-end "tubbiness".

System placement

Where best to mount line source loudspeaker systems varies from one building to another but a few typical examples may prove helpful.

Fig.3 depicts the front wall of a church with a fairly lofty, open ceiling. In such a building, a single, adequately rated line source loudspeaker system can well be bracketed high up on the front wall and tilted forward (a) so that it is directed towards the seating at the rear of the auditorium. So positioned, it should spread the sound fairly evenly over the entire congregation while, at the same time, minimising echoes from the rear wall and ceiling area.

A particular advantage of this placement is that microphones anywhere on the front platform are in a dead area as far as the loudspeaker system is concerned and problems with acoustic feedback are largely avoided.

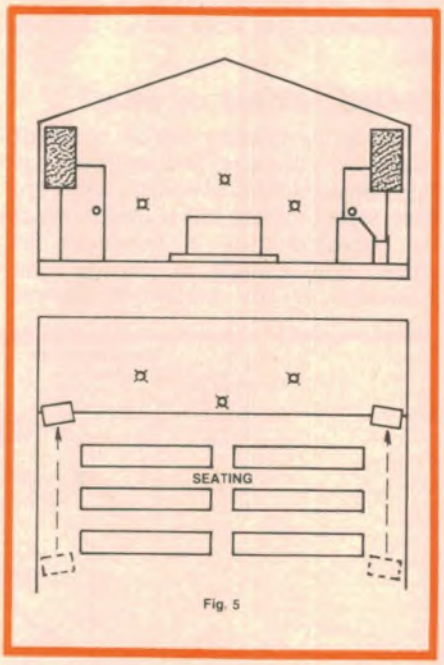


Fig.5: Some small auditoria pose serious problems for speech reinforcement. Placing the loudspeakers part way along the side walls may minimise acoustic feedback but at the expense of intelligibility.

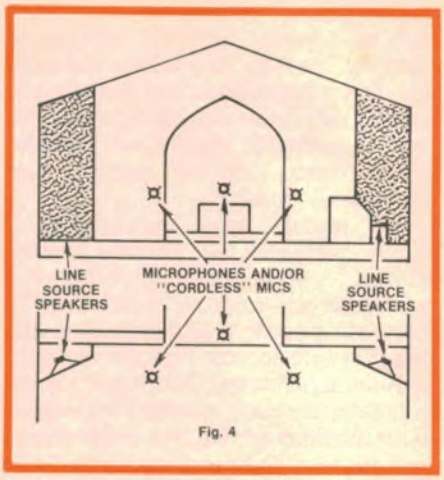


Fig.4: With a building having a low ceiling, a decorative false wall across the corners can provide ample accommodation for a good quality line source system and may be preferred to exposed enclosures.

As well, sound always appears to come from the appropriate general direction: from the front of the auditorium.

Fig.3b suggests an interesting variant in which the front face of the column is made very slim and, if considered desirable, stepped so as to direct the bottom driver towards the front seats. The enclosure itself is extended rearwards to provide sufficient internal volume to ensure extended bass response. If placed high enough and detailed to blend in with the surroundings, an enclosure so shaped can be surprisingly unobtrusive — and very effective.

With a lower ceiling (Fig.4) a centrally placed line source system is impractical and the normal course is to install smaller systems, as high as possible, in the corners above either end of the platform. If driven in phase, they will tend to produce a centre "phantom" channel so that, over much of the listening area, mono sound will appear — as it should — to come from somewhere between the two.

However, with this sort of building layout, it is well worthwhile giving some thought to the possibility of erecting false walls across the front corners of the auditorium, either finished to blend with the existing front wall or styled as distinctive feature panels.

Enclosures so created can readily accommodate a column of four wide-range drivers, with ample internal volume to ensure extended bass response and the further possibility of being used for high quality stereo music.

(In one church known to the writer, corner enclosures of this kind also accommodate supplementary loudspeakers for the electronic organ).

With everything on substantially the same level, a layout such as Fig.4 cannot offer the same intrinsic freedom from feedback as Fig.2 but, given flat response microphones and a non-peaky loudspeaker system, it can still be entirely practical, even when platform microphones are used in the approximate positions shown.

Problem buildings

Fig.5 depicts a less tractable situation, unfortunately fairly common, which can present real problems in terms of speech reinforcement. The pulpit or rostrum is in the main body of the auditorium, backed by a plain, hard wall and surrounded by other hard walls and hard furniture. Limited ceiling height and doors on either side further complicate the placement of loudspeakers.

As often as not, in such a situation, one finds small loudspeaker enclosures bracketed part way along the side walls, in an obvious attempt to minimise feedback by keeping them well forward from the microphones.

Unfortunately, such a layout can provide a recipe for sonic confusion, particularly for anyone sitting close to the loudspeakers. They tend to hear sound first from the loudspeaker above their head, followed by direct sound from the front, and then a delayed echo from behind.

The result can be very confusing, particularly if the person out front is speaking quickly. In such circumstances, the amplifier may make the speech louder but certainly not more intelligible!

To minimise such sonic confusion, the enclosures should, if at all possible, be mounted (or re-mounted) high on the side walls, in line with the edge of the platform and in front of the seating area. Tilt them slightly forward towards the audience and determine by experiment whether they are best directed down each side, or obliquely, so that they each point to the diagonally opposite corner.

If acoustic feedback intrudes, as it may well do, check to see whether it can be inhibited by obviating possible mid-range peaks. Borrow a better microphone and consider carefully whether the loudspeaker systems can be improved. Don't try to get by with makeshift open-back enclosures.

With patience and understanding, it is usually possible to come up with an acceptable system in such an environment — provided those using it follow the advice we gave last month: speak up, speak out and speak deliberately.

In an unsympathetic acoustic environment, prone to acoustic feedback, the amplifier system needs all the co-operation it can get!

(To be continued)

DEPEND ON JAYCAR

ULTRASONIC HOUSE ALARM

This alarm is fully self-contained, even includes the siren. Place it on a shelf, (it looks like a speaker) and the ultrasonic waves detect movement. Great for single room protection, or can be used as a master control for a whole house.
You can connect an external on/off switch, external horn siren. It has provision for N/O instant circuit and N/C instant and delay. A battery compartment is there for C cells, but we recommend a 1.2A 12V Gel battery. Cat. SB-2480 $26.50 and 240V power supply Cat. LA-5140

This sold well last month for $69.00.
We need to clear the last few.
This month only
$59.00
SAVE $40.00
That's almost ½ price.
10 Alarm Stickers FREE - worth $8.50

Book/Software Combinations

TI99/4A - 51 fun & educational programs • As the title suggests. 51 good examples of TI BASIC in action. Programs can be changed to meet specific needs. The book has 94 pages and contains 4 sections. The cassette has all programs listed in the book, on one side in standard form and on the other in enhanced form. Both book and cassette come in a colourful vinyl case.
Cat. BS-0750

ONLY $27.95

TI99/4A - 24 BASIC programs
This book/software product runs from child/adult entertainment games to highly applicable household utility and service programs. The cassette supplied has both standard and enhanced program listings.
Cat. BS-0754

ONLY $29.95

TI99/4A Entertainment games in TI BASIC and extended BASIC
Arcade games at a very cheap price. Add the TI joysticks and extended BASIC module and you can use this product to its fullest extent. 20 programs in 21 chapters. The cassette supplied has both standard and enhanced listings - great fun - great value.
Cat. BS-0752

ONLY $29.95

TI99/4A BASIC programs
This combination of book cassette goes through each line of a BASIC program to enable you to more fully understand what BASIC is all about. There are many programs for you to work on. Helps you learn while you enter, run and modify the programs.
Cat. BS-0755

ONLY $29.95

BASIC tricks for the TI99/4A
A valuable programmer's reference that's filled with hard to find ideas, examples, and special BASIC subroutines to help you crank out powerful TI99/4A programs.
Cat. BS-0756

ONLY $29.95

TI99/4A graphics & sounds
Sparkling routines that add showmanship to any program with brilliant graphics and sound. This is a must.
Cat. BS-0757

ONLY $29.95

COMPACT disc DIGITAL AUDIO

JAYCAR COMPACT DISC BUYERS CLUB

Compact Disc players have become very popular but there is emerging a serious problem. The problem is, availability of compact discs!
Only about half the record stores carry compact discs and those who do generally have a limited range. Apart from this, most discs have risen in price from $22 to $25 recently, so they are getting very expensive!
Jaycar has decided to do something about it!
Now you can order your favourite compact disc albums by Mail Order! You simply pick up the phone and quote your credit card number or send us a letter with your cheque or money order.
FREE PHONE SERVICE: If you do not know whether your favourite artist/album is on compact disc ring us! We have extensive files on all importers range and we will be able to advise you instantly!
SPECIAL CATALOGUE SERVICE: To save time we can send you a 56+ page catalogue of all CD titles currently available in Australia. (There are around 2,900 titles currently available, but some are in very short supply). Cost of the catalogue $4 inc. P&P or FREE with any CD order over $100. We recommend that you get the catalogue. It has separate sections for Jazz, Classical and Popular music and is a MUST for the serious CD enthusiast. (It is updated 4 times a year).
EXCLUSIVE! 30 day satisfaction guarantee! The CD enthusiasts at Jaycar have found that some albums on CD have been disappointing. This was either because the actual material was not as good as expected, or the quality of the CD itself has shown up poor mastering or excessive tape noise etc. This can be an expensive mistake!
BUT NOT if you buy your Compact Discs from Jaycar! If you buy a compact disc from us and you find that the disc is not to your liking you can ***RETURN*** the disc to us for a 50% credit towards future disc purchases. YES, you ***DO*** lose 50% but if the disc is worthless to you that's better than nothing! The offer is conditional on the returned disc being in ABSOLUTELY FLAWLESS condition and within 30 days of purchase. Once a disc is accepted back it will be kept by Jaycar. (You cannot return them to record companies for credit). We will accumulate stocks of returned discs and publish regular bulletins of these titles which will be sent to you automatically. Prices will be below normal retail.
For more information write to P.O. Box 185, Concord 2137 or ring our Mail Order Hotline (02) 747 1888.

YOU CAN ORDER NOW!

SPECIAL
POST AND PACKING CHARGES
1 disc $2.50 2 discs $3.50 3 discs $4.50 4 discs plus $FREE!! (introductory offer)

COMPACT disc DIGITAL AUDIO

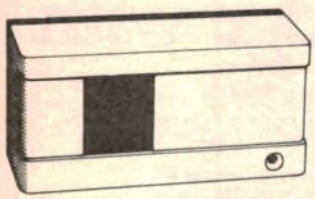
INFRA RED MOVEMENT DETECTOR

The infra red or IR detector for short, falls into the Black Magic category. It basically is a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna?) which has a "Commutated" field of view. Its reception pattern is comb like, but highly tuned to the IR wavelength of human bodies. When a human passes within proximity of the pickup area, the lens will selectively pick up IR radiation and then not. Movement across the pickup area will result in a series of pulses sent to a detector circuit.
IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects. Curtains, for example, can wave about without tripping the alarm. Even the cat is unlikely to trip the unit.

FEATURES:
- 12V DC powered
- Small 77mm x 62mm x 51mm
- Double sensor
- Computerised OC to lower failure rate
- Built-in test lamp
- Alarm output SPST 30V DC @ 1A
- NO or NC terminations

Cat. LA-5017

SAVE $20.00
ONLY $89.00 ea



COAM CHIP ONLY

MC13020 Cat. ZK-8862
Usually $11.95
NOW ONLY $6.95
SAVE $5.00

SUPER SPECIAL

12V 5AH Gel Cell
Sealed lead acid batteries
SCOOP PURCHASE
Manufacturer in distress! Quality US made product with ¼" Q.C. tab connect.
Cat. SB-2486

NORMALLY $39.50
THIS MONTH
$29.50
SAVE $10.00!!!

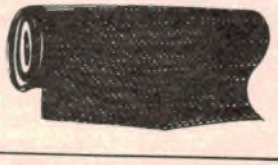
Meet Roger Harrison & Dave Tillbrook!

You can meet Roger Harrison and Dave Tillbrook from Australian Electronics Monthly at our York St. store on the 3rd Saturday in November (16th) from 10.30 - 12 noon.
BE THERE!

GRILLE CLOTH

High quality, acoustically transparent grille cloth is ideal for protecting those expensive drivers - but making sure all the sound gets through. Comes in a 1.5 x 1 metre roll. Black in colour.
Cat. CF-2752

$10.50/metre



NEW NEW NEW NEW

24V DIP RELAY
Quality OKI brand. Same size as an IC! 24V coil rating. Fast switching. Ideal for logic, train control etc. TINY!
Cat. SY-4082

$1.95 ea
10 up $1.75 each

22 PIN IC INSERTER

USUALLY $6.50
only $2.50
CMOS safe conductive plastic - exclusive bent pin alignment guides in handle - ground strap can be connected - one hand operation.

2nd HAND TELLER UNITS

This unit provides numeric display and data entry facility for bank tellers. As a spare parts bargain, this unit has several features:
★ A 12-digit (x 7 segments) LED display. Display height 8mm. US made LITRONIX displays.
★ Two Hall-Effect keypads, one 13-key pad, one 7 key pad.
★ Six PCB's crammed with LED's, IC's, IDC edge connectors, tantalum & other capacitors, resistors etc.
★ Two TO-3 voltage regulators, one LM323K & one LM320K5.
This 3.5kg unit is fitted with a 50-way Cannon D plug as well. Dimensions 210(W) x 300(D) x 150(H).
Cat. XX-5910

ONLY $15.00
Post and Packing: NSW $2.90, VIC $4.60, QLD $6.20, SA $5.80, NT & WA $8.20, TAS $5.80.

PIONEER 10" 3-WAY SPEAKER SYSTEM

A high quality 10" woofer with high power, sealed back, grilled front midrange and tweeter. System impedance is 8 ohms. In addition a quality Pioneer 3-way crossover is provided at no extra charge. Connection instructions are also provided as well as recommended 10" cabinet plans.
2 REQUIRED FOR STEREO
INCLUDES PIONEER X'OVER

$39.95 per set
(mono)

8" 3-WAY SYSTEM

Superb 8" woofer with foam surround suspension and heavy magnet assembly with sealed back mid-range and tweeter. System impedance 8 ohms. Power handling 40 watts rms. Crossover capacitors and connecting diagram and recommended 8" cabinet detail drawings supplied.
Cat. CS-2453

2 REQUIRED FOR STEREO
$29.95 per set
(mono)

FOR GREAT SPECIALS!

PIONEER 12" GUITAR SPEAKER 65W RMS

Strictly limited quantity. Crazy price. They won't last.

USUALLY $59.50
SAVE $20.00

Cat. CG-2381

★ Impedance 8 ohms ★ Power rating 65W RMS ★ Sensitivity 97dB/w ½ metre ★ Frequency range 80 - 6kHz ★ Resonance frequency 80hz

ONLY $39.50

PIONEER HORN TWEETER

Great sounding black anodised square metal horn. Two together sound great. Limited quantity.

LESS THAN ½ PRICE
WAS $13.50 SAVE $7.00

Cat. CT-2014

★ Impedance 8 ohms ★ Power rating 12W RMS - system 60W RMS ★ Crossover frequency 2000Hz ★ Sensitivity 101 dB/w ½ metre ★ Frequency response 2000 - 20,000Hz

SAVE $7.00
ONLY $6.50

IMPORTERS DISTRESS STOCK 6" PIONEER WIDERANGE

4 ohm impedance. As used in ETI projects.

USUALLY $6.95
SAVE UP TO $4.45

Cat. AS-3011

ONLY $2.95
10 up $2.50 each

12 KEY KEYPAD

This unit looks remarkably like the pushbutton keypad in the new Telecom telephones (mainly because it is). They have 12 buttons - you know the usual 0-9 plus asterisk (*) and cross hatch (#). SPST contacts are gold plated.

The application **MUST** be endless as everytime we have advertised them before they have sold within days.

Cat. YT-6902

ONLY $3.95 ea
10 plus $3.00 each

The original ETI 3600 & 4600 Synthesiser Instructions

Brought up to date

NORMALLY $17.50

A few left at

$10

Cat. BM-6500

7 segment LED Display - Litronix brand DL-750

★ 15mm character height
★ Left hand decimal
★ Crazy price!
★ Brand new, but quantity limited

Cat. ZD-1892

ONLY $1.50
10 plus $1.00 each

Computer Controller Cookbook NOVEMBER SPECIAL

Cat. BM-0800

ONLY $10.00!!!

IEC-320 240V Chassis Plug

• Electricity Authority approved.

Cat. PP-4005

ONLY $2.95

CAR STEREO WITH AM & FM STEREO

At last, a full-feature AM Stereo (Motorola CQUAM) FM - MPX Stereo and full auto reverse car cassette for only $199!

We have made a scoop purchase of these quality **JAPANESE MADE** units at an unbelievable price! Act quickly! Supply is strictly limited and we will be lucky to get further supplies this side of Christmas!

Cat. AS-1000

ONLY $189.00

2010 10 Band Graphic Equaliser Kit

$29.50 OFF THIS MONTH!
NORMALLY $149.50
NOVEMBER SPECIAL
ONLY $120.00!!!

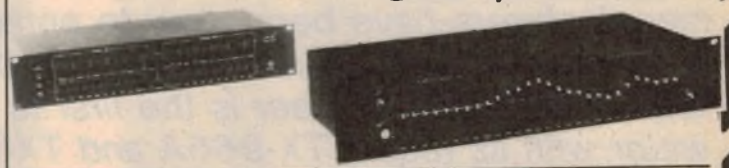
Cat. KJ-6535

2801 28 Band Graphic Equaliser Kit

★ 240V powered
★ Professional quality kit
★ Cannon in & out sockets

Cat. KJ-6531

NORMALLY $225
NOVEMBER SPECIAL
ONLY $199.00!!!



Sennheiser Muff Pads for HD-414

Cat. AA-2011

ONLY $6.95/pr

Heavy Duty Speaker/ Equipment Cabinet Handle

Cat. HS-8010

ONLY $13.95

"Tex Tool" ZIF Sockets

Due to popular demand the lever type Tex Tool IC sockets are back in stock at Jaycar.

24 PIN Cat. PI-6522
$15.95 or 10 up $12.95

28 PIN Cat. PI-6523
$16.95 or 10 up $14.95

PLESSEY POT PACK BARGAINS BACK!

BRAND NEW STOCK

You get over 50 assorted pots (mostly English made by Plessey) in a pack weighing just under ½ a kilo. All have plain shafts, most with a flat, some are log, some are linear and some are switched. This pack is a great bargain at under 12¢ a pot how could you go wrong? The price of pots has recently risen and even if you only use 3 out of the 50 you could be in front.

Cat. RP-3900

Heavy Duty DPDT Footswitch

Cat. SM-1010

ONLY $8.25 each

C&K Push button

These are quality switches which have a built-in black panel which houses the actuator and a hole for a 5mm LED (not supplied). The switches are SPDT momentary changeover.

Cat. SP-0786 YELLOW ACTUATOR
Cat. SP-0785 RED ACTUATOR

ONLY $2.95 ea
10 plus $2.50 dach

$19.95

600 ohm/600 ohm Line:Line Transformer

Telecom approved

Cat. MA-1510

Pioneer TX-960A AM-FM stereo tuner

Since the advent of AM stereo broadcasting in February of this year, the overseas electronics manufacturers have been slow to enter the market with tuners which include the Motorola C-QUAM decoder. Pioneer is the first to test the water with its model TX-960A and TX-560A AM/FM stereo tuners.

As soon as these tuners were released in September, we requested a review sample of the TX-960A. We were anxious to have a look at it as soon as possible to see what level of performance Pioneer has achieved from the AM section. For years, Australian buyers have had to make do with a miserable level of performance from the AM section of their tuner, regardless of the generally excellent FM performance.

To produce the new model TX-960A, Pioneer have modified one of their existing synthesised tuners, the TX-960L. The external appearance has not been changed though, so there is no clue that the unit includes an AM stereo decoder.

As with the vast majority of hifi equipment these days, the appearance of the Pioneer tuner is sombre. It has a charcoal-coloured plastic front panel with a matte finish. The digital readout is a blue vacuum-flourescent display which indicates the tuned frequency in megahertz or kilohertz, depending on whether FM or AM transmissions are being received.

In keeping with the generally sombre presentation, the various control legends are subdued and as a result, hard to read in less than good lighting.

There are eight presets for AM and eight for FM and these are easily loaded into memory by first tuning the desired station, pressing the Memory button and then the designated button. You can tune up or down the band with the large plus and minus buttons. These take the AM tuning up or down in 9kHz steps and the FM tuning up or down in 100kHz steps.

The TX-960A's microprocessor is permanently powered from the mains supply so that the preset station settings stored in its memory are not lost when the unit is turned off.

Surprisingly, there is no "Seek" button which would allow the unit to tune to the next strong signal up the band, automatically.

Nor is there any signal strength indicator, as is becoming increasingly the case with synthesized tuners. While a tuning indicator is not needed for a synthesized tuner, since they are automatically tuned to the exact station frequency, there is still a good case to be made for a signal strength indicator since it can tell you whether there is sufficient signal to give a good noise-free signal.

Having said that, one of the LED indicators on the front panel is to indicate that a station is tuned while another indicates whether or not the station is transmitting stereo, on AM or FM.

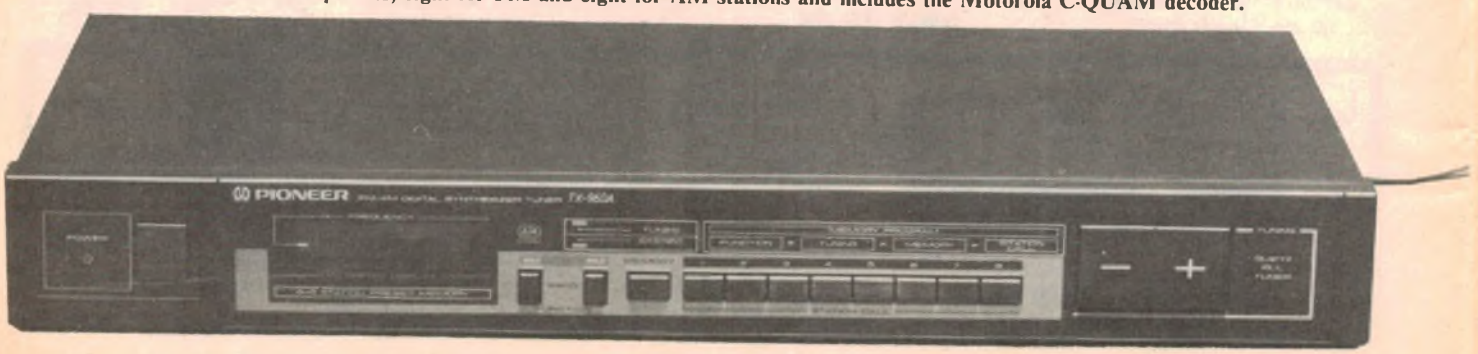
On the rear panel, in addition to the usual pair of RCA audio output sockets, there are four screw terminals and a 75-ohm coax socket for antenna connections. Up till now, most AM sections in FM/AM tuners have been fed with a ferrite rod antenna which may or may not have been capable of orientation for best signal pickup.

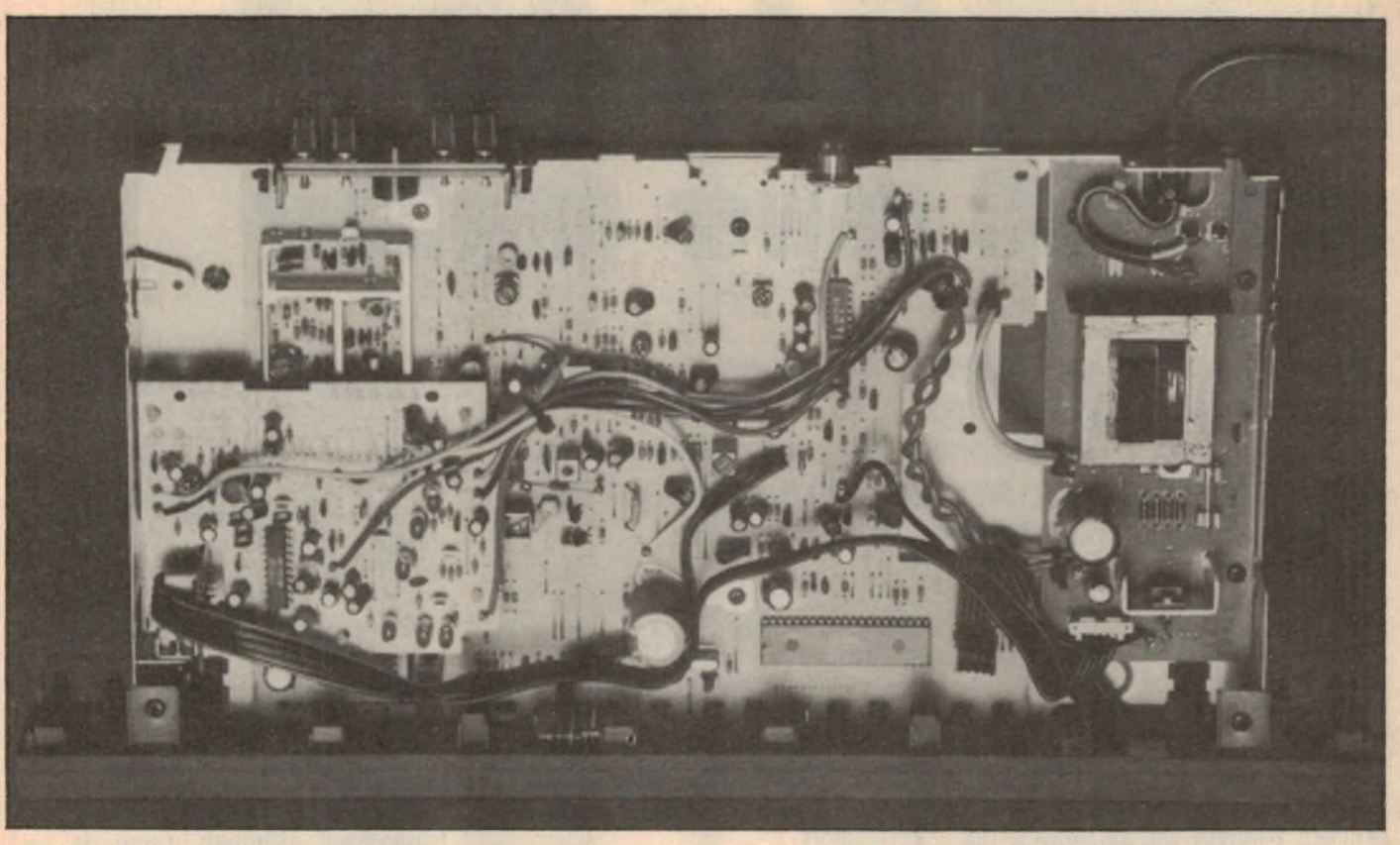
Pioneer has moved away from this approach and they supply a small loop antenna which can be positioned away from the tuner for best signal reception. It is wound on a small circular plastic former and is connected to the tuner via flying leads.

Pioneer also supply the standard wire dipole for FM reception, as well as a pair of shielded cables fitted with RCA plugs.

Inside, most of the circuitry is accommodated on one large printed circuit board which occupies almost the entire chassis area. In addition, there is a smaller board to one side for the transformer and power supply components. Then, on the other side, another board is mounted above the main, for the Motorola C-QUAM decoder and its associated components.

Pioneer's TX-960A tuner has 16 presets, eight for FM and eight for AM stations and includes the Motorola C-QUAM decoder.





Inside the TX-960A, with the added Motorola decoder board on the left.

Dimensions of the TX-960A are 420mm wide, 60mm high and 215mm deep. Weight is miniscule at 2.3kg.

The rear of the TX-960A, showing the audio and antenna connections.

Specifications

The FM specifications for the TX-960A are typical of a medium priced unit. 50dB quieting sensitivity is quoted at 1.8μV for mono and 17.8μV in stereo while ultimate signal-to-noise ratio is quoted at 77dB in mono and 73dB in stereo. Stereo separation is quoted at 40dB at 1kHz.

Our test results were not as good as these figures indicate though the FM performance was still quite respectable and certainly on a par with other medium priced synthesised tuners in the market.

For the AM section, Pioneer have not quoted any figures for AM bandwidth or distortion, which are most important for a hifi tuner. The only relevant figures are for signal-to-noise ratio of 50dB and stereo separation of 30dB at 400Hz.

Our measurements for AM bandwidth were quite disappointing. We had expected a tuner bandwidth of at least 5kHz but it is about half this. To be specific, the frequency response is 6dB down at 3.5kHz, 12dB down at 4kHz and 20dB down at 5kHz. In other words, it is definitely a narrow bandwidth design, no better in this respect than the cheapest pocket AM radio.

The signal-to-noise ratio at least is quite good for an AM tuner and we measured a result of 52dB. Combined with the low noise loop antenna, the TX-960A is capable of noise-free reception although we found it gives much better results if a really large loop, say two or three metres square, is used instead of the small loop.

Stereo separation is subjectively quite good although we have no way of verifying the manufacturer's figures for this at present.

Listening tests support the measurements. While the FM section gives good quality wide range reception with excellent stereo separation, the AM reception is disappointing. Sure, it is quiet, free of monkey chatter and clearly in stereo but that is about it. It is noticeably narrow band reception which suffers markedly in comparison with the wide range FM reception. Since the AM transmissions are of comparable bandwidth to FM, this need not have been the case.

It is clear that Pioneer's modification of the TX-960A is simply an addition of the Motorola C-QUAM decoder into the existing design with no attempt made to increase the AM bandwidth at all.

As such, we are not sure whether it will be good enough to attract buyers who will be expecting something more from stereo AM transmissions. We were disappointed. We think prospective buyers will be too.

Recommended retail price of the TX-960A is $299.00. For further information and demonstration, contact your hifi dealer. (L.D.S.)

NAD 1155 preamplifier and 2200 power amplifier

Two NAD products have been recently released and have already become very successful. They are the 1155 stereo preamplifier and the 2200 stereo power amplifier. We had a good look at these two innovative products.

At first sight, both of these new NAD products are unassuming in appearance although they conform to the same styling of previous products from this company. After a while though, their appearance grows on you with its unobtrusive style. This is really as it should be.

Both units have the same width although naturally the amplifier is the much larger of the two. Dimensions of the preamplifier are 420mm wide, 74mm high and 270mm deep. It has a plated steel chassis with a diecast front panel finished in a subdued olive-brown enamel. The various knobs and switches are a black matte finished plastic.

The control layout of the 1155 is quite different from most stereo pre-amplifier/control units. It does have bass and treble controls, which quite a few units now don't have, and also has loudness compensation, low bass equalisation and a mono switch.

Two five-position mode switches are used, one labelled "record" and one labelled "listen". As might be expected, the "record" switch selects the signal source which is to be recorded while the "listen" switch is also more or less self explanatory.

The Volume and Balance controls are concentric and both the tone controls and balance controls have centre detents.

On the rear panel there is the usual array of RCA sockets plus two slide switches, one to provide moving magnet or moving coil cartridge operation and the other to provide three choices of shunt capacitance for moving magnet operation.

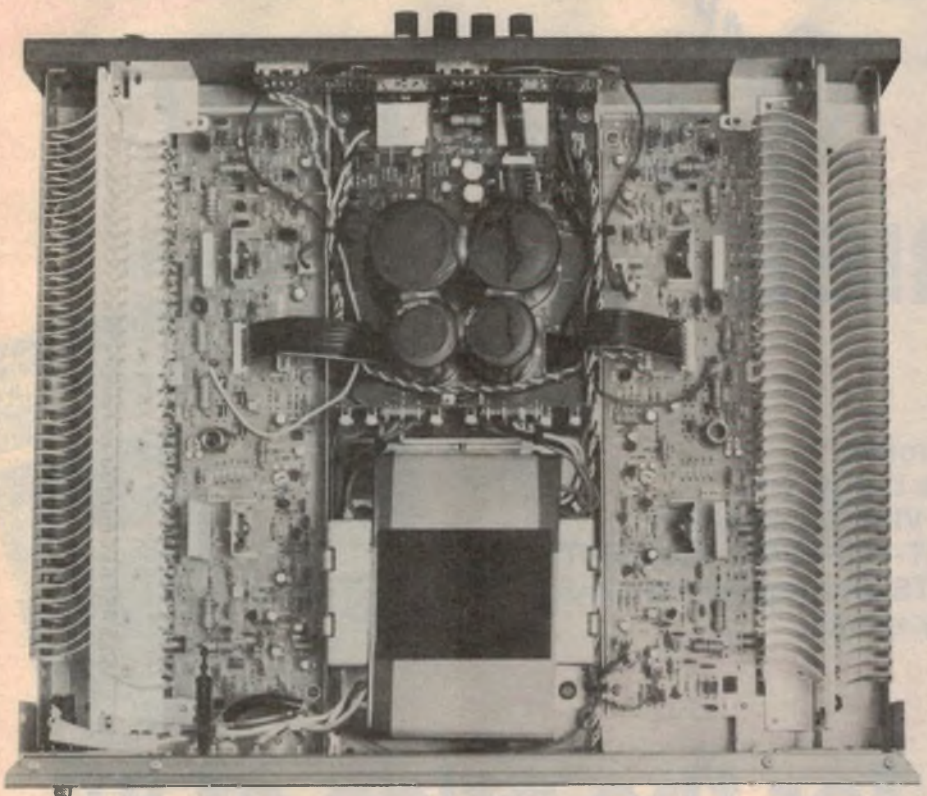
Inside the chassis, all the componentry is accommodated on one large PC board except for the volume control, headphone socket and power switch which are mounted on two small boards. The power supply is designated as being double-insulated and the transformer is fitted with a copper strap and outer shielding bracket, as well as being specially positioned to minimise hum induction into the low level circuitry.

So successful have these measures been that NAD has been able to entirely dispense with shielded cable in the entire preamplifier circuitry. This is probably only of academic interest to the user but it does indicate that the designers know their stuff.

Most of the circuitry uses discrete transistors although there is an operational amplifier in the high level tone control stages which also drive the stereo headphone outputs.

The phono stages are interesting. The main moving magnet preamplifier is a differential amplifier using FETs as the input transistors. It has a total supply voltage of 48V (±24V) to allow a high overload capability. Switching to moving magnet interposes a preamplifier to give the needed higher gain.

At left is the NAD 1155 stereo preamplifier/control unit which is teamed with the NAD 2200 stereo power amplifier.



Above is the inside view of the NAD 2200 power amplifier. Note the high capacity heatsinks.

We were very impressed with the overall presentation of the 1155 but we noted that the screw(s) for one of the transformer mounting brackets had been omitted.

Power amplifier

The 2200 power amplifier is even more unobtrusive than the preamplifier. Its front panel is completely bare except for the power switch and four very discreet LED indicators, for power, overload protection and soft clipping.

On the rear panel, it has two pairs of RCA input sockets, one set for the normal inputs and the other as the "lab" inputs. There are two slide switches, one to select bridged or normal operation and the other to select the soft clipping feature.

The binding post/terminals are shrouded to prevent the chance of electric shock (the peak output voltage can be 75 volts or higher) and will accept either standard banana jacks or extra thick loudspeaker cables. This last point is one which many power amplifier designers apparently overlook.

Dimensions of the 2200 are quite modest at 420mm wide, 120mm high and 370mm deep but the weight is quite hefty at 12.5kg, mainly due to the large power transformer.

Opening up the case of the 2200 reveals quite a range of innovative features, the first of which are the unique "fish-bone" heatsinks. These are made from aluminium angle extrusions which have the "fins" peeled up by some sort of scraping process. However they are made, they certainly give a very large surface area for heat radiation.

Seven transistors and two diodes are attached to the underside of the heatsink, a figure which does not seem so large when the ultimate power output is considered. More about that later.

Another interesting feature is the power supply. This has two sets of 10,000μF filter capacitors, one rated at 80VW and the other at 120VW. The reason for this that the 2200 has two pairs of supply rails to the output transistor stages, one at $\pm$62V and the other at $\pm$95V.

The reason for these is that the NAD has a cunning scheme whereby it monitors the incoming input signal and when it goes above a preset threshold, the higher supply voltages are switched through to the output stages, letting them deliver a great deal more power — but on short bursts only. Since the high voltage supply rails are only intended to be used for short bursts, they are protected against longer term use by positive temperature coefficient thermistors.

The power supply is also utilised in an interesting fashion. In most power

amplifiers the two channels are always driven in phase (for mono signals), because that's the way that amplifiers have always been designed. The NAD 2200, on the other hand, arranges the amplifiers so that mono signals to the two channels are 180° out of phase and this means that peaks of current drawn by the two channels are also out of phase. The result is that the power supply can deliver slightly more current before the amplifiers run into clipping. Naturally, the speaker output terminals are connected to put everything correctly back in phase.

To complete the picture, NAD has its soft-clipping feature. While the concept of "soft clipping" is intuitively simple, it is not at all easy to accomplish. The idea is that no matter how hard the amplifier is over-driven, it will always have "gently rounded" clipping instead of the "hard" clipping which normally occurs in all solid state amplifiers.

NAD's circuit is very clever in that it "diode clips" the input signal before it gets to the output stage, where it would simply "hard clip". The trick involved is that the "soft clipping" level must continually be adjusted if the amplifier is to deliver maximum power, before any clipping occurs.

The net result is that while the NAD is conservatively rated at 100 watts, the manufacturers are able to claim a headroom figure of +6dB, ie, a short-term power output of 400 watts per channel, into 8 ohm loads!

Performance

Starting with the 1155 preamplifier, we found it to be a very good performer, especially as far as the compact disc inputs are concerned. It has a signal to noise ratio of −100dB with respect to maximum gain and a distortion performance below the .003% threshold of our measuring gear. Separation between channels is very good: −72dB at 50Hz, −66dB at 1kHz and −57dB at 10kHz.

Signal-to-noise ratio for moving coil input is −65dB and for moving magnet, with respect to a 5mV input at 1kHz, −79dB. These S/N figures are good but not especially outstanding. Harmonic distortion was very low though, at .0054% at 1kHz.

Boost and cut figures for bass and treble are quite modest at around ±9dB for the bass and ±7dB for the treble. When taken into account with the bass equalisation (read: boost) of +6dB at 32Hz plus loudness compensation, it makes sense.

On its own, the 1155 must be rated a good all-round performer but when teamed with the 2200 amplifier, it makes a potent combination. We confirmed the continuous rating of the 2200, 100 watts per channel into 8 ohms, with clipping occuring just beyond this figure.

We then measured the power output in bridged mode, which effectively converts the unit into a single channel power amplifier. In this mode, the 2200 gave 400 watts into an 8-ohm load, which is exactly what the theory would suggest.

But these figures do not yet reveal the true nature of the 2200 which is capable of much higher powers for short periods. Just how high is revealed by performing the IHF peak power test which involved feeding a 20 millisecond burst of signal to the amplifier at intervals of no more than 500 milliseconds.

Under these conditions the 2200 really shows its stuff. Into an 8-ohm load it delivered 351 watts at the onset of visible clipping on the oscilloscope; 612 watts into a 4-ohm load; and a whopping 900 watts into a 2-ohm load. These figures are essentially the same for single or dual channel operation.

Soft clipping effectively pushes the clipping limit much higher for program signals although the maximum actual power output remains the same. It adds up to an amplifier which can deliver sound levels far, far beyond the levels expected from a unit having a rating of 100W per channel.

Harmonic distortion proved difficult for us to measure at all times. Most of the time this is because the NAD is below the .003% threshold of our measuring gear but at other times, under burst signals or with soft-clipping in action, the distortion perceived is subjective only. At this stage there is no effective way of measuring harmonic distortion under dynamic signal conditions. And with soft-clipping in action, distortion is certainly present although it is restricted to the less unpleasant lower order harmonics.

Intermodulation distortion at 100W into an 8-ohm load was .0125%.

Separation between channels was very good at 93dB at 20Hz up to beyond 1kHz, tapering to 89dB at 10kHz. Signal to noise ratio with the same power reference was 104dB.

Listening tests

This reviewer has had quite a few opportunities to listen to the 1155/2200 combination now and can vouch for its potent performance, particularly when teamed with the Kef 104.2 speakers which it suits very well. One word sums it up: potent.

Recommended retail price of the 1155 preamplifier is $469 while the 2200 amplifier is $899. For further information contact your hifi dealer or the Australian distributors, Falk Electrosound Pty Ltd, 28 King St, Rockdale, NSW. Phone (02) 597 1111. (L.D.S.)

ALTRONICS COMPONENTS

9th Birthday Sale

• Hundreds of Quality Electronic

Save up to 50% on

bankcard welcome here | MasterCard | VISA

Credit Cards accepted — You don't pay a

Your on Your Way Home from the Office Party, Doing Just a Few K's Over the Limit and You'd Never Guess Just Who's Over the Hill ***(Unless of course you're already the proud owner of one of these Brilliant Superhet R/D's)***

MICRO RADAR DETECTOR-CLIPS ONTO SUNVISOR (INVISIBLE FROM OUTSIDE THE CAR)

Now X band, K band stationary, gun or even Mobile Radar are detected ***up to an amazing 13Km*** with the all new "Space Age" **Micro Compuheterodyne Radar Detector.** The very 1st in the world to utilize a custom microprocessor—hence enabling quite incredible sampling/checking detection of incoming signals—and what's more it's so light and compact it simply clips securely on to your sunvisor out of sight of anyone outside the vehicle.

• **Detects Mobile Radar equipment** even monitors the pulse which is sent to the road from the Police vehicle to enable them to accurately calibrate their own speed • **Highway/City Mode** switch allows monitoring of City or Highway conditions. By measuring and storing the field strength of each microwave sample taken from the source, the compuheterodyne will automatically, whilst in City Mode, discriminate between Microwave Alarm Systems and Radar Traps etc. — **21 Day Money Back Guarantee** Unconditionally Guaranteed to out perform any other detector you've ever tried or your money back—absolutely no quibbles whatsoever.

Cat A 0920 **$399**

12 Key Keypad (Commercial Grade)

These sturdy keypads were previously standard supply on STC telecom phones — so naturally the quality speaks for itself — Brand new fully assembled with PCB and 8 way wiring harness. Just the shot for microprocessor assemblies, combination locks etc.etc. A 0495

1—9 **$3.95** 10—24 **$3.00** 25Up **$2.50**

Look at This!

Superb Quality Nicad Rechargeable's

From an Incredible

$1.50

Save Up to 50%

Cat S 5020

1—9 $2.20
10—99 $1.80
100 Plus $1.50 ea.

Video Tape Repair Kit

Highly Recommended

A **VHS/BETA** Video Tape Repair Kit. No need to throw out your damaged tapes—this nifty splicing kit can save you a fortune (if you've got small children this kit will save you several fortunes!!) All accessories included for joining tape and refixing leader ends etc. Cat.No. A 9315

Building a Disco? Or need some Hi Fi Speakers for the Den?

Why not build your own Speaker System using these Great Dainichi Drivers. After all, equivalent imported built up systems now cost a veritable fortune!!

DAINICHI HIGH FIDELITY SPEAKERS

Custom made for Altronics by Dainichi, one of the most respected loudspeaker makers in Japan (they manufacture speakers for Pioneer) All very conservatively rated—superb for building up a low cost speaker system. Naturally they also serve as rather excellent replacement speakers.

CONE TWEETER 50 WATT

50Watt Max.Power 8 Ohm Z

Amazing performance budget price. Frequency response 2 KHZ-18 KHZ. 110mm Diam. Hole centres 79mm. Australia's best value at this price.

C 3020 **$8.95** 4up **$8.00**

MIDRANGE 50 WATT

Midrange clarity that has to be heard to be appreciated

Absolutely 1st class reproduction of midrange — piano, vocal, guitar, violin etc. **Huge 50 watts max. input.** 8 Ohm. Frequency response 700-5 KHZ. Value Plus!

C 3030 **$22.50** 4up **$20.00**

DOME TWEETER 60 WATT

60 Watt Max.Power

Silky smooth frequency response. 1.5 KHZ to 20 KHZ. Wide Angle dispersion. Massive power handling capacity. Diam. 94mm. High spectrum Purity. Incredible low price!

C 3010 **$19.50** 4up **$18.00**

WOOFER

307mm (12 in.) 40 watts max. power 8 Ohm.

Roll edge one suspension. Resonant at 30 HZ. Frequency range 30-2 KHZ. Smooth faithful bass speaker. **Ideal HI-FI replacement.** 48mm voice coil.

C 3040 **$42.50** 4up **$39.95**

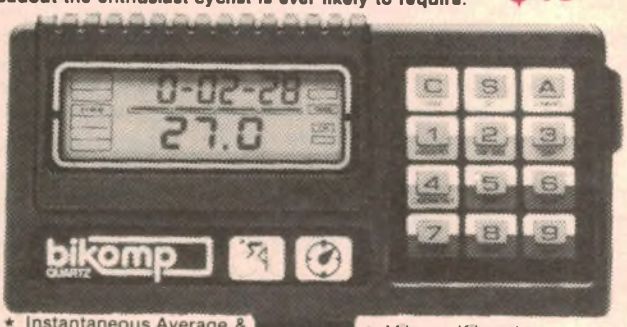
(Speaker enclosure design details and crossover info available on request) Regretably these prices must increase 25% on January 1st (Due to devaluation) **So Order Now — Stocks are limited.**

BICYCLE COMPUTER

INCREDIBLE 12 FUNCTION CAT D 2050

WHY PAY ~~$90~~ NOW **$49**

The brilliant **BIKOMP COMPUTER** that is all the rage in USA is now available in Australia.
For a few dollars more than a digital speedo this superbly accurate computer provides every activity readout the enthusiast cyclist is ever likely to require.



* Instantaneous,Average & Peak Speed Readouts
* Measures Calories Used per Trip.
* Measures Distance.
* Clock,Stopwatch and journey time(whilst Mobile)
* Miles or Kilometres
* Pacer Tone and Performance Monitor
* Dual Display
* Easy Removal for Security
* Fits to Bike in minutes

Bonanza

Components and Products — our Competitors prices.

cent until you get your statement next month!

With Altronics Jetservice We deliver to Your Door Next Day — Just Try Us !! —
(Capital Cities & Suburbs - Country areas allow extra 24 - 48 hours)

Desk Mounted Lamp Magnifier

This unit magnifies any object under a clear cool floresecent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, focal length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce. (We doubt whether 20 years continuous use would wear out the German made flexible arms for example). Spare fluoro tubes are available either from us or electrical outlets.

If you have trouble with fine PCB work or component identification but still want both hands free, this is for you. We thoroughly recommend this quality Australian made product.

TECHNICAL INFORMATION - Illumination: 22W Fluorescent **Weight:** 8.16kg **Lateral Extension:** 254mm **Vertical Extension:** 254mm **Fixing:** Heavy table base (grey & Ivory) with two chrome plated flexible arms. **Lens:** (see text) Cat A 0980

UV EPROM ERASER

Erase your EPROMS quickly and safely. This unit is the cost -effective solution to your problems It will erase up to 9 x 24 pin devices in complete safety in about 40 minutes for 9 chips (less for less chips).

• **Erase up to 9 chips at a time** • Chip drawer has conductive foam pad • Mains Powered • High UV intensity at chip surface ensures thorough erase • Engineered to prevent UV exposure • Long Life UV tube • Dimensions 217 x 80 x 68mm • Weight 670 grams

NEW $89

Cat D 1450

VHS VIDEO TAPE EXCELLENCE

We've tested the lot - **Well how does ME stack up?** — in a word **superb** - Forget all about paying a premium for BASF or TDK—Altronics possitively guarantee our new **ME Metallic** is equal to the very best- and that goes for mechanical construction as well as picture quality!

Were **$12.00** Limited Stocks

NOW $9.90 Cat A 9330

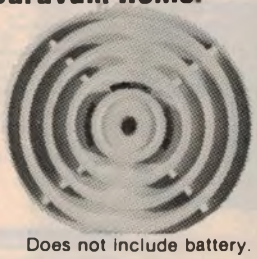
10Up **$8.90**

Brilliant Smoke/Fire Detector

100 Only — Great for Boat, Caravan, Home.

Every year 100's of Australian Men Women and Children perish through house fires and smoke inhalation.

Virtually none would have died had a **Smoke Sentry Alarm** been fitted to their home. Cat A 0090



Be Quick 100 Only

Were Selling for $59.95 **$14.99**

Does not include battery.

- Brilliantly Designed Dual Chamber ionisation sensor detects particles of combustion (smoke) at earliest stages of fire e.g.smouldering etc.
- Loud, persistent 85db alarm wakes the soundest of sleepers.
- Low cost 9 volt battery lasts approx. 1 year,easily replaced.
- Low battery alarm • Test Switch.
- Dead easy to install-takes less than 10 minutes-all you need is a screw driver. **Protect yourself and your whole family as of today.**

Quality Commonwealth Computer Fan 80MM - 240V

★ Super quiet ★ Sealed sleeve bearings for long life ²£ Sturdy die cast frame ★ Operating range -10 deg C to +70 C Cat No. F 1020

1 - 4 **$15**

5 Up **$12**

BLOOD PRESSURE & HEART RATE MONITOR

Why Risk Unnecessary Heart Attack?

A simple (take the reading yourself) periodic check of your blood pressure and pulse provides an "inward look" into a vital aspect of your bodily health. Heart disease strikes down many people in their early 40's (or even 30's). The tradgedy remains that had such victims been alerted, remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health.

A superb Gift for the dedicated fitness enthusiast **Absolutely essential** for those over 40 and concerned with their health, or on Fitness Therapy. Use this **easy to operate** Monitor, to measure your pulse (or heart rate) and Blood Pressure. Remember hign blood pressure is in itself symptomless and the usual forerunner to future chronic heart disease. **Features** include "error" display warning of incorrect use. Handbook supplied will enable anyone in your family to be fully conversant with this monitor in minutes. Easy to read display of Systolic and Diastolic Blood Pressure and Pulse Rate. Cat X 3055

Treat yourself to the Greatest thing to happen to AM in 60 years

AM Stereo Sensation

★ Am Stereo ★ FM Stereo ★ Auto Reverse Tape Deck

Delightful AM Stereo is now yours for an unbelievable price. This Top Quality **Roadsound RCR 760** Stereo AM and FM Receiver boasts 8 watts per channel and high grade Auto reverse tape deck (Metal Compatibility) C 9122

Amazing Price $189.00

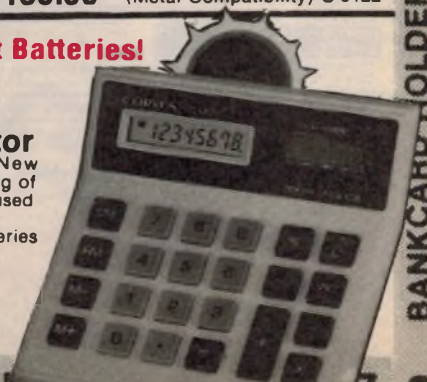
Runs forever without Batteries!
Solar Powered

Desk Top Calculator

Just released for 1985. New technology now allows powering of large desk top type display as used with our new X 1050. No more batteries to go flat. No more Batteries to leak! No more Batteries!!!

Perfect for Home or Office Fantastic Value. Cat X 1060

Was **$19.95** **$15**



ALTRONICS COMPONENTS

9th Birthday Sale

- Hundreds of Quality Electronic

Save up to 50% on

bankcard welcome here | MasterCard | VISA

Credit Cards accepted — You don't pay a

Sensational Book Set Offers on Motorola and National Semiconductor

(The super low prices on the sets are for Nov/Dec 85 only — or until current stocks are gone. As we expect next book deliveries to be 25-30% dearer we definitely cannot repeat this offer or accept back orders at these prices when current stocks are gone.

MOTOROLA SEMICONDUCTOR

MOTOROLA CMOS DATA

A comprehensive reference covering 40XX 45XX CMOS family's along with speciality devices such as LCD drivers, telephone and general communication functions and industrial control. 862 pages essential in all spheres of electronics.

B 1105 ..... $12.95

SCHOTTKY TTL DATA

Essential reference for the enthusiast and engineer alike. Designing, building and servicing digital circuitry is an absorbing pastime. Data for the LS, ALS and FAST families along with design considerations and circuit characteristics are logically presented in this manual, making it quick and easy to use.

B 1109 ..... $11.95

MOTOROLA MEMORY DATA

An absolute must for the microprocessor buff. This is the latest reprint of Motorola's famous memory data manual and includes the latest specifications and design application data on: TTL RAM, TTL PROM, MECL MEMORY, MECL RAM, MECL PROM, MOS DYNAMIC RAM, MOS STATIC RAM, MOS EPROM, MOS EE PROM AND MOS ROM. Worth many dollars more.

B 1113 ..... $11.95

LINEAR & INTERFACE DATA

Popular data manual. At last readily available. Includes Data, design procedures and equivalent listings for 1000's of devices under headings OP AMPS, VOLTAGE REGULATORS, CONSUMER CIRCUITS (e.g. TV, automotive, power), HIGH FREQUENCY CIRCUITS and SPECIAL PURPOSE CIRCUITS. Gives data, design procedures and equivalent listings for: MEMORY, MICROPROCESSOR SUPPORT, LINE DRIVERS, RECEIVERS, TELEPHONY, COMPARATORS, VOLTAGE REFERENCE AND DATA CONVERSION DEVICES. Includes comprehensive selector guide.

B 1114 ..... $22.95

MOTOROLA MECL DATA

Emmiter Collector Logic (ECL) is today's fastest form of digital logic providing the most direct way of improving system performance. This previously hard to get manual provides data on the 10KH, 10K and III families. MECL memory and PLL CHIPS.

B 1100 ..... $11.95

MOTOROLA POWER DATA

Motorola are the undisputed world leader in power transistors. Renowned for their low cost and reliability. Book includes a 9 page selection guide, application notes and data sheets for over 700 devices. 989 pages.

B 1101 ..... $19.95

MOTOROLA MASTER SELECTION GUIDE

The most useful book ever printed. Covers MOS IC's listed by function, LINEAR IC's listed by function, INTERFACE IC's listed by function, LSI memory, TTL, ECL power products, SCR's, diodes, transistors listed by application and ratings, RF small signal and opto devices listed by application and ratings. Essential data given for all devices. Terrific Value.

B 1104 ..... $7.95

TMOS DATA

This manual is intended to give the users of Power Mosfets basic information on the products, application ideas and data sheets of the broadest line of Mosfets. With over 225 device types in 11 package configurations currently available from Motorola.

B 1102 ..... $11.95

MOTOROLA 8-BIT MICROPROCESSORS AND PERIPHERALS

This manual covers all aspects of Motorola's microprocessor, microcomputer and peripheral components. A clearly written manual providing all the data necessary to design and build a working computer system from scratch. 100's of circuit examples, flow charts, truth tables and programme routines.

B 1125 ..... $16.95

NATIONAL SEMICONDUCTOR

INTERFACE

This databook provides complete specifications for a variety of transmission line drivers/receivers, peripheral power drivers and level translators/buffers. Product selection guides list applications information and operating features. Memory, dynamic memory, microprocessor, data communications and disk support products are also covered in the data book. The interface appendices section contains cross reference guides, the programmable logic section describes the technology, design and gives application suggestions.

Pages: 1520 Year: 1983

B 1005 ..... $13.50

5 Up $12.00

DATA CONVERSION ACQUISITION DATABOOK

The 1984 edition of the Data Conversion/Acquisition Databook is one of the most comprehensive in the industry. It contains specifications for high technology conversion products in the analog signal path both preceding and following the conversion process. Combining high volume production capability with leading edge technology such as thin film resistors, laser trimming and advanced micro CMOS and bipolar processing, has helped develop products best suited to your design needs.

Pages: 1232 Year: 1984

B 1007 ..... $13.50

5 Up $12.00

LINEAR DATABOOK

The 1982 edition of the National Semiconductor Linear Databook is the most comprehensive available. It presents approximately 2000 pages of specifications for our high-technology linear products. Applications, descriptions, features and diagrams in this databook include detailed sections for Voltage Regulators, Op Amps, Voltage Comparators, A to D, D to A Converters, Industrial, Blocks and Audio and TV Circuits. The databook also features advanced telecommunication devices and speech synthesis (DIGITALKER), plus other non-state-of-the-art linear products offering performance, economy, quality and reliability.

Pages: 1952 Year: 1982

B 1010 ..... $15.00

5 Up $14.00

LINEAR SUPPLEMENT

The 1984 Linear supplement provides the most recent information on Nationals new linear products. This supplement also provides a comprehensive index published in the Master Databook. New products designed are indicated by an Asterisk and in bold type. Revised data sheets are listed in bold type. Nationals supplement databook system allows you to make product selections of their latest product offerings.

Pages: 566 Year: 1984

B 1011 ..... $7.50

5 Up $6.50

LOGIC DATABOOK

National's new Logic Databook covers five of their logic families: TTL (54/74) Schottky (54S/74S) low power Schottky (54S/74S) high speed (54H/74H) and low power (54L/74L). The Logic Databook—especially organised for quick and easy referencing—offers two complete functional indices and selection guides, one for SSI and one for MSI devices. In addition, it includes over 100 connection diagrams and test waveforms to help speed the design-in cycle. All in all, it's probably the most comprehensive collection of practical information ever assembled on such a broad line of practical components.

Pages: 550 Year: 1981

B 1015 ..... $11.0

5 Up $10.00

MOS MEMORY DATABOOK

The 1984 MOS Memory Databook is a comprehensive collection of information advanced high-density memory products covering the spectrum of this mainstream semiconductor component category. National Semiconductor has an array of advanced technology processes to apply to memory design and development. These range from high-density triplepoly process used in the most advanced RAMs, the small-geometry silicon gate, oxide-isolated, micro-CMOS technology which is now being applied to high-performance memory devices for the first time.

Page: 256 Year: 1984

B 1025 ..... $7.50

5 Up $6.50

HYBRID PRODUCTS DATABOOK

The Hybrid Products Databook is the only National Semiconductor publication that contains complete information on all our hybrid semiconductor products. Included are precision thin film and thick film products which provide the user with standard functions from operational amplifiers to converters with capabilities beyond those of current monolithic technology. Product selection guides and an application section are also included.

Pages: 792 Year: 1982

B 1045 ..... $9.95

5 Up $9.25

TRANSISTOR DATABOOK

National Semiconductor has added many new transistors and product families since publication of the last databook. Many have already been widely acclaimed by users. In addition to small-signal power-bipolar and field effect transistors that have been the mainstay of our catalog, there is a section for multiple-field-effect transistors. More part numbers will be added as market needs expand. To keep current on all new National transistors, please contact your National sales representative or franchised distributor and ask to be placed on the customer mailing list.

Pages: 558 Year: 1982

B 1050 ..... $9.95

5 Up $9.25

CMOS DATABOOK—1984

The CMOS Databook contains the industry's most comprehensive collection of high-performance CMOS products available. Our early commitment to micro-CMOS technology has made possible the development of a broad spectrum of advanced devices that will simplify your design and ensure state-of-the-art systems. Micro CMOS technology describes National's array of small-geometry, silicon gate oxide-isolated processes used to build the products in this book. Using N- or P-well substrates and multiple-layer metal or polysilicon-interconnect structures, micro CMOS processes feature sizes of 3.0, 2.0 or 1.5 microns, with submicron feature sizes in development.

Pages: 1520 Year: 1984

B 1030 ..... $13.50

5 Up $12.00

VOLTAGE REGULATOR HANDBOOK

With the variety of fixed and variable regulator technology currently available, the 336 page Voltage Regulator Handbook becomes a must for the selection of three terminal and dual tracking components that meet the system requirement while utilizing the most cost effective approach. Beginning with product selection procedure and a data sheet summary, the text continues with easily accessible information about booster circuitry, power transformer and filter specifications, test methods, manufacturers' cross reference and extended use applications for National's regulators.

Page: 336 Year: 1982

B 1055 ..... $9.95

5 Up $9.25

MOTOROLA BONUS OFFER
SET OF 9 TITLES

B 9995 ..... $79

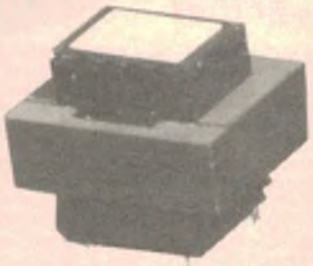
SAVE $50

NATIONAL SEMI BONUS OFFER
SET OF 10 TITLES

B 9996 ..... $79

SAVE $32

New PCB Mount Mains Transformers



7/9 VA Rating. Super Compact, wound on Grain Oriented Steel Core for High efficiency and low temperature rise.
Power Rating:
7VA Load Full voltage +3% - 0%
9VA Load Full voltage -6% to 8%

Call Us For Pinout PCB Spacing

Model	Prim/SEC's 1+2
M 7012	240/6+6
M 7015	2407.5+7.5
M 7018	240/9+9
M 7024	240/12+12
M 7030	240/15+15

Overall Height 35mm
Length 43mm
Width 36mm

1—9	$9.80 ea
10—24	$9.20 ea
25 Plus	$8.40 ea

A Great Xmas Gift Ideal for the Kids

Solar Energy Kit

Natty Solar Kit—Solar cell converts sunlight to electrical energy which in turn drives motor/propeller. Includes fantastic little booklet on Solar experimentation. **Just the shot for school projects. Free energy from the sun. Educational — Great Fun.**

A 0960 Only **$12.50**

Bonanza

Components and Products — our Competitors prices.

cent until you get your statement next month!

Remember Altronics Famous 14 Day Money Back Satisfaction Guarantee

Only $49.95

Check Appliances & Electrical Wiring

Build This 1000V Megohm Meter

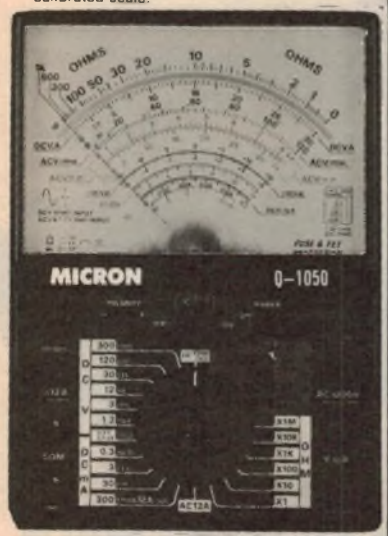
(1985 Successor to the "Megger")

(See EA July '85)

There are many situations where a stringent test of insulation resistance is required. For example, whenever mains operated equipment is repaired or built, an insulation test between the active and neutral conductors and the case should be carried out. Similarly, it is a good idea to check for insulation breakdown whenever electrical wiring is installed. There are many circumstances in which a tester of this type can be used. Apart from the applications mentioned above, a megohm meter can be used to check the insulation between transformer windings and the frame. Insulation breakdowns in automotive alternators and generators can also be diagnosed. As well, rough checks of the leakage of high voltage capacitors can be made. It uses a transistor inverter to produce a regulated 1000v DC supply which is applied to the insulation under test. Insulation resistances between 2M Ohm and more then 2000 Ohm can be measured. Cat K 2550

Precision Electronic Fet Multimeter For Laboratory Or Workshop

* 10 Meg Ohm input * 12 Amp DC a- AC Current Ranges * Centre zero Pointer ust for + and -readings * Single Rang nd Polarity Reversing switch * Power on ED indicator * Transistor Tester Inbuilt * P-P calibrated scale.



Centre Zero Pointer Setting Allows + and - Readings **$59.50**

Q 1050

We're absolutely delighted with our new laboratory FET VOM. The Q 1050 breaks new ground for an advanced, prescision analogue meter of this quality below $100. The Q 1050 has the advantages of digital multimeters i.e. insignificant circuit loading, high accuracy etc. without the misleading and erroneous readings that DVM's are "famous" for.

DC VOLTS
Ranges—0-0.3, 1.2,12, 30,120,300, 1200V— 0-+ 0 15,0.6,6,15,60,150, 600V at Centre 0
Input Impedance— Approx 10M Ohm,3M Ohm at 300mV range
Rated Accuracy—2 5% DC and 3.5% AC full scale on all ranges.

AC VOLTS
Ranges—RMS 0-3,12, 30,120,300,1200V— Peak-peak,0-8 4,33,84, 330,840,3300
Input Impedance— Approx 1M Ohm 80PF. 2.5M Ohm on 3V Range
Rated Accuracy—50Hz —5MHz + 3%—**dB**— -10dB—+63dB at all AC ranges.

DC CURRENT
Ranges—0-0.1 uA,0.3,3 30, 300mA,12A
Potential Drop—300mV Rated Accuracy Within + 2.5% full scale, all ranges

AC CURRENT
Ranges—0-12A

DC RESISTANCE
Ranges—
RX1 0-1K Ohm
Rx10 0-10K Ohm
Rx100 0-100K Ohm
Rx10K 0-10M Ohm
Rx1M 0-1000M Ohm

Protect Your Family—Protect Your Home and Valuables.

MONA LISA BURGLAR ALARM ?

The Mona Lisa is recognised as a brilliant work of art. The Altronic wireless burglar alarm is too. Why? Can you imagine a burglar alarm that hangs on the wall like a painting? If not read on.

NO HASSLE HOME SECURITY

At last A Home Security/Burglar Alarm that is comprehensive but a cinch to install!

- — No Wiring!
- — Virtually no extra hardware costs!
- — No drilling holes through walls!
- — Take it with you if you move.
- — Don't pay $500 plus in labour to install an inferior alarm when you can do it yourself for nothing!

Because the components of this system communicate by a UHF wireless link, ordinary messy wiring is eliminated. You simply place these units where they are needed. Its as simple as that.

Full Security The Altronic Security System consists of Door and Window entry detectors, Infra Red movement detector, 4 zone Main Control Box, Alarm Siren and Pocket remote controller. All detectors are battery operated and can stick to the wall with double sided tape. The system can be set for "**Home**" perimeter detection only (protecting door and windows) thus allowing you or the kids to move about the house or "**Away**" where internal movement detector is also armed. A brief description of each unit appears below.

SPECIAL PACKAGE DEAL

(Suits Normal Dwelling or Medium Business Office)

Main Control	$299.00
Remote Control Unit	$49.50
Door/Window Detector 2 of @ $49.50	$99.00
Movement Detector	$99.00
Alarm Siren	$99.00
Normally	$646.50

Buy the Whole System for Only $599

Battery Backup In case of Mains Power Failure Both the Main Controller and Alarm Siren can be fitted with rechargeable batteries permitting normal operation independent of Mains Power.

CAT S 5065 **$22.95 ea.**

Each of the detectors require standard 9V transistor battery CAT S 5009 **.85¢ ea.**

Main Control Unit The heart of the system. Locate in laundry, pantry cupboard or anywhere convenient to a power point. Accepts signals from the various detectors. Can be operated by remote control unit. CAT S 5210 **$299**

Easy to Install
(Mum can do it)

Remote Control This unit is just like the remote controller on your Video Player. You use it to turn the alarm on when leaving home and off when entering. Keep it on your bedside table to alarm the system when you retire. It also operates as a panic switch so even if you suspect a prowler you can activate the Siren even if the power is turned off. Smaller than a packet of cigarettes.

CAT S 5230 **$49.50**

Door/Window Detector Your first line of protection: They simply stick on to the door or window frame with double sided tape. They send a signal to the control box if an unauthorised door or window is opened. (Extra Units Available).

CAT S 5220 **$49.50**

Movement Detector This unit actually detects human body movement in daylight or dark. You position this unit on a wall, or shelving unit, say, facing your Video or Hi-Fi gear. It is your second line of defense. (Extra Units Available).

CAT S 5240 **$99.00**

Alarm Siren It's the unit that alerts the neighbours if a breakin occurs. Automatically mutes after pre determined period.

CAT S 5250 **$99.00**

We simply do not have the space to fully explain this system here. For more information call in and ask for a demonstration from one of our friendly staff.

See Detailed System Review by Roger Harrison, Editor Australian Electronics Monthly Magazine July 1985.
Excerpt *"The Passive Infra Red Detector is a remarkable piece of Modern Electronic Technology" R.Harrison A.E.M.*

● PHONE YOUR ORDER — ALTRONICS TOLL FREE 008 ● 999 ● 007 ●

Run them varmits off the range

Zap 'em with the Pest Off

Creeping cockies in the coffee? Fidgety fleas on the floor? Rampant rats on the range? Despair not — we have the solution! All you need is half a kilo of DDT, a housebrick and a hungry cat. Alternatively, you could build the Pest Off, EA's new ultrasonic pest repeller.

by COLIN DAWSON

If ultrasonics are indeed effective as a pest repellent, this circuit should send the little nasties packing in no time. For any unfortunate creature able to hear frequencies of up to 64kHz, it should prove most offensive.

Incorporating an efficient piezoelectric tweeter, the Pest Off switches its output frequency in steps between 23kHz and 64kHz. Apparently, this is the range necessary to harass a reasonable cross section of vermin species.

Further, it is considered preferable to switch the frequencies in a fairly long sequence. Some pests, it seems, can learn to live with a steady tone or short sequence. Our circuit has a sequence of 10 frequencies. This should be quite enough to fool an average cockroach.

We don't know whether it will fool cockroaches that are not average.

In the absence of any information regarding the aural response of cockroaches, mice, fleas, ants etc, we can only go along with what is regarded as normal for this type of circuit. Those claiming some expertise in the field recommend frequencies of between 22kHz and 65kHz, well beyond the range of human hearing. Our circuit conforms to this requirement.

Unlike most commercial circuits, the Pest Off has quite a high output power. This is achieved by using a four-transistor driver stage for the piezo tweeter. Alternatively, the driver transistors can be omitted and the tweeter driven in a low power mode.

The circuit is designed to operate from a supply voltage of between 9 and 12V DC. This can be provided by either a plugpack transformer or, where necessary, a 12V car battery. Do not use smaller dry cells — they will go flat too quickly to be of any real use.

Circuit description

The circuit can be broken into four distinct sections: clock oscillator IC1, counter circuit IC2, output oscillator IC3 and driver stage IC4 and Q1-Q4.

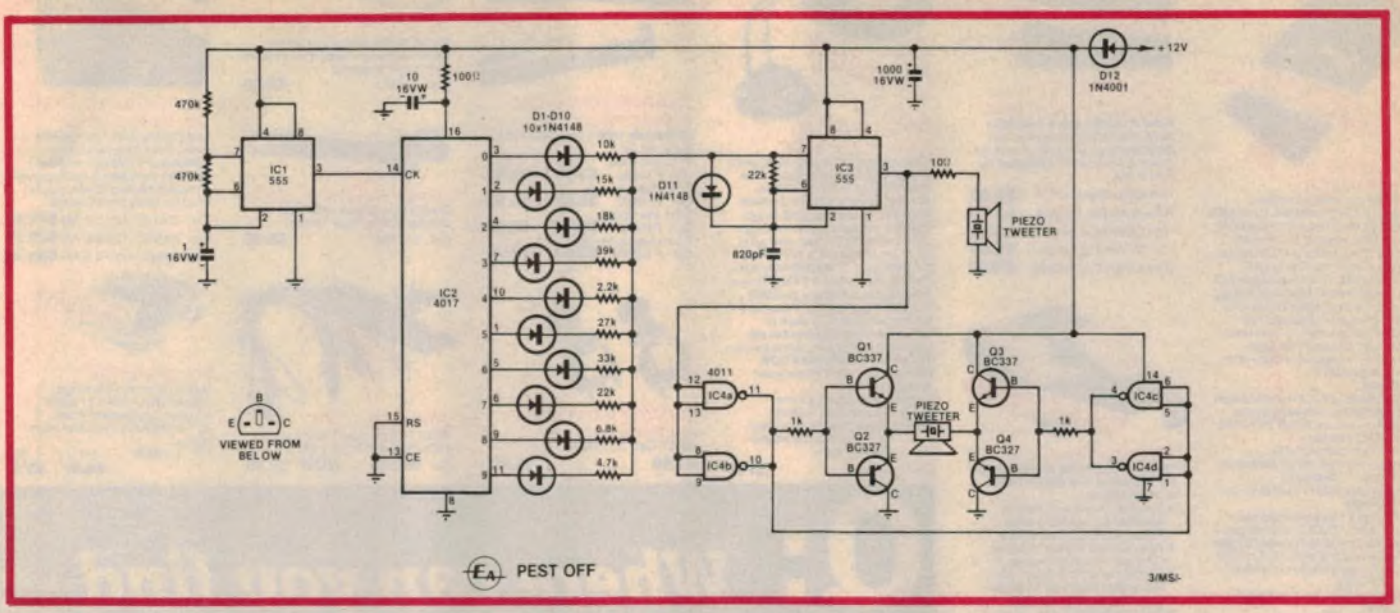
Both IC1 and IC3 are 555 timer ICs. Although their configurations may look different, both are wired as astable multivibrators. IC1 (the clock) oscillates at about 1Hz while IC3 oscillates at frequencies between 23kHz and 64kHz, the exact frequency depending upon the output of counter IC2.

Normally, the frequency of a 555 astable is set by its associated capacitor and two timing resistors. IC1 is an entirely conventional example of this arrangement.

Inside the 555 timer IC is a resistor divider network which sets reference voltages of 1/3 Vcc and 2/3 Vcc on internal comparators (Vcc = the supply voltage). At switch on, pin 3 of IC1 is high while the pin 2 trigger input is pulled low by the 1μF capacitor.

The 1μF capacitor immediately begins charging via the two 470kΩ timing resistors. When the voltage across it reaches 2/3 Vcc, pin 3 of IC1 switches

The Pest-Off is housed in a plastic project box and uses a piezoelectric tweeter.



The circuit consists of clock oscillator IC1, counter circuit IC2, output oscillator IC3 and driver stage IC4 and Q1-Q4.

low. At the same time, pin 7 also goes low (ie, an internal discharge transistor turns on) and the 1μF capacitor begins discharging.

Pin 3 remains low until the 1μF capacitor discharges to 1/3 Vcc. At this point, the pin 7 discharge transistor turns off and the 1μF capacitor re-charges towards 2/3 Vcc. Thus, the cycle is repeated indefinitely while ever power is applied.

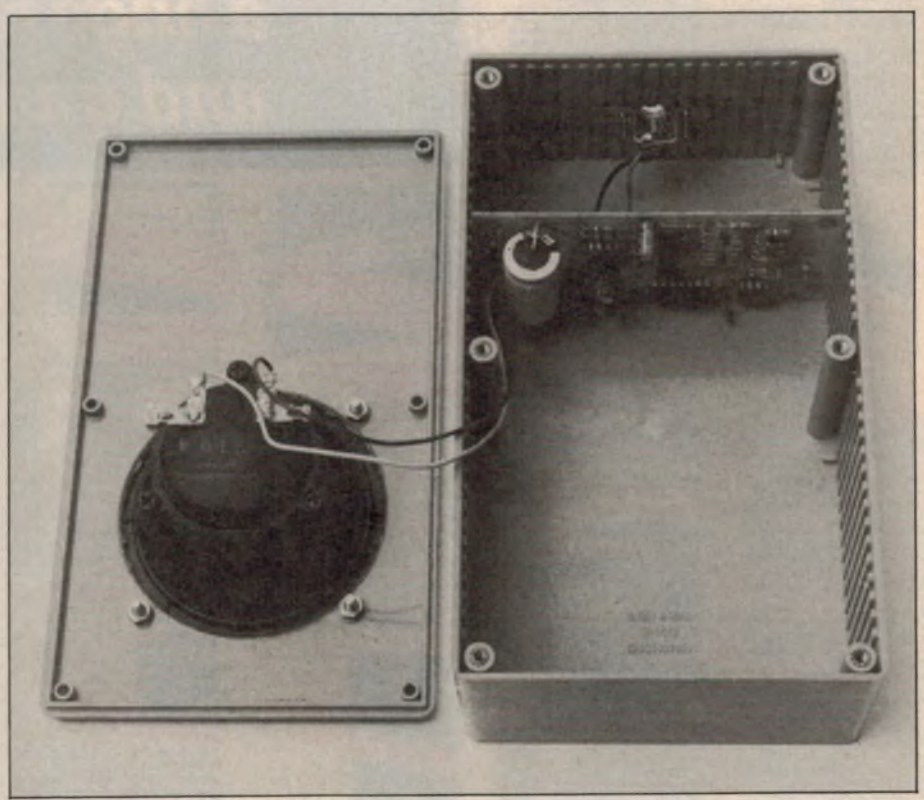
The output of IC1 clocks IC2, a 4017 CMOS decade counter. This IC has 10 decoded outputs and each output goes high in turn for the period of the clock signal. As each output goes high, it switches in a different charging resistor for astable oscillator IC3.

For example, when the "0" (pin 3) output goes high, D1 is forward biased and the 10kΩ resistor is selected. When the "1" (pin 2) output is high, D2 is forward biased and the 15kΩ resistor is selected, and so on. Note that the diodes prevent the low outputs from pulling the high output down.

The value of the charging resistor determines the frequency of oscillation for IC3. A value of 2.2kΩ results in a frequency of 64kHz while the 39kΩ resistor gives a frequency of 23kHz. Each of the remaining resistors falls within this range.

In addition to the interface with the 4017 counter, IC3 varies from the standard astable configuration in one other respect. Notice the diode (D11) connected across the 22kΩ discharge resistor. This modifies the operation of IC3 so that its output approximates a 50% duty cycle at 35kHz.

Let's look at this in more detail. Assume for a moment that IC3 is oscillating at its lowest frequency; ie the 39kΩ timing resistor is in circuit. This gives a total charging circuit resistance of



The PCB slots into the internal ribbing at one end of the plastic case.

Guarantee

The Pest Off is guaranteed to put out a certain amount of ultrasonic energy which would be almost certain to be excruciatingly annoying if you could hear it. Whether it repels nasty pests such as cockroaches, mice, rats, dogs or other creatures is a matter for conjecture. Seriously, there have been reports on these devices which say they don't work. Others do. We dunno. Give it a try.

METEX 3800 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 kV.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS

Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91530 **$79.95**

HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving.

105x65mm Cat. H10524	**$2.80**
105x75mm Cat. H10525	**$3.00**
105x150mm Cat. H10535	**$5.50**
105x225mm Cat. H10546	**$8.00**
105x300mm Cat. H10549	**$12.00**

MODEM PHONE

Check the features and the value for money of this stylish new modem phone.
- Speaker Phone with Built-in Amplifier for Detecting Busy Signal during communication.
- Auto/Manual Answer. Manual Originate, Auto Disconnect.
- Carrier Detect Indication. 20 Memories (each with 18 Digits Capacity) for Auto-dialing.
- BELL 103 CCITT V21 Compatible.
- 300 BPS Full Duplex.
- Last Number Redial.
- Pushbutton Keyboard.
- Volume High or Low Control.
- FCC Approved Direct Connect.
- "In-use" Dialing Indicator.

Cat. X19105 **Normally $199**
Save $25! only $174
(Not Telecom approved)

DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, local length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap but then again it will definitely last a lifetime. It is built like a Rolls Royce! Spare fluoro tubes are available from electrical outlets. If you have trouble with fine PCB work or component identification but still want both hands free, this is for you.

TECHNICAL INFORMATION
Illumination: 22W Fluorescent
Weight: 81.6Kg
Lateral Extension: 254mm
Vertical Extension: 254mm
Fixing: Heavy table base (grey) with two chrome plated flexible arms.

Cat. C92700 **$169**

CANNON TYPE AUDIO CONNECTIONS

We've sold 1000's because of their great value!!

	1-9	10+
3 Pin line male Cat. P10960	**$2.90**	**$2.80**
3 Pin chassis male Cat. P10962	**$2.90**	**$2.50**
3 Pin line female Cat. P10964	**$3.50**	**$2.90**
3 Pin chassis female Cat. P10966	**$3.90**	**$3.20**

QUALITY MOMENTARY (RED BODY)

SPDT Cat. S11050
$1.50 **$1.40**

INSPECTION MIRROR

Handy 35mm mirror with plastic handle, ideal for inspections of those hard to get at places.

Cat. T12081 **$6.95**

ADJUSTABLE SPANNER

Quality drop forged steel with chrome plating. Size 150mm.

Cat. T12399 **$8.95**

JUMPER LEADS

Set of 10 high quality leads approx 450mm long. Normally $4.95

Cat. W12000 **NOW $2.95**

RECHARGEABLE 12V GELL BATTERIES

Leakproof and in 3 convenient sizes, these long service life batteries are ideal for burgular systems, emergency lighting or as a computer backup power supply. Ideal for many power needs.

Cat. S15029 12V 1.2 AH **$12.95**
Cat. S15031 12V 2.6 AH **$39.50**
Cat. S15031 12V 4.5 AH **$49.95**

P.A. SPEAKERS

Low dual cone, wide range, 200mm (8in.) Ideal for public address, background music, etc. Tremendous Value at these prices!

Cat. C12000 1-9 **$6.95** 10+ **$5.95**

Q: *Where can you find a huge range, low prices and quality service?*

METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 kV.
- Capacitance measurements to 1pF.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS

Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91540 **$119**

10,000uF 75V ELECTROS

25% more microFarads! Ideal for those who want a more powerful amp!

Cat. R16587 1-9 **$10.50** 10+ **$9.00**

SPOTLIGHT 12V

Quartz halogen spotlight. Hand held with moulded plastic grip. Brilliant beam up to 55W, can be seen for miles. Orange lens cover, emergency flasher switch, 3 metre curled cord, cigarette lighter plug and replaceable H3 halogen bulb.

Cat. A15050 **$21.95**

ETI BOOKS

Scanner's World	$5.95
Computer Projects Vol.1	$5.95
Lab Notes and Data	$7.95
Electronics It's Easy Vol.1	$5.95
Electronics It's Easy Vol.2	$5.95
Test Gear Vol.1	$3.00
Test Gear Vol.2	$3.95
Test Gear Vol.3	$4.95
Top Projects Vol.5	$3.00
Top Projects Vol.6	$4.95
Top Projects Vol.7	$3.95
Top Projects Vol.8	$4.95
Top Projects Vol.9	$4.95
Top Projects Vol.10	$5.95
ETI Circuits Vol.1	$2.95
ETI Circuits Vol.2	$2.95
ETI Circuits Vol.3	$2.95
ETI Circuits Vol.4	$2.95
30 Audio Projects	$3.95
Audio Projects from ETI	$5.00
Simple Projects Vol.2	$2.95
Simple projects Vol.3	$5.95
Circuit Techniques Vol.1	$4.75
Circuit Techniques Vol.2	$4.75
Circuit Techniques Vol.3	$4.95
Circuit Techniques Vol.4	$5.95
How to Build Electronic Games	$3.95
Electronic Projects for Cars	$3.95
Project Electronics	$4.75
Radio Experimenters Handbook	$7.95
Electronics Projects for Young Scientists	$3.95
Computers and Computing Year Book	$4.95
Computers and Computing Vol.3	$4.95
Computers and Computing Vol.4	$5.95
How to Build Gold and Treasure Detectors	$3.95
Electronics and Music	$5.95

TDK AUDIO TAPE BARGAINS

Description	Cat. No.	1-9	10+
DC46 TDK	A11305	2.75	2.10
DC60 TDK	A11307	2.95	2.25
DC90 TDK	A11309	3.50	2.50
DC120 TDK	A11311	5.50	4.25
AD60 TDK	A11315	3.75	2.95
AD90 TDK	A11317	4.75	3.50
AD120 TDK	A11319	6.95	5.50
ADX60 TDK	A11320	4.95	3.50
ADX90 TDK	A11322	5.95	4.50
SA60 TDK	A11325	5.35	3.95
SA90 TDK	A11327	5.95	4.50
SAX60 TDK	A11329	5.25	3.95
SAX90 TDK	A11332	6.95	5.95
MAC60 TDK	A11335	10.95	9.35
MAC90 TDK	A11337	11.50	8.75
MAR60 TDK	A11340	13.50	10.95
MAR90 TDK	A11342	17.20	15.35

10W RMS SPEAKERS

Including boxes!! At this price you can afford to put a set of speakers in every room!

Dimensions: H 475 x W 245 x D 200mm

Cat. C12002 **Per Pair $59.50**

TDK VIDEO TAPES AT BARGAIN PRICES!

VHS:	E60	$12.50
	E120	$12.50
	E180	$11.80
	E240	$22.40
BETA:	L250	$13.50
	L500	$14.40
	L750	$17.50

PANEL METERS GALORE!

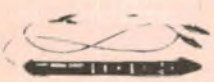
We have a great range of panel meters at great prices!

Cat.No.	Description	Price
Q10500	MU45 0-1mA	12.50
Q10502	MU45 50-0/50uA	12.50
Q10504	MU45 0-100uA	12.50
Q10510	MU45 0-5A	12.50
Q10518	MU45 0-1A	12.50
Q10520	MU45 0-1A	12.50
Q10525	MU45 0-20V	12.50
Q10530	MU52E 0-1A	14.50
Q10533	MU52E 0-5A	14.50
Q10535	MU45 VU PMetre	14.95
Q10538	MU65 0-50uA	16.95
Q10540	MU65 0-1mA	16.95
Q10550	MU65 0-100uA	16.95
Q10560	MU65 0-20V	16.95

MAGNETIC BULK ERASER

The best and by far the quickest way to erase tapes, cassettes and computer disks! Reduces noise levels below recorders own erase head level. On/Off switch located in handle 240V AC operation.

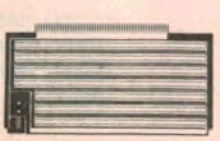
Cat. C14950 **$29.50**



LOGIC PROBE 3800A

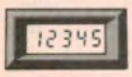
Features 20MHZ memory, TTL/CMOS operation. Normally $29.50

Cat. Q11272
1-9 **$23.50** 10+ **$19.50**



S100 PROTOCARDS

Horizontal Buss Cat. H19125	**$39.50**
Vertical Buss Cat. H19130	**$39.50**
Pad per Hole Cat. H19135	**$39.50**



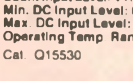
4½ DIGIT LCD UNIVERSAL COUNTER - C7224

- **Very Low Power**
- **High Count Rate**

A 4½ digit counter offering counting to 20,000 units at rates up to 10MHz. The low current consumption makes it ideal for use in portable instruments. The counter features high contrast 10mm digits 5V DC or 7.5V to 15V DC supply (typical consumption 1mA), and programmable decimal points. Standard controls are all TTL/Cmos compatible and include Reset Count, Inhibit, Store, Leading Zero Blanking, "Carry Output. The count input is protected against accidental overload. Supplied complete with mounting kit and connectors.

SPECIFICATIONS:
Supply Voltage: (5.5V Abs. Max.) 7.5 - 15V
Typical Current Consumption: 1mA
Maximum Count: 19999
Max. Counting Rate: 10MHz
Typical (Schmitt Trigger):
Count Input Level: VTH 2.5V VTL 2V
Min. DC Input Level: 0V
Max. DC Input Level: 5V
Operating Temp. Range: 0 - 50-C

Cat. Q15530 **$79.50**



4½ DIGIT LCD DPM 60

- **200mV fsd**
- **Digital Hold**
- **Bandgap Reference**
- **10uV Resolution**

A new 4½ digit LCD DPM offering levels of performance, low current consumption and compact size never previously available. The DPM-60 features Auto-zero, Auto-polarity, a logic switched 200mV or 2V fsd, Digital Hold, programmable decimal points and a 1mA current consumption. Automatic low battery indication and 'continuity' flags are built into the 10mm 4½ digit display. The DPM 60 can be readily rescaled by user to indicate many different units, amps, volts, ohms etc. Supplied complete with fixing bezel, clips and connector, the DPM 60 will suit many applications calling for low-cost, high accuracy measurements in portable instruments or bench instruments.

SPECIFICATIONS:
Accuracy: 0.01 m + - 1 digit
Linearity: + - 1 digit
Samples/sec: 1.6
Temp. Stability: 50 ppm/-C typical
Temp. Range: 0 - 35-C
Supply Voltage: 7.5 - 15V
Supply Current: 1mA typically
Max DC Input Voltage: + - 20V

Cat. Q15520 **$99.95**

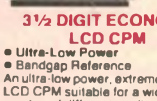
DPM-200 PANEL METER

- **Ultra Low Power**
- **Separately Addressable Annunciator**
- **15mm Digits**
- **Bandgap Reference**

A low profile LCD DPM with a range of useful symbols as shown. The DPM 200 features 15mm 3½ digit display, and ultra low current consumption and a bandgap reference for high stability. It also features Auto-zero, Auto-polarity, 200mV fsd. It may be used in single-ended, differential or ratiometric modes. The fsd can be easily changed by the user to indicate any other units. The decimal points and symbols can all be driven from an internal source. Wide supply and symbols can all be driven from an internal source. Wide supply rail (5-15V DC) with a variable threshold low battery warning indicator. Supplied with mounting clips and comprehensive data sheet.

SPECIFICATIONS:
Accuracy: 0.1% + - 1 digit
Linearity: + - 1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50-C
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: + - 20V

Cat. Q15510 **$79.95**



3½ DIGIT ECONOMY LCD CPM

- **Ultra-Low Power**
- **Bandgap Reference**

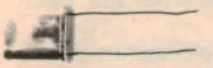
An ultra-low power, extremely stable LCD CPM suitable for a wide number of different applications. Features Auto-zero, Auto-polarity, 200mV fsd. User adjustable Low Battery indication, 12.5mm digit height, programmable decimal point. The QP-5513 has an external bandgap reference for extra temperature stability, with connections brought out, allowing use in single ended, differential or ratiometric mode. The fsd can be easily rescaled by the user to indicate volts, amps, ohms or many other engineering units. Supplied with a beezel mounting, clips, connectors and full data sheet.

SPECIFICATIONS
Accuracy: 0.1% + - 1 count
Linearity: + - 1 count
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50-C
Supply Voltage: 5 - 15V DC
Supply Current: 200uA typical
Max DC Input Voltage: + - 20V

Cat. Q15513 **$54.95**

TRIGGER TRANSFORMERS

Cat. M10104 **$1.20**



CRYSTALS SPECIALS

Prime Specs. We just have too many in stock!

Description	Cat.No.	1-9	10+
1MHz	Y11000	$7.50	$6.50
1.8432MHz	Y11003	$7.50	$6.50
4MHz	Y11020	$2.50	$2.00
4.194304MHz	Y11022	$2.50	$2.00
4.433618MHz	Y11023	$2.50	$2.00
4.75MHz	Y11025	$2.50	$2.00
4.915200MHz	Y11026	$2.50	$2.00
5MHz	Y11030	$2.50	$2.00
6MHz	Y11040	$2.50	$2.00
6.144MHz	Y11042	$2.50	$2.00
6.670MHz	Y11045	$2.50	$2.00
8MHz	Y11050	$2.50	$2.00
8.867238MHz	Y11055	$2.50	$2.00
10MHz	Y11060	$2.50	$2.00
12MHz	Y11070	$2.50	$2.00
14.31818MHz	Y11072	$2.50	$2.00
15MHz	Y11075	$2.50	$2.00
18MHz	Y11082	$2.50	$2.00
18.432MHz	Y11085	$2.50	$2.00
20MHz	Y11090	$2.50	$2.00

XENON/STROBE TUBES

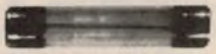
As used in projects or as replacements

Cat. M14050 **$2.95**

MINI JUMPERS

- Contact terminal: Phosphor bronze
- Material: P.B.T. 94V-0
- Gold plated

Qty	Cat.No.	Price
10	P12053	$2.95
25	P12055	$4.95
100	P12057	$21.95

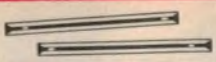


FUSE SPECIAL 3AG

Two values. 3 Amp and 1 Amp.

1-99	100-999	1000+
8¢ each	6¢ each	5¢ each

STOCK UP NOW



CARD EDGE GUIDES

2½"	Cat. H19180	**$0.75**
4½"	Cat. H19182	**$0.90**
6½"	Cat. H19184	**$1.20**
12½"	Cat. H19186	**$1.40**

HORWOOD ALUMINIUM CASES

We have a full range of quality Horwood cases.

Cat.No	Dimensions	Price
H10382	3x4x2"	$5.50
H10383	3x4x3"	$ 6.50
H10384	3x4x4"	$ 7.50
H10385	3x4x5"	$ 7.95
H10386	3x4x6"	$ 8.50
H10387	3x4x7"	$ 9.50
H10388	3x4x8"	$10.50
H10389	3x4x9"	$10.95
H10390	3x4x10"	$11.95

ECONOMY TRANSFORMERS

	1-9	10+
2155 Cat. M12155	$6.75	$5.95
2156 Cat. M12156	$9.50	$8.95
2851 Cat. M12851	$4.50	$3.60
6672 Cat. M16672	$9.95	$9.30

5mm PRIME SPEC LEDS!

1-9	10+	100+
Red Cat. Z10150		
15¢	12¢	10¢
Green Cat. Z10151		
25¢	18¢	12¢
Yellow Cat. Z10152		
25¢	18¢	12¢

ARLEC SUPER TOOL

A versatile 12V electric tool for...

- Sanding
- Engraving
- Grinding
- Polishing
- Cutting
- Drilling
- Milling
- Erasing, etc.

Features:

Operates on safe low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee

Contents:

- 12V Super Tool
- Plugpack AC adaptor
- 1 spherical milling cutter
- 1 wire brush
- 1 grinding wheel
- 4 drill bits, 0.6, 0.8, 1.0, 1.2mm
- Set of 5 chuck collets
- 6 eraser sticks
- Instruction sheets

Cat. T12300 **$44.95**

STROBE LIGHTS 12V

Available in 3 colours, red, blue and yellow. These units have a magnetic base and are fitted with 4 metres of cable terminating in a cigarette lighter plug. Ideal for displays, parties, attention getting, motoring emergencies/breakdowns etc.

Desc.	Cat. No.	Price
Blue	A15046	$32.50
Red	A15047	$32.50
Amber	A15045	$32.50

KEYBOARD AND CASE

A stylistic low profile case to give your system the professional look it deserves. Comes with an attached encoded, parallel output keyboard and provisions for 2 x 5¼" slimline disk drives.

Cat. X11080 **$249**

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866
48 A'Beckett St, MELBOURNE, 3000
VICTORIA, AUSTRALIA
Ph (03) 663 6151
Mail Order and correspondance
P.O. Box 620, CLAYTON 3168
TELEX. AA 151938

MAIL ORDER HOTLINE (031 543 7877 (2 lines)

POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates

Certified Post for orders over $100 included "free"!

Registered Post for orders over $200 included "free"!

MasterCard VISA

Errors and Omissions Excepted.

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips).

Features include:

- Erase up to 9 chips at a time
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Long life UV tube
- Dimensions 217 x 80 x 68mm
- Weight 670 grams

Cat. X14950 **$89.50**

A: *Rod Irving Electronics, the proof is right in front of you!*

WIND SPEED/DIRECTION INDICATOR

This quality engineered European import enables you to monitor windspeed and its direction from the comfort of inside your boat cabin or home. The system comprises a fully factory made wind direction transducer which is weatherproof and has a drip seal around its moving collar. It is fitted with quality reed switches for trouble free life. An 'N' (indicating North) is shown on the outside of the body for initial compass alignment. The wind speed transducer is built into a similar high quality case but is fitted with three moulded cups on equidistant radial arms. Again high quality reed switches are employed. Both transducers are moulded thermoplastic and are supplied with 25 metres (80 feet) of factory terminated connecting cable. Each transducer is fitted with a stainless steel mounting stud with nuts.

The output of each transducer is displayed on an attractive panel measuring 150(W) x 100(H)mm. A LED shows when the wind direction indicator shows main compass point (i.e. N,S,E,W) when the wind shifts between these points, two adjacent LEDs show, indicating the appropiate wind vector.

Wind speed is indicated on analogue meter with a standard Km/Hr scale. Scales of 0-30 metres/sec, 0-60 knots, 0-70 mph and 0-7 Beaufort (force) scale, are also provided. It must be emphasised that the meter movement must be carefully dismantled and the scale glued on the face in order to mount the other scales. Warranty is voided doing this, however, damage is unlikely if you are careful. The panel is also provided with a toggle switch to minimise power drain. (powered by 4 penlight batteries.)

Dimensions of transducers:
Main body: 40mm dia. 125mm (H)
Diameter of cup rotation is 160mm
Diameter of vane rotation is 240mm

Cat. Q96150 **$199**

POWERFULL MINI DRILL

Featuring a powerful 6000 r.p.m. motor, this lightweight (113gm) drill is ideal for many jobs. Perfect for PCB work! Has a 0.8 to 1.2mm chuck and 1mm drill bit. Requires 12V 1 AMP. (use with M19010)

Cat. T12302 **$13.95**

MIDRANGE HORNS

Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS in a system they will handle over 100 watts RMS.

Two sizes to choose from:

Size: 4"x 10½"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm

Cat. C92082 **$49.95**

Size: 3"x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm

Cat. C92084 **$29.95**

2K OHM MULTI METER

11 Ranges, pocket size.

SPECIFICATIONS
11 RANGES
DC VOLTAGE: 0-10-50-250-1000 volts 2000 ohms/volt
AC VOLTAGE 0-10-50-250-1000 volts 2000 ohms/volt
DECIBELS -10 to +22dB in four ranges
OHMETER: 0-10 k/ohms, 0-1 mega-ohms.
DC CURRENT: 1-100mA

Normally $14.95 **NOW $9.95**

RS232 MINI PATCH BOX

- Interface RS232 devices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat. X15654 **$25.95**

ULTRASONIC PEST REPELLER

The state of the art in pest control!

Just think, no dead pests to dispose of, no toxic chemicals, maintenance free, economical (approx. 2¢ a day) and covers an area up to 2,000 sq. ft. Simply plug it in and enjoy a clean pest free environment. Perfect for the home, apartment, restaurant, school office or any indoor area.

Effectively controls...

- Mice/Rats
- Fleas
- Flies
- Mosquitoes
- Silverfish
- Cockroaches
- Ants
- Crickets
- Moths
- Waterbugs
- and many other pests

Cat. Y95510 **$55.95**

FREE STANDING, FOLD UP MAGNIFIER

An economically priced "hands free" magnifier, lets you take care of all those tricky fine detailed jobs so often encountered in electronics, or any of many other practical uses such as home work, hobbies etc.

Cat. T12083 **$11.95**

NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:

Cat. H10450 190x120mm **$11.95**

Cat. H10455 256x185mm **$19.95**

(measurements are approx. only)

STANDARD DESOLDING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 195mm.

Cat. T11241 **$15.95**

MINI DESOLDERING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 165mm.

Cat. T11251 **$14.95**

DELUXE DESOLDERING PUMP

Light weight, non conductive, powerful suction, ceramic long life tip. One of the best in the business. Length 210mm, replacement tip HT3C ceramic.

Cat. T11261 **$18.95**

IC STORAGE CASE

Electro static charge proof plastic IC case with conductive sponge. Dimensions: 75 x 130 x 19mm.

Cat. H10095 **$5.95**

PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance.

- All aluminium construction
- Removeable top and bottom panels
- All dimensioning conforms to the International Standard.
- Natural or black finish.
- Ventilated lid.
- Deluxe brushed finish anodised front panel.

	1-4	5+
H10401 Natural	$49.50	$44.50
H10402 Natural	$59.50	$53.50
H10403 Natural	$69.50	$62.50
H10411 Black	$55.00	$49.50
H10412 Black	$65.00	$58.50
H10413 Black	$75.00	$67.50

WE HAVE THE BEST MEMORY PRICES!

IC SPECIALS!

	1-9	10+	100+
4116	$1.80	$1.70	$1.60
4164	$1.95	$1.75	$1.70
2716	$5.90	$5.50	$5.50
2732	$6.25	$5.95	$5.50
2764	$8.25	$7.95	$6.00
27128	$7.00	$6.50	$6.25
6116	$2.50	$1.95	$1.75
41256	$9.00	$8.00	$7.50
6264	$8.00	$7.50	$7.00

MSM5832 BACK IN STOCK!

1-9	10+
$12.50	11.50

6116P-3 PRICES SLASHED!

1-9	10+
$2.75	$2.50

WORLD MODEM CHIP

Cat. **$49.95**

8000 SERIES IC SPECIALS!

	1-9	10+
8085	4.50	3.50
8212	1.50	1.40
8216	1.50	1.40
8226	1.70	1.50
8243	4.50	3.90
8251	3.90	3.50
8253	3.50	3.30
8255	2.90	2.50
8257	3.50	3.10
8259	3.50	3.10
8279	3.50	3.10
2532	7.50	6.90
2764	5.50	5.10
27128	7.50	6.90
1488	55	45
1489	55	45

BANKCARD
VISA
MASTERCARD

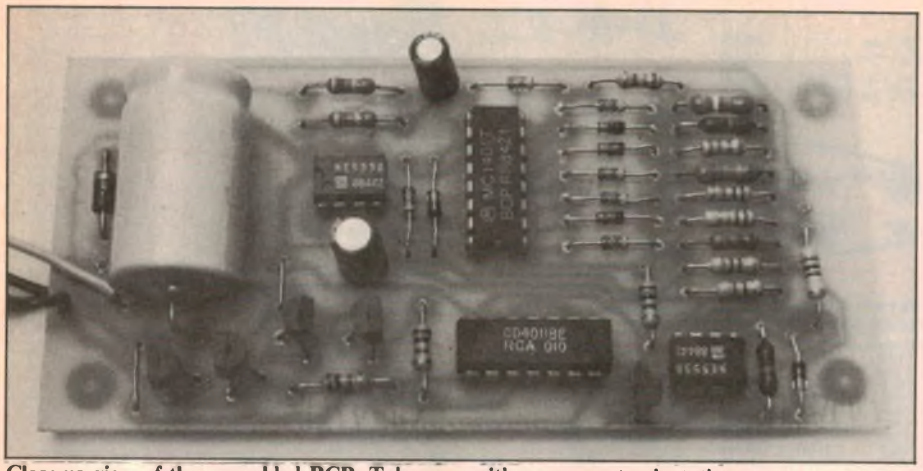
SIGNATURE _____ EXPIRY DATE / /

NAME _____

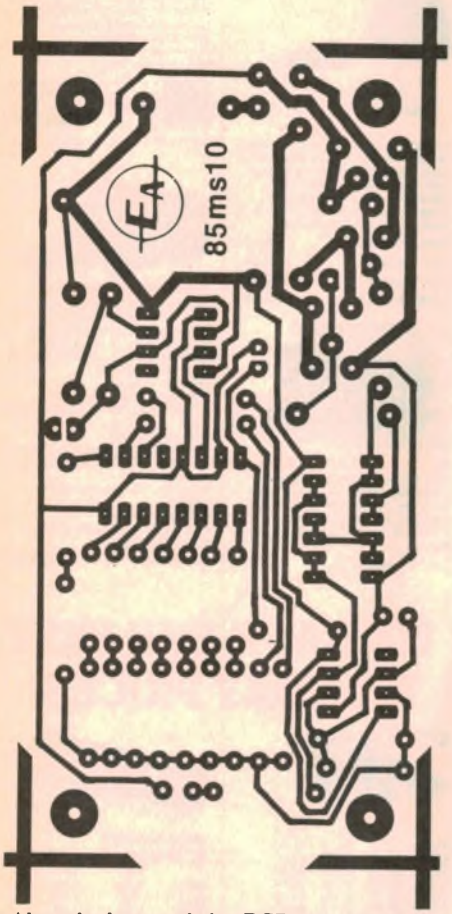
ADDRESS _____

P/CODE _____

EA 11/85 DATE / /



Close-up view of the assembled PCB. Take care with component orientation.



Above is the actual size PCB artwork.

39kΩ + 22kΩ = 61kΩ. Now compare this to the discharge resistance of only 22kΩ — the ratio is about 3:1. This means that if D11 were not included, the output duty cycle would also be 3:1.

Since we want to drive the tweeter with maximum power, it is desirable to keep the duty cycle as near as possible to 50%. D11 shorts the 22kΩ discharge resistor during the charging period which means that the charging period is now determined solely by the selected timing resistor at the output of IC2.

Superficially, this implies a worst case frequency ratio of 22kΩ to 2.2kΩ (10:1), but this is not the case. Because there are two diodes in the charging circuit at any given time (D11 and one of D1-D10), the response is considerably modified. In practice, the duty cycle varies somewhat to either side of 35kHz but the circuit shown provides a reasonable compromise.

For low-power applications, the tweeter can be driven from the output of IC3. A 10Ω resistor limits the peak drive current to a safe value. In this mode, the overall current drain of the circuit will be about 50mA. Even at this level, the tweeter will blast any unfortunate creatures in the immediate vicinity.

If higher power is required, NAND gate IC4 and the transistor output stage can be added. The output stage uses four transistors (Q1-Q4) arranged in a bridge configuration. No limiting resistor is required for this circuit — the transistors specified are able to drive the piezo element directly.

IC4 provides complementary drive signals for the output stage. IC4a and IC4b buffer and invert the output of IC3 and drive Q1 and Q2 via a 1kΩ limiting resistor. IC4c and IC4d provide the complementary drive signal to Q3 and Q4.

The overall current drain for the high-power version of the circuit varies between 100mA and 220mA, depending upon the output frequency.

Construction

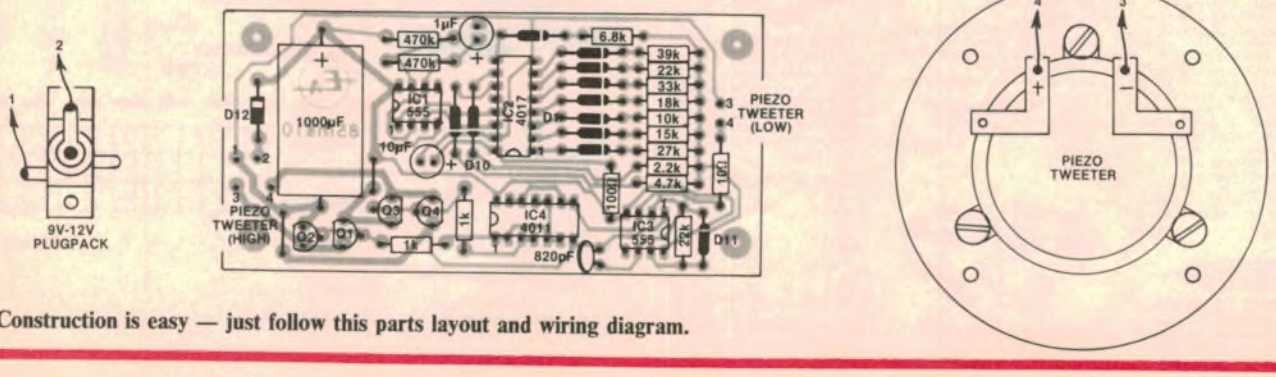
All the circuitry, with the exception of the tweeter and the power socket, is accommodated on a PC board measuring 117 x 51mm and coded 85ms10. This is housed in a plastic project box measuring 106 x 181 x 55mm (internal). The box we used has internal ribbing which is used to hold the PC board in place.

The first job is to check that the board slides neatly between the supporting ribs. Although the board dimensions are designed specifically for the box, it is possible that a little filing will be necessary.

No special procedure need be followed when assembling the PC board although we suggest that the smaller components be installed first. If you are building the low-power version, then IC4 and transistors Q1-Q4 can be left out. Similarly, the 10Ω resistor can be left out if you are building the high-power version.

Note carefully the orientation of the diodes, ICs and electrolytic capacitors when they are being installed. Note that D12 should be a 1N4001 type to give the necessary current rating.

Once the PC board has been completed, attention can be turned to the plastic case. The main job here is to cut a mounting hole in the lid for the tweeter. If you don't have a hole saw, this can be done by drilling a series of holes inside the circumference of the cutout area and then filing to a smooth shape.



Construction is easy — just follow this parts layout and wiring diagram.

Zap 'em with the Pest Off

The power socket is mounted on one end of the case. This requires a 6.5mm hole to provide access for the plugpack connector and the two 1.5mm holes for the socket mounting screws.

Construction can now be completed by installing the PC board and wiring up the tweeter and power socket. The Scotchcal artwork is mounted to the right of the tweeter and will prove useful for those cockroaches that can read.

Testing

You can verify that the circuit is working correctly by altering it to work at audio frequencies. The best way to do this is to temporarily connect a .047μF capacitor in parallel with the 820pF capacitor associated with IC3.

The circuit should start working immediately power is applied. Check that the output frequency changes every second. If other household members complain about the noise, the unit is working properly.

Assuming that all is well, remove the .047μF capacitor to restore the unit to ultrasonic operation.

Above: actual-size front panel artwork.

PARTS LIST

1 PC board, code 85ms10, 117 x 51mm
1 piezoelectric tweeter
1 plastic utility box, 60mm x 190mm x 110mm
1 plugpack power supply, 9V or 12V DC, 200mA minimum
1 panel-mounting socket to suit plugpack supply
2 screws to suit socket
1 Scotchcal adhesive label

Semiconductors

2 555 timers
1 4017 CMOS decade counter
1 4011 CMOS quad NAND gate
11 1N4148 diodes
1 1N4001 diode
2 BC327, BC328 PNP transistors
2 BC337, BC338 NPN transistors

Capacitors

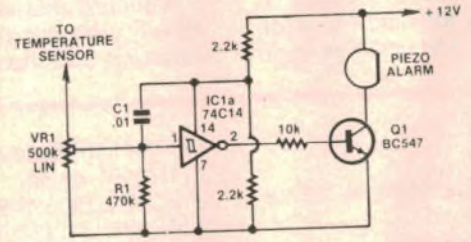
1 1000μF 16VW axial electrolytic
1 10μF 16VW PC electrolytic
1 1μF 16VW PC electrolytic
1 .047μF greencap (see text)
1 820pF ceramic

Resistors

(¼W, 5% tolerance)
2 x 470kΩ, 1 x 39kΩ, 1 x 33kΩ, 1 x 27kΩ, 2 x 22kΩ, 1 x 18kΩ, 1 x 15kΩ, 1 x 10kΩ, 1 x 6.8kΩ, 1 x 4.7kΩ, 1 x 2.2kΩ, 2 x 1kΩ, 1 x 100Ω, 1 x 10Ω

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Audible engine temperature alarm

This audible engine temperature alarm was designed for use on a ski boat, although it is equally applicable to cars.

The circuit is based on a single 74C14 Schmitt trigger gate (IC1a). In most engines, the voltage across the temperature sensor decreases as the engine temperature rises. Thus, as the engine temperature rises, the voltage on pin 1 of IC1a decreases.

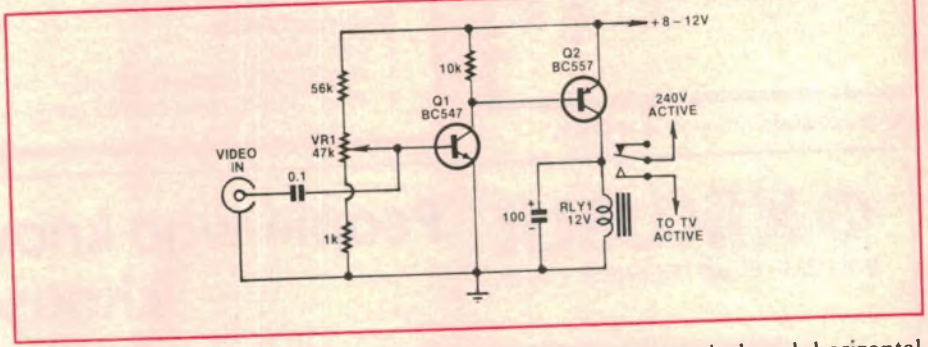
When the input voltage falls below a preset critical level, pin 2 of IC1a switches high. This turns on Q1 and sounds the alarm.

Trimpot VR1 sets the trip point for the alarm. As a precaution against false triggering, IC1a is run at half supply (6V) and supply transients coupled back to the input via C1 (.01μF). In addition, C1 and R1 provide automatic reset at switch on.

K. Hamilton,
Bundoora, Vic. **$12**

Video-controlled power switch for TV

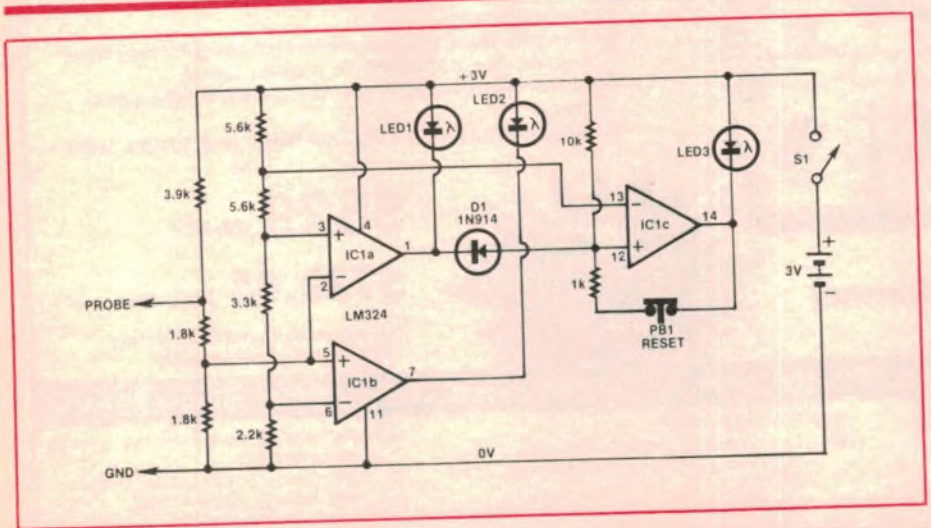
Many VCRs feature infrared remote control and are particularly handy for use with TV sets without this feature. However, you still have to get up to turn the TV set on or off. This circuit overcomes that problem by automatically switching the TV set on whenever the VCR is switched on.



The circuit consists of two transistors and a relay. VR1 sets the bias on Q1 to just below 0.6V so that the transistor is normally just held off. When the VCR is switched on, the video output from the recorder is coupled to the base of Q1 and biases the transistor into conduction. This turns on Q2 which, in turn, activates the relay and applies power to the TV set.

The 100μF capacitor ensures that the relay remains on when Q1 and Q2 turn off during the vertical and horizontal sync pulses. When the VCR is switched off, the video signal disappears and Q1 and Q2 turn off.

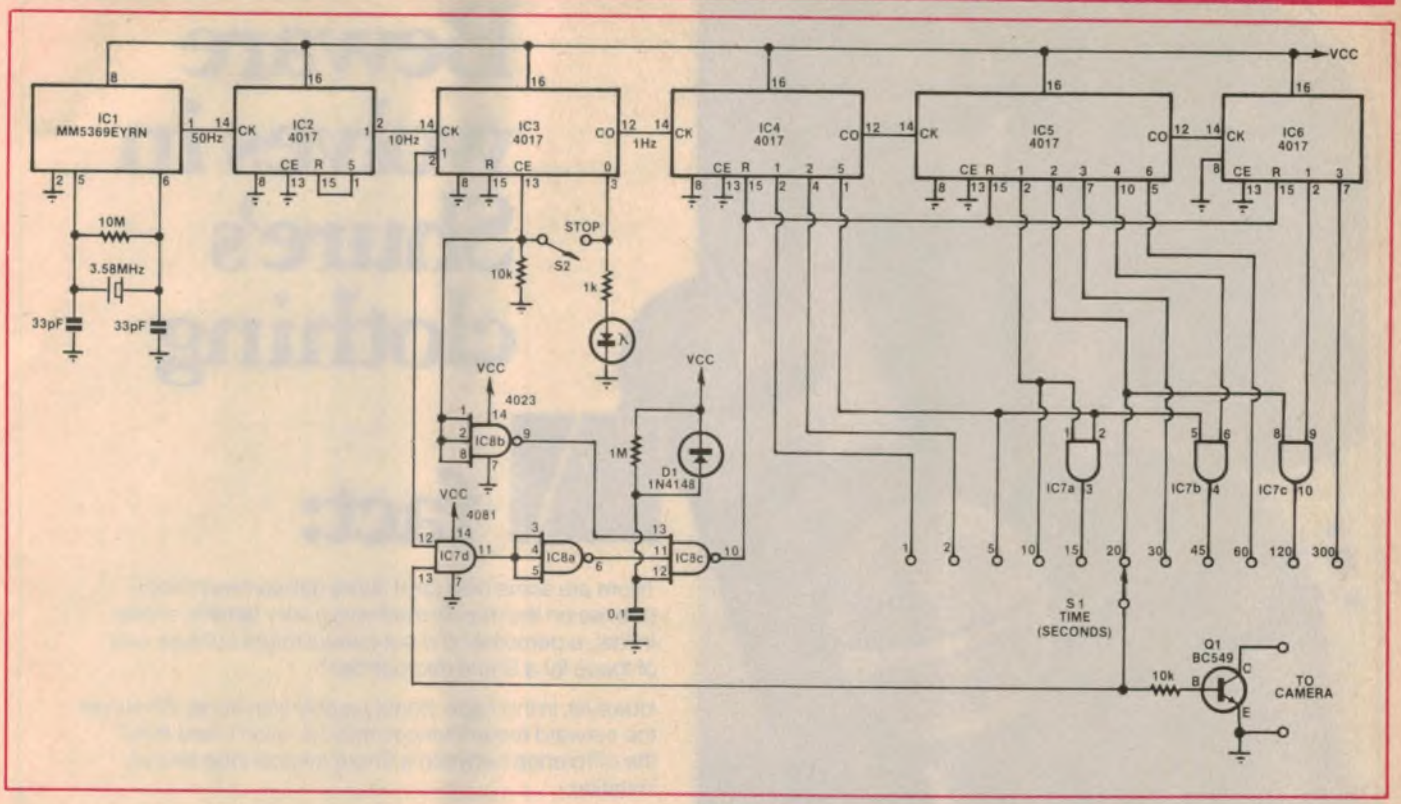
D. Price,
Geelong, Vic. **$15**



Digital logic tester

This digital logic tester will operate from a couple of 1.5V "penlight" cells. The circuit incorporates two LEDs to indicate a HIGH or LOW digital logic state, while a third LED indicates pulses.

Here's how it works: a voltage divider network across the power supply provides proportional high and low reference voltages to comparators IC1a and IC1b, corresponding to the two logic states. When the probe input is connected to a voltage above the HIGH level, the output of comparator IC1a goes low and turns on LED 1. Similarly, when the input is connected to a voltage below the LOW level, the output of



Camera timer

A motor driven camera can be set to trigger from between one and 300 second intervals with this timer circuit. It can be used for time lapse photography of slowly changing natural phenomena to include movements of the sun, moon, clouds, etc. With this camera/timer setup you can literally watch the grass grow.

Eight common ICs are used for the circuit. IC1 is a crystal oscillator/divider device which provides a 50Hz output from a 3.58MHz crystal. This signal is divided by five with IC2, a 4017, to obtain 10Hz and then divided by ten with IC3, another 4017.

IC4, IC5 and IC6 are all 4017 ICs which are connected to provide 11 separate outputs to be selected with switch S1. For some of the time selections, these are directly available from the outputs of IC4, IC5 and IC6. For example, the one second interval is chosen by taking the "1" output from IC4.

AND gates are used to select times that are "in between" those that can be directly chosen from the IC outputs. For example, the AND of the 5 second and 10 second outputs from IC4 and IC5 respectively give the 15 second output at IC7a.

Once the time selected by S1 elapses, the output goes high and switches on the BC549 transistor. This activates the camera. At the same time the high signal is coupled to the input of AND gate IC7d. It is used to reset IC4, IC5 and IC6 via the inverter IC8a and three input NAND gate IC8c. Resetting occurs as soon as the "1" output of IC3, which connects to the second input of AND gate IC7d, goes high (in this case after 100ms).

Longer closed circuit times can be accomplished by connecting pin 12 of IC7d to one of the higher count outputs of IC3. For example, the "2" output will give 200ms of closed circuit time for the transistor. This modification may be necessary for different cameras.

Switch S2 is used to prevent counting and to reset IC4, IC5 and IC6 via inverter IC8b and NAND gate IC8c. With the switch open circuit, counting starts from reset. The LED connected to the "0" output of IC3 flashes at a one second rate to indicate counting.

The 0.1μF capacitor and 1MΩ resistor at pin 12 input of IC8c is a power on reset for the counters when power is first applied.

The unit should be powered from at least 9V and no more than a 15V supply. This minimum voltage ensures reliable operation of IC1.

R. Man,
Bardon, Qld.

$25

comparator IC1b goes low and turns on LED 2.

For this circuit, the HIGH and LOW threshold levels are 2V and 0.8V respectively, corresponding to the standard TTL logic voltage levels.

The logic levels for CMOS circuits are somewhat different and depend on the supply voltage used. For a supply voltage of 5V or more, the output of a typical CMOS gate should be capable of swinging between the standard TTL logic levels, provided that the load current does not exceed 0.35mA or so.

To enable both TTL and CMOS circuits to be tested, the input resistance was set so that slightly less than 0.36mA flows between the PROBE and GND terminals when the probe voltage is at either of the TTL logic levels. If the probe is connected to an open circuit, it will float at about 1.4V in which case neither LED 1 nor LED 2 will light.

The tester will thus indicate a faulty, open circuit or high resistance condition in a digital logic circuit. In addition, if a positive pulse appears at the probe input, this will trigger IC1c, which is wired as a latch, and cause LED 3 to light. This LED will stay lit until the RESET pushbutton is pressed.

In the prototype, LEDS 1, 2 and 3 were red, green and yellow respectively. Input voltages up to $\pm$60V will probably not damage the IC but negative voltages may give a false indication.

H. Nacinovich,
Gulgong, NSW.

$20

Beware wolves in Shure's clothing

fact:

There are some new (and some not-so-new) microphones on the market that have a very familiar shape. In fact, a person who is not careful might confuse one of these for a Shure microphone!

However, in this case, beauty is only skin deep. Whatever the outward resemblances may be, it isn't hard to tell the difference between a Shure microphone and an imitation:

Sound Quality. The famous Shure Sound has *never* been duplicated— whether you prefer Shure's distinctive, crisp response with a presence peak that is perfect for vocals, or a flat frequency response for instrumental pickup.

Reliability. Shure has the most demanding and rigorous Quality Assurance programs in the sound industry ensuring dependable performance, time after time. Each Shure microphone shrugs off the kind of abuse that's associated with tough usage, adverse humidity and temperature conditions, and accidental mishandling. What's more, Shure microphones carry a one-year guarantee on parts and labor!

Shure Nationwide Dealer Network. When you are thousands of miles away from the place where you bought your Shure microphone, and you find you need service, or technical advice, or a matching component, you know you can put your hands on what you need— quickly. Worldwide!

Model SM58

the real thing

Insist on the Shure name on your microphone. It's performance insurance that can't be imitated.

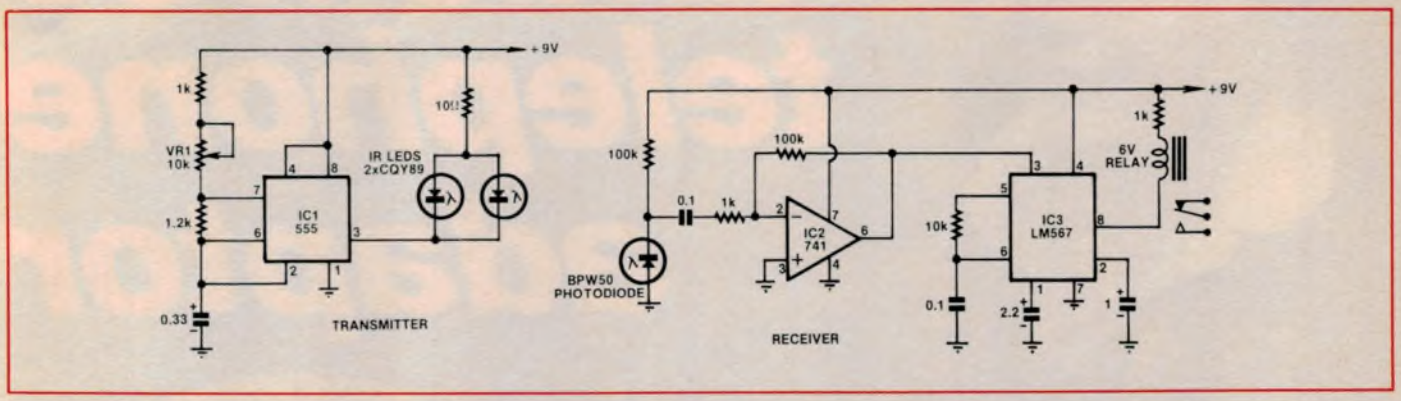
SHURE

NEW SOUTH WALES AND VICTORIA
AUDIO ENGINEERS P/L: 342 Kent Street, Sydney NSW 2000.
(02) 29 6731

QUEENSLAND
AUDIO ENGINEERS (Qld): 47 Castlemaine Street, Milton QLD 4064.
(07) 44 8947

WESTERN AUSTRALIA
MARKETEC: 18 King William Street, South Fremantle W.A. 6162.
(09) 335 8275

Circuit & Design Ideas



Simple infrared door minder

Here's a really simple infrared light beam relay. It can be used as a shop minder, in burglar alarm systems, or as a flash trigger for photography.

The circuit consists of two parts: a receiver and a transmitter. The transmitter is based on 555 timer IC1 which is connected as an astable oscillator. This drives two infrared LEDs via a 10Ω current limiting resistor. VR1 sets the oscillator frequency to 1kHz.

At the receiving end, the infrared light generated by the transmitter is picked up by a BPW50 infrared photodiode. The received signal is then amplified by IC2 and applied to the input of IC3, an LM567 tone decoder. The 10kΩ resistor and 0.1μF capacitor on pins 5 and 6 of IC3 set the centre frequency of the tone decoder to 1kHz, while the 1μF capacitor on pin 2 determines the passband.

When the received frequency falls within the passband, pin 8 of IC3 goes low and the relay is held on. When the beam is interrupted, pin 8 goes high and the relay turns off.

To calibrate the unit, simply adjust VR1 until the relay turns on over the maximum possible range. Note that the range can be increased by fitting light-tubes in front of the LEDs and the photodiode.

J. Kiss,
(address not supplied). **$15**

16-channel Data Sampler for the Microbee

This circuit allows Microbee owners to individually select and test up to 16 input lines. It could be used to test digital circuits or an extra keyboard, or for testing the state of a number of sensors.

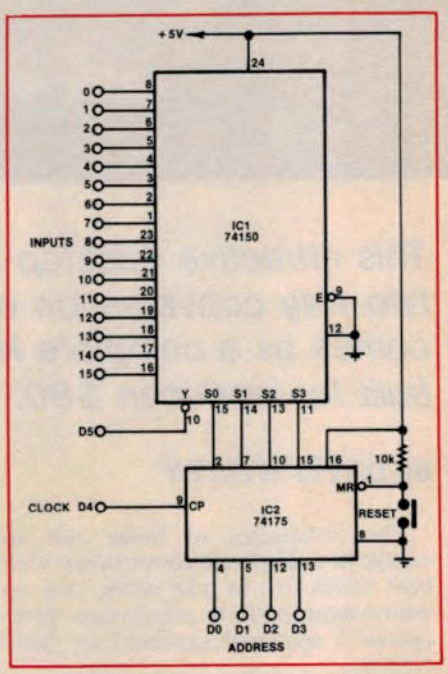
Bits 0 to 3 of the computer's 8-bit parallel port are used for the address of the input line to be tested and are latched onto the address inputs of a 74150 multiplexer using bit 4. If the input line selected is active, ie at +5V, bit 5 goes low.

The short program included will continuously scan the input lines and print the address of any lines which are active. Line 10 sets the PIO to mode 3 and selects the lines to be used for inputs and those to be used for outputs. The address is latched out at line 30 by first setting bit 4 to 0 and then to 1.

The remainder of the program prints the address of the input lines which are active. For faster operation, this program can easily be converted to machine language.

```
10 OUT 1,255:OUT 1,224
15 FOR A=0 to 15
30 OUT 0,A:OUT 0,(A+16)
35 S=IN(0)
40 IF S=32 THEN 45
42 PRINT A
45 NEXT A
50 OUT#0:STOP
```

Philip Wakeman,
Altona, Vic. **$15**



Source for 32.768kHz crystal

If your $5 digital watch fails, don't throw it in the rubbish tin. Even if the watch fails, the 32.768kHz crystal is likely to be okay. (The most common reason for watches being discarded is failure of the cheap liquid crystal display or its elastomer connector).

The crystal is housed in a very small can with two flexible leads at one end. Extracting the crystal is simply a matter of opening the watch back, lifting out the watch module and clipping the two leads.

A 32.768kHz timebase circuit was used in the 2MHz frequency counter published in the August 1983 issue of *Electronics Australia*.

Other components which can be salvaged from discarded crystal watches are the "grain of wheat" light bulb and the watch battery.

WANTED: *your circuit and design ideas. We pay between $5 and $40 per item published, depending on the merit and how much we have to do to publish it. The payment for each of the items on these pages is given as a guide. If you have an original idea, why not send it to us?*

Hands-free telephone adaptor

This attractive desktop unit enables hands-free two-way conversation over the telephone. It comes as a complete kit of parts and can be built for less than $80.

by DAVID WHITBY

The advantages of being able to engage in a telephone conversation with both hands free to take notes, look up information, perform calculations or to operate a computer keyboard are fairly obvious.

That increasingly valuable commodity called "time", much of which we often waste waiting for our called party to be found or to finish another phone call, can be put to good use when we are freed from having to hold the handset to our ear to keep track of proceedings.

"Please hold the line" need not mean a hold up in our busy schedule when a simple switch to "hands-free" will enable us to continue with the job in hand. Recorded announcements telling us that our call has been placed in a queue and will be answered by the first available operator are becoming increasingly common these days, and can be a source of much time wasting. By switching to "hands-free" operation we can avoid losing our place in the queue but at the same time make valuable use of that otherwise wasted time.

If we add to this the ease of answering a call by simply pushing a button and the fact that others may join in the conversation, then a hands-free telephone begins to look like a very useful device indeed.

The hands-free telephone, also known as the loudspeaking or conference phone, has been around for many years now. Until recently, it was found mainly in the upmarket telephones used in business situations.

Of late, a large number of commercial units has become available. These range from the upmarket types which offer features such as multiple number storage and sell for up to $475.00 to the cheaper Asian imports which can be bought for $80-$200.

The more expensive units normally incorporate voice-operated switching to overcome the perennial problem of loudspeaking telephone design; ie acoustic feedback caused by the simultaneous operation of a sensitive microphone and a loudspeaker on the same two wire line.

The cheaper units often do not use

voice-operated switching but rely on operating just below the point of acoustic feedback. This gives rise to a characteristic sound which can be described as "like speaking through a long tunnel" and is the reason for the many complaints levelled against hands-free telephones.

The *Hi-Fone* hands-free telephone adaptor has been designed to eliminate the tunnel effect problem. Careful attention has been paid to speaker-microphone isolation and a voice-operated switch operates on the outgoing signal.

The unit is intended for use in conjunction with a standard telephone receiver. The telephone is used to dial the required number in the normal manner after which the *Hi-Fone* is brought into operation by pressing a pushbutton switch. The telephone handset is then replaced and the call continued in the hands-free mode.

For incoming calls, the handset need not be lifted. Instead, the call may be answered directly in the hands-free mode simply by pushing a button on the *Hi-Fone*. The incoming conversation may be heard either on the inbuilt loudspeaker or via lightweight headphones as shown in the photograph.

The headphones may seem at first to be somewhat redundant on a hands-free telephone but in practise they have been found invaluable. There are many

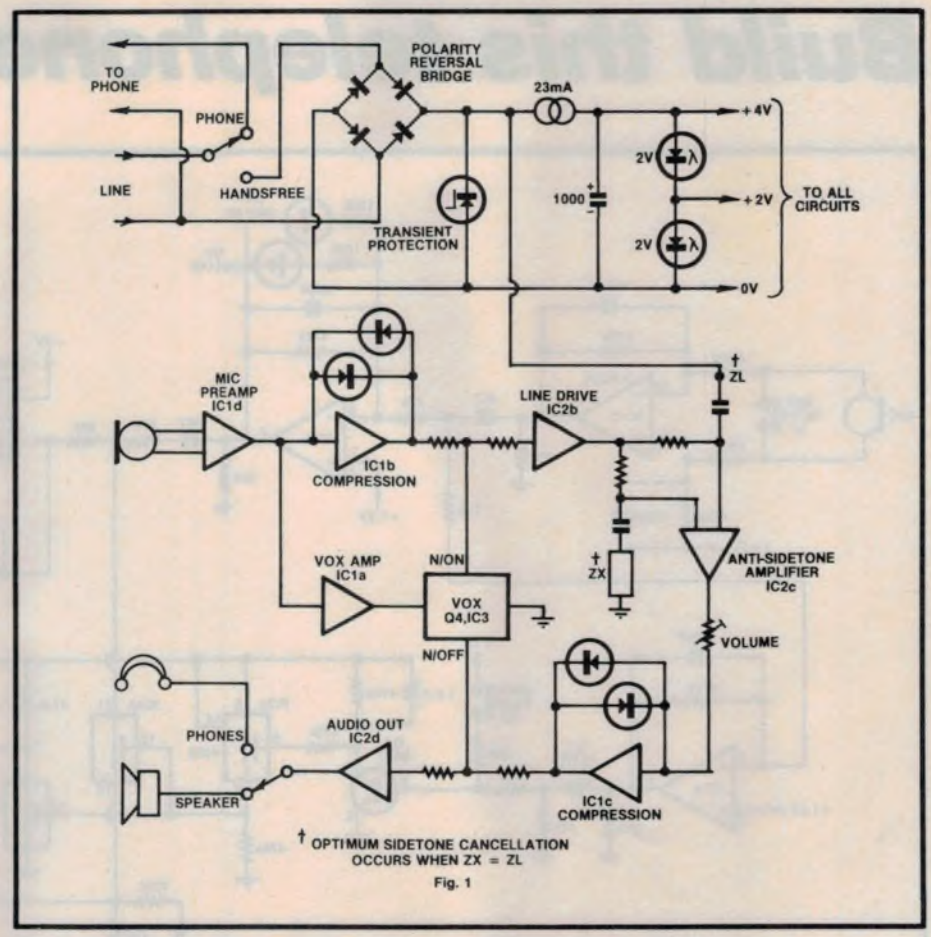
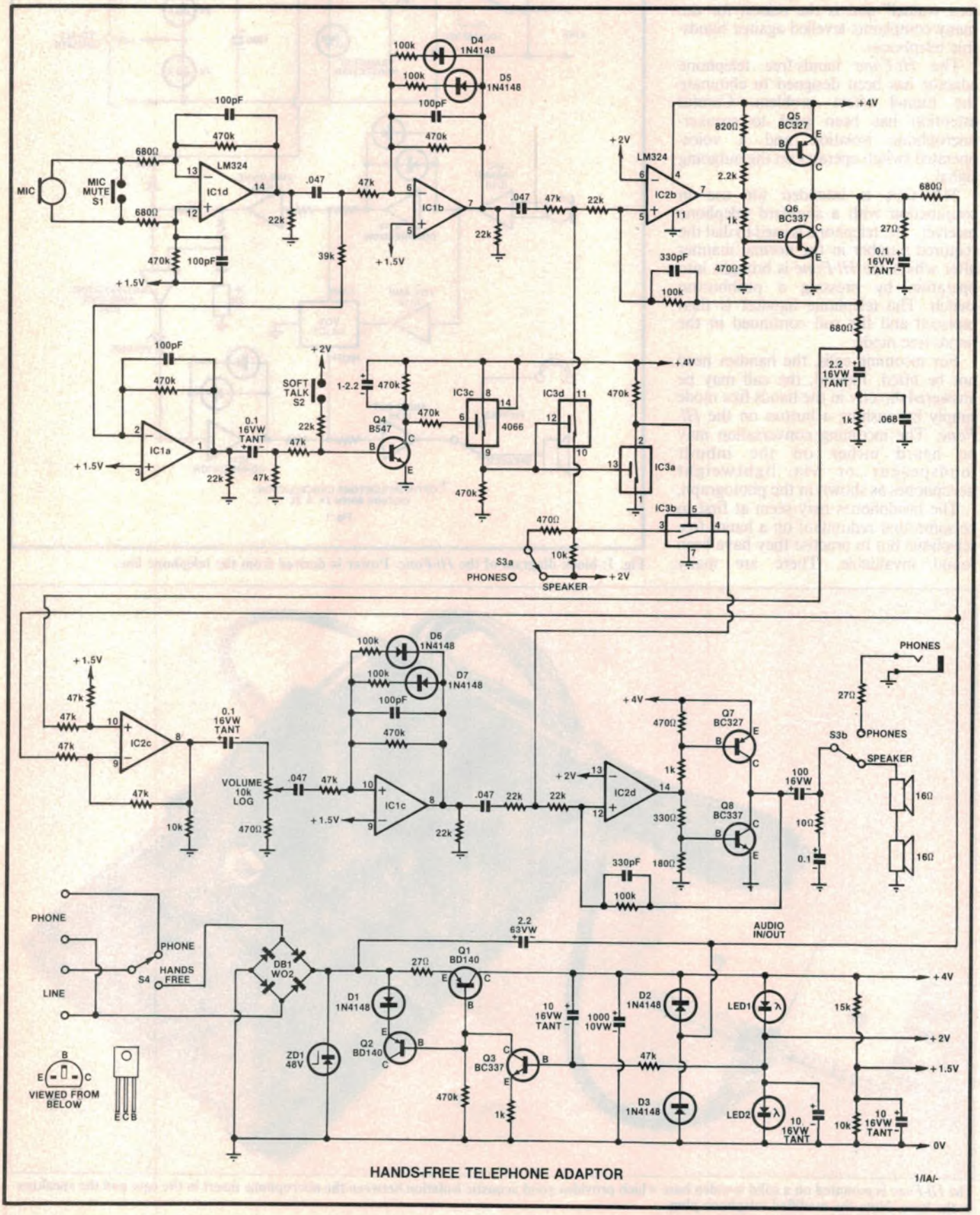


Fig. 1: block diagram of the *Hi-Fone*. Power is derived from the telephone line.

The *Hi-Fone* is mounted on a solid wooden base which provides good acoustic isolation between the microphone insert in the case and the speakers in the base. Note the modified telephone plug.

Build this telephone adaptor



HANDS-FREE TELEPHONE ADAPTOR

occasions when the hands need to be free but privacy is also required. With lightweight headphones, there is no need to sacrifice privacy to free your hands.

The headphones are also ideal for use while operating a keyboard. As long as the main unit is within arm's length or so, its microphone will transfer your voice efficiently to the line.

A microphone mute button is fitted, being the electrical equivalent of a hand over the mouthpiece but easier and more efficient in preventing the remote party from overheating confidential information.

The Soft Talk button provides manual operation of the voice switch. It is useful in conferences if those outside the immediate group are too far away to operate the voice switch but need to contribute to the conversation. It may also prove useful when someone with a particularly soft voice is involved.

The voice-operated switch is not needed to the same extent when headphones are used, due to reduced feedback. Its effect is thus deliberately reduced in the headphone switch position.

Acoustic design

As already mentioned, microphone/speaker interaction can present problems on two-wire lines.

Even with electronic precautions, such as voice-switching, it is still essential to reduce microphone speaker interaction to a minimum for good results.

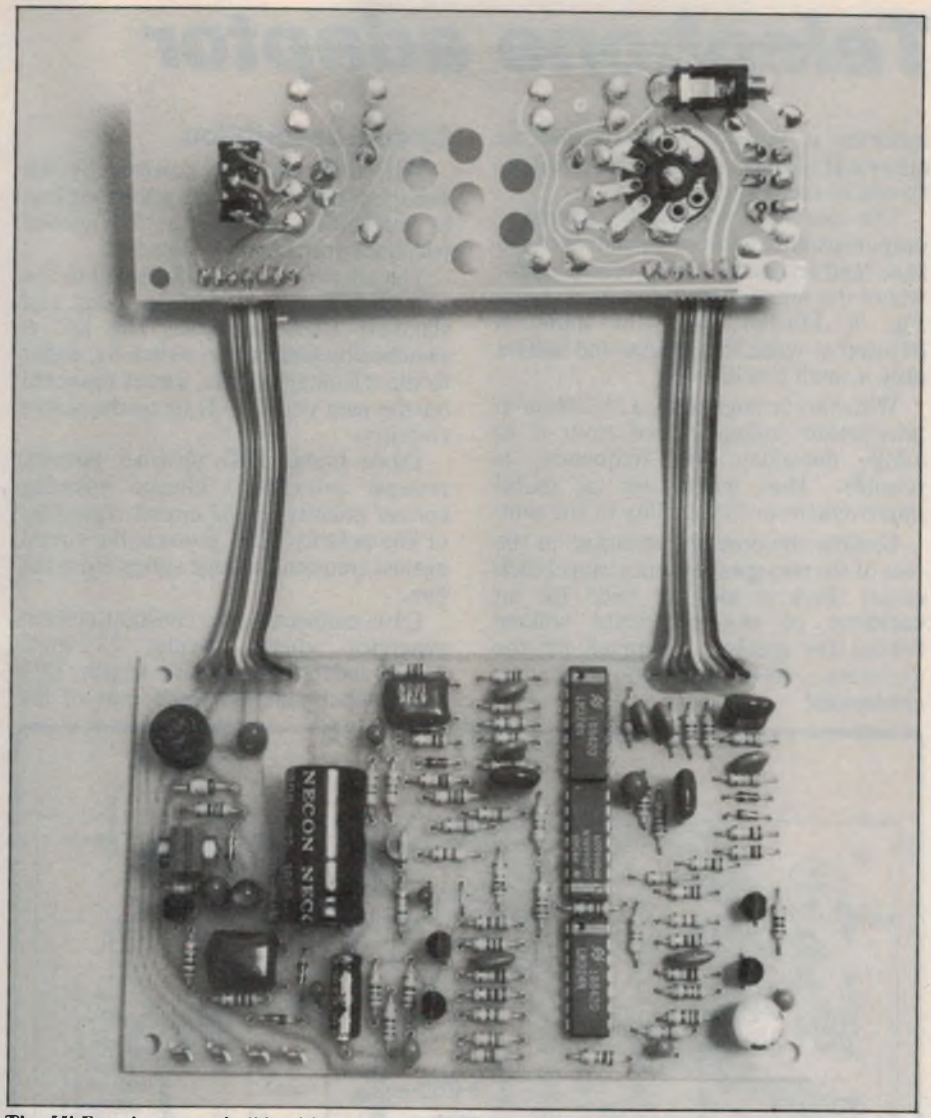
The *Hi-Fone* is mounted on a solid polished wooden base. This is not just for appearance — although we think it looks pretty good — but also provides acoustic isolation between the microphone insert in the case and the speaker unit mounted under the base.

A unidirectional dynamic microphone insert is used to reduce sensitivity to sounds from the rear and sides of the case.

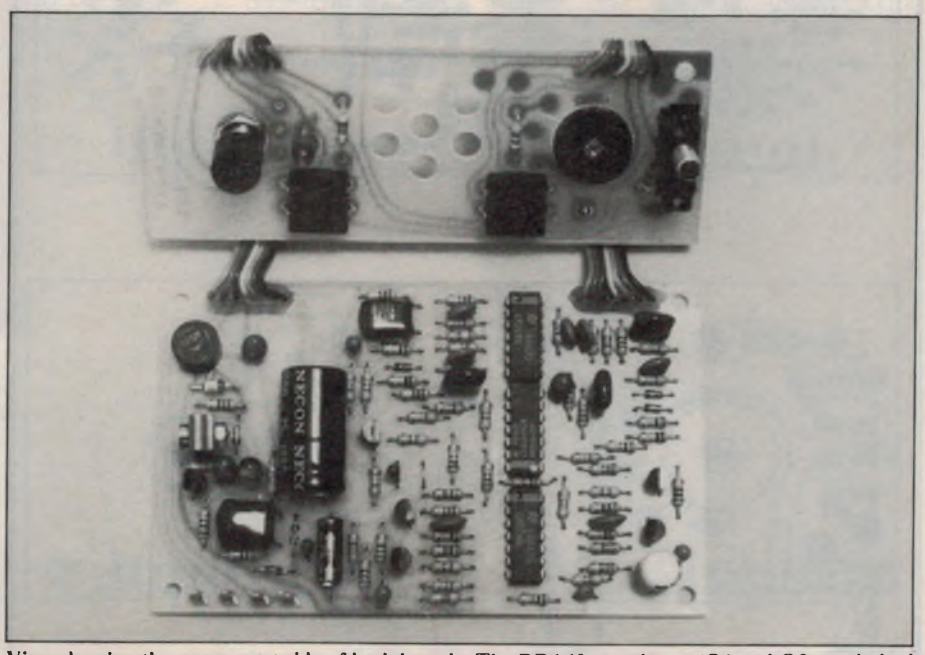
The speaker unit under the base consists of two 57mm speakers connected in series antiphase with the magnets facing into a cavity in the base. The speakers are secured to the base by a plastic grille assembly and the front

SPECIAL NOTE

The *Hi-Fone* has been designed to comply with Telecom technical requirements regarding line termination, line levels, safety and quality of transmission, etc. The intention is to submit the unit for approval application in the near future. At the time of writing, however, the unit does not carry approval for connection.



The *Hi-Fone* is easy to build, with all the circuitry accommodated on two small PC boards. Note that the headphone socket and volume pot are mounted on the copper side of the top board.



View showing the component side of both boards. The BD140 transistors (Q1 and Q2) are bolted together for good thermal contact.

Telephone adaptor

radiation is separated and directed to either end of the base by rubber strips, as shown in the photograph.

The idea here is that the antiphase outputs emanating from either end of the base tend to cancel at the centre point, where the microphone is positioned (see Fig. 3). Further away, the sound is diffused at voice frequencies and suffers only a small loss in level.

With this arrangement, a reduction in mic/speaker interaction of from 6 to 12dB, dependent on frequency, is possible. This makes for a useful improvement in the stability of the unit.

Because the pressure variations at the rear of the two speaker cones cancel each other, there is also no need for an enclosure of any significant volume behind the speakers. So much for the acoustics, let's now look at the electronics!

Circuit description

The entire circuit is powered by the voltage available from the telephone line in much the same way as the normal telephone instrument is powered.

The telephone line is connected to the unit by a modified telephone plug and standard 1.8-metre cable. The line is switched by pushbutton switch S1, either to the telephone via the socket mounted on the plug (see Fig. 1) or to the active circuitry.

Diode bridge DB1 provides polarity reversal protection, always ensuring correct polarity to the circuit regardless of line polarity. ZD1 protects the circuit against transient voltage spikes from the line.

Q1 is connected as a constant current generator which provides 23-24mA, largely independent of line length. Q2's base-emitter junction forms part of the constant current reference voltage. It is thermally coupled to Q1 and provides effective temperature compensation for the current generator, especially at short line lengths where the dissipation and hence the temperature rise in Q1 is highest. Q3 provides a constant current to Q2 and its associated diode.

The constant current generator serves two main purposes.

First, from the line side it appears as a high dynamic impedance and does not load the line appreciably for voice signals. This allows the terminating resistance of the device to be set independently of the power supply by a simple resistor, in this case 680Ω via 2.2μF from the output of the line drive amplifier Q5 and Q6.

Second, the current generator, in conjunction with the 1000μF capacitor across its output, effectively isolates the line from supply current fluctuations due to the audio power amplifier.

DC termination

Telecom regulations require a minimum current of 23mA for exchange line seizure with a line resistance range of 400-1900Ω from a 50V nominal exchange supply battery.

A 1900Ω line limit with 23mA minimum current leaves only 6.3V across the termination. Allowing 1.2V for DB1 and 1V for the regulator leaves little more than 4V to operate all the active circuitry of the unit.

Under these conditions, a series LED for "on" indication is not possible. This problem has been solved by using two LEDs in series as a shunt regulator, thus providing voltage regulation and power "on" indication in the one component.

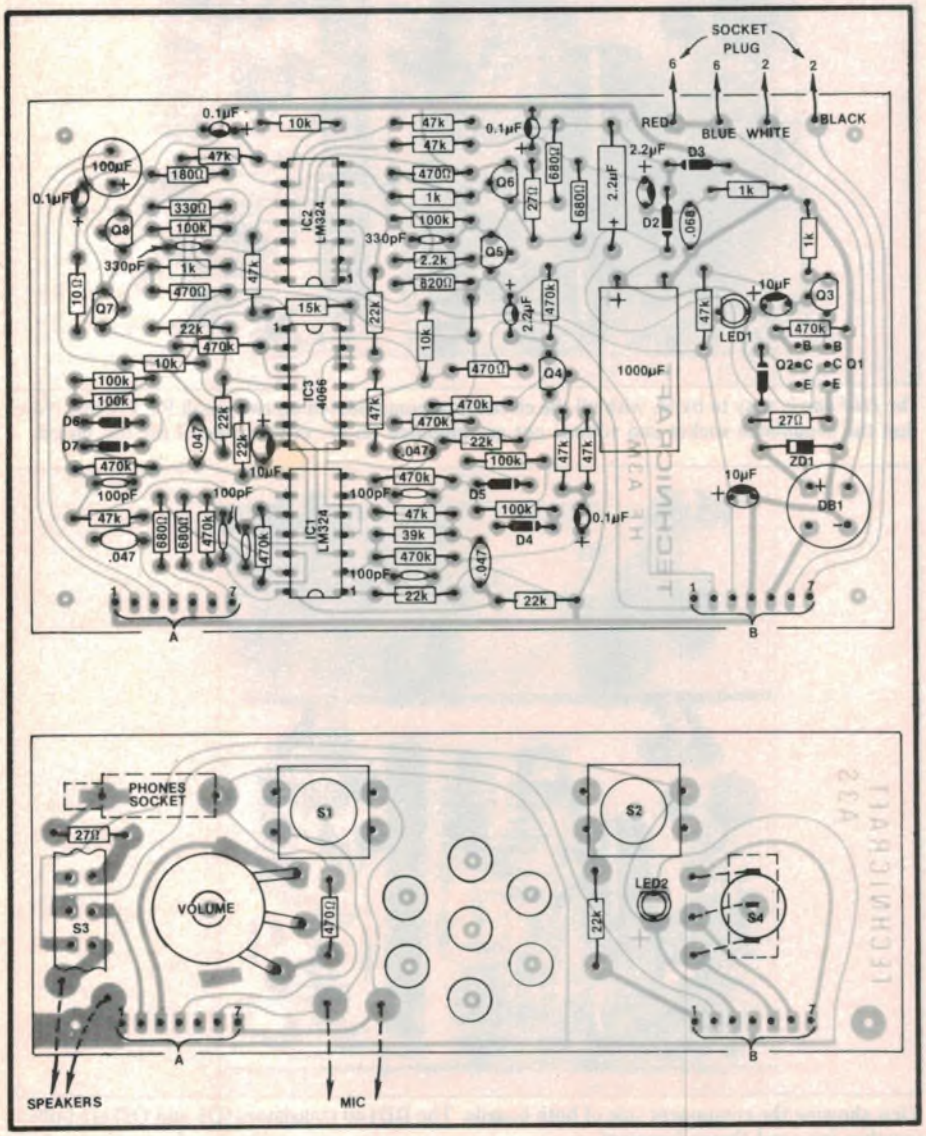
The particular red LEDs chosen have a voltage drop of between 1.9-2.0V at 23mA and this provides a supply of 3.8-4.0V with a convenient centre tap for amplifier bias, etc. Another bias voltage of +1.5V is provided by a voltage divider and is used to give a better operating point for some of the op amp stages under the low supply voltage conditions.

Low voltage circuitry

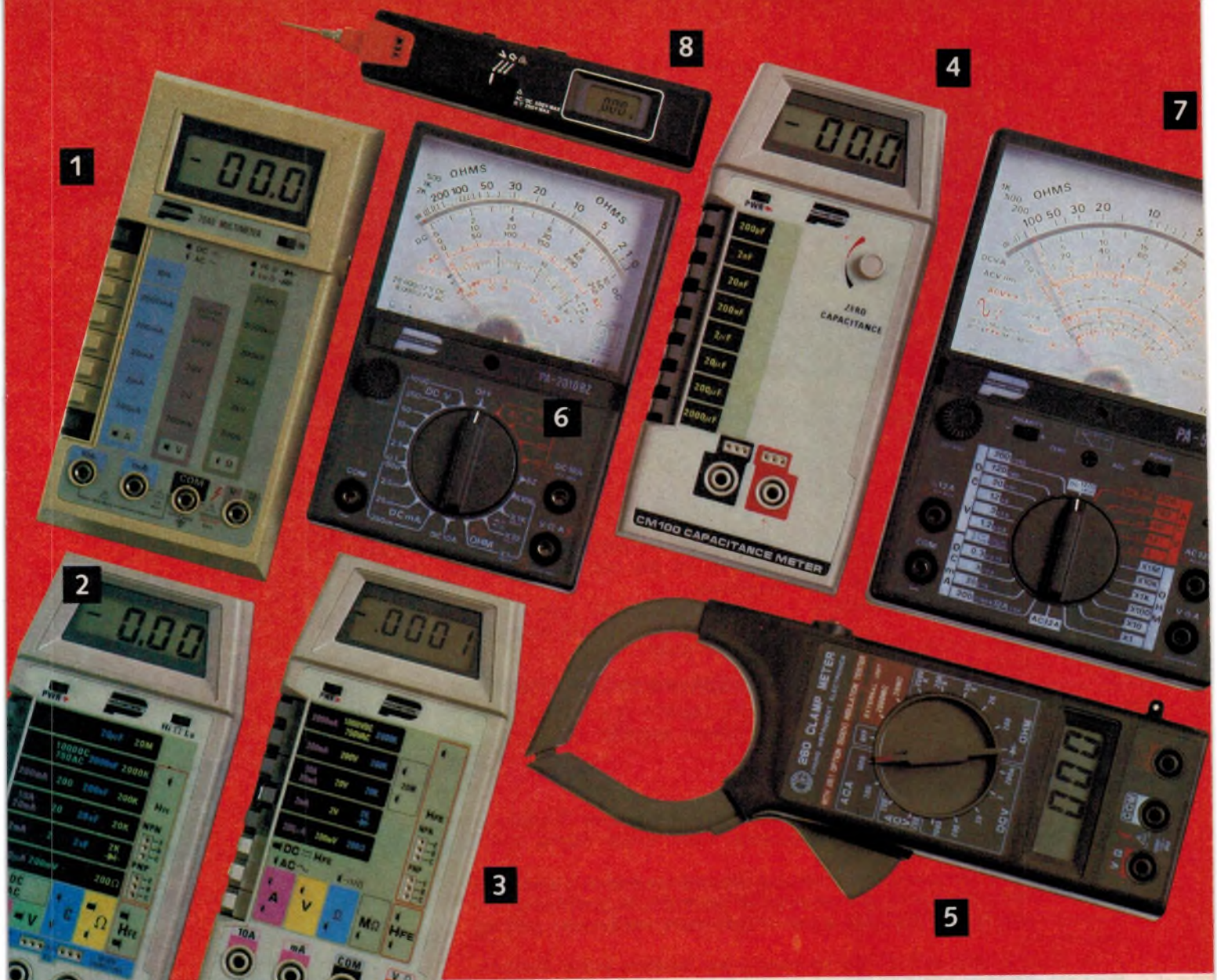
Because of the low supply voltage, the choice of IC types for the circuit was fairly restricted.

The LM324 quad op was chosen for most of the circuit functions because it is one of the only readily available devices which will work well down to three or 4V, as well as having very modest quiescent current requirements. Crossover distortion, which can be a problem with the 324 in AC-coupled applications, has been eliminated by using pull down resistors on all outputs, this at the expense of a small increase in quiescent supply current.

To overcome the limited output swing



Parts layout for the two PC boards. Take care when installing polarised components.



Glover & Assoc. PM5810

Test us..

No matter what you're after in a multimeter, Parameters has it.
Top value digitals and analogues, clamp meters and probe testers.

All digital meters feature ● Easy to read LCD displays ● Overrange and low battery indicators ● Overload protected on all ranges ● 10A current ranges ● Diode test ● Complete with case and probes ● 12 month no-nonsense warranty

1. 7040 3½ digit DMM
33 ranges
0.1% DCV accuracy
$99.00

2. 7080 3½ digit DMM
37 ranges
0.1% DCV accuracy
Capacitance measurement
— HFE measurement
$128.80

3. 8040 4½ digit DMM
31 ranges
0.05% DCV accuracy
HFE measurement
Audible continuity test
$207.25

4. CM100 Capacitance Meter
3½ digit, 0.1% accuracy
8 ranges 0.1pF-2000μF
$171.35

5. 260 Clamp meter
AC current to 1000A
AC 750V, DC 1000V
Resistance to 2MΩ
Diode test
$194.35

6. 2010BZ multimeter
24 ranges, 20,000Ω/VDC
Continuity buzzer
$39.68

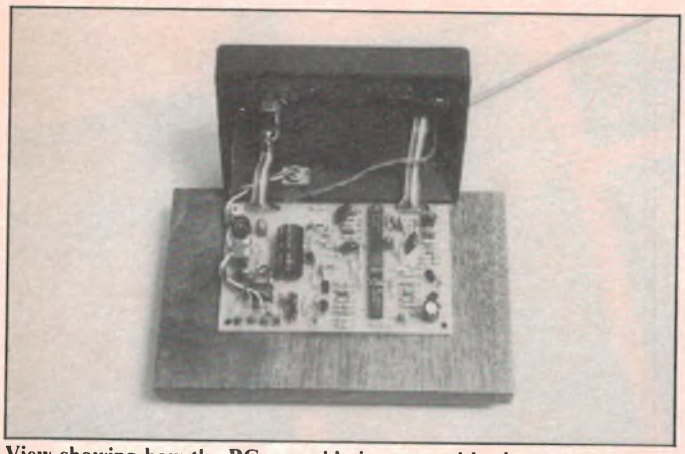
7. 5050E FET multimeter
43 ranges including 0.1μA DC and 12A AC
Input imp. approx. 10MΩ
Polarity reversal switch
$85.68

8. 2447 Circuit tester
A convenient probe-style multimeter.
12 ranges + continuity test
DCV, ACV and resistance
$108.10

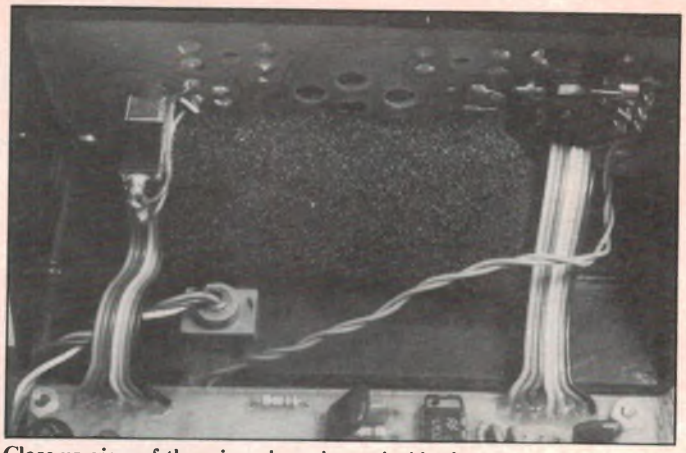
Parameters Pty Ltd. SYDNEY: 25-27 Paul St. North Ryde NSW 2113. (02) 888 8777.
MELBOURNE: 1064 Centre Road, Oakleigh South, Vic. (03) 575 0222
ADELAIDE: Trio Electrix (08) 212 6235. BRISBANE: L.E. Boughen & Co. (07) 369 1277.
HOBART: Imbros (002) 34 9899. NEWCASTLE: DGE Systems (049) 69 4242.
PERTH: W.J. Moncrieff (09) 325 5722. TOWNSVILLE: Nortek (077) 79 8600.
WOLLONGONG: Macelec (042) 29 1455.
CAIRNS: Thompson Instrument Services (070) 51 2404.

PARAMETERS PTY LTD
PERFECTION IN MEASUREMENT

Due to currency fluctuation prices are subject to change without notice. All prices are recommended only and include sales tax. Tax free prices on request.



View showing how the PC assembly is mounted in the case.



Close-up view of the microphone insert inside the case.

Telephone adaptor

of the devices, a 1.5V bias point (ie, less than ½Vcc) has been used for all low level stages. This allows up to 2.6V p-p output and symmetrical clipping with a 4V supply.

The line drive and audio output amplifiers, which require maximum output swing as well as higher current drive, have been implemented using complementary collector output stages which allow the output to swing within millivolts of the rail under full load conditions.

The only other IC type used is a CMOS 4066 which works quite happily at the 4V supply.

Microphone-to-line amplifier

IC1d operates as a differential input microphone amplifier with a gain of almost 700 and a high rejection of stray hum and noise pickup.

The output of this is AC-coupled to IC1b which has a gain of 10 for signals below 100mV p-p. For higher level signals, a diode compression circuit operates and, by soft limiting, holds the output of this stage to a maximum of 1.7V p-p, even for the highest likely practical voice levels.

This peak limiting compression keeps the line drive level within Telecom requirements. It also prevents the hard clipping distortion which would otherwise occur under high input conditions.

The output of IC1b is fed to a line drive amplifier stage consisting of IC2b Q5 and Q6. The gain of the drive amplifier is 1.45 and the line is driven via a 2.2μF coupling capacitor and a 680Ω resistor which form the AC line termination impedance of the whole unit. The two diodes to +4V and 0V from the junction of the line coupling capacitor and resistor protect the line drive amplifier and the receive amplifier input from transients. These transients can occur during on and off switching and during normal operation.

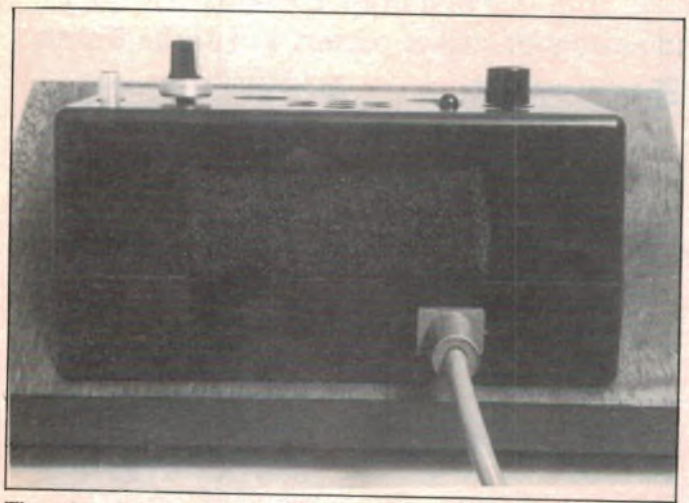
Where to buy the kit

A complete kit of parts for this project is available from Technicraft Electronics, 338 Katoomba St, Katoomba, NSW 2780. Phone (047) 82 3418.

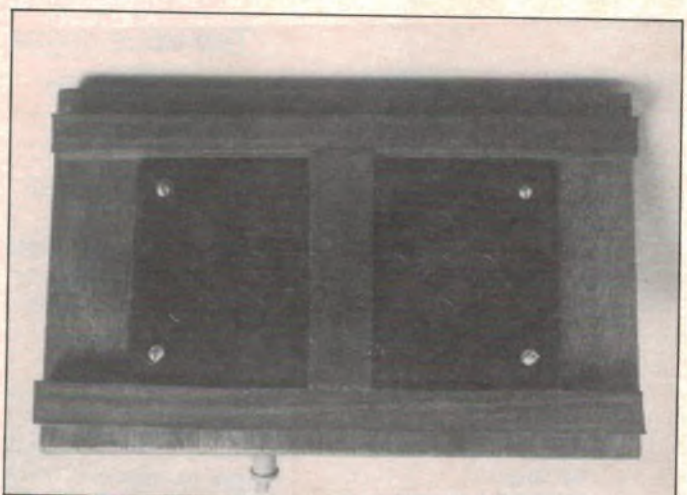
The kit comes complete and includes the finished woodwork, a drilled and screen-printed case, the circuit boards and all components, a microphone, a telephone plug/socket and cord, a pair of lightweight headphones, plus full instructions.

The price is $79 plus $5 for packaging and postage within Australia. Payment should be made by way of cheque or money order. Please phone or write for availability and prices of fully assembled units.

NOTE: The name *Hi Fone* and the printed circuit board copyright are the property of Technicraft Electronics, 338 Katoomba St, Katoomba, NSW 2780.



The microphone is contained in a foam rubber surround which is inserted through the cutout in the rear of the case.



The loudspeakers are secured to the base by a plastic grille assembly. Note the rubber strips.

The thrilling new C-Series from KEF

Now the famed bestselling British speakers attain new standards of exceptional performance.

KEF'S C-Series speakers have been bestsellers for more than two decades, winning the loyalty and delight of audiophiles the world over. Now the elaborate research tools developed by this trail-blazing British manufacturer have produced numerous performances and aesthetic improvements in KEF'S remarkable range of six new C-Series models for 1985.

New cabinet design, new drive units, and radical new crossover networks for lighter amplifier load are just some of the features. And the innovative use of polypropylene as the revolutionary new cone material has brought the major benefits of reduced colouration and substantially improved efficiency.

From the tiny but amazing C10 bookshelf speaker right through to the elegantly tall C80 with its exceptionally high sensitivity, these latest speakers by KEF are masterpieces for the money.

KEF

FALK ELECTROSOUND GROUP
BOX 234 ROCKDALE 2216.
PHONE (02) 597 1111

Telephone adaptor

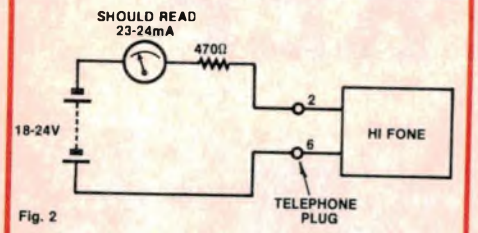


Fig. 2: this simple test circuit can be used to check for correct DC operation.

The overall bandwidth of the amplifier from microphone input to line is within -3dB from 200Hz to 3kHz. This is more than adequate for good voice transmission.

Voice operated switch

IC1a amplifies the output of microphone amplifier IC1d by 12 and the resultant output is applied to the base of transistor Q4 which is normally off.

The gain of IC1a controls the switching threshold for the voice-operated switch and has been chosen by practical experiment for the best compromise between sensitivity and stability.

In the rest state (ie, with below threshold sound input to the microphone), Q4 is off, IC3d is on and IC3b is off. This holds the transmit side of the system in a low gain state and the receive side in a high gain state. When sound levels above the predetermined threshold are present at the microphone, Q4 switches on, charges the 2.2μF capacitor in a few milliseconds and reverses the state of all switches in IC3. This immediately produces a high gain state on the transmit side and a low gain state on the receive side.

At the cessation of sound input, and after a time constant determined by the 2.2μF capacitor and 470Ω resistor in Q4's collector (approximately 1.5s) the system reverts back to the rest state; ie, low gain on transmit, high gain on receive.

In the rest state, the loudspeaker or headphones are always open to incoming line signals. Note that, when S4 is in the headphone position, a 10kΩ resistor is placed in series with gain switching elements IC3d and IC3b. This changes the transmit gain reduction at rest from around 100:1 to 5:1, and the receive gain reduction from around 50:1 to 2:1. This makes the voice switching not greatly noticeable on the headphones but still avoids feedback problems, even if the headphones are placed near the microphone.

Line to speaker amplifier

The line signal consists of both outgoing and incoming voice frequencies. In order that as little as possible of the outgoing signal is heard in the loudspeaker or headphones, an anti-sidetone circuit is used.

This consists of unity gain differential input amplifier IC2c which has one input taken from the line and the other from a simulated line impedance driven from the same line drive amplifier through another 680Ω resistor. Both inputs to IC2c are thus driven with a similar in-phase outgoing signal which is largely cancelled at the output of IC2c due to its common mode rejection. Only the inverting input of IC2c has the incoming signal on it and this is passed unchanged in level to its output.

High rejection of the outgoing signal is possible with this arrangement, provided that the line simulator accurately represents the actual line impedance and phase angle.

In practice, this is a compromise due to wide variations in practical lines. The values used here were chosen after calculation and experiment with published Telecom artificial line circuits. With the values shown the sidetone rejection is more than 12dB over most encountered line connections.

Following this stage is a volume control which feeds into ×10 amplifier IC1c with the same soft limiting

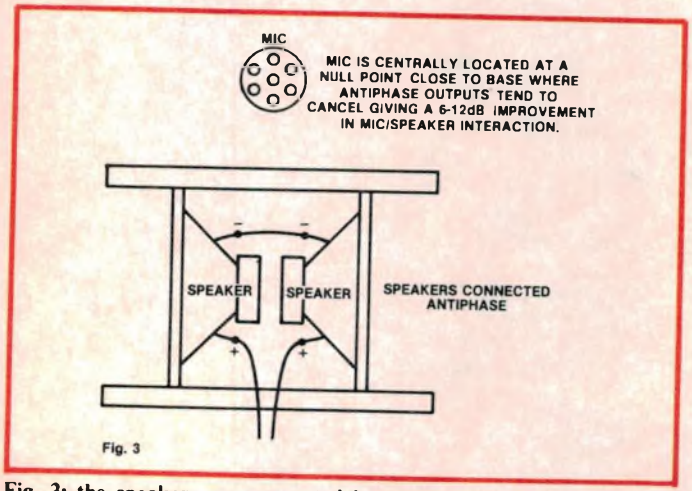


Fig. 3: the speakers are connected in antiphase and the microphone positioned at the null point.

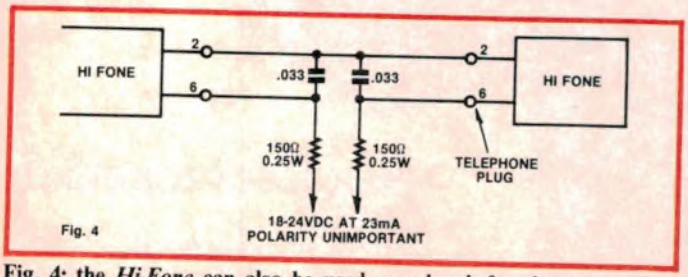
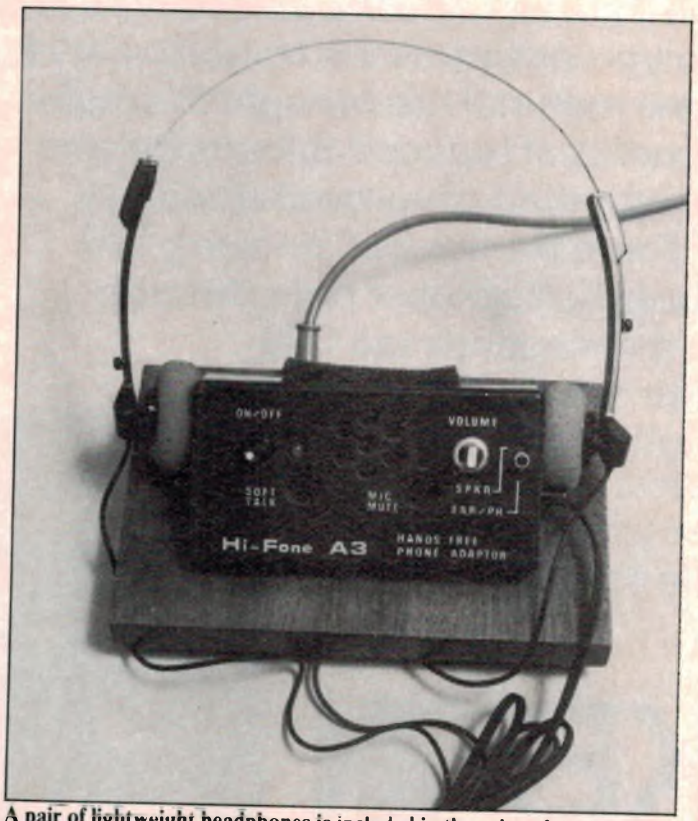


Fig. 4: the *Hi-Fone* can also be used as a hands-free intercom. This diagram shows the basic scheme. All that is needed to complete the system is a simple calling system.



A pair of lightweight headphones is included in the price of the kit. They are ideal for use when operating a keyboard or when privacy is important.

compression characteristics as IC1b on the transmit side. This prevents overload of the audio amplifier over a wide range of line inputs.

The speaker drive amplifier is similar to the line drive amplifier but has higher quiescent and drive current in order to provide the higher power needed for the 32Ω loudspeaker load. The amplifier delivers up to 50mW which provides good conversational sound level.

The bandwidth from line to speaker input is within 3dB from 200Hz to 3kHz.

The headphone output includes a 27Ω resistor to limit the available power to the headphones for comfortable listening levels.

Construction

Two printed circuit boards are used. The main board contains most of the active circuitry while the sub board holds the switches, "on" indicator LED, the volume control and headphone socket. The boards are connected together by two short lengths of ribbon cable.

Construction is straightforward and should present no real problems. The circuit board component overlays, along with the wiring interconnections, are shown on page 54. Note carefully the orientation of the diodes, transistors, ICs and electrolytic capacitors when they are being installed. Note that the two BD140s both face in the same direction (ie, marking towards the outside edge of the board) and are bolted together for good thermal contact (see photo).

The headphone socket is mounted on the sub board. The headphone plug, which is a 2.5mm type, mates with the socket through a hole in the side of the case. This is to eliminate exposed metal and discourage the connection of other devices.

When the boards are complete and interconnected (the ribbon cable is supplied cut and stripped in the kit), the unit may be tested before mounting in the case. A simple test circuit is shown in Fig. 2.

Correct DC operation is indicated if both LEDs light up and the current is between 23-24mA.

To check the audio operation, temporarily connect the microphone and the headphones to the sub board. If all is well, microphone signals should be heard in the headphones. Assuming everything checks out, unsolder the mic and unplug the headphones. The unit is now ready to mount in the case.

The sub board is mounted in the case by two self-tapping screws, while the main board is fastened by two screws from underneath the base. A couple of nuts, one on either side, act as spacers between the board and the case.

When the boards are located, the speaker wires may be soldered to the sub board as shown in the wiring diagram.

A foam rubber gasket is fitted between the loudspeaker grille and the wooden base.

The case is then placed over the main board and tightened down onto the base by two 1.5 inch × ⅛ inch screws from underneath. These two screws also hold one side of the plastic speaker grille in place, the other side being fastened by two woodscrews. A foam rubber gasket is fitted between the loudspeaker grille and the base.

The microphone wires can now be soldered to the sub board through the rectangular cutout in the back of the case and the microphone inserted through the cutout and into the case. Make sure that it faces towards the front (the front of the microphone is marked).

The unit is now ready to be tested under actual operating conditions.

For best results, set the volume control no higher than needed and speak in a normal conversational voice with the *Hi-Fone* facing towards you at about arms' length.

PARTS LIST

2 PC boards (available from Technicraft Electronics, see text)
1 DPDT slide switch
1 SPDT pushbutton switch
2 pushbutton on/off switches
2 16Ω 57mm dia. loudspeakers
1 microphone insert with foam rubber surround
1 pair of lightweight headphones
1 2.5mm headphone socket
1 modified telephone plug and cable (Technicraft Electronics)
1 wooden base and case (Technicraft Electronics), plus rubber mounting strips
1 loudspeaker grille plus sealing gasket
4 quick connect tabs (to suit cable)

Semiconductors

2 LM324 quad op amps
1 4066 quad bilateral switch
2 BD140 PNP transistors
2 BC327 PNP transistors
3 BC337 NPN transistors
1 BC547 NPN transistor
7 1N4148 diodes
1 W02 bridge rectifier
1 48V 1W zener diode
2 red LEDs

Capacitors

1 1000μF 16V PC electrolytic
1 100μF 16V PC electrolytic
3 10μF 16V tantalum
1 2.2μF 63V PC electrolytic
2 2.2μF 16V tantalum
4 0.1μF 16V tantalum
1 .068μF metallised polyester (greencap)
4 .047μF greencap
2 330pF ceramic
1 150pF ceramic
4 100pF ceramic

Resistors (0.25W, 5%)

10 × 470kΩ, 6 × 100kΩ, 10 × 47kΩ, 2 × 39kΩ, 8 × 22kΩ, 1 × 15kΩ, 3 × 10kΩ, 1 × 2.2kΩ, 4 × 1kΩ, 1 × 820Ω, 4 × 680Ω, 4 × 470Ω, 1 × 330Ω, 1 × 180Ω, 3 × 27Ω, 1 × 10Ω, 1 × 10Ω, miniature log pot.

Miscellaneous

Hookup wire, machine screws and nuts, solder, etc.

A practical approach to Electronics

PART 2

Soldering components on the board

Many projects don't work because of poor soldering. In this chapter, we take a look at the pitfalls inherent in soldering components to PC boards.

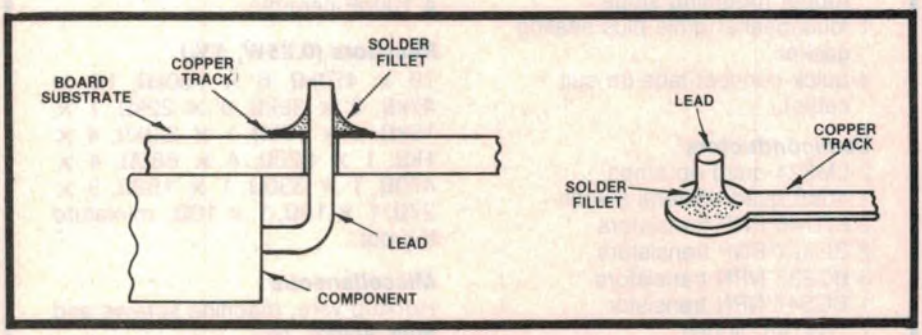
by KINGSLEY HOWE

There are basically two types of material used in the manufacture of circuit boards. The most economical is the Synthetic Resin Bonded Paper (SRBP) board. This is made by laminating layers of paper saturated with uncured resin, under high pressure and heat. This sets the resin to a permanently hard state; it cannot be remelted. Whilst it is considered to be of lesser quality than "fibreglass", most VCRs, TV receivers and stereo amplifiers employ this type, mainly due to cost.

Some constructors who make their own circuit boards will not use SRBP, preferring the reinforced types. However, after viewing many thousands of boards, in hundreds of different products, I have found the "paper" boards to be very reliable and long-lasting.

Fibreglass boards are the obvious choice when expense is secondary to quality. They are used extensively in medical equipment, fire and burglar alarms, aircraft and where safety is a priority; eg. in traffic signals and industrial areas where extreme heat and vibration exist.

Two types of resin are used in the manufacture of "glass" boards. The first is polyester resin, as used to construct boat hulls and patch car bodywork. The second, and far superior, type is epoxy resin. Identifying which resin is which by the appearance of a board is very difficult. Colours vary from pale green to a light grey for both types. Each is sold as a "fibreglass board", the bulk of which is resin and some filler material, such as clay or silica. The glass fibres are used only for strengthening purposes.



How to make a good soldered joint. The solder fillet should meet the component lead and the PC track at a tangent, and should be smooth and bright.

Some indication of the difference between the two can be found when soldering. Epoxy bonded board will withstand soldering temperatures three times longer than polyester.

When handling "glass" boards, some precautions should be noted. The edges often have fibres protruding from the surface. These may enter the skin and break off, causing irritation and itching. When cutting, filing or sanding this board, be careful not to breathe in the dust.

Manufacturers process this material either wet (which carries off the broken fibres safely) or dry with dust extractors drawing the air away from the work area. If you must cut it at home, vacuum the area thoroughly afterwards. Should a rash develop, see a doctor.

Copper tracks

The copper bonded to circuit boards is of high purity. It will solder readily, provided it is clean. When manufactured, the surface is clean and shiny. After exposure to the air, however, a coat of oxide forms and the copper may appear dull and glassy.

Even a very hot iron will not shift this and solder will not adhere. To remove this layer and expose a fresh copper surface, polish with steel wool or scrub with Ajax powder or something similar in cold water.

Many PC boards bought over the counter have a protective coating applied. This could be a clear lacquer or flux made from resin. For best results, treat the board as described above. "Tinned" boards are really copper tracks coated with solder. Do not attempt to solder with this type of board until it is polished with steel wool. Wipe the board immediately with a cloth or tissue soaked in methylated spirits after cleaning. Wash your hands!

Veroboard and other types of stripboard should also be cleaned. When using steel wool, examine the board carefully for stray pieces of steel wool, as these may cause short circuits. With Ajax, rinse well in running water and scrub in and around any holes with a toothbrush to remove any trapped powder. Finally, use methylated spirits to remove any remaining contaminants.

You should now have a nice clean, shiny board, ready for soldering. If you are still not sure that it is clean enough, try applying solder to a small area of track. The solder must flow on easily. Should a blob form on this test spot, or the time taken to solder seem unduly long, clean the board again.

Note that the "tinned" board will require more heat than plain copper, due to the extra thickness of metal.

We now have a board ready for

soldering. After all that work, don't neglect the component leads. These may need cleaning too. Most resistors can be inserted as is. The leads are tin plated and cause little trouble. However, be careful with the resistors that are taped together.

After removing the tape, a small amount of the adhesive (white) will remain. Clean this off with mineral turps or kerosene on a rag. Otherwise the adhesive drags into the hole and will coat the lead all the way through. This may cause a dry joint.

Ceramic and small capacitors

Ceramic capacitors deserve special treatment in preparation. Note that the bodies (disc) of these capacitors are wax coated. This is to prevent moisture penetration, as the body coating is porous. As these capacitors are packed in bulk, the bodies and leads are in contact. Wax can then coat the leads and make soldering difficult (heat from the iron causes the wax to melt on the lead and form a solder repellent film). This wax may not be visible, but it can be detected by drawing a lead through your thumb and index finger (in other words just pinch it and pull).

Greencaps and tantalums are usually clean and can be inserted without treatment, if they are fresh stock.

Electrolytics

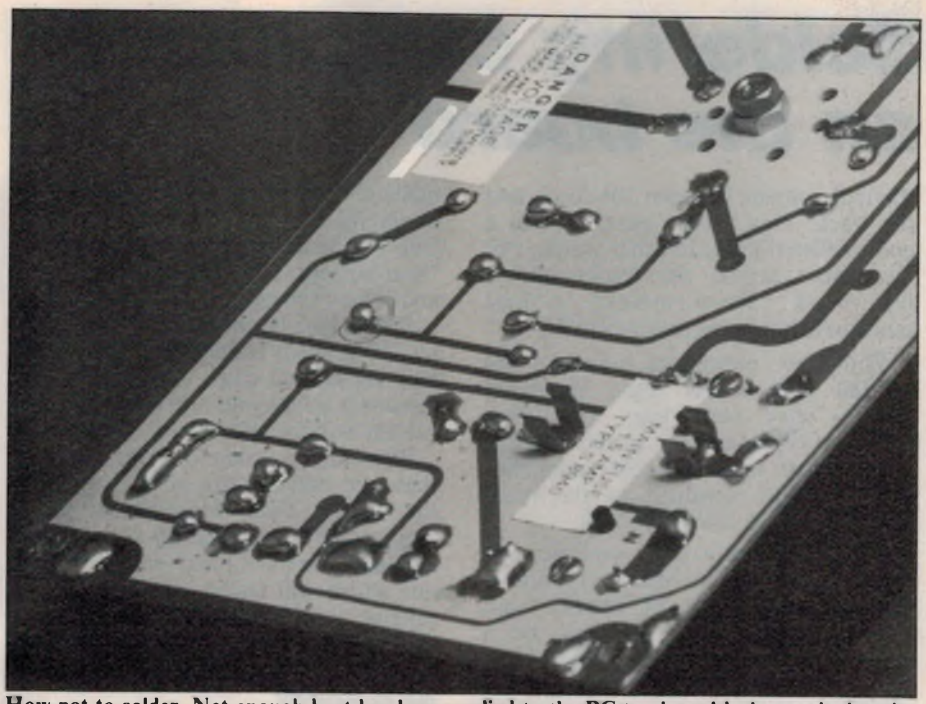
The majority of these are fitted with steel legs. Why? Well for a start they are heavier than most other components, and therefore need more support. Secondly, some of the chemicals used in the electrolyte affect copper. Also, when working in a circuit, some of the copper may plate from one side to the other.

If the capacitors have been stored for some time, check the leads; there may be some corrosion on the surface. On single ended electrolytics, both legs are attached to one end, and fitted with a synthetic rubber bung or seal. Examine the area where the leads enter the seal. Look for a brown or white "fur" on the surface. This is caused by the electrolyte leaking, in which case the capacitor is faulty and should not be used.

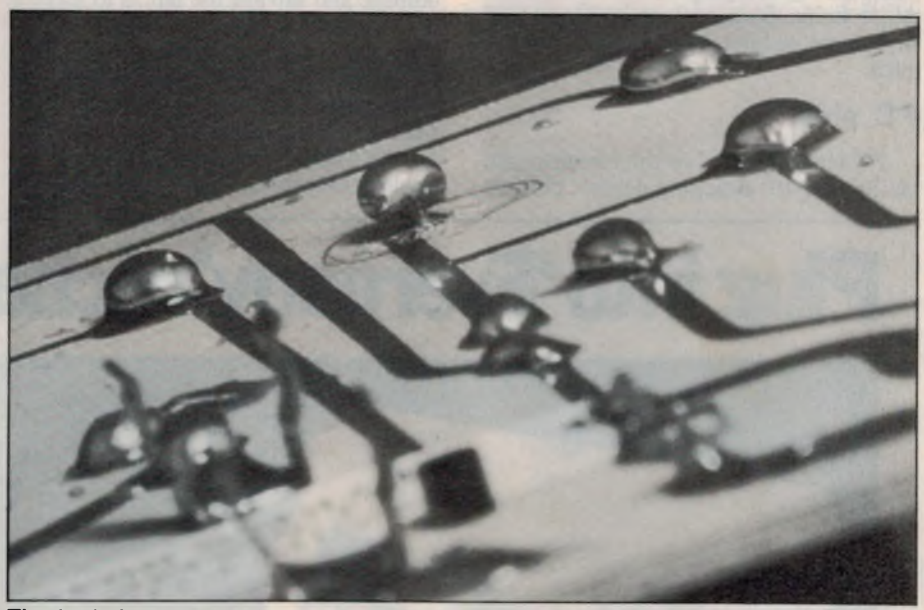
Once soldered in place this end of the capacitor will be hidden. You could then spend more time looking for the reason the project won't work than time spent on construction.

Transistors

The smaller sizes of transistors will have leads plated with tin or gold. These take solder well. The metal cased types such as BC107 have steel legs, the plastic versions (BC547) are of copper. Medium power types in the plastic "flatpacks", (BD139, TIP31 etc,) have soft copper leads (mainly to avoid stresses on the case when the leads are bent).



How not to solder. Not enough heat has been applied to the PC tracks, with the result that the solder forms a blob on the component lead.



The classic dry joint. It took only a slight tug to prise the solder blob circled clear of the PC track.

Large power types (2N3055 etc) are fitted with steel legs which are tin plated. The significance of these differences will become obvious in the section on assembly.

The legs on a 2N3055 are sometimes difficult to solder. Give them a good polish with steel wool. Just draw a small piece of steel wool over them, (fold up a piece, wrap it around a leg). Now pinch the piece tightly and draw it away from the body towards the end of the lead. Do not use sandpaper or coarse emery cloth, as this will strip off the tin coating. The leads can be tinned at this point, provided they are not to be inserted through a mica washer. This is to avoid damaging the washer.

Diodes

Small signal diode leads present no problems when soldering. However, be careful with power diodes. The leads on these are silver plated copper. The silver tarnishes readily, and will appear dull and stained. Lightly rub this layer off with steel wool. This will aid the flow of solder onto the lead. This is important for a rather obscure reason. The power diodes carry all the current supplied to a circuit, and naturally heat up.

Most of this heat will be conducted to the relatively heavy copper tracks on the circuit board, provided there is good

Soldering components on the board

thermal contact between the leads and the track. This is only possible with a good soldered joint. In other words, you have now turned the tracks into a heatsink. Remember, a hot semiconductor leads to a short life.

With few exceptions (notably the LM380 with copper legs), integrated circuits have steel legs. The most common types are tin plated. Special purpose types may have gold plating, but this is mostly confined to the more expensive range (EPROMs etc).

After handling a large number over the years, the only problem in this area is the occasional piece of plastic foam sticking to the pins. This can be a nuisance when soldering, as the plastic burns onto the pin and, because of the small size, is hard to see. It is best removed by scraping with a retractable blade knife. Both anti-static (black) and styrofoam (white) have been found on pins.

PC pins

PC pins are fitted to the circuit board as an aid to attaching leads, and are made of brass. I have found the quality of plating on these to vary considerably. One technician reported that he had to "heat hell out of them". Some are tinned and others silvered.

If they look bright and shiny, you may not have much trouble. Being so small, they are hard to clean. Possibly the best method is to hold one end with pliers and rub the surface with emery cloth.

The thing to watch for when soldering these are pinhead size bubbles rising to the surface. These will continue for as long as the iron is held on them. If this happens, you have a bad joint, or at least one which will fail in use. Don't try to remove the pin unless you are careful and have the right tools, as the hole will be enlarged and the replacement pin will not fit securely.

All that can be done to minimise damage and salvage the pin, is to leave it in place, and file the end of the pin. You should see a brass coloured spot sitting in a mound of solder. Now remelt the solder from the side, and apply fresh solder from the roll directly onto the end of the pin. Enough solder should be applied to connect the end of the pin with the solder on the board. Before attaching a wire to the pin, file the sides lightly with a points file or similar tool. Tin the pin, then solder the wire.

If you are suspicious of any pins, a simple test is to grip the unsoldered end with a pair of pliers, then slowly try to turn the pin. If it is a good joint, it will resist mightily. In fact it will spring back slightly.

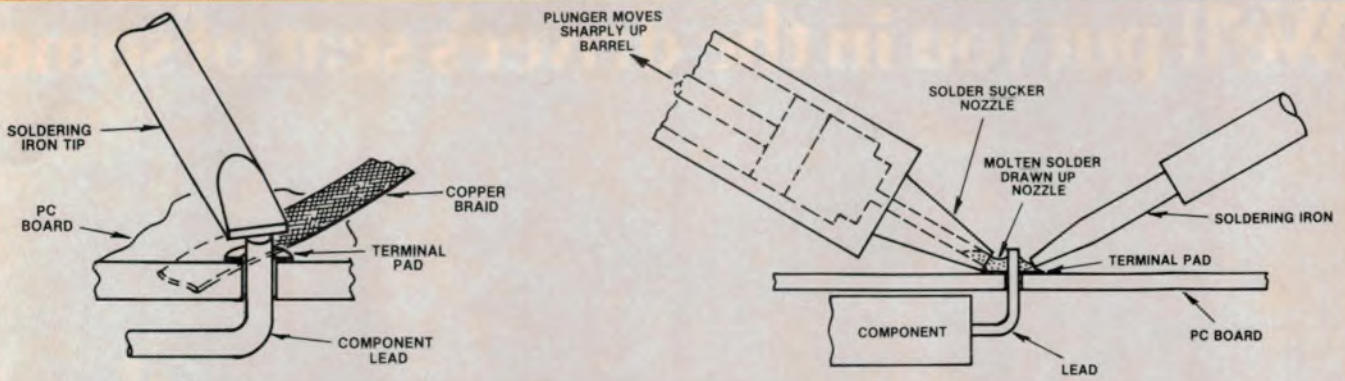
Assembly

Now we can start installing components on the board.

Start with resistors, as these will be the lowest components on the board. If you insert electrolytics first or other high components, and the resistors last, it will be difficult to load them.

Bend the leads so that they will drop into position easily. You should not have to pull the leads hard to get them to sit down on the board. If the resistor body length is greater than the distance between holes bend one lead against the body and insert the resistor in a vertical position. Now turn the board over and bend the leads at 45°, so that they will not drop out.

When soldering these apply the tip of the iron to both lead and copper board. Feed solder to the top of the tip, directly onto the lead. This will ensure the lead solders first, then the solder will flow onto the copper pad. When the copper pad is covered fully, remove the iron and



A joint may be desoldered using either copper braid (solder wick) or a solder sucker.

cut the lead off close to the board. I usually solder one row first, cut off the leads, move on to the second row, etc.

Small capacitors

Ceramic capacitors will usually withstand a lot of heat. However, the body is brittle and will crack if the leads are bent too close to it. Stand the body a few millimetres above the board unless there is a special reason for pulling it down tight, such as in digital or radio frequency work.

Other small size capacitors are generally of plastic construction. Soldering these components into circuit is straightforward. Be careful not to overheat the part, as the plastic insulation inside the capacitor may warp or even melt. Once the solder has covered the joint, remove the iron immediately.

Electrolytics

Electrolytics demand an entirely different soldering technique than other capacitors. The legs are mostly made of steel, the exception being axial types (one lead at each end) which have copper leads. When soldering in these steel legs, place the flat face of the bit against the leg so that it is touching the full length of the face. Keep the tip of the iron one to 2mm above the copper pad. At this point you are mainly concerned with raising the steel lead to soldering temperature.

Now place your solder against the wire lead. When the solder begins to melt, slide the iron down, on to the copper pad, feed a little more solder, and when the solder has covered the pad, withdraw the iron.

The reason for the above method is that the steel will take longer to heat up than the copper pad. If you try to solder in the normal way, the pad will absorb most of the heat and you may destroy the adhesive bonding the copper to the board, long before the steel reaches correct temperature.

Another reason is that the copper pad will take solder readily, the joint will look good, but the steel leg will remain unsoldered. It will sit in a mound of nice shiny solder — a nice shiny dry joint.

It will feel tight when pulled. Of course it will. The solder was applied hot. It has now shrunk. This gives the impression that the joint is good. This also applies to dirty leads. They are not really soldered, merely surrounded with solder. They are hard to locate, as they are hidden.

As an experiment, try soldering a dirty lead in a pad. Remove the solder with solder wick. The pad will remain tinned, but the lead will have little, if any, solder on it.

Transistors

Treat all transistors carefully. Solder one lead on each only. Now turn the board over and bend them, so that they are in an upright position. Again, solder one leg per transistor. This way they have a chance to cool off faster. Keep the leads long, to allow ample ventilation. If the solder does not take readily on the first application, stop. Try again later when the joint has cooled.

Integrated Circuits

Integrated Circuits are a different matter. These have steel legs but, because of their small dimensions, can be soldered as per copper. Do one pin at a time. Hold the iron face against the pin. Feed a little solder, to start with, then a little more to ensure there is enough to cover both pin and pad. Change from one side to the other; don't do one side all in one hit. This prevents the chip inside from overheating.

Now that you have completed all the soldering on the board, use a toothbrush dipped in methylated spirits to scrub it down. This is to remove any slivers or small particles of solder trapped in the flux, which could cause short circuits. The resin flux dissolved by the methylated spirits then spreads over the whole board; as a bonus it protects all the copper pattern from corrosion.

Examine all joints carefully. Especially around the ICS. If in doubt use a magnifying glass. When using the toothbrush, spread out a sheet of newspaper as the resin flicked off is very sticky and hard to remove when dry.

Some handy hints on construction

(1) Insert resistors with the tolerance band at the right hand end (read left to right). Insert resistors at right angles to these with the tolerance band towards you (read top to bottom).

(2) Bend the leads on power diodes and wire wound resistors so that the value of the component can be seen from the top.

(3) Position greencaps and ceramic capacitors with the printed side facing away from larger components. (You may have to service the board at a later date).

(4) Be careful when cutting off leads — they may fly into your eyes. With steel leads, hold them with one hand before cutting. You can buy spare components but not spare eyes.

(5) If solder does not flow onto a joint readily, don't keep adding more solder in the hope that it will "take". You are making circuit boards, not paperweights. Only a minimum amount is required. If you are having trouble, clean off the solder, remove the component, and clean the lead.

(6) If you become tired — take a break. This is when most mistakes are made.

(7) If the project does not work, switch off immediately, then spend some time checking the board against the diagram. Don't be disappointed — some of my first efforts didn't work.

We'll put you in the driver's seat of someth

When an RAAF pilot says he's heading home, it's not behind a steering wheel.

Chances are, he'll have just completed a mission.

Taking a Hornet to the outer limits of its performance in simulated air-to-air combat.

Scanning the oceans for renegade foreign fishing trawlers in a P3C Orion Maritime Surveillance Aircraft.

Hoisting flood victims to safety with a new Squirrel chopper.

Or flying low-level strike/reconnaisance runs in a supersonic swing-wing F111.

Few, if any, careers can offer a bright young man such opportunity.

Not to mention excitement.

Together with the Navigator Tactician and Airborne Electronics Analyst, the Pilot forms a close-knit team called Aircrew.

The spearhead of Australia's air defence.

And like the Navigator Tactician and AEA,

ing far more exciting than a company car.

the Pilot is an expert on avionics, the theory of flight, physics.

It's a thrilling, well paid career with excellent security. And it could take you all around the world.

To apply, you must be at least 17 and under 27. You must have completed Year 12 with good passes in specific subjects.

You must also be an Australian citizen.*

If you meet our selection requirements, you'll be in the air within the year. Flying to work.

*Or eligible to become one.

Send off this coupon now to find out more about your career as an RAAF Pilot.
To: RAAF Careers, GPO Box XYZ (in the Capital City nearest you).

Name _____

Address _____

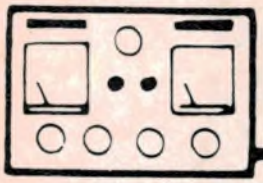
_____ Postcode _____

Date of Birth _____ Highest Educ. level attained _____ or being studied _____

Or phone an RAAF Careers Adviser on Adelaide 212 1455. Brisbane 226 2626. Canberra 82 2333. Geelong 21 1588. Hobart 34 7077 Launceston 31 1005. Melbourne 697 9755. Newcastle 26 3011. Parramatta 635 1511. Perth 325 6222. Sydney 219 5555. Townsville 72 4566. Wollongong 28 1855.

PILOT

Authorised by Director-General of Recruiting, Dept. of Defence. AFAC 100.DPS.85



The Serviceman

If you must be good — be careful!

Most servicemen, along with other businessmen, sooner or later find themselves involved in some kind of charitable organisation. And, while the cynical ones may proclaim that charity begins at home, the truth is most of us gain a good deal of satisfaction from using our particular skills to benefit those less fortunate than ourselves.

Unfortunately, there is a "but" to the above statement. It is all too easy for such situations to get out of hand; what starts as a simple gesture can quickly escalate into a situation of continual worry and frustration, with the possibility of embarrassment for all concerned. How to keep such situations under control is one of the things we learn only with experience.

Naturally, these sentiments were inspired by a real life situation, and which I feel is interesting in both the technical and diplomatic sense. The charity involved was a local church organisation which, with community help, had established a cottage to house handicapped adults; typically people unable to look after themselves for one reason or another. It normally accommodates some five or six inmates, some temporary, some permanent.

I first became involved several years ago. One of my very good customers is a member of the church concerned and actively engaged in administering the cottage charity. One day, when I was at his home on a service call, he broached the subject of an old monochrome TV set which he had pensioned off about five years previously when he bought a colour set.

Was it possible to get the set working again without too much trouble or expense. I replied that I probably could get it going, but that there was a risk that it would prove more costly than it was worth. I also expressed some surprise that he would want to resurrect it after all this time, since he had a couple of very good colour sets.

"Oh, it's not for me", he explained. "I thought of giving it to the cottage. They have no TV set and any money we acquire is needed for more essential things; food, clothing, medical expenses, and that sort of thing. Its a battle to get by anyway."

That, of course, put a different slant on things. I immediately volunteered to have a go at the set in my spare time and not to charge any more than the cost of whatever substantial bits and pieces might be needed.

In the event the job proved to be relatively simple. A new 6CM6 valve and a general once over of various adjustments was all that was needed to produce a surprisingly good picture. I found an old antenna in the junk room, along with most of the necessary hardware, and the customer and I spent a few hours one Saturday afternoon installing everything and getting it working. The customer met the cost of the valve, plus a few bits of hardware and the necessary coax cable.

The whole exercise went off quite smoothly and everybody, particularly the inmates, were highly delighted. I must admit that I even felt a small glow of satisfaction regarding my own contribution. The set performed quite well for the next three years or so, with only a couple of minor faults requiring my attention and which, as before, I performed on a materials cost basis only.

Then another set became available. One of the local retailers, whom I know very well, sold a new colour set and the customer asked him if he knew of any charity which would like his old colour set. If so they were welcome to it. The retailer, knowing my involvement with the cottage, referred the customer to me.

A salty K9

The set turned out to be a Philips K9 and I was happy enough to accept it on behalf of the cottage committee. Of course, there had to be a catch. I wasn't really surprised to find that the set didn't work, but I was shocked at its condition. A few enquiries from my retailer friend confirmed what I suspected; the owner lived in a nearby beachside suburb, and right on the waterfront.

The result was heavy corrosion throughout the set. I cleaned it up as best I could and, after spending a lot of time on it, eventually restored it to working order. Naturally, everybody else was delighted with the new set, which was so much more exciting than the old monochrome faithful. But I had my doubts. I had cleaned away the superficial evidence of corrosion, but I knew that this was mainly cosmetic. Sooner or later it would take its toll and it would fall to my lot to keep it going.

Unfortunately, my prognosis proved all too accurate. All went well for a few months, then it suffered a major breakdown in the power supply board. Repairs turned out to be fairly expensive in both time and money, for which I made only a nominal charge. Following this there were several minor faults over the next 18 months and, while they didn't cause any serious problems in themselves, I became aware that the picture quality was getting progressively worse, meaning that the picture tube was almost certainly on the way out.

The final crunch came quite recently, after a more than usually long spell without any calls. This time it was frame collapse and, once again, it took me some time to track down the fault and correct it. And when I did I realised just how far down the drain the picture tube had gone since I last saw it. The picture was quite woeful and, while I had no doubt that the inmates would accept it, I was far from happy with the situation.

Quite apart from the fact that it goes against the grain to return any set in an obviously poor condition, there is another trap awaiting the charity worker. While all those directly concerned with the organisation had always expressed genuine gratitude for my efforts and obviously trusted me to do the best job possible, there is always some outsider ready to find fault and imply that, because it is a voluntary effort, it will be done to lower standards than if commercial rates had been charged.

And that's the kind of reputation we can all do without.

But what was I to do? A new picture tube was out of the question, on the score of its cost alone. The charity's funds simply wouldn't stand it, and I

certainly could not afford that kind of donation. Then there was the labour involved in fitting it. I suppose, had it come to a point, I would have been prepared to donate that but considering the set's condition, a new tube would be impossible to justify anyway.

I put the problem aside for a day or so while I thought about it, and was on the point of approaching the original benefactor who had started it all with the monochrome set. Then suddenly a possible solution suggested itself.

To put the reader in the picture I will need to backtrack several months before the present crisis. I had been called to inspect a set which had failed completely. It was one of the very early Rank receivers, C1851, of similar vintage to the original 2601 and 2201 models. In fact it uses almost identical circuitry and boards but, as the type number suggests, is an 18in (46cm) version.

It apparently didn't sell in very large numbers and there are only a few of them around these days. On the other hand, they were a very good set, with an order of reliability similar to their big brothers. The set belonged to a retired couple whom I had not met before, but whose son I know very well. The symptoms were that the set had suddenly failed and that there had been a small cloud of smoke from the back of the cabinet.

My intuitive reaction was to suspect a tripler failure and, on removing the back of the cabinet, this diagnosis proved to be correct; the tripler was well and truly charred and clearly beyond any hope of repair. Had that been all I would not have hesitated to recommend a new tripler, even though it would be moderately expensive.

But it wasn't all. Closer inspection of the "Deflection Out" board revealed that a hole, about the size of a 20c piece, had been burnt in it, in the vicinity of the pin cushion transformer, T554 and L558, the two components being in a single package. Exactly why this had happened, or what connection, if any, it had with the tripler failure, wasn't clear.

More to the point was the fact that there were now two relatively expensive faults involved. The board could possibly be replaced, or even repaired if no replacement was readily available but, either way, it was going to be an expensive operation. As I put it to the owners, material and labour costs to repair the obvious faults would approach $150, plus any other faults which might not be apparent until these were fixed.

Without any prompting from me they made an immediate decision. "We don't feel like spending that amount of money on a set as old as this one. We'd rather put the money towards a new set." So that was that. I accepted their decision — which was not unreasonable — and went on my way. I didn't even charge them for the visit. I'd spent only a few minutes on the job and was happy enough to write that off against public relations.

Bits and pieces

I thought no more about it at the time but a couple of weeks later the couples' son called into the shop and dumped the Rank set on the counter. "My parents thought you might like the old set for bits and pieces. They've bought a new set, they're very happy with it, and the old set is no use to them. So, if it's any good to you you can have it."

It was a nice gesture and I expressed my thanks to all concerned. I had no immediate need of such bits and pieces, but old sets like this are always handy as a source of hard-to-get spares, so I dumped it in the store-room along with several other defunct sets and promptly forgot about it.

Until I was faced with the K9 crisis. I suddenly remembered the Rank, and an idea began to form. Was it worthwhile trying to repair the Rank and donate that to the cottage in place of the Philips?

It would cost me both time and money, of course. I would have to supply a tripler, and I would have to repair the board, or at least attempt to. This was something of a risk. I could spend a lot of time working on the board, only to find it couldn't be salvaged. Then there was the risk that I could find more faults created by one or other of the major faults.

On the other hand, if I could get the set working it would likely turn out to be a much more reliable set than the old salt ridden Philips. Furthermore, I would be spared the worry of trying to repair the Philips, and of keeping it going in the future. And that, I told myself, would be really worth striving for.

Good news and bad

So I fished out the Rank, put it on the bench, and pulled the back off. This chassis is a pretty tight fit in the smaller cabinet, but I managed to slide it part way out where I could get a better look at the burnt board. The result was both good news and bad news.

The good news was that the damaged portion involved about five well spaced copper tracks, which could easily be replaced with wire links. Also, the damage involved only one corner of the transformer mounting area, so it was still securely held.

The bad news was that, on closer inspection, it was obvious that the transformer was also a write-off, being well and truly cooked. So now I would have to find a pincushion transformer as well. The best bet seemed to be salvage one from a defunct 2201 or 2601 board, already ratted for other items, and which were tucked away somewhere in the store-room. The question was whether the C1851 used the same transformer. They were the same physically and, in the absence of specific data to the contrary, I was prepared to take a punt.

But before becoming too deeply involved there was one more essential check to be made. There was the risk that the original fault may have been generated by grossly excessive EHT which could have punctured the picture tube near the yoke. I slipped the yoke back and made a thorough check, but found nothing.

The next thing was to tackle the board itself. I removed the damaged pincushion transformer, then attacked the burnt section with a knife and a file, paring it back until all signs of carbonised material had been removed. Then I fitted another transformer from a 2201 board, and patched it into the remaining copper tracks with short lengths of hookup wire.

For the tripler I used a Philips unit modified according to the system described by a colleague in the November 1984 issue, and which I have since adopted. In this case, it had the distinct advantage of providing a much cheaper replacement than a new Rank tripler.

Putting it all together took some time,

The Serviceman

mostly snatched when I had a few spare minutes between regular jobs. But it was finally done and I was ready for the big switch-on. This turned out to be an anti-climax, because the set was completely dead. On the other hand it did not give forth smoke or show other signs of distress.

A meter check showed that the main HT rail was down to a few volts and further checking led me to the line output transistor, which was completely shot. I didn't have a direct replacement but found a suitable substitute, fitted, it, and tried again. And lo and behold, we had a picture, and a good picture to boot. Granted it needed a bit of a touch-up, but the picture tube appeared to be in excellent condition, in spite of its age.

So I gave the set a routine once over, and noted that the pincushion control seemed to work at least as well as they ever work in these sets. Then I let it run on the bench for several days before finally delivering it to the cottage. Naturally everybody was surprised at the change, but very happy because even they had begun to realise that all was not well with the Philips. Nor did the smaller size worry them, it being really more appropriate for their room.

So everyone was happy, not least yours truly in the hope that service calls would be reduced to a minimum. But I think readers will appreciate the point I made at the beginning; how easy it is for an initial simple gesture to snowball into a much more complex situation. While I have no intention of abandoning this charity, I intend to tread more carefully in the future and make sure nothing else snowballs.

Here are a couple of stories in a lighter vein. Acting on instructions — correction; orders — from Mrs Serviceman, I called in at the local butchers recently to pick up our weekend supply of quail and pheasant. (Actually a couple of pound of snags and a piece of scrag end, which is about all we can afford — and even the snags are moving into the luxury class!)

As the butcher was measuring off the snags he began complaining about interference in local TV sets. "It looks like this", he said, pulling a sheet of butcher's paper towards him and reaching for a pencil stub behind his ear. He quickly sketched an acceptable outline of the picture tube face, then he drew in a rectangle, about one third the area of the screen, towards the top left hand corner.

"That part of the picture goes bright every so often. And everyone around here is getting it. What do you reckon would cause it?" My mind boggled. I couldn't for the life of me imagine what kind of outside interference — could create such an effect.

"Is the bright area sharply defined, as you've drawn it?" I asked. He scratched his head. "Probably not", he admitted. "And are you sure it was confined to that area, or was that just the centre of interest". Once again he hesitated. "You could be right I 'spose". "So what you are really saying is that the picture is varying in brightness at odd times?"

"Yes, well, it's very annoying. And you know what", he added, "I reckon I know what's doing it. The County Council came through here recently and changed all the power lines from copper wire to aluminium. Wouldn't that do it?"

How do you answer a question like that? I did think of one answer. It had a bovine connotation and, for a butcher, seemed appropriate. But I bit my tongue. He sells the best scrag end for miles (kilometres) around so I could hardly afford to insult him.

I settled for "I don't think that's very

The Serviceman

likely". Then added, "What's this about everybody having the same trouble? How many others have had it?"

"Well, Mum has".

Ah yes, that explained a lot of things. I have met "Mum". She lives next door to the butcher and is, as the saying goes, "getting on a bit". (The butcher himself is no spring chicken.) Also, not to put too fine a point on it, she's not as "with it" as she might be.

It is easy to imagine how she might react if asked whether her TV set had been varying in brightness. Remembering a dramatic night scene in a picture, suddenly interrupted by a brilliantly coloured dog-food commercial, she would almost automatically answer "yes".

"Are you sure you didn't suggest the idea, or that Mum may have misunderstood you?"

"Yeah, I 'spose so".

"My bet is that you have a brightness fault in the set, and its nothing to do with outside interference."

So we more or less left it at that, except that I learned that the set was still under warranty, so it was out of my area. But when I dropped in to collect our ration of snags next week, he was all excited again.

"That trouble with my TV set's cleared up. I think it was coming from the railway line." (His house backs onto the railway line.)

He went on to explain that there had been extensive re-ballasting of the line over previous weeks, following a rather spectacular derailment. During this time there had been a speed restriction sign behind his house, topped with a flashing light. It had just been taken away and the trouble in his set had vanished. So, Q.E.D.

I shook my head. "No way in the world mate." He looked surprised.

"You reckon?"

"I'm sure. There's something wrong with your set." But I don't think he believed me.

That's a perfectly true story, and I have told it as much for its humour as anything. But it also highlights the technological gap between the man in the street and the run-of-the-mill serviceman. And when he realises that there is probably just as big a gap between the serviceman and the boffins at the top of the line it puts the man in the street well behind scratch.

Worth thinking about, isn't it?

The dog and the mirror

If that story was good for a smile, then I reckon this next one will raise a laugh. It comes from one of my regular contributors, J.L. of Geilston Bay, Tasmania. It has already been published in the TETIA "Newsletter", but J.L. felt that it deserved a wider audience so, by special arrangement, here it is.

I was summoned to the posh part of town recently to repair an AWA TV set. I thought residents there threw away their broken down TV sets, but a summons is a summons, so I answered it.

I parked the van between the Rolls and the Porsche and was immediately confronted by the biggest Alsatian I've yet seen. All teeth and laid back ears it was, ready to take my arm off at the knees.

"Poppy won't hurt you", said the lady of the house, dragging the animal away by its ear. I raced into the house and the beast stood snarling outside the glass doors. I could almost hear it saying, "You got in mate, but you won't get out".

After the repair was completed the set was showing a decidedly green picture, and badly needed a grey scale touch up. But to do this I needed a mirror and all those in the house were screwed to the walls in heavy gold frames. There was nothing for it but to get my mirror from the van, in the face of that slavering beast outside the door.

The door opened outwards and the animal was leaning on it. Its owner had to go out the front door, around the house, and drag the dog away to let me out. I made a note to triple the service fee, for mental anguish. I raced over to the van and grabbed the mirror. I was half way back to the safety of the door when the dog broke free from the lady. It was after me like a shot, its top lip curled half back to its eyes. "This is it", I thought, "They'll have to wait until I'm through to bury what's left of me".

I had only one line of defence — hit the brute with the mirror. Seven years bad luck was preferable to the present prospect. So I turned the mirror towards the dog, shiny side forward. The result was staggering.

The instant the dog saw itself in the mirror, it changed into a terrified kitten. It's tail went between it's legs, belly on the ground, and away it went under the Rolls.

I took the mirror over to the Rolls and gave the dog another look. It shot out from under the car and dived under the Porsche — a model that has only six inches clearance. I've never seen such a big animal fit into such a small space.

When the job was finished and the cheque safely in my pocket, I carried the tool box out to the van. The dog crept out from under the car and had a careful look at me from some distance away. Satisfied that I didn't have the mirror, it reverted to the snarling villain it had been when I arrived.

I beat it to the door by half a second and it crashed against the glass with such force that I was sure it was determined to get me inside if it couldn't do so outside. But this time I had my secret weapon.

I picked up the mirror, carried it over to the door, and turned it to face the dog. It was a repeat performance except the dog didn't bother with the Rolls this time — it yelped and went straight under the Porsche.

I didn't see it again before I left the house.

Thanks J.L., I'm sure our readers will appreciate that one.

TETIA Fault of the Month

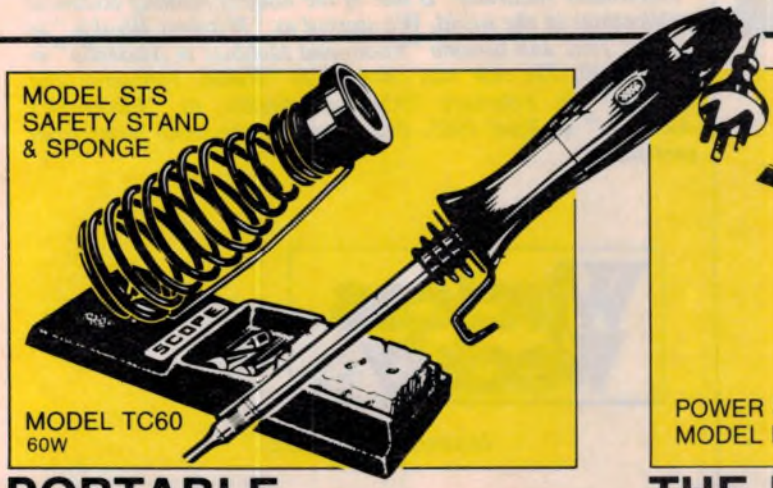
National TC1802

Symptom: No colour. Chroma board TNP65443BZ produces colour only if fine-tuned deep into sound bars.

Cure: C615 (1μF 50V electro) open circuit. C615 parallels R615 in the 12V feed to the ACC amp in IC601. Fault in C615 limits response of ACC amp, reduces burst amplitude and causes colour killer to operate.

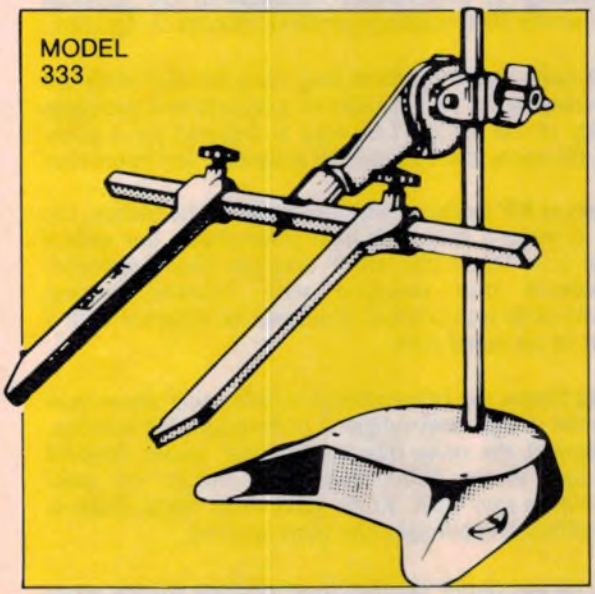
SCOPE

SOLDERING IRONS & SPECIALISED TOOLS



PORTABLE SOLDERING STATION

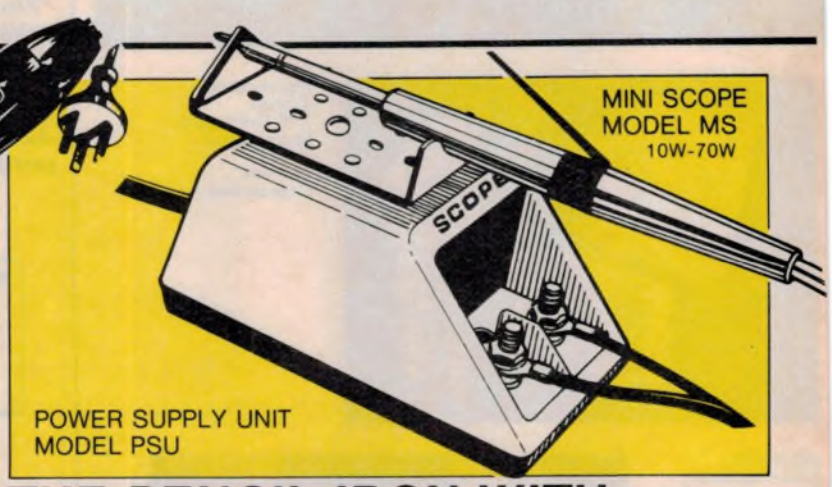
●CMOS PROTECTION ●FULLY EARTHED ●60W BACK UP ●2% TEMP. CONTROL 200-400°C.



INDEXING P.C.B. HOLDER

●ROTATES & LOCKS IN 32 POSITIONS

CONTACT YOUR NEAREST SCOPE RETAILER

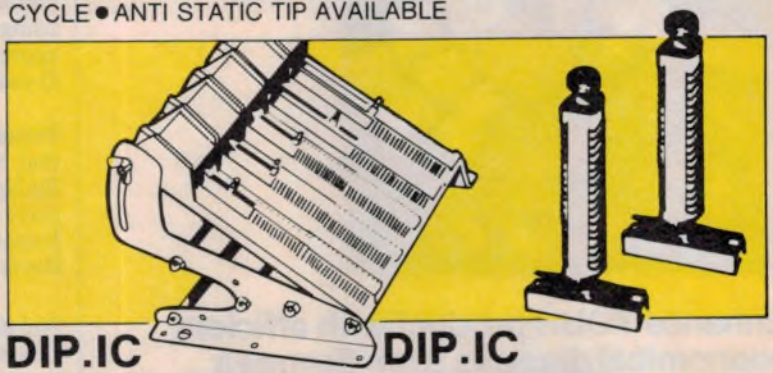


THE PENCIL IRON WITH REAL POWER

●YOUR FINGER ADJUSTS WATTAGE & TEMP. 200-500°C. ●FAST HEAT FOR MAINTENANCE & REPAIR WORK

SELF CLEAN METAL TIP BODY

●CRUSH PROOF METAL BODY ●TIP SELF CLEANS EVERY CYCLE ●ANTI STATIC TIP AVAILABLE



DIP.IC DISPENSER STRAIGHTENER

●CONTROL FEED VELOCITY VARI SLOPE ●ANTI STATIC

DIP.IC INSERTER STRAIGHTENERS

●SLIM LINE FOR HIGH DENSITY BOARDS ●ANTI STATIC ●8 SIZES

FOR A FREE CATALOGUE SEND YOUR NAME AND ADDRESS TO:
FREEPOST No. 2 SCOPE LABORATORIES P.O. BOX 63, NIDDRIE, VICTORIA, 3042 AUSTRALIA

N.S.W.
Promark (02) 439 6477
Selectro Parts (02) 708 3244
D J Coulter (049) 67 1455 AA 28650
Geo Brown (02) 519 5855
Sheridan (02) 699 6912
Martin De Launay Pty Ltd (02) 267 1055 AA26679
David Reid (02) 267 1385

S.A.
AJF Electrical (08) 269 1244
Gerard & Goodman Pty Ltd (08) 223 2222 AA 88983

QLD.
L E Boughen (07) 369 1277
ECQ (07) 376 5677
Fred Hoe (07) 277 4311
Delsound (07) 229 6155
Dunlop IBC (07) 392 0011 AA41561
St Lucia Electronics (07) 52 7466 AA42883
Magraths (07) 832 3944

W.A.
Atkins Carlyle Ltd (09) 321 0101 AA93750
Letco Trading Company (09) 387 4966 AA94396

VIC.
Aust School of Electronics (03) 523 5622
Ballarat Electronics Supplies (053) 31 1947 AA37435
Ellistronics Pty Ltd (03) 561 5844 (03) 602 3282
Radio Parts (03) 329 7888 (03) 211 8122 (060) 21 8177
Teleparts Investments Pty Ltd (052) 21 7085
McGraths Electronics (03) 347 1122 AA31001
Rod Irving (03) 489 8131
Electrotool (03) 848 1045

TAS.
GHE Electronics (002) 34 2233 (003) 31 6533

SCOPE
BOX 63 NIDDRIE,
VIC., 3042
TEL: (03) 338 1566
TLX: AA38318

No skill required. Build these

Budget 2-way Loudspeakers

by LOUISE UPTON & LEO SIMPSON

The only tools required are a screwdriver and a soldering iron.

When Dick Smith Electronics approached us with the idea of producing a new compact loudspeaker system which would suit those on a budget, we leapt at the idea. After all, most people do not have large living rooms so a compact speaker system is likely to have wide appeal. This is supported by trends in the high fidelity marketplace where compact speakers are booming while the larger systems are in the doldrums.

Still, while compact speakers may be all the go, no one wants to sacrifice overall performance to gain those svelte dimensions. We want wide-range sound, plenty of power handling, reasonable efficiency and the capacity to handle bass boost — to kick things along at the odd party or two.

This new system from Dick Smith Electronics really fits the above prescription to a tee. It is a two-way system with a bass reflex enclosure of 16.7 litres internal capacity.

The loudspeakers are made by Magnavox (Australia) Pty Ltd, a company which has turned out a number of very successful hifi drivers in the past. The woofer is the Magnavox 6MV, a nominal 15cm driver which is fully characterised with Thiele-Small parameters. The 6MV has an effective cone diameter of 115mm and a large foam rubber roll surround. The voice coil diameter is 38mm, although this is disguised by the much larger shiny aluminium dust cap.

Its compliance volume, Vas, is 19 litres, its free-air resonance is 47Hz and its Qt is 0.36. Using these parameters, Dick Smith Electronics and Magnavox have jointly designed a vented enclosure which has a close approximation to a Butterworth alignment of 49Hz. This gives good overall efficiency, good bass down to a little below 50Hz and a compact enclosure volume of just 16.7 litres.

A suitable match for the 6MV woofer is the Magnavox 3AC tweeter which has closed-back construction to allow it to be

Genuine GM-H: (from an advertisement) with your car fitted with the GM-H Air Chief car radio you will enjoy unlimited entertainment anywhere at any speed . . . you will shorten the longest trip . . . and bring companionship to the loneliest miles.

The GM-H Air Chief is made in 6 and 12 volt models, and although specially designed for all General Motors-Holden's cars, it can easily be fitted to any other car.

November 1960

Tennis-court take-off: (referring to cover picture) Jets are not the only aircraft with spectacular take-off performance these days. This Piper Super Cub is supposed to be able to take off in the length of a tennis court. It is the smallest in the range, carries two people, and costs around 4000 pounds sterling.

Space probe: the latest technique in astronomy — that of sending telescopes aloft in balloons and nose cones — seems likely to provide man with more knowledge about the universe in the space of a few years, than in all the history of astronomy. Above the turbulence and murk of the earth's atmosphere, even small telescopes outperform their earthbound counterparts.

An enormous unmanned Stratoscope balloon will soon carry a 36 inch mirror on 20 mile high flights to photograph the moon, the planets and certain radio stars. A prime objective is to get the most revealing pictures of the red planet ever made.

World time standard: most radio enthusiasts have heard of WWV, the US frequency and time standard transmitter. Signals are currently transmitted by the bureau's two shortwave stations. However, due to propagation variables, these transmissions are not always accurate enough for the most precise measurements required by today's scientists. In an effort to provide even greater accuracy, signals are now to be broadcast on a unique 20kc transmitter.

The antenna is a copper coated steel cable stretching more than half a mile across the top of Sunset Canyon, Colorado.

Missile early warning: an antenna reflector, larger than a football field, has been erected as part of the United States Air Force's ballistic missile early warning system.

The super power radar system is designed to detect possible intercontinental ballistic missiles as they rise over a horizon thousands of miles away. When in operation, the surveillance will generate a giant curtain of radio energy over the polar region, giving the American defense units a 15-minute warning in the event of a missile attack.

Hot wire: a new and more accurate device for measuring wire temperature during drawing enables markedly higher drawing speeds to be achieved.

The unit depends on the pressing of two pulleys made of two different metals and which therefore form a thermocouple against the moving wire. This enables a signal to be generated which is transmitted to the measuring unit.

Clean air: air in part of the New York factory of General Electric was found to be cleaner than air in the Arctic. This discovery was made by the company's general engineering laboratory, which has been conducting regular tests of the air in the "Snow White" room where minute parts of television camera pick-up tubes (Image Orthicons) are assembled.

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

November 1935

Shoe-business: the foreman of a shoe factory in Prussia lost a case against his firm for "unlawful dismissal" on the ground that "listening to Moscow is calculated to shake the confidence which ought to subsist between employer and staff". Also, in Austria, listening to programmes "inimical to the national interests" is worth 2000 schillings or three months in the clink.

Ferrite IFs: radio engineers have long been familiar with the fact that increasing the permeability of a transformer increases the efficiency of the device. Less wire is required for a given inductance, therefore lowering the RF resistance and improving the Q.

Since losses at RF increases with the square of frequency, the problem is to make a coil, with high permeability but with a minimum of loss. To do this, an IF core has been developed, using powdered iron moulded with bakelite, having approximately 90% iron content. Coils can be designed with a Q twice that of air cored coils.

Broadcasting tastes: the International broadcasting union says that Stockholm is the most religious of broadcasting stations, Budapest devoted the most time to "serious" music, Madrid plays most light music, Tokyo talks most and is "the most feminine", Algiers says least, Rome gives most opera, Paris is the most studious, Copenhagen the most sporting.

No nickers, please: (letter to the editor) nothing sounds more ridiculous than men announcers advertising ladies' underwear over the air, yet they seem to enjoy it; some of them simply revel in speaking about the feminine gender, especially when advertising certain remedies for reducing the figure. It is about time they changed their tune and spoke about the masculine gender and stopped keeping lady announcers out of a job.

Growling listener: a listener at Tangier and his bulldog were listening when the loudspeaker began to bark; the bulldog rushed over to the receiver and smashed it. The owner went to law against the broadcasters and won.

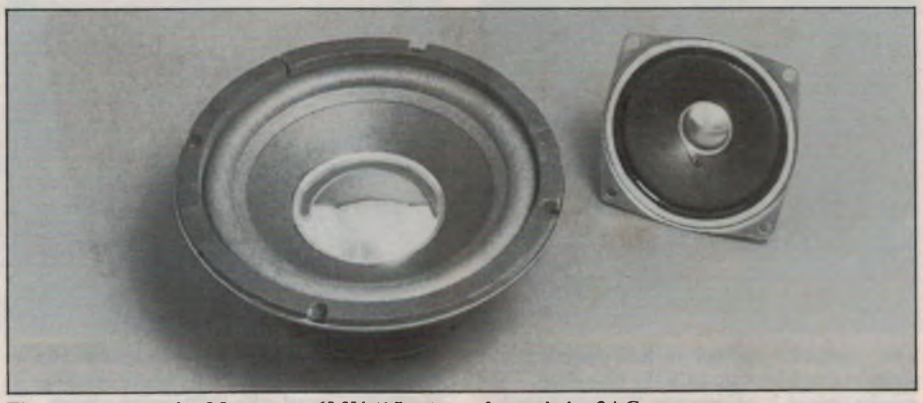
The court ordered the broadcasters to pay for the receiver because "a broadcasting station has no legal right to cause domestic disturbance in a home".

The enforcers: the Austrian broadcasters employ 450 persons to trace interference with reception, and 300 cars fitted with interference detection gear.

Fancy a low cost compact loudspeaker system that is a cinch to build? If so, here is the ideal answer. This two-way system from Dick Smith Electronics costs just $229 for a complete kit of two loudspeakers, with everything included. You can easily put them together in a couple of evenings.

housed in the same enclosure as the woofer. This has a curvilinear cone with an effective diameter of 81mm and a frequency response up to beyond 18kHz. Specifications for both the woofer and tweeter are shown in the panel accompanying this article.

The tweeter is about 5dB more sensitive than the woofer which means that it has to be fed via an attenuator to match it precisely to the bass driver.



The system uses the Magnavox 6MV (15cm) woofer and the 3AC tweeter.

This view shows the complete kit of parts for one loudspeaker. Note the pre-cut cabinet.

PARTS LIST

2 enclosure kits, including grille cloth frames
2 6MV 8Ω woofers
2 3AC 8Ω tweeters
2 0.74mH air-cored inductors
2 0.35mH air-cored inductors
2 P 1764 two-way terminal panels
2 crossover PCBs
2 PVC 50mm ID vent tubes
28 self-tapping screws 6g × 12mm
16 countersunk woodscrews 8g × 25mm

Capacitors

4 22μF bipolar electrolytics
2 10μF bipolar electrolytics
6 6.8μF bipolar electrolytics
2 4.7μF bipolar electrolytics

Resistors

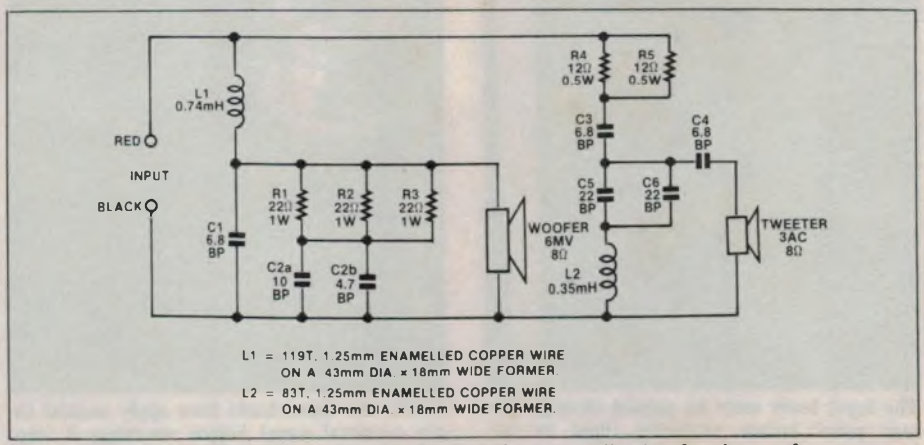
6 × 22Ω 1W, 4 × 12Ω 0.5W

Wire

1.6m red insulated wire (13 × .12mm or similar)
1.6m black insulated wire (13 × .12mm or similar)

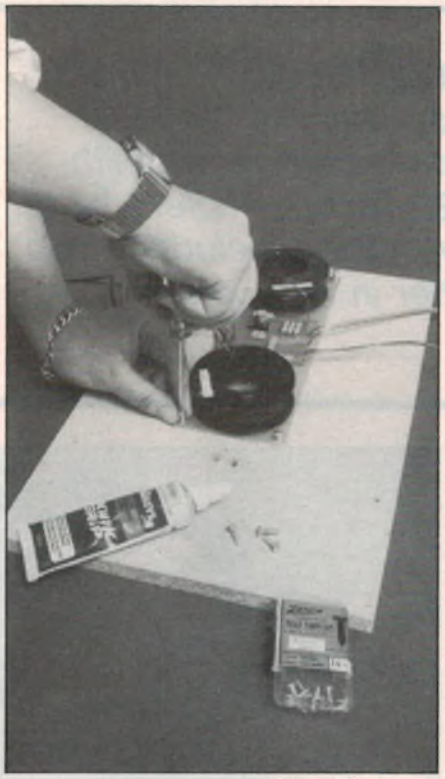
Miscellaneous

0.8m × 0.7m Innerbond lining, contact adhesive, PVA glue, draft excluder tape (Engel's No. 5 or equivalent).



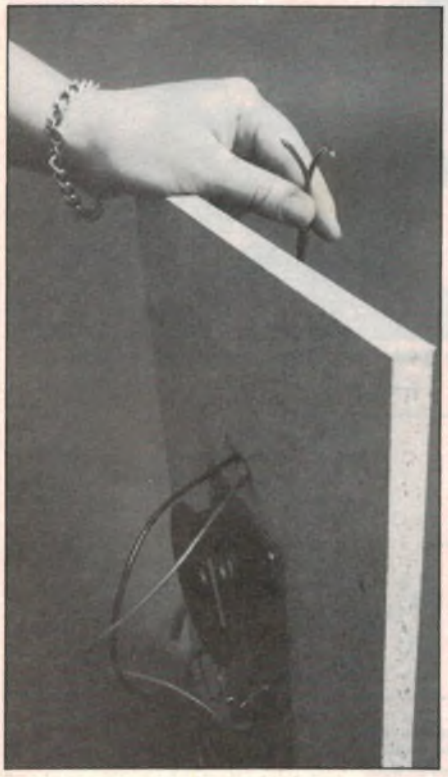
The crossover is a second order network with impedance equalisation for the woofer.

The assembled cabinet is held together by strips of masking tape until the glue dries. The woofer cutout is adjacent to the base board.



Apply a small amount of white sealant to the rear of the crossover PCB before securing it to the rear panel with self-tapping screws.

Budget 2-way loudspeakers



The input leads must be passed through the rear panel before soldering them to the terminal panel.

Solder the input leads then apply sealant to the terminal panel before screwing it into position.

Crossover network

The crossover network is a second-order network for both the woofer and tweeter. This means that both the tweeter and woofer signal drive is rolled off at 12dB/octave. For the woofer, L1 and C1 roll off the signals above 2.4kHz. In addition, the parallel combination of R1, R2 and R3 (7.3Ω) in series with the parallel combination of C2a and C2b (15μF), provides impedance equalisation for the woofer.

This is necessary to remove the effect of the voice coil inductance which would otherwise reduce the efficacy of L1, C1, and stop the 12dB/octave rolloff slope from being achieved.

The high frequency section is an elliptical filter which, in addition to its role as a high pass filter, also effectively prevents unwanted response from the tweeter at its resonance peak (approximately 1.3kHz). The 6Ω series resistance (R4 and R5 in parallel) provides the required 5dB attenuation as well as the correct source impedance for the high pass filter.

The power ratings of the resistors used in the crossover have been chosen to be adequate for use when playing normal program material. Anyone who wishes to apply continuous high level test signals to the system may have to fit higher rated components.

The frequency response of the complete system is within ±4dB over most of the audible frequency range. These figures are very good for a budget loudspeaker system and will stack up well in comparison with many more expensive "name" systems. In practice, the bass response is smoothly maintained down to just below 50Hz and it can easily handle bass boost if the situation seems to need it. Treble response is well maintained up to the limit of audibility with some "presence" in the midrange which tends to slightly increase the overall efficiency, which is quite reasonable anyway.

Power handling is quoted nominally at 40 watts but they will comfortably handle the full power of a 100 watt per channel stereo amplifier on normal program material.

Taken all round, the new System 17 is a bargain loudspeaker system which gives a surprising amount of "sound punch" for your dollar. It's easy to build too. We'll let Louise Upton take up the story at this point.

Construction

"If you can do it, anyone can!" With this back-handed compliment, I was given the task of putting these nifty little speakers together. Tackling such a task for the first time was a trifle daunting. The question entertaining everyone was,

to match the versatility, expandability and higher intelligence of the new Commodore 128

(and it costs less too).

The new Commodore 128™ personal computer is breakthrough technology at a breakthrough price. It outshines the Apple® IIc in performance capability, performance quality and price. It is expandable to 512K RAM while the IIc isn't expandable at all.

And the new Commodore 128 has a numeric keypad built right into its keyboard that makes crunching numbers a lot easier. And the Commodore 128 has graphic and sound capabilities that far exceed those of the Apple IIc. But the most important news is that

the new Commodore 128 jumps you into a whole new world of business, productivity, education and word processing programs while still running over 3,000 programs designed for the Commodore 64.™ That's what we call a higher intelligence.

COMMODORE 128 A Higher Intelligence

commodore COMPUTER

Keeping up with you.

BEEMAN MAYRHOFER STOTT/CC422

The tweeter is mounted on the inside of the baffle using four 12mm self-tapping screws.

Budget 2-way loudspeakers

"Would it work when I had finished?" With a stiff upper lip, I set to work.

Before me lay all the components for a pair of high quality loudspeaker systems at a bargain price. Designed in line with the universally highly-regarded "Thiele/Small" parameters outlined in our August and September 1981 issues, these new bookshelf speakers certainly looked as though they would fulfil their promises. All that remained was to prove the theory in practice. I decided to make one complete enclosure at a time, and so learn from any mistakes I might make with the first one.

To make things as easy as possible the enclosure is essentially a wraparound construction. The four sides of the enclosure are precision machined so that they will fold up around the front baffle, to form a box. In this way, no special tools or wood-working skills are required. As they said, "if I could do it, anybody could."

The procedure for putting the enclosure together is delightfully simple. Lay out the continuous side piece on a flat surface such as the floor or large table. The three fold joints should be flexed as little as possible because it is only the external veneer which keeps the whole thing from breaking into four pieces at this stage. Then run a fillet of PVA glue (such as Selleys Aquadhere) into each of the V-cuts for the three fold joints and then into the rebate for the baffle board.

Next, place the baffle board into the rebate for what will become the base panel (ie, the woofer cut-out should be closest to the base board).

The enclosure is then carefully wrapped around the baffle, making sure that no stress is placed on any of the three corner joints. That done, the final corner is held together with strips of masking tape or pressure sensitive tape, applied to place as much pressure on the joint as possible. (This is shown in one of the photographs).

Leave the enclosure for about 30 minutes or so, to give the PVA glue plenty of time to dry.

The rear panel is then a push-fit into the now-formed box and it is secured with eight wood-screws into the four cleats which are already fitted to the wraparound section of the enclosure. That does not happen until later though.

Constructing the crossover network seemed the next logical step. Two prewound air-cored inductors, a variety of resistors and bipolar capacitors, and the flying leads sat waiting to be assembled and soldered into the printed circuit board.

I glued the two coils onto the printed circuit board with contact cement. This is necessary because the coils are too heavy to be supported by their leads alone.

Once the coils are in place, they can be soldered into circuit. Don't forget to scrape the enamel off the ends of the copper leads before soldering them into place. The capacitors were bipolar and so did not have a specific orientation. This means that they could be soldered into the board either way around. The same can naturally be said of the resistors.

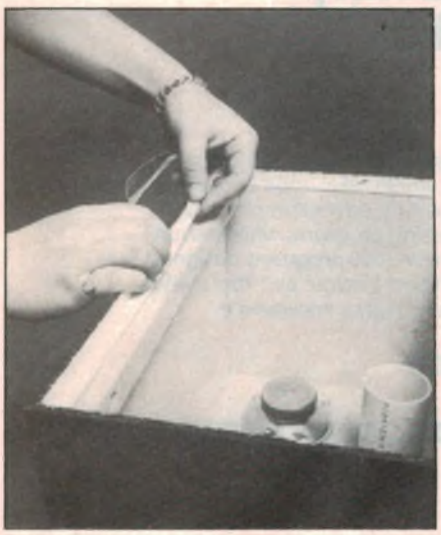
One tip that I found handy though, is to place all the components on the board so that their values can be easily read. This made it so much easier to check my work when all the components were in place.

To secure the crossover network in place on the back panel use a small amount of white sealant (such as Bostik) under the non-copper areas of the PCB and then screw the PCB to the rear panel, using four 12mm long self-tapping screws.

The next few steps involve fixing the terminals to the rear panel. This step confused me, so you have to follow the wiring diagram exactly.

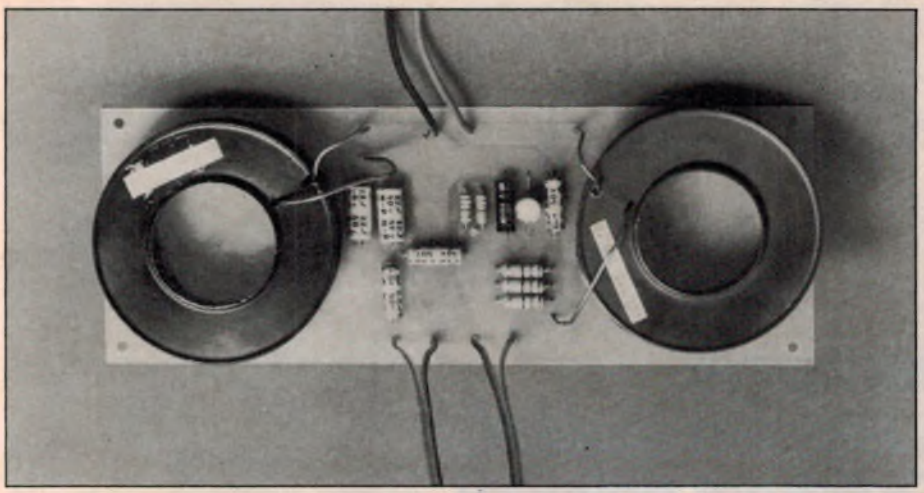
Use a red wire for the positive (+) input wire and a black wire for the negative (−) output. The same applies to the flying leads connecting the tweeter and woofer.

Tin the ends of all the wires and the terminal connections before attempting to solder the leads from the crossover to the terminals. Pull the wires through the hole in the rear panel and connect the red wire to the red terminal and the black to the black. To fix the terminals to the rear panel apply some sealant to the back of the terminals and then screw them into place, using two 12mm long self-tapping screws.

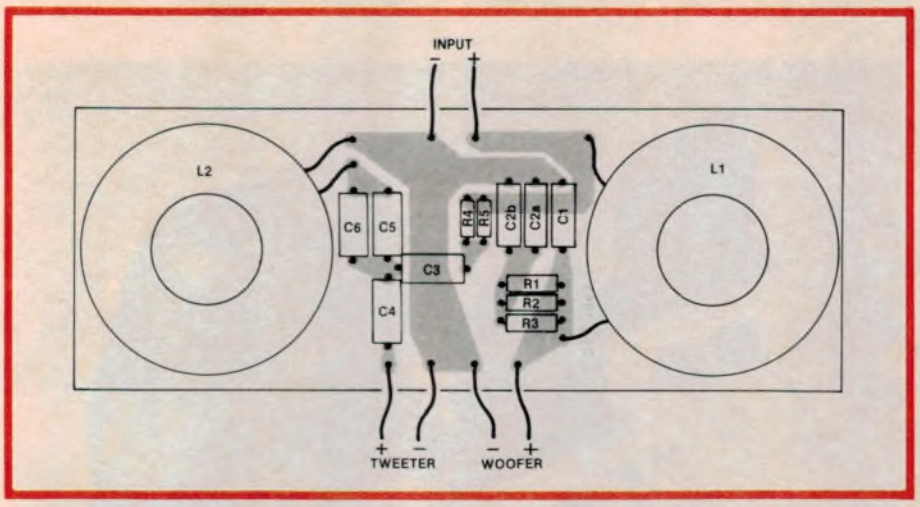


Draft exclusion tape is applied to the cleats to provide an airtight gasket for the rear panel.

Make sure that you don't transpose the loudspeaker leads.



Above: the assembled crossover network. The coils are glued in position using contact adhesive. Below is the parts layout for the PC board.



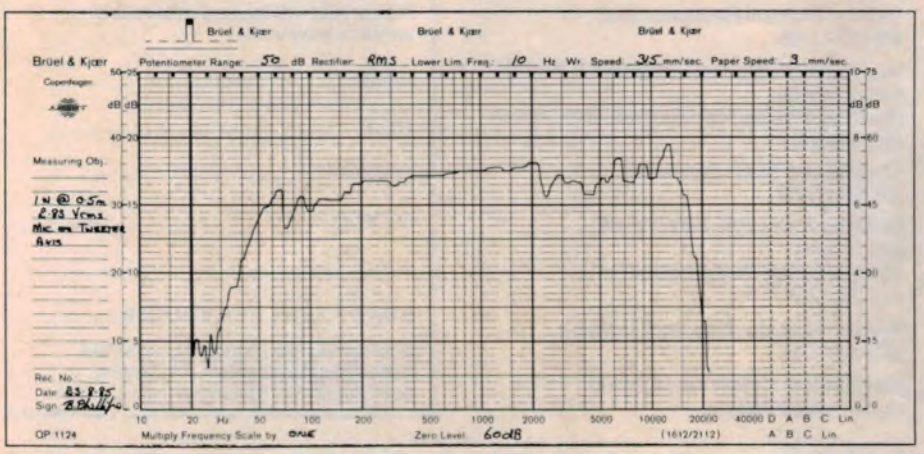
At this stage the use of a multimeter to check for continuity in the circuit can quell a number of mounting fears about how the whole thing is progressing, or not progressing, as the case may be.

Switch your multimeter to the low "Ohms" range and check the continuity of all leads and connections to the board.

Baffle assembly

After checking the crossover network and its connections, I was able to turn my attention to the baffle board. The first step was to mount the vent tube which is a piece of PVC pipe, 110mm long and with inside diameter 50mm. This is secured into place with contact cement.

The way I did it was to apply the contact cement to the outside of the tube and then force it into the appropriate baffle hole, making sure that it is properly aligned with the baffle front surface. I am well aware that this is not



This graph plots the on-axis response of the System 17.

SIEMENS

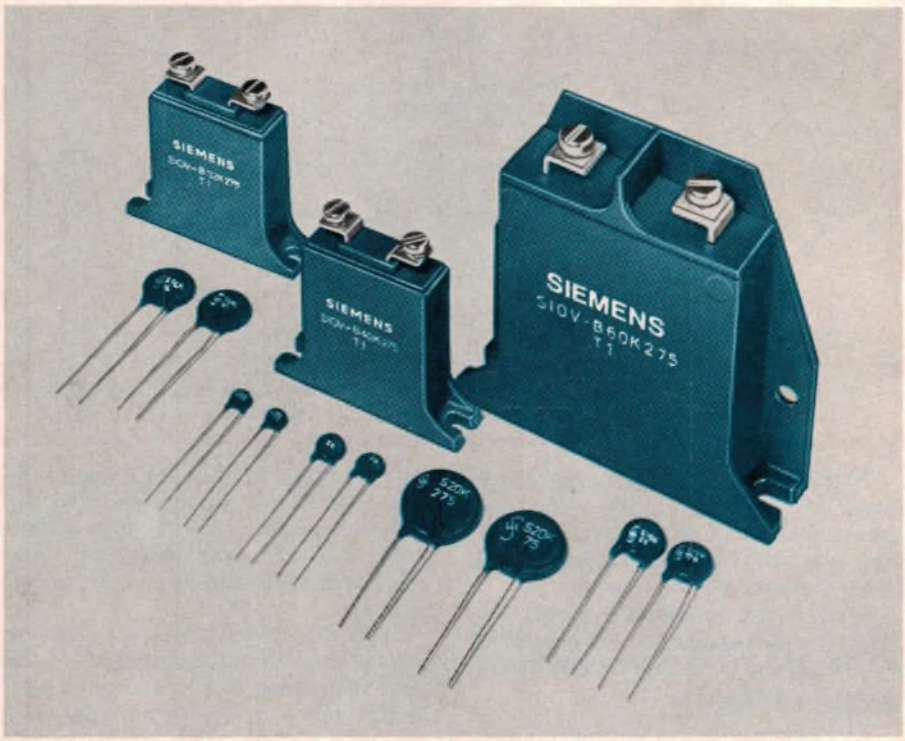
VARISTORS

Australia's widest range. All applications. Biggest stocks. Lowest prices. Quickest delivery. What else?

Siemens is now the biggest and best source of varistors in Australia with a full size range for all applications up to 70 kA. This is of special interest to the telecommunications industry. Comprehensive stocks, plus Siemens position as one of the world's largest manufacturers of varistors underwrites our promise of quick delivery and suitability.
Siemens innovation aims at achieving substantial cost reductions across a wide spectrum in the following applications:

- ☐ Power engineering
- ☐ Electronic communications
- ☐ Power electronics
- ☐ Measuring technique
- ☐ Processing technique
- ☐ Office electronics
- ☐ RFI suppression
- ☐ Stepped protection

This wide range of varistors is available through Siemens newly strengthened national distributor network. For further information, post the coupon or phone your nearest distributor.



Distributors

Victoria: Promark Electronics (Vic)
(03) 878 1255

New South Wales: Nexus Electronics Pty Ltd
(02) 439 5800
New South Wales: Promark Electronics Pty Ltd
(02) 439 6477

Queensland: ECQ Electronics
(07) 376 5677

South Australia: R.G. Pank Pty Ltd
(08) 51 2411
South Australia: Protronics Pty Ltd
(08) 212 3111

Western Australia: Reserve Electronics
(09) 328 9755

New Zealand: Delphi Industries Ltd
Auckland 563 259

Please mail me the new informative varistors brochure.

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

.....

STATE..... POSTCODE.....

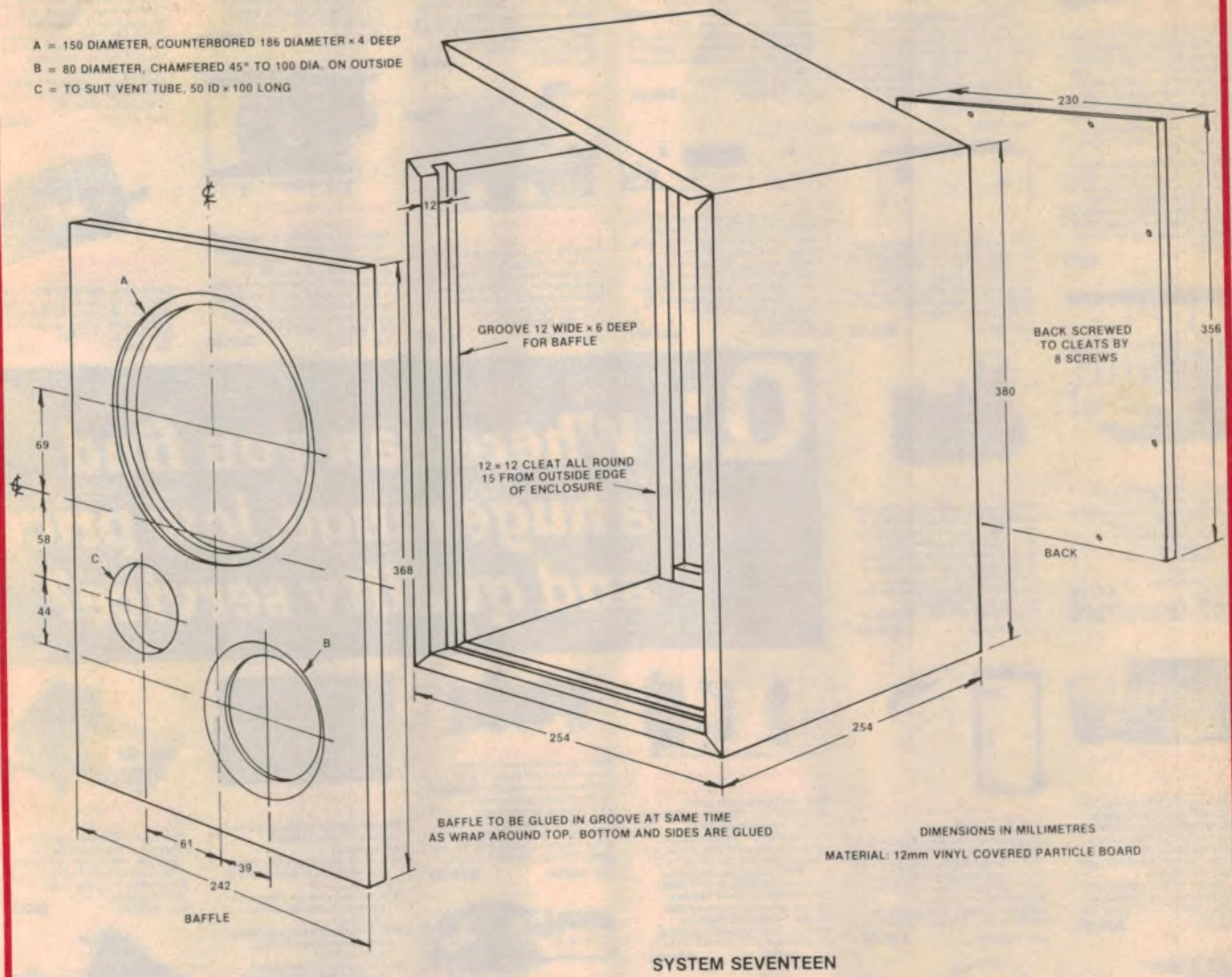
Post this coupon now to Siemens Ltd. Advertising Department, Melbourne. 544 Church St., Richmond 3121.

Siemens Ltd.
544 Church St., Richmond, Vic.
Melbourne: 420 7318 Sydney: 436 8730
Brisbane: 369 9666 Perth: 362 0123

INGENIOUS ELECTRONIC ENGINEERING

823/2352CSA

Budget 2-way loudspeakers



Dimensional details for the System 17 enclosure. Note that it is drawn in the upside down position in which it is assembled.

the usual way to use contact cement but if you do it the regular way, applying it to two surfaces and letting them dry, it would be impossible to push the tube fully into place before the adhesive "grabbed" the tube.

That done, the tweeter could be screwed into place, inside the enclosure, using four 6g × 12mm self tappers.

Mounting the woofer was a different process. It is secured to the front of the baffle, rather than the rear, as for the tweeter. This means that a bead of white sealant has to be run around the rear of the woofer flange, before it is set into place and secured with four 12mm long self-tapping screws.

Solder the four flying leads to the speakers, making sure that the connections have all been tinned to give a proper joint. Make sure that you don't confuse the wires to the tweeter and woofer. I actually did this on one of the pair of speakers so that the woofer was receiving the tweeter drive and vice versa.

This resulted in a very emasculated sound from the speaker system and the fellows in the laboratory all fell about laughing and giving each other bruises from excessive nudging.

The next step, after connecting all the flying leads, is to loosely roll up the supplied Innerbond filling material and place it into the enclosure. It is supposed to just loosely fill the space, not be jammed tightly into it.

Most important, the four cleats which secure the rear panel have to be treated to stop air leaks. The enclosure has to be airtight, otherwise the vent tuning will be degraded. The way we provided a seal was to apply strips of draft exclusion tape (adhesive backed foam: Engles No. 5) to the cleats. This produces an effective air seal gasket which is not likely to be ruined if the rear panel has to be removed in the future, for any reason.

Finally, I was able to push the rear panel into place and secure it with eight countersunk screws. Shortly after, I discovered to my chagrin that the speakers were wrongly connected, as outlined above, and had to remove the rear panel to correct my mistake.

Still, making the second system was much easier and I was able to avoid making any mistakes the second time around.

The most satisfying step was to connect the newly completed speakers to my stereo system and listen. The sound was great!

CATHODE RAY OSCILLOSCOPE KIT

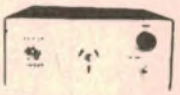
At last a CRO kit! This CRO kit has a gauranteed 5MHz bandwidth but should also go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Keep in mind that a 5MHz scope is usually adequate to troubleshoot most microprocessor and other digital circuitry as well!.
This is a wonderful opportunity to learn electronics and end up with a valuable piece of test equipment as well. The RIE CRO kit is totally complete. The chassis is pre-punched and every component including nuts and bolts are provided, along with instructions.

Cat. **$279**

PARALLEL PRINTER SWITCH

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently so that you can select one or the other at the flick of a switch.
(ETI 666, Feb. 85)

Cat. 46660 **$69.95**



40 W INVERTER

This 12-240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May 82) 82IV5

Cat. K82050 **$54.50**

MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a "no compromise" design and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.
ETI 477 (ETI Jan. '81)
(Single module only)

Cat. K44770 **$79.50**
Plus power supply (No trans) **$49**
Plus transformer PF4361/1 **$49.50**

PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov. 83) 83MA11

Cat. K83110 **$14.95**

LOW-COST BIPOLAR MODEL TRAIN CONTROLLER

Here is a simple model train control for those enthusiasts who desire something better than the usual rheostat control. It provides much improved low speed performance and is fully overload protected, yet contains relatively few componenets. Best of all, you don't need to be an electronic genius to construct it. (80TC12) (EA Dec. 80)

Cat. K80120 **$34.50**

TRANSISTOR TESTER

1000's SOLD

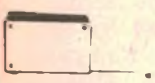
Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester. (EA Sept. 83) 83TT8

Cat. K83080 **$15.00**

EPROM PROGRAMMER EP1

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.
(EA Jan. 82) 82EP1

Cat. K82013 **$69.50**
(Including Textool Socket)



TEMP PROBE

Can measure temperature from -50 to 150°C. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1°C resolution of 0.1°C.
(ETI June 83) ETI 153

Cat. K41530 **$27.50**

ELECTRONIC WATT METER

This unit will measure the power consumption of any mains appliance with a rating up to 3 kilowatts. It makes use of a special op amp called an "output transconductance amp" or OTA, for short.
(EA Sept. 83) 83WM8

Cat. K83082 **$89.95**

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr. 83)

Cat. **$19.95**

PH METER KIT

Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3½ digit liquid crystal display and resolution to .01 pH units, making it suitable for use in the laboratory as well.
(EA Dec. 82) 82PH12

Cat. K82123 **$139**

MOTORCYCLE INTERCOM

OVER 300 SOLD!

Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build!
(EA Feb. 84) 84MC2

Cat. K804020 **$45.00**

FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting.
(EA April 82) 82AO3A/B

Cat. K82040
Cat. K82041 **$87.50**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an "RS232" connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel "Centronics" interface printers. Save money by building this interface. (ETI Jan. 84) ETI 675

Cat. K46750 **$59.00**

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

Here's what you've been asking for! A full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Mircorbee, tips are available on interfacing the unit to other computers.
(ETI Nov. 84) ETI 755

Cat. K47550 **$139.00**

CAR IGNITION KILLER

Most car burgular alarms are easily circumvented, but not this cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable — a sure deterent to thieves! (EA Feb. 84) 84AU1

Cat. K84010 **$16.95**
(Our kit includes the box!)

ZENER TESTER

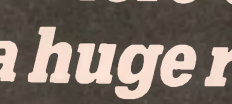
A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.
(ETI May 83) ETI 164

Cat. K41640 **$9.50**

LOW BATTERY VOLTAGE INDICATOR

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner's project.
(ETI 280, March 85)

Cat. K42800 **$7.95**



VIDEO ENHANCER

100's SOLD

Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct. 83) 83VE10

Cat. K83100 **$35.00**

VIDEO AMPLIFIER

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugback supply.
(EA Aug. 83) 83VA8

Cat. K83081 **$17.50**

15V DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. (ETI 581, June '76)

Cat. **$19.50**

DUAL TRACKING POWER SUPPLY

Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages up to 2A. In addition the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway.
(EA March 82) 82PS2

Cat. K82030 **$87.50**

AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder.
(81AO10) (EA Oct '81)

Cat. K81101 **$47.50**

BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188/288, 82S23 & 82S123 etc.
(ETI June '83) ETI 688

Cat. K46880 **$49.50**

Q: Where can you find a huge range, low prices and quality service?

ELECTRIC FENCE

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automative ignition coil, it should prove an adequeate deterrent to all manner of livestock. Additonally, its operation comforms to the relevant clauses of Australian Stnd 3129. (EA Sept. 82) 82EF9

Cat. K82092 **$19.50**

PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb. 84) 84TP2

Cat. K84020 **$27.50**

300 BAUD DIRECT CONNECT MODEM

Modem? What do I want with a modem? Think of these advantages:

- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use electronic mail.
- Ever used a CP/M system? CP-DOS? UNIX? Well a modem will make a your computer a remote terminal on some of the most exciting systems around.

Save on ready built modems.

Cat **$99**

HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!
If you play any type of electronic instrument, this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household, or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb. 84) 83MA11

Cat. K83011 **$29.95**

LOW OHMS METER

How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms.
(ETI Nov. '81) ETI 158

Cat. K41580 **$39.50**

ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug. 84) ETI 1524

Cat. K55240 **$32.50**

300W "BRUTE" AMPLIFIER

The "Brute" develops 300W into 4 ohms, 200W into 8 ohms!
For many aduio applications there's no substitue for sheer power - low efficiency speakers, outdoor sound systems, or maybe you like the full flavour of the dynamic range afforded by a high power amp. Whatever your requirement - this "super power" module should fill the bill. (ETI 466) (ETI Feb. 80)

Cat K44660 **$89.50**
(Heatsink not included)

50 W AMPLIFIER MODULE (ETI 480)

Cat. K44880 **$27.50**
(Heatsink optional extra)

100 W AMPLIFIER MODULE (ETI 480)

Cat. K44801 **$29.95**
(Heatsink optional extra)

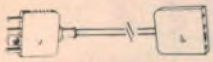
IBM COMPATIBLE CARDS

MULTIFUNCTION CARD
(384K RAM) Parallel, serial and game port. Plus battery backup clock.
Cat. X18013 **$429**

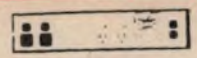
DISK CONTROLLER CARD
Controls 2 slimline drives.
Cat. X18005 **$149**

HIGH RESOLUTION MONOCHROME GRAPHICS CARD
Give your IBM real graphics capability.
Cat. X18007 **$249**

512K RAM CARD
(Includes RAM)
Cat. X18015 **$399**



TELECOMMUNICATION EXTENSION LEADS
Cat. Y16010 5m **$12.50**
Cat. Y16012 10m **$14.95**



MAINS MUFFLER
Sudden mains distrubances can seriously affect your computer equipment, and stored data. Why risk it, when you can have a Mains Muffler, particularly when the cost of one failure is likely to be greater than the purchase price!

Specification:
Maximum total load
1000w 4 AMP 250v 50Hz
First Stage Single Pi Section Attenuation
150KHz 40dB
500 KHz 65dB
10 KHz 80dB
Second Stage Dual T Section Attenuation
150KHz 20dB
500 KHz 60dB
10 KHz 70dB
VDR Transient Suppression
Surge capacity 2000 AMP 8x20 uS
Cat. X10090 **$249**

APPLE* COMPATIBLE SLIMLINE DISK DRIVE
Japanese Chinon mechanism
Normally $225 **This month $185**
(*Apple is a registered trade mark.)

JOYSTICK FOR IBM
Features:
- Selectable "Spring centenng" or "free floating"
- Electncal trim adjustments on both axis
- 360 degree cursor control

Cat. C14205 **$39.95**

ADD ON HARD DISK DRIVE FOR IBM
Includes disk controller card. Available and installed free only at our city store
Cat. X20010
10 M Byte **$1,395**
20 M Byte **$1,550**

GRAPHIC MOUSE SYSTEM
Now everybody can create superb computer graphics in minutes. Think of how much more professional your work could look with the Graphic Mouse!! An absolute must for Apple IIe users. Includes software and mouse.
Cat. X17037 **only $99**

IBM COMPATIBLE DISK DRIVE (NEW MITSUBISHI 4851)
Slimline 5¼" disk drive. Double sided, double density 500K unformatted. 40 track/side. Steel band drive system.
Cat. C11901 **$199**

3½" XIDEX DISKETTES!
Yes, that's right, we now have "hard to get" 3½" diskettes!
Cat. C12600 S/S box of 10 **$65**

5¼" FLOPPY DISK SPECIALS!

	1-9	10+
XIDEX		
S/S D/D	$31.00	$29.00
Cat C12401		
D/S D/D	$38.00	$36.50
Cat C12410		
VERBATIM DATALIFE		
S/D D/D	$27.95	$26.95
Cat. C12501		
D/D D/D	$39.95	$37.95
Cat C12504		
VERBATIM VALULIFE		
S/D D/D	$24.95	$22.95
Cat. C12421		
D/D D/D	$31.95	$29.95
Cat. C12425		

IBM* COMPATIBLES from $1,495!

Incredible deals to suit everyone including our special package deals!

256K RAM: Colour Graphics, Disk Controller Card, 1 parallel port, 2 disk drives and 3 months warranty **only $1,495**

640K RAM: Colour graphics, Multifunction Card, Disk Controller Card, 2 serial and 1 parallel ports, 2 disk drives and 3 months warranty **only $2,100**

256K PACKAGE DEAL: Includes Colour Graphics Card, Multifunction Card, Disk Controller Card, 2 serial and 1 parallel ports, A 120 C.P.S. printer and a monochrome monitor and 3 months warranty! **only $2,400**

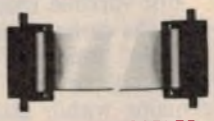
640K PACKAGE DEAL: Includes Colour Graphics Card, Multifunction Card, Disk Controller Card, 2 serial and 1 parallel ports, A 120 C.P.S. printer, a monochrome monitor and 3 months warranty! **only $2,500**

*IBM is a registered trademark.

A: *Rod Irving Electronics, the proof is right in front of you!*

NEW 180 CPS PRINTER! KAITEC KAI 180 EX
Standard 80 column Dot Matrix Printer. High quality printing by NLQ mode. 2K Buffer. High-speed, low-energy consumption 9 wire dot head gives: Printing speed 180 C.P.S.
Logic seeking printing or incremental printing with high response, stepping motor. Use of fan-fold, roll or cut-sheet paper is possible with adjustable sprocket pin feed and friction feed. Both fixed and proportional character pitches are available. Emphasized and double print modes are possible. 9 graphic modes are available. 8 language international character font internalized.
SPECIFICATIONS:
Printing Type: Impact Dot Matrix
Maximum Printing Range: 203mm
Print Types: ASCII 96 Others 7 language
Character Format: Character Mode Standard 9 x 9 dots NLQ 18 x 20 dots Graphic Mode
Printer Modes: (a) Fixed pitch mode (b) Proportional pitch mode
Character Size: 2.42(H)x 1.99(W)
Printing Speed: 180 Character per sec. (pica)
Paper Feed Method: (a) Adjustable sprocket pin feed paper width 4-10 inch (pull through) (b) Friction feed paper width 4-8.5 inch
Paper Feed Pitch: (a) Standard pitch 1/6 inch (b) Min. pitch 1/216 inch
Ink Ribbon: Special nbbon cassettes
Power Requirements: 240V + 10% 50 Hz
External Dimensions: 408(W) x 314(D) x 96(H)mm
Weight: Approximately 7.2kg
Ambient Environment: (a) 5-C-40-C (less than 80% RH) (b) Horizontal operating surface
Reliability: (a) MTBF $3x10^6$ lines (excluding print head and ink ribbon) (b) Print head life: $100x10^6$ characters (c) Ink Ribbon life: $2.5x10^6$ characters
Interface: Parallel interface 8-bit parallel (Conforms to Centronics)
Cat. C20020 **Only $590**

JUKI PRINTER
Professional daisy wheel printer 18CPS full incremental mode Diablo 630 emulation. Large range of daisy wheels. 8K internal buffer available.
Cat. C20040 **$785**



READY MADE CABLES
Serial to serial, 2 m
Cat. P19011 **$24.95**
Parallel centronics to centronics, 2m
Cat. P19013 **$29.95**

COMPUTER PAPER
Top quality at a very affordable price! Blank 11 x 9½", 2,000 sheet quality 60 gsm bond paper.
Cat. C21001

1-9	10+
$34.50	**$29.50**

APPLE* COMPATIBLE CARDS

Printer Card Cat. X17029	$89
Drive Card Cat. X17019	$95
80 Column Card Cat. X17025	$109
Speech Card Cat. X17009	$69
Music Card Cat. X17011	$99
Super Serial Cat. X17035	$129
RGB Card Cat. X17039	$79

KEYBOARD AND CASE
A stylistic low profile case to give your system the professional look it deserves. Comes with an attached encoded, parallel output keyboard and provisions for 2 x 5¼" slimline disk drives.
Cat. X11080 **$249**

PHOENIX 5
Suits Apple, Commodore, even your VCR!
- Pal and R.G.B.
- Normal Resolution
- 13" CRT Dot Pitch 0.65mm
- Horiz. Resol. 320 TV lines
- Vert. Resol. 560 TV lines
- Display Characters 1,000 Ch.(40x25)
- 16 Colours (Pal)
- Green text display

Cat. X14522 **$499**

PHOENIX 4
- R.G.B. TTL
- High Resolution
- 13" CRT Dot Pitch 0.31mm
- Horiz. Resolution 720 dots
- Vert. Resolution 240 T.V. Lines
- Display Characters 2000 Ch. (80 x 25)
- 8 Display colours and intensity
- Green text display

Cat. X14520 **$849**

RITRON 2
Stylish swivel base monitor, available in amber or green.
Green Cat. X14500 **$215**
Amber Cat. X14500 **$219**

RITRON 1
Our most popular model in a steel cabinet to minimise R.F.I. interference.
Green. Cat. X14500 **$199**
Amber Cat. X14500 **$209**

MODEM PHONE
Check the features and the value for money of this stylish new modem phone.
- Speaker Phone with Built-in Amplifier for Detecting Busy Signal during communication.
- Auto/Manual Answer, Manual Originate, Auto Disconnect.
- Carrier Detect Indication. 20 Memories (each with 18 Digits Capacity) for Auto-dialing.
- BELL 103 CCITT V21 Compatible.
- 300 BPS Full Duplex.
- Last Number Redial.
- Pushbutton Keyboard.
- Volume High or Low Control.
- FCC Approved Direct Connect.
- "In-use" Dialing Indicator.

Cat. X19105 **Normally $199**
Save $25! only $174
(Not Telecom approved)

RITRON MULTI PURPOSE MODEM
Our New RITRON Multi Purpose Modem has arrived and has all the standards you require.
Just check the Ritron's features:
- CCITT V21 300 Buad Full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect.

Telecom Approval No. C84/37/1134
$379

1200/75 BAUD RATE/BIT CONVERTER
For computers not capable of split baud rates. Buffers characters at 1200 and converts to 75 baud
Cat. X19105 **$99**

TELEPHONE ADAPTOR
- Australian plug to U.S. socket
- Length 10cm
- Cream colour cable

Cat. Y16026 **$6.95**

MINI DISK STORAGE BOX
Holds up to 30 x 5¼" diskettes.
Cat. C16020 **$16.95**

COMPUTER CASSETTES
Quality 20 minute tapes.
Cat. D11141

1-9	10+	100+
$1.50	**$1.40**	**$1.20**

RS232 MINI TESTER
- Male to female connections
- All pin wired straight through
- Dual colour LED indicates activity and direction on 7 lines
- No batteries or power required

T.D. Transmit Data
D.S.R. Data Set Ready
R.D. Receive Data
C.D. Carrier Detect
R.T.S. Request to Send
D.T.R. Data Terminal Ready
C.T.S. Clear to Send
Cat. X15656 **$39.95**

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866
48 A'Beckett St. MELBOURNE 3000
VICTORIA, AUSTRALIA
Ph (03) 663 6151
Mail Order and correspondance:
P.O. Box 620 CLAYTON 3168
TELEX: AA 151938

MAIL ORDER HOTLINE (03) 543 7877 (2 lines)

POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.
Certified Post for orders over $100 included "free"!
Registered Post for orders over $200 included "free"!

MasterCard VISA

Errors and Omissions Excepted

BANKCARD
VISA
MASTERCARD

SIGNATURE EXPIRY DATE

NAME

ADDRESS

P/CODE

EA 11/85 DATE

Basic facts on passive components

Selecting the best resistor/capacitor

Part 1

by VICTOR MEELDIJK

There's much more to selecting components for your designs and projects than meets the eye. In this article, we'll look at the various types of resistors and capacitors, and what factors you should consider when selecting which type to use.

Did you know that:

Polystyrene foil capacitors may be better for timing circuits than polycarbonate types?

Tantalum capacitors are not recommended for any application where current spikes are present?

A hybrid potentiometer consisting of a wirewound element and a conductive plastic track will have a life span that is 10 times greater than that of a wirewound potentiometer?

Power wirewound resistors can be operated with a body temperature of 275°C, and that some can operate at body temperatures of as high as 500°C?

From the above, it should be clear that there's a lot to know about the many different types of resistors and capacitors available. That's because each type has its own unique characteristics, and those characteristics make some types of resistors and capacitors far better for certain applications than others. Selecting the proper component for a particular application is vital in order to ensure the reliability of your design. In this article, we'll look at the various factors that you should consider when selecting resistors and capacitors for your projects.

Resistors

When selecting a resistor, consider stability, noise, power dissipation, environment, AC requirements, and resistance. Actual resistance value is a function of tolerance, voltage coefficient, temperature coefficient, and drift with time. The power rating is based upon ambient temperature and derating. Derating, which is the operation of a component at something less than 100% of its specified rating, may be necessary because of environmental conditions.

Resistor compositions include carbon, film, and wirewound for fixed resistance units, and cermet and conductive plastic for variable resistors. Fig. 2 shows many of the types of resistors available.

Carbon resistors

Carbon-composition units have a resistive element that is moulded from carbon powder that has been mixed with a phenolic binder to form a uniform resistive body. That device, moulded with end leads, is a general purpose resistor capable of withstanding temperature and electrical transient shocks. The carbon-composition resistor is used in applications where initial tolerance need not be closer than ±5% with long term stability no better than ±20%.

For variable resistors, one problem is that the carbon element requires a high contact force to ensure that any variation in the contact resistance remains within acceptable limits. That results in high shaft-torque and poor adjustability.

Carbon elements are susceptible to moisture absorption and such moisture absorption can cause the resistance to change by as much as 20%. That resistance shift can be reversed if the device is baked at high temperatures (100°C).

Film resistors

Metal-film devices are used in applications requiring higher stability and precision than available from carbon devices. In addition, metal-film resistors should be used in applications where AC is present. Operation is satisfactory from DC to the MHz range. Metal-film units have low temperature coefficients and suffer little degradation to ambient temperatures of 125°C and higher. Film resistors can be classified according to the techniques used in their manufacture.

One such technique is vacuum deposition, which is also known as evaporated metal film. In it, a nickel-chromium alloy is superheated in a vacuum. The alloy vaporises and is deposited on a ceramic substrate. Small quantities of contaminants, called dopants, are used to control resistor characteristics such as resistance range.

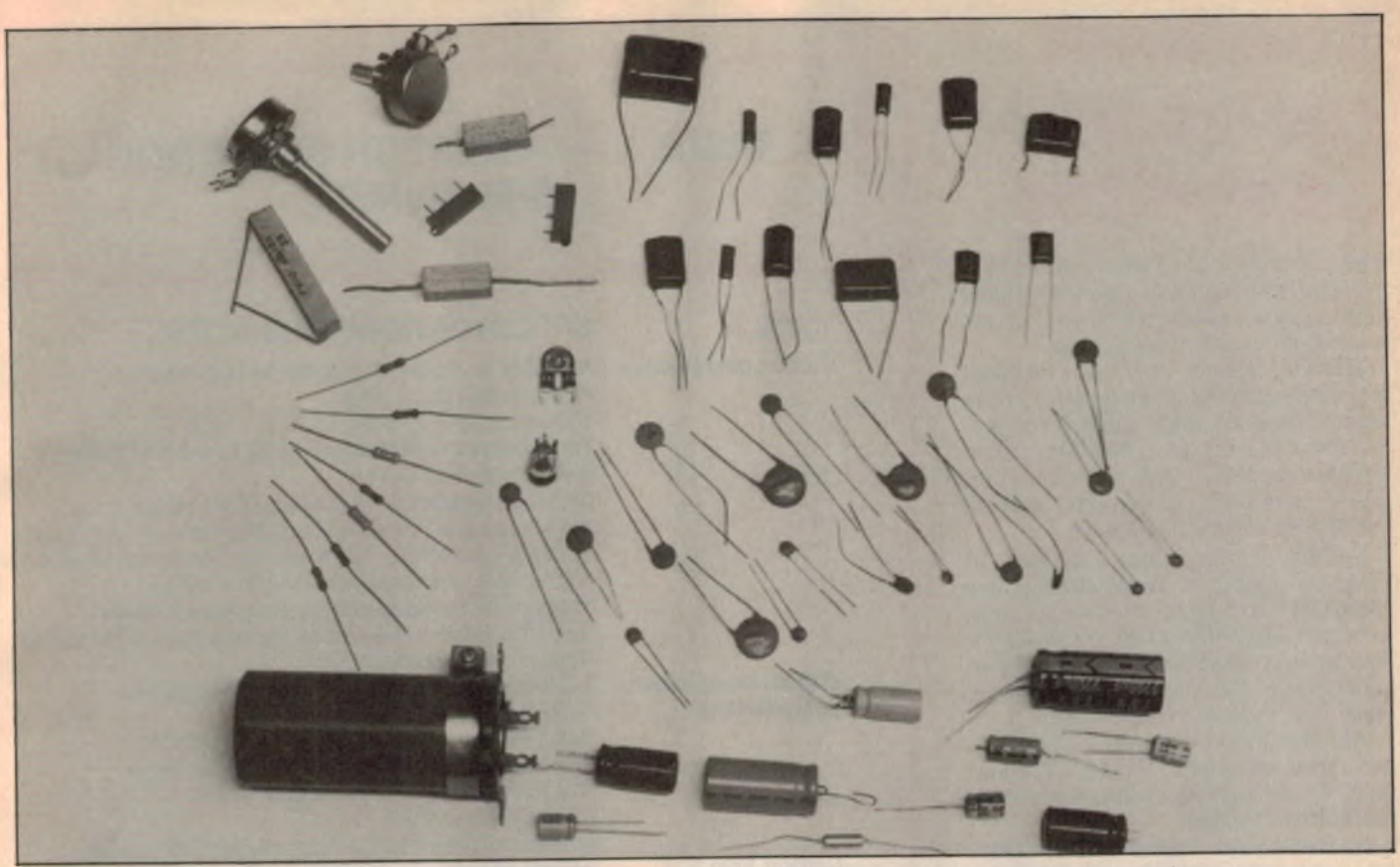


Fig. 1: passive components come in all shapes and sizes. Above is a range of resistors (both fixed and variable) and capacitors.

These resistors are used in applications that require an extreme degree of precision.

In sputtering, a nichrome target is heated and bombarded by argon atoms. That results in metal atoms being knocked off and deposited on a substrate. Resistors manufactured using the sputtering technique are also suitable for applications that require a high degree of precision.

In metal-oxide deposition, a chemical vapour is used to deposit a tin-oxide film onto a glass substrate. This technique, which is primarily used by Corning, is used to produce resistors for general purpose, semi-precision, and precision applications.

Thin-film resistors are highly stable, have low-noise characteristics, and have a very low temperature-coefficient. They are used in digital multimeters, precision voltage-dividers, attenuators, A/D and D/A circuits, and in current-summing applications.

Typical thin-film resistors are sputtered tantalum nitride, deposited chromium cobalt, or nichrome, on a substrate. Substrates of alumina, sapphire, glass, quartz, beryllia or silicon are used.

Thin-film resistor networks are also available; these are housed in DIPs and SIPs (Single Inline Package).

In individual resistors, the terminals used may be either surface or wrap-around types. Wrap-around terminals wrap around the side of the substrate, allowing connections to the underside. Terminals of solder, silver over nickel, platinum, or platinum gold are available. Trimming of the resistor is done either mechanically or by using a laser.

In thick-film resistors, a ceramic substrate is coated (silk screened — a mechanised stenciling process) with a glass-metal material and then fired (to cure it) at a high temperature. The glass-metal materials include nichrome, silver palladium, platinum, ruthenium, rhodium, gold and a tantalum-modified tin oxide. That film is up to 100 times thicker than evaporated or sputtered metal film (greater than .0001 inches thick) and is used in applications requiring high power density or the capability of surviving power spikes or overloads. Those units are suitable for some precision applications, but not those requiring an extremely high degree of precision.

Bulk metal resistors, made in a process that is proprietary to the Vishay Corporation, use metal foil that is laminated to a substrate and then chemically etched to produce a conductive path. The flat element is used exclusively for high-precision applications and has tight tolerances and an excellent temperature coefficient.

Carbon-film resistors were introduced to perform the same basic functions as carbon-composition resistors, but at a lower price. Just like composition types, they lack the ability to withstand transient voltage spikes and have a poor temperature coefficient.

An axial-lead, carbon-film resistor is made by screening carbon based resistive inks on a ceramic rod and then firing the assembly. Alternate techniques include depositing pure carbon by cracking a hydrocarbon gas or by depositing a nickel film for resistor values of less than 10 ohms. The resistive element may also be sprayed on, applied with a transfer wheel, or dipped on.

The rod is then cut to size, leaded end caps are attached, and the unit is trimmed to a precise value. The resistor is then coated with an insulating material. Carbon-film resistors are available in the same resistance values as carbon-composition units and have a typical tolerance of ±5%.

Wirewound resistors

Wirewound resistors are used where large power dissipation is required and where AC performance is relatively unimportant. Those devices are generally satisfactory for use at frequencies up to 20kHz. They are available with various insulating/moisture preventative coatings such as vitreous enamel, cement, moulded phenolic, glass sleeves, or silicone.

Vitreous enamel units have excellent

The best resistor/ capacitor

moisture-resistance properties and will not burn (although they may melt) under high overload conditions since they are made from a glass type material.

Silicone, which also has excellent moisture-resistance characteristics, is an organic material and is more flammable at lower overload conditions than vitreous enamel. It will also emit gases under overload conditions leaving deposits on electrical contacts.

Cement coatings are composed of inorganic materials. Those coatings are essentially flameproof but can be made to burn if subjected to high overloads for long periods. Resistors coated with that material are also subject to changes in value with exposure to moisture.

Aluminium and water-cooled housings are also available. Those housings facilitate the transfer of heat away from the resistive element.

In wirewound resistors, three alloys are commonly used for the resistive element. They are nickel-chromium, copper-nickel, and gold-platinum. Nickel-chromium is the most common due to its excellent temperature coefficient (less than ±5 PPM/°C) and its availability in many different diameters. Copper-nickel is the next most popular, with a temperature coefficient of ±20 PPM/°C. The gold-platinum alloy, that is actually a complex alloy of gold, platinum with small amounts of copper and silver, has a high temperature coefficient of ±650 PPM/°C, but has low resistance. That resistance is 85 ohms/cmf (cmf is a circular mil foot, a hypothetical quantity equivalent to one foot of wire that is .001 inches in diameter) while nickel-chromium has a resistivity of 800 ohms/cmf. The gold-platinum alloy can also withstand harsh environments.

The ceramic core of a wirewound resistor is either beryllium oxide, which has a high cooling capability, alumina (aluminum oxide) or steatite, which has the lowest thermal conductivity of the three materials but is low cost.

Wirewound resistors are most often used in voltage divider circuits, as power-supply bleeder resistors, or as series dropping resistors. Variable devices are used where voltage and current variations are expected, such as motor-speed and heater controls. Precision variable types are used in servo systems requiring precise electrical and mechanical performance.

TABLE 1 — RESISTOR SELECTION GUIDELINES

TYPE	SPECIFICATIONS AND NOTES
Carbon composition	**Resistance range:** 2.7 ohms to 100 megohms **Power rating:** to 2 watts **Tolerance:** 5% to 20% **Temperature coefficient:** −200 to −8000 PPM/°C **Noise:** less than 6 μV/V **Derating factors:** 50% power, 80% voltage **Notes:** General purpose. Excellent transient and surge handling capabilities. RF produces capacitive effects end to end, and operation at VHF or higher frequencies reduces effective resistance due to dielectric losses. Resistance increases by 20% during storage under humid conditions.
Carbon composition potentiometer	**Resistance range:** 50 ohms to 10 megohms **Power rating:** to 5 watts **Temperature coefficient:** 1000 PPM/°C **Derating factors:** 50% power, 80% voltage **Life expectancy:** 5,000,000 rotations **Failure mode:** noise **Notes:** High shaft torque causes poor adjustability
Carbon Film	**Resistance range:** 10 ohms to 25 megohms **Power rating:** 0.1 to 10 watts **Tolerance:** 2% to 10% **Temperature coefficient:** −200 to −1000 PPM/°C **Noise:** less than 10 μV/V **Derating factors:** 50% power, 80% voltage **Notes:** General purpose, cost less than carbon-composition units
Metal film	**Resistance range:** 10 ohms to 3 megohms (high voltage types: 1 kilohm to 30 gigohms) **Power rating:** to 10 watts (high voltage types: to 6 watts) **Tolerance:** 0.1% to 2% **Temperature coefficient:** ±25 to ±175 PPM/°C **Noise:** less than 0.1 μV/V **Life expectancy** (potentiometers): 100,000 rotations **Failure mode:** resistance change or catastrophic failure **Derating factors:** 50% power, 80% voltage **Notes:** Fair degree of precision in lower value units. High stability, long life, and excellent high-frequency performance. Resistance values stable to about 100 MHz; begin to decrease beyond that frequency. Used in high-frequency tuning circuits, measuring circuits, filters, etc.
Film networks	**Resistance range:** 10 ohms to 33 megohms **Power rating:** to 0.2 watts per element, to 1.6 watts per network **Tolerance;** 0.1% to 5% **Operating temperature range:** −55 to +125°C **Temperature coefficient:** ±25 to ±300 PPM/°C **Notes:** Tracking between resistors 5 PPM/°C
Chip resistors	**Resistance range:** 1 ohm to 100 megohms **Power rating:** to 2 watts **Tolerance:** 1% to 20% **Operating temperature range:** −55 to +125°C

Power wirewound	**Resistance range:** 0.1 ohm to 180 kilohms **Power rating:** to greater than 225 watts **Tolerance:** 5% to 10% **Temperature coefficient:** less than ±260 PPM/°C **Noise:** low static, high dynamic noise levels **Derating factors:** 50% power, 80% voltage
Precision wirewound	**Resistance range:** 0.1 ohm to 800 kilohms **Power rating:** to 15 watts **Tolerance:** .01% to 1% **Temperature coefficient:** varies with resistance **Noise:** low static, high dynamic noise levels **Life expectancy (potentiometers):** 200,000 to 1,000,000 rotations **Failure mode:** Catastrophic failure **Derating factors:** 50% power, 80% voltage **Notes:** Wirewound resistors are used in low-tolerance, high-power dissipation applications where AC performance is not critical. Power dissipation depends on heat sink or air flow around the device. When mounting on a PC board, standoffs should be used to prevent charring the board. Not suitable for use at frequencies above 50kHz. Wirewound potentiometers do not suffer from contact resistance variations. The units can be manufactured with low temperature coefficients and tight tolerances. Applications include motor speed controls, lamp dimmers, heater controls, etc. Precision types are used in servo mechanisms.
Cermet	**Resistance range:** 50 ohms to 5 megohms **Power rating:** to 2 watts **Life expectancy (potentiometers):** 50 to 500,000 rotations **Failure mode:** noise **Derating factors:** 50% power, 80% voltage **Notes:** Very stable under humid conditions. Low temperature coefficients. Low end resistance (2 ohms). Short life expectancy. High resolution of the resistive element allows for more precise trimmer settings. Less reactance in high-frequency applications than wirewound units, and are lower in price. Cermet is also the thick film used in resistor networks and chip resistors.
Conductive plastic potentiometers	**Resistance range:** 150 ohms to 5 megohms **Power rating:** to 1 watt **Temperature coefficient:** −600 to −300 PPM/°C **Life expectancy:** 100,000 to 4,000,000 rotations **Failure mode:** Noise **Derating factors:** 50% power, 80% voltage
General purpose conductive plastic potentiometers	**Resistance range:** 1 ohm to 15 kilohms, depending on power rating **Power rating:** to 1000 watts
Precision conductive plastic potentiometer	**Resistance range:** 100 ohms to 500 kilohms **Power rating:** to 7 watts **Tolerance:** 3% **Temperature coefficients:** less than 70 PPM/°C **Life expectancy:** Greater than 2,000,000 rotations
Conductive plastic trimmers	**Resistance range:** 10 ohms to 100,000 ohms **Power rating:** to 1 watt **Notes:** Conductive plastic potentiometers have a long life expectancy and low-noise characteristics. Resistance will shift if exposed to humidity.
Hybrid potentiometers	**Resistance range:** 200 ohms to 250,000 ohms **Power rating:** to 7 watts **Tolerance:** 5% **Temperature coefficient:** less than ±100 PPM/°C **Life expectancy:** 10,000,000 rotations

Just when you thought you'd seen it all . . . .

Latest Generation Receivers from Yaesu!

FRG9600 Scanner

Never Before! A scanning receiver that has so many features, offers so much. And it's absolutely ideal for the amateur, too! It offers **continuous coverage** between 60 and 905MHz, in all modes (SSB up to 460MHz), with FM and AM in both wide and narrow bandwidth. But that's not all:

You get 100 keypad-programmable memory channels, full rotary dial tuning as well as push-button tuning, fully programmable scanning in various modes . . . and much, much more.

PLUS it's a CAT unit: with the optional interface you can control its operation from most micros! Virtually unlimited customised control functions in software are possible!

Impressed? Not half as impressed as you will be with one in your shack!

Specifications:

Range: 60 — 905MHz (SSB 60 — 460MHz)
Modes (3dB bandwidth)
FM (N): 15kHz 0.5uV Sens (12dB SINAD)
FM (W): 180kHz 1.0uV Sens (12dB SINAD)
AM (N): 2.4kHz 1.0uV Sens (10dB S+N/N)
AM (W): 6kHz 1.5uV Sens (10dB S+N/N)
SSB : 2.4kHz 1.0uV Sens (10dB S+N/N)

Conversion:	Triple for FM (N) AM & SSB, Double for FM(W)
IFs:	45.75MHz, 10.7MHz and 455kHz
Image rejection:	60-460MHz — 50dB typical 460-905MHz — 40dB typical
Memory Channels:	100
Power Supply:	12-15V DC 550mA (lithium cell back-up)

LIMITED STOCK!

(Includes power supply) **$799**

Cat D-2825

FRG8800 Receiver

What about HF, you ask?

No worries. Yaesu design engineers have excelled themselves yet again!

- General coverage from 150kHz to 30MHz
- All mode, including AM wide and narrow and FM narrow
- 12 internal memories (push-button) with scanning functions
- Selectable AGC rates, noise blanking widths & tuning rates
- Dual digital clocks (great for different time zones)

And so much more!

PLUS, it's also a CAT system: add a microcomputer and the optional interface and you can transfer function to your micro!

And even more: with the optional VHF coverter (fits completely inside) you also get 118 - 174MHz.

It also uses the '7700' series of accessories: active antenna, and antenna tuner.

Specifications:

Modes:	AM, SSB & CW in both wide and narrow; FM (N)
Sensitivity:	AM, SSB & CW: 10dB or better (S+N/N) FM (N): 20dB or better (S+N/N)
Selectivity:	AM (W) 6kHz (−6dB), 15kHz (−50dB) AM (N), SSB, CW 2.7kHz (−6dB), 8kHz (−50dB) FM (N) 12.5kHz (−6dB), 30kHz (−40dB)
Antenna Imp:	50 ohms and 500 ohms (VHF conv 50 ohms)
Power:	240V AC

Cat D-2820

Alternative: FRG-8800 SW — 2MHz to 30 MHz range, otherwise identical **$829.00**
Cat D-2821

$899

LIMITED STOCK!

Optional VHF Converter

Yes! 118-174MHz from your FRG-8800. And it fits completely inside the set — operation is completely automatic. Full dial or pushbutton selection, same features as standard set.

Incredible versatility - and full CAT operation too.

Cat D-2823 **$189**

Orders taken now at your nearest DSE store

DICK SMITH ELECTRONICS PTY LTD

B-052

The best resistor/capacitor

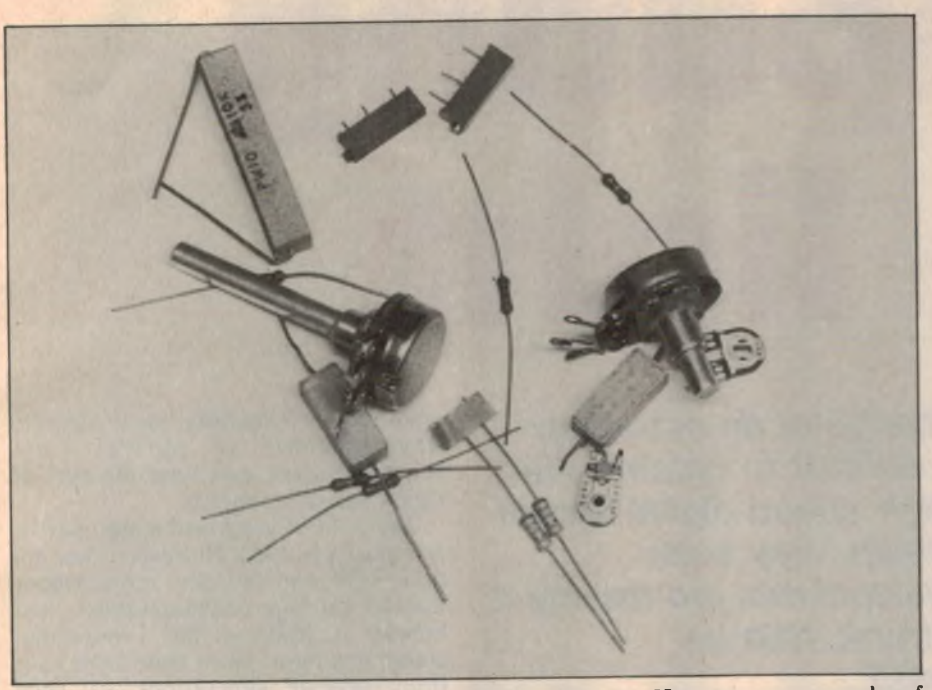


Fig. 2: there are many different resistor compositions and types. Here are some examples of power resistors, trimpots, potentiometers and low-wattage fixed resistors.

Other resistor types

For low resistance/high current applications, edgewound ribbon type power resistors are available. Designed for power handling up to 1000 watts (at currents up to 100 amps) these devices are made up of steel ribbons wound into a coil and supported by ceramic insulators. They are generally rated for normal operation with a temperature rise of 375°C. Those units are used in power-supply testing and in motor-breaking systems.

Cermet devices have a resistive element made by combining very fine particles of ceramic, or glass, with precious metals. Cermet devices are very stable under humid conditions and have low temperature coefficients of ±100 PPM/°C. Conductive-plastic or hot-moulded carbon potentiometers, for example, have an average temperature coefficient of ±1000 PPM/°C. In variable resistors, however, the cermet element is abrasive and long periods of rotational cycling will wear out the wiper long before similar use would wear out the wiper in resistive-film or conductive-plastic units. Cermet potentiometers are available in low resistance values, which makes them useful in many audio applications.

Cermet is also the thick film used in resistor networks and in chip resistors.

Conductive plastic potentiometers have a resistive element consisting of a blend of resin (epoxy, polyester, phenolics, or polyamides) and a carbon powder applied to a plastic or ceramic substrate. The plastic substrate results in a better temperature coefficient due to greater compatability between the ink and the substrate. Those devices have a long rotational life and excellent contact resistance variation, or low noise. End resistance is low, 2 ohms maximum.

Conductive plastic units are suitable for use in applications that require a consistent temperature coefficient over a limited temperature range, such as −25°C to 75°C. Temperature coefficient values of −200 PPM/°C may be attained by special processing of the carbon material or by incorporating metal powders, or flakes, into the element. Nickel, silver, and copper are frequently used in low-resistance devices. Conductive-plastic elements, like carbon units, vary in resistance when exposed to humid conditions.

Hybrid potentiometers are wirewound units with a conductive-plastic track deposited along the contact path of the resistive element. That results in a device that has a better resolution and a longer life, by a factor of 10, over wirewound types. Compared to conductive-plastic units, hybrid devices have a higher power handling capability, due to the wirewound element. Like wirewound units however, they have stray capacitance at higher frequencies and have high contact resistance and marginal output smoothness when drawing current through the wiper contact.

Table 1 summarises the resistor types

continued page 124

Computing with light

Technology undergoes change at an extremely rapid rate but it would be difficult to outstrip the field of computers. The high speed digital optical computer, once a pipe dream, may soon become reality! What developments are making it possible and will the electronic chip be superceded in the process?

by JOHN SENIOR

As unemployment has risen over the past few years, demand for an entirely new skill has evolved in the job market. The need is for optronic engineers who can deal with optical circuits in much the same way as an electronics engineer works with electrons and an integrated electronic circuit.

The domain of the new skill is integrated optics, the name given to circuits of thin layers, with electrical and optical properties, built on flat substrates. The technology of engineering light can already carry out simple processing of signals and provide logic functions. In fact, its components, whose progress has been closely linked to developments in optical fibre communications, may form the basis of digital optical computers.

The birth of integrated optics may be traced back to 1965. However, it was not until 1969, and the early investigations into optical fibre communications, that Stewart E. Miller of Bell Laboratories coined the term. Since then there have been several generations of such communications systems. The earliest allow communications over only a few kilometres without repeaters. They are found in industrial telemetry, local area computer networks, closed circuit and cable television, and in control systems for vehicles.

Second-generation systems can

This article first appeared in *New Scientist*, London, the weekly review of science and technology.

1: Mixed frequencies make clearer signals

All optical fibre systems installed to date carry information by varying or modulating the intensity of the carrier signal in sympathy with the information signal. The receiver is, therefore, basically a photon counter that converts each detected photon into an electron-hole pair, usually within the material structure of a semiconductor photodiode. The electron current obtained is then amplified.

In theory, however, it is possible to modulate other properties of the transmitted light. These could be the frequency, phase or polarisation of the carrier wave. Modulation of one of these properties would allow well established (for electrical systems) coherent detection techniques to be applied to optical systems. Such techniques, namely heterodyne and homodyne detection, have worked successfully in optical communication through free space.

Coherent detection by heterodyning involves mixing the incoming signal with the signal from a local oscillator to produce an intermediate frequency (IF), which is a difference signal from which the information signal is derived. Alternatively, with homodyne detection, a local oscillator is set at the same frequency and phase as the carrier signal, prior to mixing.

These techniques provide more sensitive detection and demodulation of the information signal, thus enabling transmission over greater distances without intermediate repeaters (200 kilometres has already been achieved with an optical-fibre system).

However, there are difficulties associated with coherent optical-fibre transmission. The transmitter, usually a semiconductor laser of a narrow spectral width, is frequency modulated by the information signal. The modulated carrier is then launched into a single mode fibre. Ideally, to obtain coherent transmission a single polarisation state of the fundamental mode is sent into and maintained in the fibre. This requires special fibre cable designs which are being developed.

Alternatively, conventional single mode fibre may be employed, but this necessitates a more complicated demodulation process at the receiver. Assuming polarisation is maintained, the received signal is mixed with the output from a local, optical oscillator, provided by a suitable semiconductor laser. To permit satisfactory heterodyne detection, the optical mixer must combine efficiently the polarised optical signal field with the similarly polarised local optical field.

Both the optical source and the local oscillator must be spectrally pure and produce light at the same frequency.

The light bench as a communications tool: Herriot-Watt is researching the "optical transistor".

transmit well in excess of 10 kilometres without repeaters. They can carry the equivalent of 2000 or more telephone conversations along one fibre. The most recent generation, currently being installed in public telecommunications links, can transmit even more information over several tens of kilometres without repeaters. The newest systems differ from earlier generations in that their fibres have a much smaller core diameter of 5-10 micrometres. They are called "single-mode" because they transmit only the lightwave's fundamental electromagnetic mode. The resulting low dispersion allows a much higher bandwidth (a measure of the amount of information carried by an electromagnetic wave) to be transmitted.

A major factor in the development of integrated optics is that its components tend to be compatible only with single-mode fibres. The next generation of optical-fibre communications (see Box 1) will lean heavily on integrated optics. But integrated optical devices, in many cases "reinventions" of electronic circuits, have advantages other than a compatibility with optical fibres.

Electronic circuits have a top limit of operation of around 10^{10} Hertz, a limit which makes the transmission of bandwidths larger than a few gigahertz difficult. If the electricity is replaced with light, which is an electromagnetic wave with a frequency ranging 10^{14} to 10^{15} Hertz, then such an optical circuit could run around 10^4 times faster than anything conceivable with electronics. Also, light interacts with semiconductors and transparent dielectrics at speeds of 10^{-12} to 10^{-15} seconds, so providing a possible basis for a subpicosecond switch.

Signals can be carried on light waves of different frequencies or wavelengths within the same optical fibre or device. This is called "frequency or wavelengh division multiplexing." It is a technique that can send more information along one line than any electronic method. Multiplexing also permits parallel access to information within an optical system. Coupled with high-speed operation, it offers great potential for both communications and computing.

The fundamental element in integrated optics is the waveguide, which is analogous to a metal strip in an electronic circuit. The simplest dielectric transparent waveguide is a transparent rectangular film sandwiched between a substrate and a cover layer both of which have a lower refractive index than the film. The cover layer is often air, which has a refractive index of one. Light is contained and propagated within the film layer by total internal reflection.

The differing refractive indices of the cover layer and substrate creates an asymmetric waveguide. This variation from the refractive symmetry of a fibre dictates a minimum thickness for the film layer, so far, of one micrometre if singlemode propagation is to be obtained. If the micrometre barrier remains in the future, it will seriously limit the size of devices and the density at which they can be packed onto a chip. A planer guide allows light to spread only across the guiding layer. To confine the light to a particular path, the layer is fabricated as a thin strip (Fig. 1) so that total internal reflection prevents the light escaping.

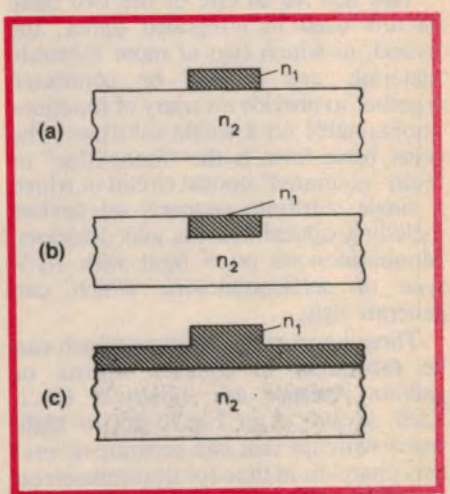
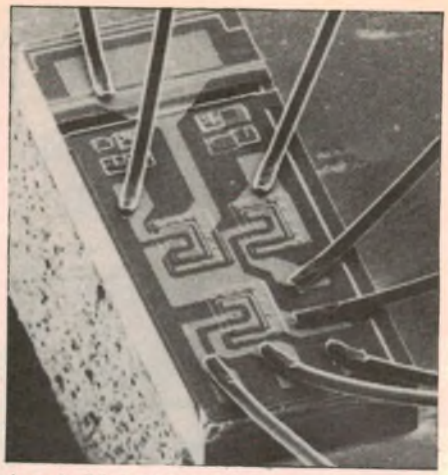


Fig.1: Strip guides are made by (a) etching (b) diffusion or (c) deposition; n_2 is the refractive index.

Computing with light



A typical hybrid laser IC.

The electro-optic effect

The choice of substrate for a circuit depends largely on its function. No single substrate can produce all the necessary devices for integrated optics such as beam splitters and directional couplers, switchers and modulators, filters and wavelength multiplexers, frequency translators, lasers and amplifiers, photodetectors and bistable elements.

Planer waveguides can be of glass or other isotropic materials such as silicon dioxide or polymers. These materials are suitable for simple components, but their properties cannot easily be varied in use. To deflect, focus, switch and modulate the trapped light it is necessary to choose crystal materials that allow refractive index to be varied locally by the application of electrical, magnetic or acoustic energy.

The electro-optic effect, by which refractive index is altered by applying an electric field across the waveguide, is the most popular technique. It is easy to control and highly efficient. As regards suitable materials, there are two general types: those that cannot generate light (such as lithium nitrate and lithium tantalate) and those that can (such as gallium arsenide and indium gallium arsenide). Lithium niobate exhibits strong electro-optic properties as well as a high optical quality. However, most circuits require a source of light (such as a photodiode or a semiconductor laser) which cannot be fabricated in lithium niobate or a number of otherwise suitable materials.

This has led to one of the two basic circuits used in integrated optics, the hybrid, in which two or more substrate materials are bonded or connected together to provide a variety of functions unobtainable on a single substrate. The other basic form is the "monolithic" or "fully integrated" optical circuit in which a single substrate supports all devices including optical sources and detectors. Monolithics are often built with III-V type of semiconductors, which can generate light.

Three basic optical devices which can be fabricated in lithium niobate or gallium arsenide are shown in Fig.2. Such devices as in Fig.2b act as high-speed switches that can separate several data channels in time for transmission on one line. When several couplers are operated together, they offer a whole range of logic functions. Developments of this kind may switch future optical-cable television and optical telephone exchanges.

Simple phase modulation of a beam may also be obtained by using the electro-optic effect in the Mach Zehnder interferometer (Fig. 2c). When no potential is applied to the electrodes of the interferometer, light is split between the two arms and arrives at the output in phase. This condition corresponds to the "on" state. Switching the bias produces a relative phase shift of $n\pi$ in the arms, and leads to destructive interference and the "off" state. The process thus converts phase modulation into amplitude modulation.

British Telecom's laboratories at Martlesham are investigating the integration of electro-optic devices on a lithium niobate substrate. The work is directed particularly at applications in future coherent, optical fibre communications systems.

Over the past few years, many monolithic circuits incorporating both optical sources and detectors with electronic components have been developed. This is called optoelectronic integration. Optoelectronic circuits need III-V semiconductor materials to incorporate lasers and photodiodes with suitable electronic devices, such as certain types of transistors, to provide laser drive and photodiode amplification on a single substrate. Semiconductor lasers with narrow spectral width and single mode operation are essential to provide long distance transmission. Several semiconductor lasers have been developed that are suitable for optoelectronic integration.

The technology of III-V semiconductor devices is sufficiently advanced that small-scale optoelectronic integration has been achieved experimentally on single chips. For example, the Ortel Corporation and the California Institute of Technology recently announced a rudimentary optical repeater. This monolithic circuit incorporates a buried heterostructure laser, a photodiode and a metal semiconductor field effect transistor (see Box 2) to provide amplification on a semi-insulating gallium arsenide substrate. Such monolithic structures have an immediate application in optical fibre communications to provide transmitters, receivers and repeaters on a single chip.

But, will optical switching and control elements lead to the high-speed digital optical computer? Modern computer systems consist of a large number of interconnections: these range from the microscopic dimensions of electronic circuits to the long distances of computer networks. However, taking advantage of optical processing in computing requires logic circuitry.

The fundamental element which provides the main logic of a computer

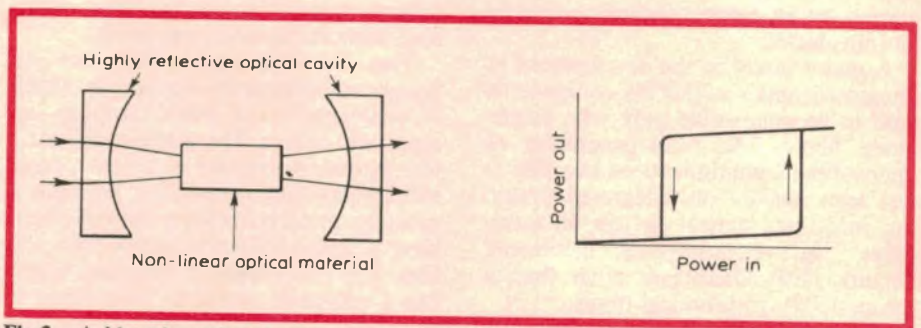


Fig.3a: A bistable optical device based on a Fabry-Perot cavity. In one stable state, the beam resonates between the mirrored surface. In the other stable state, the refractive index of the optical material is changed to vary transmission.

Fig.3b: If the material in a Fabry-Perot cavity does not change its refractive index in direct proportion to an applied electric field, then the device shows hysteresis. The result is a switch that works rapidly at low energy levels.

Electronics Australia

ANNOUNCES

POSCH INVENTORS' CONTEST No. 1

Electronics Australia in conjunction with Trojan Systems Pty Ltd and Posch Marketing Pty Ltd proudly announces this exclusive Inventors' Contest in search of innovative commercially viable material.

VALUABLE PRIZES TO BE WON!

PLUS chance for manufacturing and international marketing of your invention!

1st Prize VALUE $4000 — *A week's holiday for two in Thailand, flying Thai International*

2nd & 3rd Prizes *Sony D-50 Portable CD player*

VALUE $429 EACH

Electronics Australia has made arrangements with an innovative manufacturing and marketing partnership, in order to promote Australian ingenuity and enterprise. We want to see Australian ideas developed and properly marketed, both here and overseas, for the benefit of Australians. Aussie ideas are as good or better than those from overseas. Let us develop them to the full.

If you have devised an original electronic invention you think could be commercially viable, why not fill in the coupon below to obtain the comprehensive details of the contest? These include all details of obligations of all parties, royalties and so on.

Only when you have all this information can you enter. Filling in the coupon below does not impose any conditions on you and does not oblige you to disclose any details of your invention. When you decide to enter you fill in separate forms.

Entries to the contest must be received on or before Monday, December 2. All entries will be acknowledged and will be kept strictly confidential. The winners will be announced in the February 1986 issue of Electronics Australia.

First Prize: A week's holiday for two in Thailand, flying Thai International. Value: $4000.

Second and third prizes: Sony D-50 portable compact disc player. Value: $429 each.

IF YOU HAVE AN INVENTION THEN DO NOT MISS THIS GREAT OPPORTUNITY!

MAIL COUPON FOR YOUR OFFICIAL ENTRY FORM & CONDITIONS

to: POSCH INVENTORS CONTEST
C/- Trojan Systems Pty Ltd,
9 Lace Street, Daveton, Vic 3177

Please send me ☐ entry forms — Ask for an entry form for each invention

Name .....

Address .....

.....

State ..... Postcode .....

Signature of Applicant:

Businessmen & Hackers finally see eye to eye on printers.

Businesspeople will welcome it as a new price break-through in near letter-quality printers. Hackers will welcome it as a whole new standard in low-cost printers.

On appearances, you'd never suspect it was a low-cost printer. And when you see its superb, near letter-quality printing, you'll find it hard to believe that the recommended retail price (excluding sales tax) is under $440!

The Epson® "NLQ Special" gives you so much more than you've learned to expect from a printer in this price range.

It offers superb, near letter-quality printing in a variety of type styles and sizes.

It prints up to 100 characters per second, and includes a 1024 byte input buffer which reduces the time your computer is tied up during printing.

It produces charts and graphics with a crispness and definition that's seldom been seen on a printer in this price range.

It comes with standard friction feed, optional tractor & cut sheet feeders, and uses standard interfaces.

In its GX-80 configuration, it emulates Commodore, Apple and IBM printers and operates directly with these computers without modification.

In LX-80 configuration, it offers a variety of built-in word processing functions – so you can produce professional-looking documents even without word processing software – and is compatible with almost all other computers.

There is so much more to the Epson GX-80 and LX-80 that you won't find on other low-cost printers. Call in to your nearest Epson dealer and see what's so special about the "NLQ Special."

The "NLQ SPECIAL" by EPSON AUSTRALIA

Epson Australia Pty Ltd, 3/17 Rodborough Road, Frenchs Forest. Sydney (02) 452 5222. Melbourne (03) 543 6455. Brisbane (07) 832 5400.

*Registered Trademark of Epson Corporation. EPS 0051/R

circuit is the binary switch. The equivalent for the optical computer is the bistable optical device (BOD). The BOD can provide optical logic and memory elements as well as other, more general signal processing devices such as analogue-to-digital converters. Its simplest form is a Fabry-Perot cavity that contains a material in which variations in refractive index are nonlinear (Fig.3a). As with the laser, such a cavity exhibits a sharp resonance to light passing through it when the optical path length is an integer number of half wavelengths.

In contrast to the laser, the value of refractive index within the cavity controls transmission, giving high output on-resonance and low output off-resonance. As shown by the transfer characteristic (Fig.3b), the Fabry-Perot cavity exhibits two-state hysteresis (the delay between the change in a cause and the resulting effect). This occurs by changing the refractive index which tunes the output into and out of resonance. BODs can therefore be switched between two, distinct optical states; this binary switching provides memory and logic functions.

The switching speed of a BOD depends on drive power, but they offer the potential to switch very quickly at low power levels: possibly within a picosecond while consuming only picojoules of energy. A BOD like this would be far superior to an analogous electronic device. However, suitable nonlinear materials and device structures have yet to appear.

Variations in refractive index within the cavity material can be produced using the elecro-optic effect. In materials such as lithium niobate and gallium arsenide this effect is not linear, and it can be combined with an electronic feedback loop. Such hybrid BODs (Fig. 4) have been fabricated in integrated optics; they consist, typically, of a titanium-diffused, optical waveguide on a lithium niobate substrate with cleaved and silvered end-faces to form the resonant optical cavity. The light emitted from the cavity is amplified.

The electrical signal obtained is then fed back to the electrodes on either side of the cavity to vary the refractive index, thus allowing the device to exhibit hysteresis and bistability. The switching speeds of hybrid bistable devices are ultimately limited by the use of electrical feedback. Nevertheless, it is possible that several of them could be connected to provide a complex logic circuit.

Alternatively, all BODs may be built with an appropriate nonlinear optical medium. Current research centres on materials such as indium antimonide, zinc selenide, gallium arsenide, gallium aluminium arsenide and indium gallium arsenide phosphide in which optical absorption changes the refractive index. Unfortunately, these effects are generally weak and often work only at low temperatures. However, the possibility of small, fast-switching, integratable devices for use in real-time processing and digital computing has encouraged activity at Heriot-Watt University and Bell Laboratories.

The team of 20 at Heriot-Watt, led by Desmond Smith and Brian Wherrett, is looking at indium antimonide in the near infrared and, more recently, in the visible region at temperatures of 77°K. It has found bistability at room temperatures in zinc selenide interference filters. This work was done with visible light, which allows the switching and hysteresis effects to be seen.

The team is also studying gallium indium arsenide and indium gallium arsenide phosphide, using near infrared

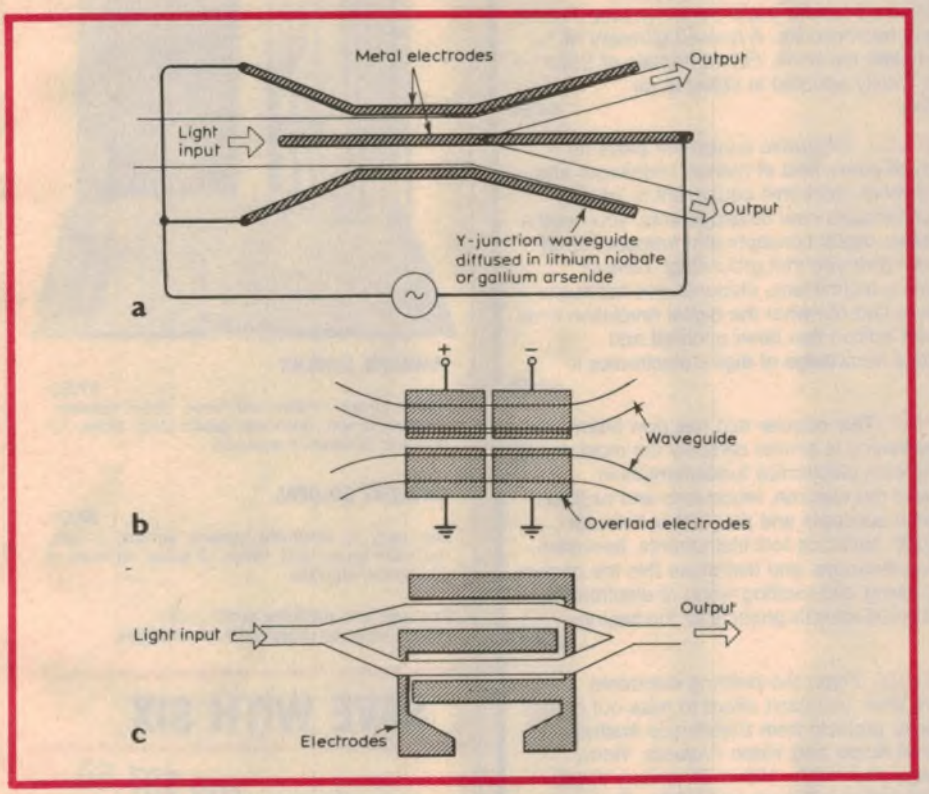


Fig.2a: A junction that switches a beam along a specific arm when an electric field increases the refractive index of one arm relative to the other. Fig.2b: A coupler that switches light progressively from one waveguide to the other if an electric field varies their refractive indices. 2c The Mach Zehnder interferometer can act as a switch when an electric potential changes the phase of light in the split waveguide.

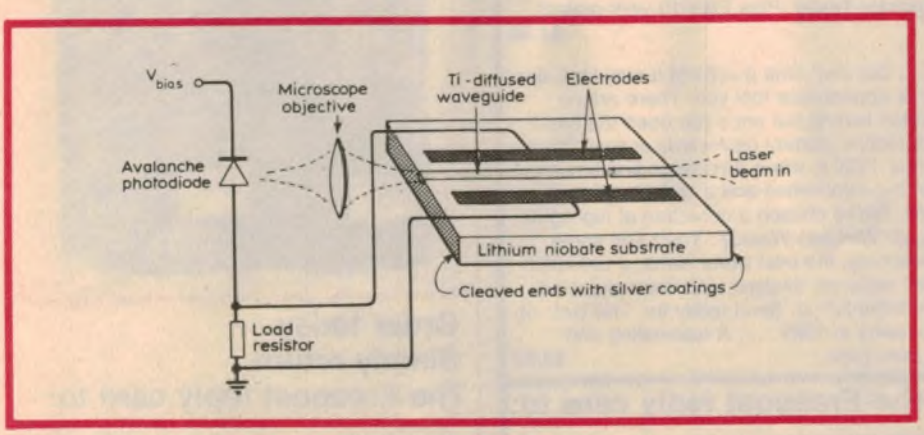
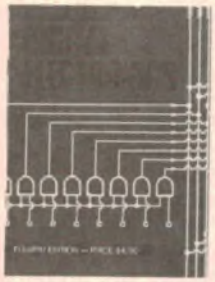


Fig.4: A hybrid bistable optical device. The electrodes create an electro-optic effect which varies the refractive index of the waveguide. The mirrored ends make the waveguide a Fabry-Perot cavity, thus the device is bistable. The beam energy, via a photodiode, is fed back to the electrodes, thus the hybrid also shows hysteresis.

Special Publications from Electronics Australia

FUNDAMENTALS OF SOLID STATE. Now in its second reprinting — which shows how popular it has been! It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts heavy going. Starting with a background chapter on atomic theory, the book moves easily through discussions on crystals and conduction, diode types, unijunction, field effect and bipolar transistors, thyristor devices, device fabrication and microcircuits. A revised glossary of terms and index complete the book. *Fundamentals of Solid State* has also been widely adopted in colleges as recommended reading. **$4.50**



DIGITAL ELECTRONICS. Electronic equipment plays an important role in almost every field of human endeavour and every day, more and more electronic equipment is 'going digital'. In order to understand new developments, you need a good grounding in basic digital concepts and *Introduction to Digital Electronics* can give you that grounding. Tens of thousands of engineers, technicians, students and hobbyists have used this book to find out what the digital revolution is all about. This new fourth edition has been updated and expanded. No previous knowledge of digital electronics is necessary. **$4.50**

BASIC ELECTRONICS. This popular text has now been re-issued. *Basic Electronics* is almost certainly the most widely used reference manual on electronics fundamentals in Australia. It begins with the electron, introduces and explains components and circuit concepts and progresses through radio, audio techniques, servicing test instruments, television, etc. Easily understood diagrams and text make this the perfect introduction to the growing and exciting world of electronics. We've even included five electronic projects for the beginner. **$4.50**

PROJECTS & CIRCUITS. If you like building electronic projects in your spare time, you can't afford to miss out on this exciting book of popular projects from Electronics Australia. Just look what's inside! *Audio and Video Projects:* Video Amplifier for Computers and VCRs, Video Enhancer, Vocal Canceller, Stereo Simulator for Tuners and VCRs, Guitar Booster for Stereo Amplifiers. *Automotive Projects:* Transistor-assisted Ignition System, Breath Tester, Low Fuel Indicator, Speed Sentry, Audible Turn Indicator. *Mains Power Control Projects:* Musicolor, Photographic Timer, Driveway Sentry, Touch-lamp Dimmer. *Power Supplies and Test Equipment:* Battery Saver for Personal Portables, Dual Tracking ±22V Power Supply, 3 1/2-Digit LCD Capacitance Meter, In-Circuit Transistor Tester. Plus EA's 10-year project index. **$4.50**

WIRELESS WEEKLY. Our own time machine! It may look like a book, but don't let its appearance fool you. There are no whirling dials and control levers; but once you open the cover, it'll take you on an incredible journey backwards in time. You'll find yourself back in the 1920's, when Australia's first few radio stations were just getting established and a typical radio set cost ten weeks wages. We've chosen a collection of highlights from the 1927 issues of 'Wireless Weekly': You'll find some front covers, a few editorials, the best news items, a collection of typical do-it-yourself radio set designs, and some selected pages from the programme listing. Send today for 'The Best of Australia's *Wireless Weekly* in 1927' . . . A fascinating and nostalgic trip into our radio past. **$3.95**

Order today — Simply return The Freepost reply card to:

The Federal Publishing Company,
PO Box 227, Waterloo 2017 NSW.
Tel: (02)663-9999. Tlx: AA74488

Protect your copies of ELECTRONICS AUSTRALIA in these binders or holders

NOW AVAILABLE AGAIN

MAGAZINE BINDERS ***$7.50***

Ready to use binders with easy, clip-in fastener, covered in soft, decorator brown vinyl. Holds 12 issues of Electronics Australia.

MAGAZINE HOLDERS ***$7.00***

Big, easy to assemble holders, covered in soft, decorator brown vinyl. Holds 12 issues (at least) of Electronics Australia.

Postage and packing additional:
Please refer to reply card for charges.

SAVE WITH SIX

6 Holders — only **$37.50**
6 Binders — only **$39.95**

Order today — Simply return The Freepost reply card to:

The Federal Publishing Company,
PO Box 227, Waterloo 2017 NSW.
Tel: (02)663-9999. Tlx: AA74488

Computing with light

radiation with a view to achieving compatibility with optical fibre communications. This latter activity overlaps research at Bell Laboratories where work is centred on the ability of gallium arsenide and its associated compounds to produce bistability.

A further aspect of this work is the investigation of BODs when a second beam is introduced into the cavity. This controls the resonance and transmission of the main beam to create the optical equivalent of the transistor. The optical transistor, in which a weak beam controls a stronger one, has been dubbed a "transphasor" by the team at Heriot-Watt. The transphasor is considered a fundamental element for optical signal processing as it offers the potential for optical amplification within an integrated optical circuit.

Optical systems can communicate with many channels in parallel, without interference, by using different optical frequencies. In theory, this means that all memory elements are accessible in parallel, and so removes the bottleneck. So the potential advantage of the digital optical computer does not depend solely on a switching time of less than a pico-second.

Optical information technology is still very much in its infancy. There remain at present certain limitations, particularly in relation to integration of a large number of diverse optical devices on a single substrate. These include the seemingly fundamental restriction on device size, material configurations to achieve strong effects as well as full monolithic integration and problems of power consumption coupled with heat dissipation within integrated optical circuits. The latter problems, however, are not necessarily fundamental and could change rapidly with inovations in the field.

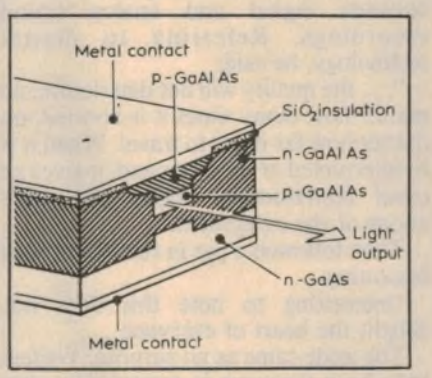
For example, alternative organic materials are already under investigation in an attempt to overcome some of these difficulties. Furthermore, it is clear that these drawbacks wil not restrict the application of small-scale circuits, particularly within optical fibre communications. In addition, it is quite possible that the high rates of data transmission offered by optical fibre communications will force changes in areas where the use of optical signals generates problems that can only be solved in the optical regime. It only remains to be seen how quickly and to what extent, such circuits are able to supplant conventional electronics.

2: Building the buried heterostructure laser

A typical buried heterostructure BH laser, designed for operation in the 0.8 to 0.9 micrometre wavelength band, is fabricated as a GaAlAs/GaAs/ GaAlAs multilayer on a GaAs substrate. This provides a double heterojunction DH) structure. A heterojunction is an interface between single crystal semiconductors which exhibit different bandgap energies (the energy difference between the valence and conduction bands within the semiconductor material). It provides a dielectric step which results from the different refractive indices either side of the junction.

The DH structure restricts the optical emission and current flow to the central, active region of GaAs. The laser light is contained both horizontally and vertically by etching a narrow stripe (as small as 1 × 0.7 micrometres) which is entirely embedded in the high resistivity *n*-type GaAlAs. This produces a very narrow rectangular region in which laser action can take place. In common with the vast majority of semiconductor laser structures, the active *p-n* junction region is an optical (Fabry-Perot) cavity created by cleaving the crystal end faces to form mirrors.

Stimulated optical emission, the basis of laser action, is encouraged within this cavity, by applying a suitable forward bias voltage. The



A buried heterostructure laser integrated on a gallium arsenide substrate.

subsequent forward bias current creates a population inversion at the junction of the heavily doped *n*-type and less heavily doped *p*-type semiconductor material. The effect is to inject elecrons and some holes into the active junction region where a proportion of the electrons will lose energy in recombination with holes through the energy bandgap.

Within GaAs there is a high probability that these electron-hole recombinations will emit photons. These photons which are contained within the cavity by reflection at the cleaved end mirrors, then cause further radiative recombinations and thus give stimualted optical emission. The process continues as the photons reflect off the mirrors in what is effectively a resonant cavity.

Although the laser is often said to act as an amplifier of light, the positive feedback provided by the cavity makes it more analogous to an optical oscillator. Furthermore, the cavity will generally support a number of oscillations each having its own resonant frequency. These oscillations are supported over only a very small range of frequencies so the light generated has a narrow spectral width.

When the distance between the mirrors is an integral number of half wavelengths then the photons generated are in phase and coherent emission results. Light escapes the device through a small non-reflecting area in one mirror. Restricting the cavity size such that only one resonance (the fundamental) occurs in each plane leads to single mode operation. This is obtained in the horizontal and vertical planes within the BH laser by use of a suitably-narrow buried stripe.

Single-mode operation along the axis of the cavity is achieved, with some difficulty, restricting the cavity length to around 50 micrometres. Although making a BH laser is complicated, the device generally exhibits a very low threshold current for laser action (10 to 20 milliamps) together with a linear output characteristic in the lasing region.

High fidelity sound — or

How could anyone, least of all a professional technical writer, seriously prefer the sound from an old-fashioned wind-up gramophone to a modern digitally sourced LP or compact disc? He may be just stirring, of course, or he might be one of those quaint folk who exhibit a chronic affinity for yesterday's technology.

FORUM

Conducted by Neville Williams

Nostalgia is all right in its place and I'll spend as much time as the next person looking at, and reminiscing about, things that belong to the past. But please don't try to convince me that such things routinely possess qualities that make them more desirable than their modern counterparts!

While on the road at weekends, I may well edge in behind some vintage car and admire the handiwork of the person who's restored it but I certainly don't feel envious. In my younger days, I spent too much time keeping cars like that on the road, when they were merely worn out, to want to do it all again!

And I'm a sucker for old trains — at least to look at and talk about. But, after clocking up something like 20,000km of country travel annually, to and from

I prefer nowadays to travel in air-conditioned comfort.

school, variously sweltering, shivering and picking cinders from my eyes, I prefer nowadays to travel in air-conditioned comfort.

The same goes for old wireless sets, radiograms and amplifier systems. It's interesting to renew acquaintance with things that were produced back down the industry learning curve — just so long as I don't have to use them on an everyday basis!

As for wind-up phonographs, gramophones and such like, I had the opportunity to look them over once again, while preparing the recent article on the "Century of Sound" Museum (May '85 issue).

"Primitive but fascinating" said the heading: Fascinating to look at and talk about but much too primitive to consider as a serious source of audio enjoyment for the '80s — a remark that brings me to the reason for this present train of thought.

Real enjoyment!

Some weeks ago, as is my custom, I was checking through the "Computer Monday" pages of the Sydney Morning Herald. In the particular issue (Aug 5, p 15) the lead article was headed "The digital age heralds a brave new world of communications".

Seeking to explain, in simple terms, what it was all about, the writer, SMH Computer Editor Gareth Powell, adopted a similar approach to that often employed when explaining the difference between digital and analog sound recordings. Referring to digital technology, he said:

". . . the quality will not deteriorate, no matter how many times it is boosted, no matter how far it has to travel. When it is re-interpreted at the other end, it gives an exact reproduction, within the limitations of the equipment."

Then followed a par in the parenthesis beginning:

"Interesting to note this does not delight the heart of everyone . . ."

The aside came as no surprise. Writers have been throwing in remarks like that ever since digital technology came into prominence, although they're doing so less frequently now than they used to. It was the remainder of the paragraph that stopped me short:

". . .True fidelity is in the ear of the listener. I much prefer listening to 78rpm Edith Piaf records on my HMV wind-up horn gramophone using a hand-cut dried-bamboo needle than I ever do listening to her in the highest of high fidelity.]"

What was the writer really trying to say? Was he suggesting that his old HMV horn gramophone (bamboo needles, etc) possessed intrinsic musical qualities that transcend modern "highest of high fidelity", or did the reference to Edith Piaf signify that he had particular circumstances in mind?

The reader was left to guess.

Arguments about the relative merits of acoustical and electrical recording and playback, as such, were commonplace in the late '20s and '30s, when record buyers were still adjusting to the changeover in technology — but, in those far-off days, there was something substantive to argue about.

The use of microphones, amplifiers and electrical cutters had provided recording engineers with better "tools" and an ability to cope with a range of everyday sound sources impractical when sound had to be collected by an acoustic horn. Frequency response on disc was different — with bass, sibilants

. . . the whole exercise was really a ploy to create obsolescence . . .

and overtones more evident — and the potential existed for increased groove modulation and dynamic range.

On some acoustic players, the new electrical recordings were impressive but, on others, they were disappointing, because they tended to emphasise overload and resonance effects in the diaphragm and horn. Popular dance records in particular were often harsh and strident, lending credence to allegations that the whole exercise was really a ploy to create obsolesence and boost the sales of new equipment!

Electrical playback in the home added further to the controversy, with the earliest pickups and audio systems arguably offering no improvement on the better acoustic players.

Arguments favouring acoustic gramophones persisted well into the '30s and were effectively silenced only by the ultimate emergence of high quality, lightweight pickups which could not be matched by any conceivable acoustic soundbox.

Re-recording old 78s

As it turned out, some of the arguments from the '20s were recycled 40 years later in another context, following the release of microgroove LP records. Gareth Powell's specific

what turns you on?

reference to Edith Piaf could well relate to the situation that arose from this.

Appreciating the nostalgic interest in many of their outdated 78rpm recordings, record companies began to re-record and re-issue them on LP albums, complete with pictures, biographies, notes, etc. But in their anxiety to minimise surface noise and obvious differences in balance, they often resorted to excessive treble filtering, effectively eliminating any vestige of sparkle from the old recordings.

It was a compromise that collectors tended to reject and, rather than buy the LP re-issues, many hunted around for original pressings and equipment on which to re-record or play them to their own satisfaction. In the process, some turned the clock right back, opting for an acoustic gramophone and needles that would best complement particular records, the diaphragm and the horn.

However, nostalgia notwithstanding, an acoustic gramophone is hardly the best way to recapture the true sound of an original performance from a 78rpm disc — especially in the light of recent work in Australia by recording engineer Robert Parker, in association with the ABC and RCA Records.

As detailed in our September '84 issue, Robert Parker has developed a method of re-recording jazz classics from the 78rpm era on to digital master tape, using a high technology "de-clicker" to remove surface noise — without prejudicing frequency response. He re-balances the sound as appropriate, adds a discrete amount of reverberation and stereo spread, and compensates for the dynamic compression that was often mandatory for 78rpm recordings.

. . . I soon tire of it if the music is not to my liking . . .

As indicated in our reviews, the end result is virtually noise-free, with gratifying quality, response and presence, even from originals dating back into the '20s.

It's very much a high technology procedure and it would be intriguing indeed to compare an Edith Piaf recording, so processed, with the sound that would be available via "an HMV wind-up gramophone using a hand cut dried bamboo needle . . ."

Disc recording & playback circa 1926

(Insight from an engineering paper by Maxfield & Harrison in Transactions of the AMIEE, 1926)

Acoustic recording:

"The amount of power available to operate the recorder directly from the sound in the recording room is so small as to make it extremely difficult to make records under natural conditions of speaking, singing or instrumental playing."

(Typically) "the musicians are grouped very closely around the horn. In the case of weaker instruments such as violins, it may be possible to use only two of standard construction. The rest of the violins are of a type known as the 'Stroh' violin which is a device strung in the manner of a violin but so arranged that the bridge vibrates a diaphragm attached to a horn. This horn is directed towards the recording horn . . .

"With such an unorthodox arrangement of musicians, it is difficult to arouse the spontaneous enthusiasm which is necessary for the production of really artistic music . . .

"As the use of high quality electric apparatus with associated amplifiers has a very distinct advantage over the acoustic method, they have been adopted for the recording part of the process."

Acoustic playback:

"Since any method of reproducing from mechanical records by electrical means involves the use of a mechanical device for transferring from mechanical to electrical power and a second such device for transferring from electrical back to mechanical power, it is necessary to use two mechanical systems, one at each end of an electrical system.

"Where the power which can be supplied by the record is sufficient to produce the necessary sound intensity, as in the case of home use, it is in general simpler to design one mechanical transmission system, than to add the unnecessary complications of amplifiers, power supply and associated circuits.

What turns you on . . .

Gareth Powell's observation that "True fidelity is in the ear of the listener" is a nice turn of phrase but again I'm not sure what it's supposed to mean.

It reminded me of a certain married couple: she a professional musician and a former member of the Sydney Symphony Orchestra; he an avid hifi and music buff, with top quality recordings and equipment, which the couple often enjoy together.

Occasionally, however, he comes home late, to find her listening quite happily to some old or indifferent disc or tape on equally indifferent equipment in the family room. She seems quite unconcerned by the mediocre quality of the sound, her attention being focused entirely on the music which she knows so well.

Even a situation like this does not support the notion that "true fidelity is in the ear of the listener" because fidelity, as distinct from music, is essentially a technical quality, able to be assessed or measured, as such. It is really a matter of what "turns you on": the fidelity (or technical quality), the music itself, or the combination of the two.

Personally, I'd have to put myself into the last category. I am partial to certain kinds of music but I can't enjoy it to the full if the sound quality is poor. Equally, I can respond to vivid sound reproduction but I soon tire of it if the music is not to my liking.

What turns Gareth Powell on? The sound of his HMV gramophone, or Edith Piaf, or both? What if he could hear his Piaf recordings reprocessed in the modern manner? Maybe he'd change his mind.

But why pose such hypothetical questions? Could I not have put at least some of them directly to him by phone?

Perhaps I could but, if he chose to answer them, I'd forfeit the opportunity to speculate in print, and to get others involved!

Hertz possibly hurts!

To change the subject, I'd be more than willing to put to anyone, who could offer positive answers, the questions raised in yet another letter from that diligent correspondent from Gulgong, NSW I quote:

Sir.

You may have seen the recent "Four Corners" program on ABC-TV raising the question of whether EMR (electromagnetic radiation) generated by

FORUM – *continued*

man-made sources is affecting our health.

We are all, to some extent, exposed to EMR. From the humble electric blanket to powerful RF welding units, all AC operated electric appliances generate some EMR. The power lines, too, generate levels of radiation that are not insignificant.

No one would be surprised that exposure to very high levels of EMR may cause physical harm, particularly at high frequencies such as microwave and x-radiation. We know that such radiation can cause damage due to heating and other effects, as a result of the intense energy levels.

But what about low frequency, low energy levels of EMR, such as may be radiated by the ordinary 50Hz power lines passing our homes, or by machines that are used in our places of work?

Are there, as suggested by the "Four Corners" program, subtle adverse effects that we may not realise? Are there certain groups such as linesmen and RF equipment operators who are at risk? If so, are there precautions that could or should be taken to reduce the risks?

Inasmuch as the use of electricity has become an indispensible part of our lives, I would be interested in any comments which EA might care to publish on it.
H. N. (Gulgong, NSW).

The questions raised by the above letter find a parallel in apprehensions expressed, these days, about many aspects of modern living: what we eat, drink, breathe, wear and expose ourselves to, ad infinitum.

Somebody pinpoints something that is apparently harmful in excess and proceeds to the assumption that, even in minor amounts, whatever it is must surely have undesirable effects in the longer term.

Such assumptions are easy to make, not necessarily logical or valid, and very difficult, as a rule, either to prove or disprove. Short of becoming paranoid about them, the best advice I can give is to avoid those "risks" that are clearly avoidable and to make value judgments about the rest.

... the shadowy implications of using an electric blanket...

After all, we balance our perceived need and convenience against risk every time we venture out on to the road!

At EA, our specialty is electronics but I doubt that any one of us could produce conclusive proof that there are no "subtle adverse effects" resulting from proximity to AC mains wiring or to ordinary AC powered equipment.

On the other hand, I am sure that nobody on the staff could suggest any cogent reason to be apprehensive about low level electromagnetic radiation from ordinary electrical installations, or to take special precautions against it.

At a personal level, I would certainly not, knowingly and willingly, stand in front of an active high-power microwave transmitting dish, or take liberties with x-ray equipment, or operate the domestic microwave oven with a faulty door, etc.

But I don't lose any sleep by reason of the high and low voltage mains in the street outside, or the shadowy implications of using an electric blanket on cold nights. And, when morning dawns, I'm content to heat a mug of milk in the microwave oven and, if necessary, warm the room with an electric radiator.

Why? Because I have not a shred of evidence to suggest that any of these customary things are potentially harmful, allegations to the contrary notwithstanding.

I know of a family which tries assiduously to avoid any food or drink which has been prepared in a microwave oven. Why, I am not sure, except that they apparently associate radio frequency energy with radioactivity. Yet that same family will quite happily join in a barbecue, irradiating their food with EMR of even higher frequency (infra red or heat rays), turning some of it into allegedly carcinogenic neo-charcoal and impregnating the rest with random chemicals from the fuel!

I know which appeals to me as more logical and more hygienic! While on the subject of back-to-front logic, I do wonder how many folk, pondering the vaguely possible long-term effects of low-level EMR, spend their long winter evenings in a closed room with a flueless oil or gas heater, competing with the naked flame for the available oxygen?

EMR or no EMR, I can't help but feel that, comparatively, electricity is an environmentally clean source of energy. Perhaps I should add: "especially when

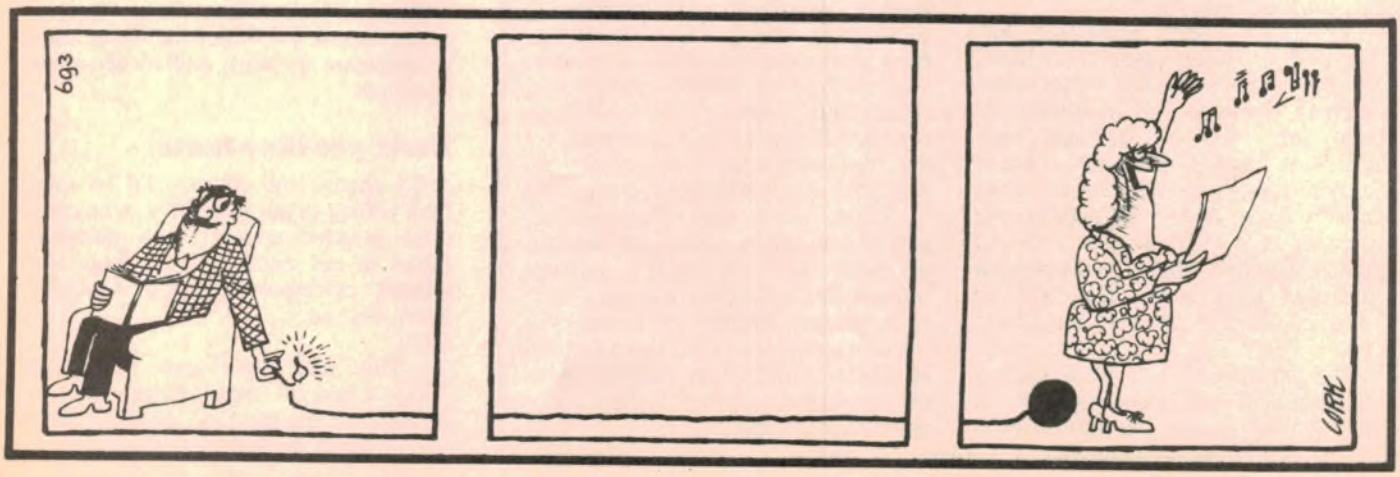
... potential high-risk situations are now being recognised...

generated from nuclear fuel". But that would start a riot!

H.N. mentions high power welders and their operators, and high power lines and linesmen. These are subjects of which I have no first-hand knowledge but, in talking them over with friends who are better informed, I gather that potential high-risk situations are now being recognised and guarded against much more than they once were, by both employers and unions.

But it's one thing to protect a linesman from obvious physical trauma, as he works on a live installation; it's quite another to be certain that he and his mates are not still significantly exposed as they squat on the ground nearby to munch their lunch!

It's a subject about which other readers may hold strong opinions. Over to you!



DSE - THE LARGEST DISTRIBUTOR OF SCOPE PRODUCTS IN AUSTRALIA

WE HAVE MORE SCOPE!

SCOPE Cordless!!

It's here! Now you can take your work anywhere — outside, inside, in the field . . . it doesn't matter! With the incredible Scope Cordless 60W Soldering Gun there's no need to be near a power outlet.

If you're a serviceman, auto electrician, technician, hobbyist: in fact any one who needs a powerful, reliable soldering tool then the new Scope is ideal!

FREE
With every Scope Cordless Soldering Iron we're giving away an AC Battery Charger . . . absolutely free! You won't find better value anywhere! Cat T-1600

NEW

Don't pay $99 elsewhere!

Includes BONUS Charger

$85

Spares Pack!
Spare tip and element to suit your T-1600 Scope Cordless. Keep some spares just in case!
Cat T-1601
$5.10

NiCad Replacement
Spare NiCads so you've always got power!
Cat T-1602
$14.50

SUPERSCOPE!

The Scope superspeed mini-iron is ideal when you need to get things done . . . Fast! A massive 150W capacity and features you'd only expect in the big ones. Thumb operated switch delivers just the right heat — at the right time.
Cat T-1660

Operates from 30 amps AC or DC. Quality non-corrosive stainless steel barrel and comes with spare tip and element!

$38.50

GENUINE SCOPE COPPER TIPS: $1.15 EA
Standard 1A: T-1610 Instrument: T-1618
Spare Element T-1618 $1.15

MINISCOPE!

When you're cramped for space you wouldn't want to cramp your style. The amazing Mini-Scope has all the advantages of bigger irons **and** it's easy to handle!
Fantastic for servicing PC boards, etc!
Cat T-1605

Finger tip control gives tip temperature equivalent of irons 10-70W. Comes complete with spare tip and element.

$33.95

SPARE TIP:T-1662 SPARE ELEMENT:T-1666
EACH: ONLY $1.15

Scope Transformer

It's made for your Scope iron! Mounts under or on the bench. Delivers 3-4 volts AC and it's completely safe!
Earthed Insulation shield prevents capacitive coupling and possible voltage leaks.

Suits T-1605 & T-1660 Cat T-1692

$39.95

SEE ADDRESSES ON MAILER

DICK SMITH ELECTRONICS
PTY LTD

Panasonic N3 in a class of its own

Every once in a while a genius is born, whose natural ability projects well above the rest.

From GEC-National comes the Panasonic N3 colour video camera, the first with 3 Newvicon half inch pick-up tubes that enable it to record high contrast subjects virtually burn free. A camera so sensitive that the signal-to-noise ratio figure is 54dB at an illumination level of 1400 lux, while minimum required illumination is 22 lux at f1.4 with 18dB gain.

Impressed?

Add to these outstanding features a newly designed auto centering circuit that gives precise registration even from the unstable position of a cameraman's shoulder, a feedback beam control circuit which significantly reduces comet tailing, plus standard features including full field colour bar generator, auto white and black facility with memory battery and built in gen lock circuit board.

Now, can you see more clearly why the Panasonic N3 from GEC-National is certain to have a brilliant future?

The N3 is designed with ENG applications in mind and weighs only 6.5kg with 10 x zoom and 1.5 electronic viewfinder.

To find out more about this clever little video camera, send in the coupon or give us a call — the rest is academic.

GEC AUSTRALIA LIMITED

DISTRIBUTORS OF: National

VIDEO SYSTEMS

SYDNEY (02) 887 6222
PERTH (09) 382 1144
ADELAIDE (08) 272 3100
MELBOURNE (03) 813 2977
BRISBANE (07) 52 3801

Send to: GEC, PO Box 143, North Ryde, NSW 2113.
Please send me more information on GEC-National Panasonic N3 colour video camera.
☐ Please send brochures ☐ Representative to call.

NAME:
COMPANY:
ADDRESS:
TEL:

XNEA 9/85

A 130 Megabyte hard disk for the IBM PC

Adaptive Electronics Pty Ltd have released the Aim Dart 130 megabyte subsystem for the IBM personal computer and its compatibles.

The Dart-130 is a random access Winchester storage device employing four 5.25 inch disks on a common shaft. These provide seven read/write surfaces and one surface for disk servo information. Seven read/write heads service 916 data tracks on each surface, providing an unformatted storage capacity of 129.266 megabytes. Track density is 1000 tracks per inch and data transfer rate is 9.677 megabits per second.

When formatted, the system gives a storage capacity of 100 megabytes.

Physically, the system is housed in a metal cabinet measuring 300mm wide, 130mm high and 330mm deep. The front escutcheon is bevelled slightly and carries two LED indicators, one for power and the other for "activity".

The space inside the case itself is mostly devoted to the hard disk drive which occupies about half the volume. It is fitted with its own small fan to cool the drive itself and associated electronics. The rest of the space inside the case is taken up with the switch-mode power supply. The whole lot is cooled by an additional small fan, fitted to the rear of the case.

Attached to the rear of the cabinet are two flat cables, one consisting of 30 twisted pairs. These are connected to the disk controller board which is of the standard size for installation in one of the expansion slots of the IBM PC or PC-compatible personal computer.

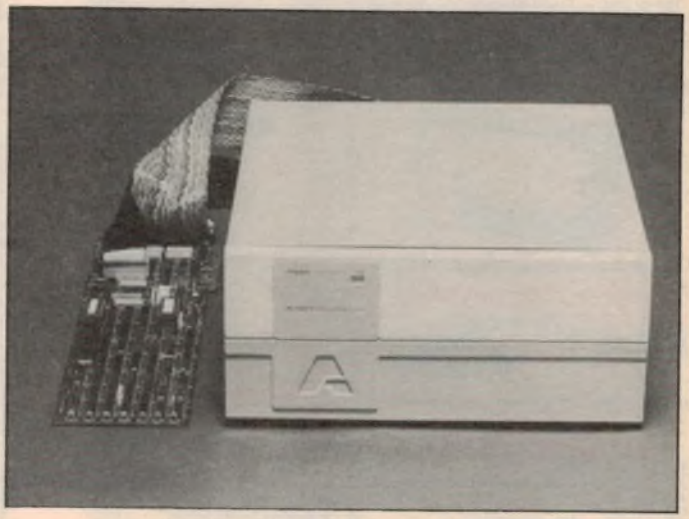
Also on the rear of the case is the recessed three-pin mains socket and IBM PC-type on-off switch.

Supplied with the system are two manuals: a 60-page spiral backed manual on the system hardware and a much larger manual on system installation and software integration, the latter process being necessary to enable all the user's programs to be booted directly from the hard disk.

This very comprehensive literature is complemented by the Dart 130 boot disk which also includes DOS 2.1 for the IBM PC.

The whole package, hard disk, disk controller board, manuals and 5.25 inch floppy disk, has a recommended retail price of $7995.00.

For further information, contact Adaptive Electronics Pty Ltd, 418 St Kilda Road, Melbourne, 3004. Phone (03) 267 6800.



At right is the Dart 130 Megabyte hard disk system together with its controller board. It uses four 5.25-inch disks on the one drive shaft.

KITS, KITS AND MORE KITS

AEM8500 Courtesy Light Extender

NEW

Ref: AEM November 1985

This great little project keeps the interior light of your car 'ON' for a specified period enabling you to find your keys etc in light. Compact and inexpensive.

Cat. KM-3025

ONLY $8.95

AEM6010 Ultra Fidelity Preamp

NEW

Ref: AEM November 1985

Jaycar will be doing a full version of this kit in the near future. Please order in our shops - call head office for details.

SPECIAL NOTE REGARDING KIT PRICES.

It has been brought to our attention that one of our major competitors appears to be selling similar kits to Jaycar at what **APPEARS** to be much lower prices. The inference of course, is that we are expensive! The problem is, however, that the so called cheaper kit is actually a 'short form' version of some of the kits we advertise! Their cheaper kits **are missing essential items** which were originally specified in the magazine project. Usually the same kit supplier offers them as 'options' - which you generally must buy to get the project going! After you add the price of the options in, you may be surprised to learn that the genuine Jaycar kit is cheaper.

PLEASE BE CAREFUL

DWELL/TACHOMETER

Ref: EA Sept. 1985

Tune up your car quickly and easily with this handy piece of gear. The Jaycar kit includes case, large meter and Scotchcal meterscale.

Cat. KA-1612

ONLY $34.95

Suits 4-6 or 8 cylinder cars

ETI 698 Microbee Digiter - ETI July 1985

Complete set of parts.

Cat. KE-4696

ONLY $19.95

40 WATT DC INVERTER

Ref: EA August 1985

An upgrade of a previous design featuring a smart new ABS case.

Cat. KA-1598

$79.95

300 WATT INVERTER

Ref: EA Sept. 1985

This totally new design is a vast improvement over the EA June 1982 project. It features a modern all-plastic case, easier assembly, toroidal type inverter transformer, auto start up and double switched power outlets.

And it's cheaper than the old model!!

The Jaycar kit contains all specified parts to enable you to complete the project in one go.

Cat. KA-1610

ONLY $199.00

The Listening Post

Ref: AEM July 1985

This device attaches between audio output of a short wave receiver and the input port of a computer. It allows decoding and printing of Morse Code, Radio-teletype (RTTY), AND radio facsimile (FAX) pictures! You can, for example, watch weather maps from the Met and dump them on to your printer!

Specific software for the Microbee is in the first article. Programs for other popular computers will be printed in later issues of AEM.

Complete set od specified components (Inc. IDC plug).

Cat. KM-3015

ONLY $29.50

Meet Roger Harrison & Dave Tillbrook!

You can meet Roger Harrison and Dave Tillbrook from Australian Electronics Monthly at our York St. store on the 3rd Saturday in November (16th) from 10.30 - 12 noon.

BE THERE!

HEBOT II

FULL KIT BELOW COST! WAS $299

Cat. XR-1020

ONLY $99.00

8 SECTOR BURGLAR ALARM - Ref: EA Jan/Feb 1985

Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE.

- ★ 8 SECTORS
- ★ 2 delayed entry sectors
- ★ Steel box
- ★ Includes battery and siren driver in the price
- ★ Variable exit and entry delays

Cat. KA-1580

$149.00

MAIL ORDER HOTLINE (02) 747 1888

Digital Bench Type Capacitance Meter

Ref: EA August 1985

- ★ Easy to assemble
- ★ 4 digit LED readout
- ★ Measures from 1pF to 99.9uF
- ★ 3 ranges
- ★ Bench type mains powered

Cat. KA-1595

ONLY $79.95

DON'T buy a speaker kit until you check our ***GREAT NEW*** 1986 Models of low cost Jaycar "Euro-Style" speaker system kits. ***CALL US*** or you ***WILL*** be sorry!!!

"PEST OFF" Ultrasonic Pest Repeller

NEW

Ref: EA November 1985

Why pay up to $150 when you can build a pest repeller yourself and save a fortune? The 'Pest Off' works on a similar principle to the expensive commercial designs.

The Jaycar kit contains all specified components including the special piezo electric transducer.

Cat. KA-1620

ONLY $39.95

ETI 1401 DIRECT INJECT BOX

Ref: ETI Sept. 1985

This unit accepts unbalanced audio inputs (line or mic. level) and produces a line level balanced signal to drive mixers or balanced input equipment. The Jaycar kit includes die cast box, specified push button switch bank and all other parts.

Cat. KE-4708

'SONICS' D.I. BOX

After some field experience it has been decided to replace the push bank of switches with a set of toggle switches. There are two reasons for this: (1) The push button switch bank is fairly fragile and a good kicking will destroy the bank.

(2) Constructors have had difficulty filing the slot in the die cast box to accommodate the switch bank. The toggle switches only require a ¼" drill hole. (Incidentally we could not punch the slot in the side of the box - it's virtually impossible)

(3) The new kit is cheaper!

Cat. KE-4708

ONLY $29.95

Electronic Jumper Leads - ETI 341

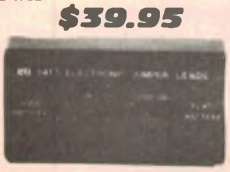
Ref: ETI August 1985. This project enables you to charge up a car battery via the cigarette lighter plugs in each car. A small inverter boosts the battery voltage from car No 1 to charge the flat battery in car No 2 via its cigarette lighter socket.

It's amazing how quickly you can put enough charge in a flat battery to start the car!

Complete set of parts including 2 x cigarette lighter plugs.

Cat. KE-4703

$39.95



MAIL ORDER HOTLINE (02) 747 1888

DRUM SYNTHESISER

Original design from the UK magazine 'Electronics and Music Maker' April 1981. This self-contained unit can produce a variety of fixed and falling pitch effects triggered either by tapping the unit or striking an existing drum to which the unit is attached! The Jaycar 'SYNTOM' Drum Synthesiser comes complete with a high quality pre drilled moulded all ABS box measuring 152 x 80 x 47mm with professional silk screened front panel.

FEATURES:

Decay from less than 0.1 second to several seconds - pitch control - sweep control and volume on/off.

Cat. KJ-6502

ONLY $36.50

Ignition Killer

Ref: EA Feb 1984

This little project is cheap, easy to fit and is effective. It basically is a timer circuit that disables your ignition system a few seconds after it is activated. A would-be thief starts the car, it goes a few metres and stops. he immediately cranks the engine and it fires but it stops again moments later. This could continue indefinitely. Frustrated, the thief looks for easier "game" elsewhere.

The Jaycar kit contains specified original components, instructions and two BONUS alarm stickers.

Cat. KA-1535

ONLY $14.95

8 CHANNEL MIXER Model 8002

Balanced input 8 channel stereo mixer with features only found in units costing $1,500 or more!

MAIN FEATURES:

- Balanced (600 ohm) mic. inputs/line inputs
- Input attenuators
- Cannon connectors included in the price
- Bass, mid and treble equalisation on each input
- Effects (i.e. echo etc) capability
- Foldback on all 8 inputs
- Stereo pan on all 8 inputs
- 60mm slide faders used throughout
- 19" rack mount capability (or console mount)
- Professional black front panel with format borders and multicoloured knobs to assist function indentification
- Designed for quick and easy service
- VU metering
- Only high quality components used
- 5534A OP amps used for low noise and very low distortion

TECHNICAL:

- Signal to noise microphone input -75dB with ref to +4dBM
- Signal to noise line input -90dB with ref to +4dBM
- Line level +4dBM (0VU)
- Distortion less than 0.005%
- Power requirements 240V AC 50Hz 25 watts

8002 MIXER

Ref: EA April/May 1983

8002 RACK KIT This is the basic mixer. This kit gives you virtually all the electronics. Provided front panel, VU meters, 11 PCB's, all pots (rotary and slide), knobs, components for PCB's, hook-up wire etc. All Cannon XC chassis connectors are included as well. It is ideal for rack mount and all that is necessary is a ±15V 1A power supply.

Cat. KJ-6504

$535.00

JAYCAR NO 1 IN KITS

300W PLAYMASTER AMPLIFIER

Ref: EA June 1980

This rugged design provides 200W rms into 8 ohms and 300W rms into 4 ohm loads. All parts fit onto a single PCB. It also features comprehensive protection circuitry, and will even withstand short circuits for short durations without adverse affect. Unlike other high powered amps, it is unconditionally stable. It will not therefore break into supersonic oscillations, overheat and fail.

The Jaycar kit of this project provides a quality roller tinned fibreglass PCB and other quality components down to the heatsink compound.

Cat. KA-1115

ONLY $99.95

300W AMP POWER SUPPLY KIT

This basically consists of a 300VA power transformer (PF4363), rectifier and filter capacitors. It also has 15VAC power for the speaker protector.

Cat. KA-1116

ONLY $79.95

Speaker Protector for Playmaster 300W amp

Ref: EA July 1980

This device is designed to mate with the Jaycar KA-1115 Playmaster 300W amp module. It also provides the handy facility of switch on mute. This disconnects the speakers for the first few seconds when the amp is switched on, avoiding the horrifying 'thump' in the speakers. If you have expensive speakers (whether you have the EA 300W amp or not) this speaker protector is cheap insurance. The Jaycar kit provides all PCB parts including the relay.

Cat. KA-1117

ONLY $14.95

Electronic Crossover

Ref: EA November 1984

NEW SHORT FORM KIT!

You can NOW build this desirbale project for a lot less! There have been requests for a version of this kit that can be built into other equipment. This is it!

The kit contains PCB and all board components etc. The box (including front panel) and selector switches are not supplied but everything else!

Cat. KA-1571

ONLY $79.00

Car Booster Amp

Ref: EA August 1985

This project enables you to have 2 x 50 watts RMS of power for your car sound system. In order to do this, a special high voltage power supply forms part of the system. Absolutely stunning value for money. Around half the price of inferior commercial units.

The Jaycar kit is, as usual, absolutely complete.

Cat. KA-1600

ONLY $179

AEM 6500 - 60/120 WATT UTILITY MOSFET AMP MODULES

Ref: AEM July 1985

This is a low cost high performance design using proven MOSFET technology. A single pair of (2SJ49/2SK134) Mosfets will deliver up to 60 watts output. Another pair may be added for 120 watt performance. The module has been designed to fit into a large variety of commonly stocked instrument cases and rack boxes. It features VERY LOW distortion and impeccable transient performance. It is unconditionally stable and virtually blow-up proof. It can be powered from common transformer/rectifier/capacitor combinations. A Winner!

As usual, the Jaycar kit reflects a quality approach. All specified components for each version are included.

60 WATT MODULE Cat. KM-3010

$49.50

120 WATT MODULE Cat. KM-3012

$65.00

20 WATT UTILITY AMPLIFIER

Ref: EA November 1984

This is a low cost general purpose amplifier which is easy to build and gives Hi Fi performance. All components mount on the printed circuit board which is provided. Capable of up to 19 watts rms from a 35 volt supply. Note that 35V is the maximum permitted supply voltage.

See the Jaycar 1985 catalogue for specs.

Cat. KA-1567

ONLY $17.50

ETI 467 MIXER/PREAMP

Ref: ETI July 1980

The ideal companion to the Utility Amp (KA-1567). Mixes up to 4 inputs (high and low level) with individual level controls. Includes high performance 3 band tone controls making it ideal for musical instrument use. Kit comes without a case so that you can build it in with a power amplifier if you wish. Operates from 2 x 15V AC (usually available from power amp supply, or use Cat. MM-2008 transformer).

Cat. KE-4014

ONLY $29.50

BUSKER AMPLIFIER

Ref: EA Feb 1985

Fantastic, portable amplifier kit for low-level PA. Buskers or for practice.

- ★ Battery or mains operation
- ★ Full control - bass, treble and volume
- ★ 17 WATTS RMS output
- ★ Gel battery automatically recharged when mains used.

★ INTRODUCTORY PRICE ★

ONLY $125.00

All electronics including Gel battery, 8" speaker, metal chassis etc.

Cat. KA-1592

PRE-CUT WOODEN CABINET to suit

Cat. KA-1593

ONLY $30.00

SAVE 20%

this month and pay

ONLY $124.00

You must buy both!

BASIC AMP

Ref: ETI 061

Teaches the basics of transistor amplifiers and builds 2 useful low power amp at the same time. Amp can be used to amplify microphones or crystal radios sao they they can be heard through a small loudspeaker.

Cat. KE-4001

ONLY $5.90

ETI 499 150 watt MOSFET Amp Module

Ref: ETI March 1982

A high power amplifier with the stability and reliability of MOSFET's. Genuine 150 watts rms with power supply components on board. You only need to connect a power transformer (Cat. MM-2015) and heatsink. The Jaycar kit includes a magnificent jig drilled extruddd heatsink bracket for greater thermal efficiency.

Cat. KE-4220

ONLY $79.50 ea

ETI 480 SERIES AMPLIFIER MODULES

Ref: ETI December 1976 & ETI's 30 Audio Projects

ETI 480/100 A complete audio amp on a single board. Just add a power supply and you have a 100 watt Hi Fi musical instrument or PA amplifier. Use it with the KE-4014 mixer/preamp for instrument or PA. Kit contains metal bracket, all PCB items and instructions. Legendary performance at a modest price.

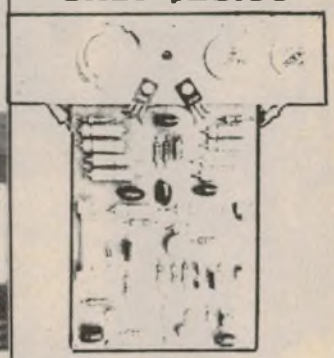
Cat. KE-4052

ONLY $27.00

ETI 480/50 Same circuit as the 480/100 except 2 less output transistors. Half the power and a little cheaper. Great if you don't need 100 watts. All parts supplied.

cat. KE-4050

ONLY $23.00



ETI 477 MOSFET AMP MODULE

Ref: ETI Jan/Feb 1981

Two 477 amp modules form the basis of the 5000 power amp. You can buy the modules (mono) individually to make your own custom MOSFET amp). For performance specifications refer to the Black Monolith amplifier in the Jaycar catalogue. Power supply extra.

Cat. KE-4210

ONLY $59.00 ea

BENCH AMPLIFIER

Hobby Electronics Project

If you ever need to test whether a preamp is functioning correctly this is the ideal project to test it with. It can amplify signals as low as a few millivolts to an audible level.

Cat. KS-8105

ONLY $9.75

PLAYMASTER SERIES II MOSFET AMP KIT

Ref: EA Jan/Feb/March 1985

"... s stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". Leo Simpson, Editor of EA, February 1985.

MAIN FEATURES

- Switchable phono input for MM and MC cartridges
- Electronic signal switching
- Full facilities for dubbing between two cassette decks
- Monitor loop for either of two cassette decks or a signal processor
- Click action pushbutton switches for selection of sources, dubbing and tape monitor with LED status indicators
- Centre detents on bass, treble and balance controls, multiple detents on volume control
- Heavy duty heatsinks
- Power transformer for low hum and noise
- Easy to build - all parts except power supply mount directly on the two printed circuit boards; wiring has been kept to an absolute minimum
- 100 watts RMS per channel into 8 ohm load
- Less than 0.01% total harmonic distortion

Cat. KA-1500

ONLY $429.00

New Products...

Product reviews, releases & services

Impedance and gain-phase analyser

A new impedance and gain-phase analyser from Hewlett-Packard, the HP 4194A, is an intelligent instrument that makes both impedance and transmission measurements.

The HP 4194A can be used to evaluate materials, discrete components, ICs and circuits. The analyser's Auto-Sequence-Program (ASP) function can easily automate the measurement and analysis functions without using a separate computer.

Frequency coverage is 100Hz to 40MHz for impedance measurements and 10Hz to 100MHz for gain-phase measurements. It has a 19cm colour display for presenting measurement data, making it the first HP instrument with a colour CRT.

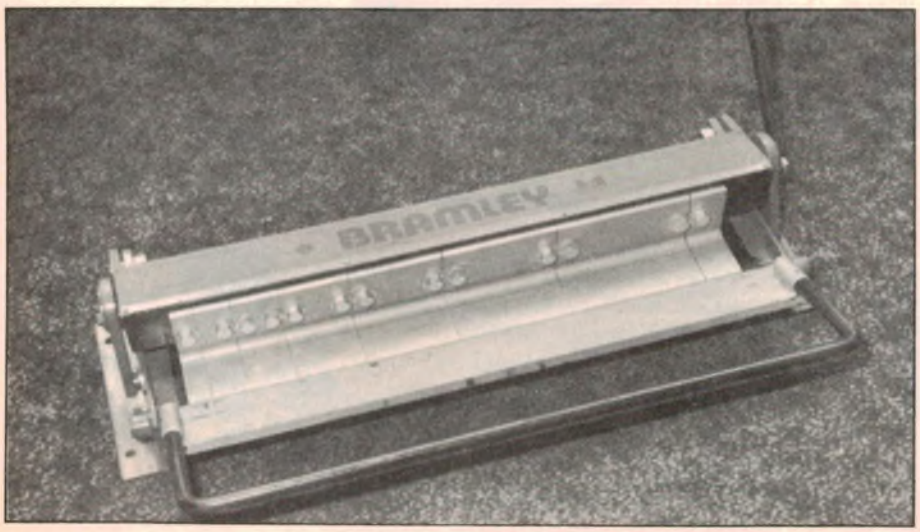
The HP 4194A simplifies impedance and gain-phase measurements by using menu keys and softkeys to select measurement conditions. Two measurements can be displayed simultaneously on its colour CRT. Displayed measurements can be analysed using graphics-analysis functions.

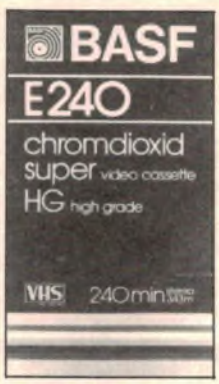
For further information, contact Hewlett-Packard Australia Ltd, 31-41 Joseph St, Blackburn, Vic, 3130. Telephone: (03) 895 2895.

Chassis builder

Melbourne Machinery company has introduced the Bramley pan brake from New Zealand. It is 24 inches wide and handles up to 18 gauge steel with detachable segments to enable it to perform the complicated folds required in making box type shapes for mounting or even the metal cabinets to house them.

A clamp holds the metal then the folding section bends all or only the selected section. Being bench mounted it takes up little room. For further information contact Melbourne Machinery Co. (Sales) Pty Ltd. Telephone: (03) 61 2911.

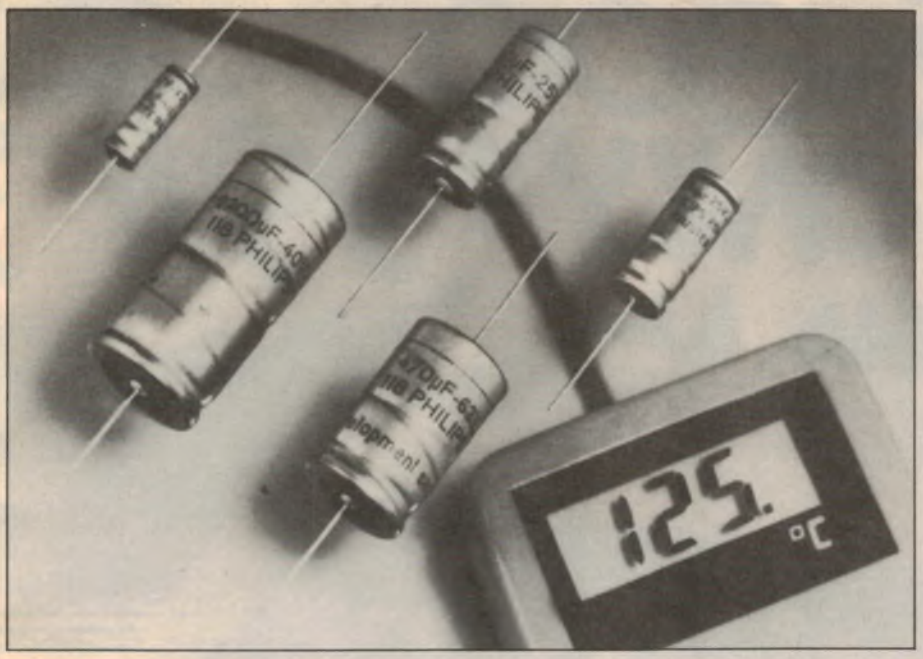




Special tape offer from BASF

BASF is offering an incentive to VCR owners. Customers who buy three normal grade four-hour BASF Chromdioxid video tapes will receive a free BASF four-hour high grade tape.

According to BASF, this high grade tape has been specifically formulated for sharper pictures and cleaner sound and normally retails for $16.95. It is claimed to be especially suitable for hifi sound recordings.



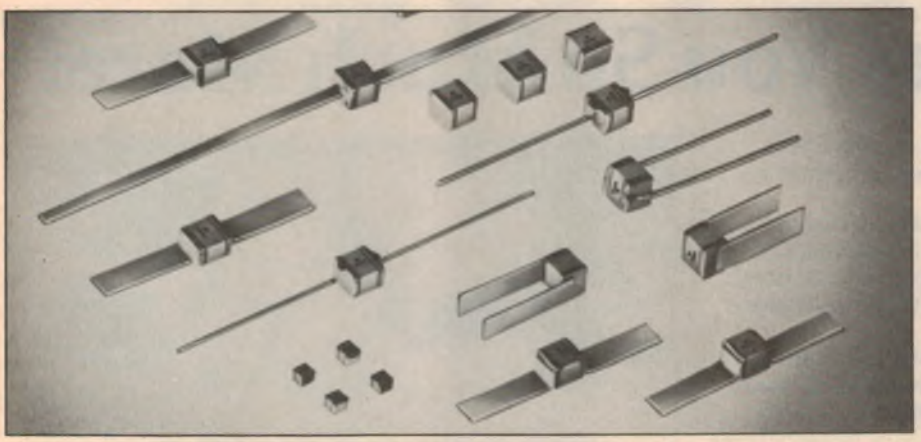
Wet aluminium electrolytics

A new series of high-temperature aluminium electrolytics from Philips offers case sizes up to a factor of two smaller, for a given CU product, than any previous wet electrolytic capacitor designed for operation up to 125°C.

The capacitors have lifetimes of 2000 hours at 125°C and 500 hours at 150°C. At 40°C lifetime is typically 450,000 hours. These extended lifetimes under normal conditions make the new electrolytics very suitable for telephony, telecommunications, military and other professional applications. The wide temperature range (−55 to 125/150°C) also makes them ideal for automotive applications.

Nominal capacitance range (E6) is 1 to 15,000μF, tolerance on nominal capacitance is ±20%. Rated voltage is 6.3 to 200V.

For more information contact Philips Elcoma, 11 Waltham Street, Artarmon, 2064. Telephone: (02) 43 9332.



Miniature RF power capacitors

This series of capacitors from IRH is specifically designed for high voltage and high RF current microwave applications.

They are ideally suited to commercial mobile and fixed communication equipment. Glass encapsulation protects the UFP capacitors against corona, contaminants and other environmental factors. Wide, fine silver lead terminations assure minimum inductance and high RF current capabilities. They can withstand temperatures far in excess of soldered units due to solderless lead attachment.

Their current rating is 8A at 25°C, being derated for higher temperatures.

For further details contact IRH Components, 32 Parramatta Road, Lidcombe, 2141. Telephone: (02) 648 5455.

VZ-300 NOW ONLY $99!!

And It Gives You So Much More!

It's unbelievable! The amazing VZ-300 colour computer is at its lowest price ever!! Whether you're a computer expert or a first-timer, the VZ-300 has plenty to offer.

Now, for under $100 there's a computer that will expand to meet your needs. With 18K RAM memory — expandable to an amazing 32K, high resolution graphics, and optional disk drive, printer and a host of extras available: the VZ-300 is unbeatable value!

Because it uses the most popular computer language in the world, 'Microsoft Basic', there's an incredible range of software available; games, business/management, education . . . there's dozens to choose from!

Look at these fantastic specifications!:

CPU. — Z80A running at 3.5MHz

Memory. — 16K Basic ROM

RAM — 18K expandable to 32K

Keyboard — 46 key full stroke with automatic repeat key.

Graphics — 32 columns x 16 lines. 128 x 64 dot (8 colour)/64 x 32 dots (9 colour) selectable colours.

With an unbelievable range of add-ons available your VZ-300 will give you years of service! When good value isn't good enough — DSE makes it even better! Cat X-7300

B061

Dick Smith Electronics Pty Ltd

COMPUTERSTORE™

New Products...

New plug-in time switch

Arlec Pty Ltd has introduced the PC737 Multi-timer Plug-in Timeswitch which provides up to 96 switchings every 24 hours.

Completely self-contained, the PC737 plugs directly into any 240V power socket and can control a wide variety of electrical appliances, such as heaters, electric blankets, airconditioners, security lighting and cooking appliances.

For further information contact Arlec Pty Ltd, 30 Lexton Rd, Box Hill, 3128. Telephone: (03) 895 0222.

Audio analysers for broadcast and transceiver testing

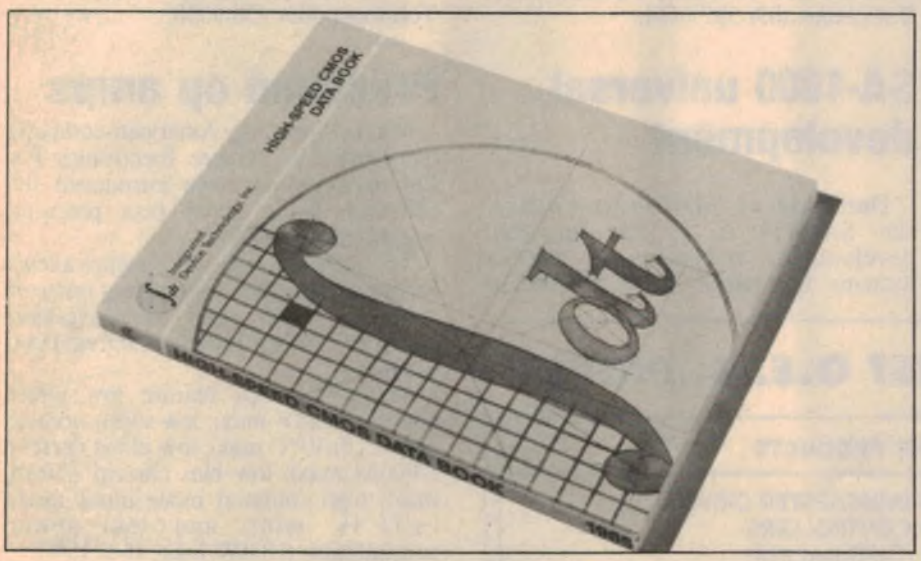
Hewlett-Packard has two new products for audio analysis, the HP 8903B audio analyser and the 8903E distortion analyser, which are intended for testing broadcast receivers and transceivers.

Included in both analysers are the same functions of AC voltmeter, fully automatic distortion analyser, DC voltmeter, SINAD meter and audio-frequency counter.

In addition, the HP 8903B has an audio source capable of swept measurements down to −90dB.

Both instruments include plug-in filters, lower noise floor and rms/average detection.

For more information on this product contact Hewlett-Packard Australia Ltd, 31-41 Joseph Street, Blackburn, Vic, 3130. Telephone (03) 895 2895.



High speed CMOS data book

Integrated Device Technology Inc are providing CMOS — TM technoogy which employs gate lengths down to 1.2 microns. The IDT high speed data book is available fro Protronics Pty Ltd, a member of the George Brown Electronics Group. For further information, contact 456 Spencer Street, West Melbourne, 3003. Telephone: (03) 329 7500.

New Products...

MS-200 image scanner

The MS-200 is a high-resolution image scanner capable of scanning documents such as text, drawings, graphics, pictures or mixed pages.

Scanning modes are text mode (including graphics and drawings), halftone mode (for pictures with multiple grey levels) and mixed mode. In mixed mode, up to four picture windows are allowed.

The compact, portable desktop MS-200 scanner utilises a sensor array and image processing techniques. A real-time algorithm compensates for the non-uniformity of the CCD (Charge Coupled Device) image array.

A flexible interface allows the MS-200 to easily integrate with various host configurations for specialised office automation and communication system requirements.

For further information contact Macro Dynamics, PO Box 336, Bayswater, 3153. Telephone: (03) 220 7260.

32-bit microprocessor based Unix system

Labtam International Pty Ltd have released their full 32-bit microprocessor Unix based system. The Labtam 3015/V32 floor mounted unit will be the first of two models to be released over the next couple of months, the other being a desk top model.

The common feature of this new range of systems is Labtam's 32-bit processor board, the first commercial implementation of National Semiconductor's 32032 processor running Unix System V. The 32032 board incorporates an NS 32081 64-bit floating point math processor, an NS32082 demand-paged virtual memory management unit for up to 16M-byte address space, 2M-bytes on-board RAM, with a 32-bit wide extension bus connector for expansion up to 12M-bytes.

Initial configuration of the 3015/V32 includes a 56M-byte Winchester disk, streamer tape, and eight serial ports mounted in a 15-slot Multibus.

For further information, contact Labtam International Pty Ltd, 43 Malcolm Rd, Braeside, Victoria, 3195. Telephone: (03) 587 1444.

SA-1000 universal development

Distributed in Australia by Alfatron, the SA-1000 is a new universal development system from Sophia Systems. It supports about 20 different microprocessors, both 8-bit and 16-bit, by adding the appropriate device probe.

Two integral floppy disc drives provide data storage in formats to suit the application. A disk operating system as well as assemblers, linkers and loaders, are provided to facilitate program development and debugging.

For further information, contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Vic, 3156. Telephone (03) 758 9000.

Precision op amps

Micro Power, an American company represented by Ampec Electronics Pty Ltd in Australia, have introduced the MP108A Series super beta precision operational amplifiers.

The MP108A Series of op amps allows for operation over a wide supply range of $\pm 2V$ to $\pm 20V$, and have excellent supply rejection for use with unregulated supplies.

These op amps feature low offset voltage (0.5mV max), low offset voltage drive ($5.0\mu V/°C$ max), low offset current (2000pa max), low bias current (2.0nA max), high common mode input range ($\pm 15.3V$ min), and low power consumption (18mW max, at $\pm 15V$).

Devices are available in three temperature ranges, with 883B processing, in dice form or to customer specifications.

For further information contact Ampec Electronics Pty Ltd, 21 Bibby Street, Chiswick. Telephone: (02) 712 2466.

KIKUSUI 20MHz DUAL TRACE SCOPE

$629 EX TAX
$729.64 inc tax
INC PROBES

Compact and easy to operate for hobbyists and professionals

- 5mV/div sensitivity
- Hold-Off function
- CH1, CH2, Dual, Add, X-Y modes
- Intensity modulation
- 0.2uS to 0.5S/div sweep range

COS5041 40MHz DELAYED SWEEP SCOPE

- *40MHz, 5mV/div (1mV x5 Mag)*
- *20nS max sweep speed (x10 Mag)*
- *Built-in delay line*
- *Variable Hold-Off and Trigger Lock*
- *12kV PDA bright clear display*
- *Includes 2 FREE Probes*

$1167.00 *ex tax*
$1353.72 inc tax

KIKUSUI

TRUE RMS

EDM1346

- *4½ digits • 8 functions Vdc, Vac, Adc, Aac, Ohms, Audible Continuity, Diode test, Data Hold • 0.05% basic accuracy*

ONLY $225.00 *ex tax ($258.75 inc tax)*

DC Voltage	
Range	• 200mV, 2V, 20V, 200V, 1000V
Resolution	• 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy	• 200mV – 1000V ± (0.05%rdg + 3dgt)
AC Voltage: (True RMS, AC coupled 10% to 100% of range)	
Range	• 200mV, 2V, 20V, 200V, 750V
Resolution	• 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy	• 200mV – 200V @45Hz-1KHz ± (0.5%rdg + 20dgt) @1KHz-2KHz ± (1.2%rdg + 30dgt) @2KHz-5KHz ± (5.0%rdg + 40dgt) (200V @2KHz-5KHz not specified) 750V @45Hz-1KHz ± (1.0%rdg + 20dgt)
DC Current	
Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA – 200mA ± (0.3%rdg + 3dgt) 2A-10A ± (0.75%rdg + 3dgt)
AC Current: (True RMS, AC coupled 10% to 100% of range)	
Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA @45Hz-400Hz ± (2.5%rdg + 20dgt) 20mA-200mA @45Hz-400Hz ± (0.75%rdg + 20dgt) @400Hz-1KHz ± (0.75%rdg + 30dgt) 2A-10A @45Hz-500Hz ± (1.2%rdg + 20dgt)
Resistance	
Range	• 200Ω, 2KΩ, 20KΩ, 200KΩ, 2MΩ, 20MΩ
Resolution	• 0.01Ω, 0.1Ω, 1Ω, 10Ω, 100Ω, 1KΩ
Accuracy	• 200Ω ± (0.2%rdg + 5dgt + 0.04Ω) 2KΩ-200KΩ ± (0.1%rdg + 3dgt) 2MΩ ± (0.15%rdg + 3dgt) 20MΩ ± (0.5%rdg + 3dgt)

HANDY IC STORAGE FRAME

Ideal for development labs and advanced hobbyists. No more searching for tubes of IC's when they're neatly filed in this storage rack. Holds up to 9000 16 pin IC's in a compact 460 x 460 x 410mm space. 60 pigeon holes with individual label holders. Stores flat. 2 minutes to assemble. Think of the time and frustration you'll save!! **$34.00 (p&p $4)**

8.30 to 5 Monday to Friday. 8.30 to 12 Sat.
Mail Orders add $3.00 to cover postal charges.
Next day delivery in Sydney add $5.00.
All prices INCLUDE sales tax.
Tax exemption certificates accepted if line value exceeds $10.00

GEOFF WOOD ELECTRONICS PTY LTD
Incorporated in N.S.W.
656A Darling St, Rozelle 2039
(One door from National Street)
Tel: **810 6845**

bankcard
$10.00 minimum

specialising in electronic components for the professional and hobbyist.

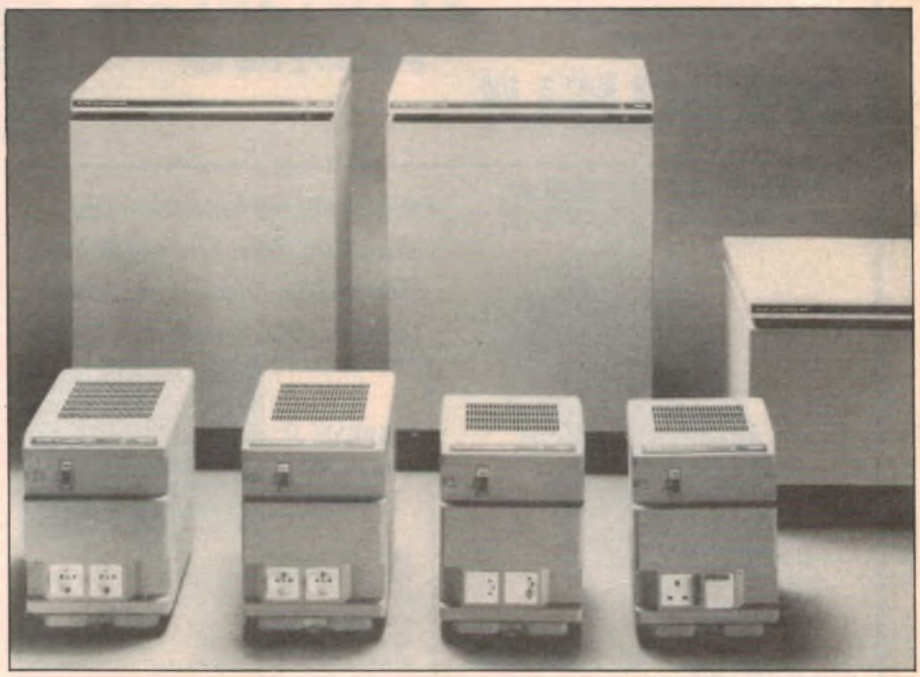
New Products...

Jumbo LEDs

Telefunken Electronics are now shipping a new type of visible LED, the TLH-400 series which are 10mm in diameter. To achieve high brightness in such a large package, Telefunken employ two high efficiency LED chips on a three lead header.

The LEDs are available in red, yellow and green. They will find use in large indicator panels in power station control rooms and industrial situations where high visibility is important.

For further information on this ex stock from Promark Electronics contact PO Box 381, Crows Nest, 2065.

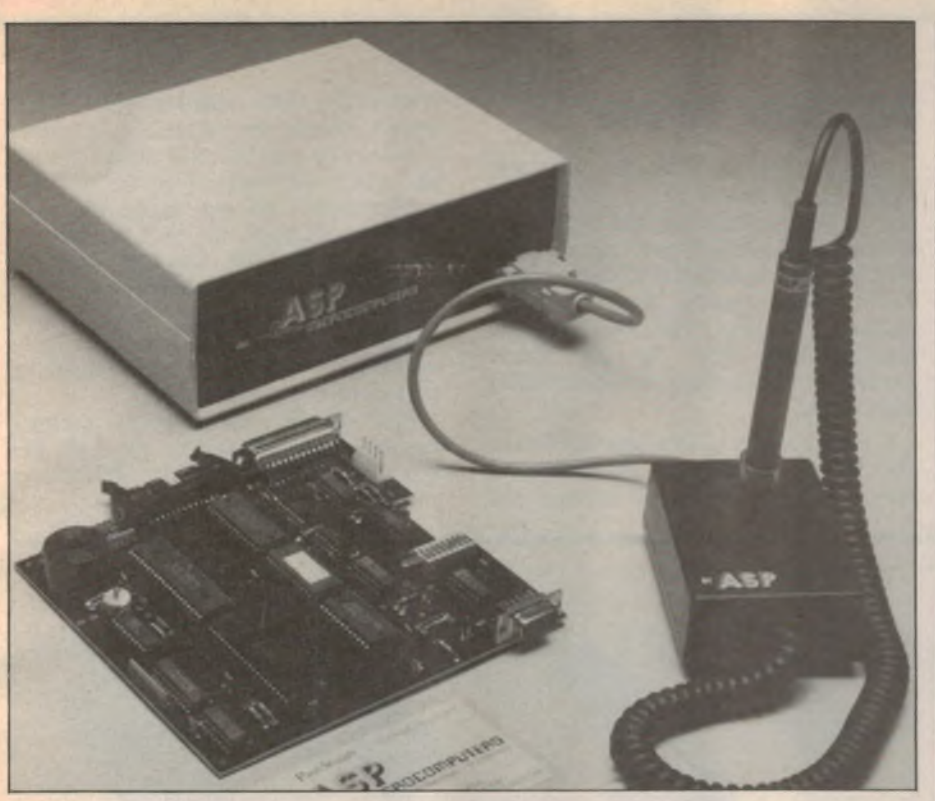


Philips line conditioners

A new range of line conditioners suitable for 50 or 60Hz, 240V operation has been introduced by Philips. This new range enables Philips to offer protection equipment with mean time beween failure figures in excess of 200,000 hours. Philips' range of 34 models embraces seven different power ratings: 200, 400 and 850VA, 1.5, 3, 4.5 and 6kVA.

In the filter mode, the transient suppression can be as high as 100dB for narrow short pulse widths; the output voltage variation will remain within ±2% of rated limits. In the stabiliser mode, the output voltage will remain within ±1%.

Further information is available from Philips Scientific & Industrial, 25-27 Paul Street, North Ryde, 2113. Telephone: (02) 888 0403.

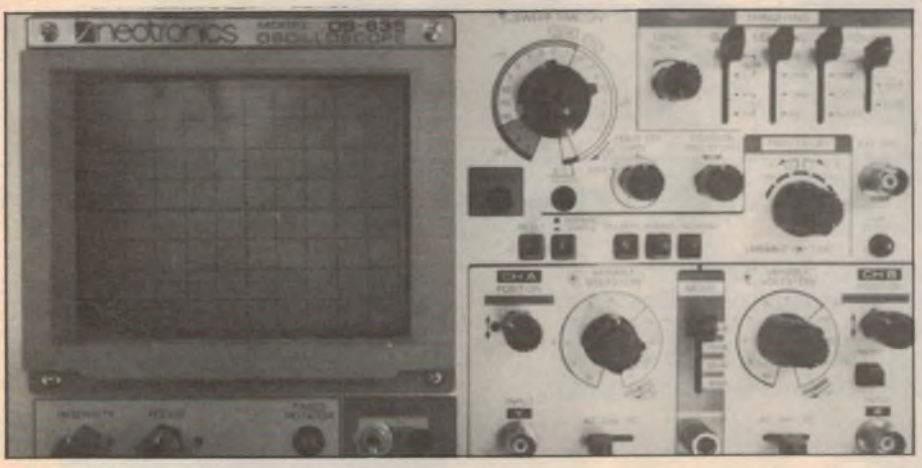


Barcode products

ASP Microcomputers have developed a Bar Code Interface (BCI) which not only reads barcodes but can translate text received on its RS232 interface into barcode labels and print them on a matrix printer attached to its parallel printer interface.

The BCI includes a battery backed clock/calendar to append time/date to barcode reads, circuitry to allow it to be connected in parallel with a video terminal, and it can log barcode reads to a printer with or without a host computer attached.

The product is designed and made in Australia. For further information contact ASP Microcomputers, 30 Cummins Grove, Malvern, Vic, 3144. Telephone: (03) 500 0628.



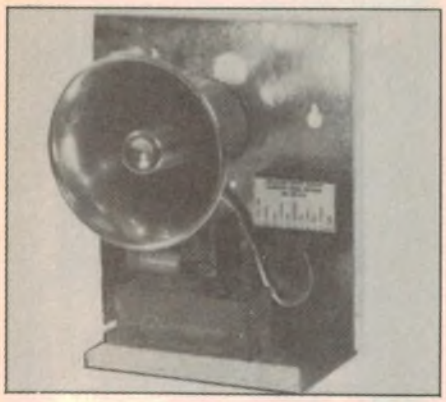
High performance oscilloscopes

Neotronics markets a range of four oscilloscopes. The popular OS620 features 20MHz bandwidth and a component tester. The OS635 has 35MHz bandwidth, trigger delay and 1mV/div sensitivity. For higher frequency work, the model OS645 with its input delay line is recommended. This unit has 45MHz bandwidth.

The portable model OS615 has internal rechargeable batteries and 15MHz bandwidth.

For more information and data sheets, contact Neotronics, PO Box 289, Newport, 2106. Telephone: (02) 918 8220.

New Products...



Satellite Sirens

A large number of alarms today can easily be disarmed by switching the power off and removing the battery, or by cutting all wires to noise makers. If a satellite siren is installed in conjunction with a good quality alarm, it could prevent a break-in. The SS2 Universal Satellite Siren from Burglar Alarms Australia Pty Ltd could be the answer at around $90.

It is housed in a 16-gauge steel case, and the back plate is galvanised to prevent rusting. The cover is fixed into position by four stainless steel fixing screws. Should one of the fixing screws be loosened the SS2 will sound. If the SS2 was prised away from the wall the tamper switch will also trigger the siren.

When triggered, the SS2 has two 12 volt 1 amp outputs. The first output is for the siren and will operate for eight minutes to comply with noise regulations. The second output is for a strobe light which will latch on until the control unit is switched off.

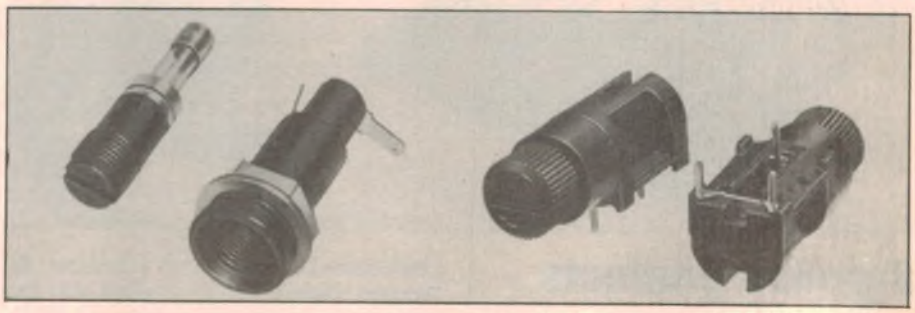
For further information contact Burglar Alarms Australia Pty Ltd, PO Box 118, West Ryde, 2114. Telephone: (02) 858 3211.

Smart switch box for RS232 connections

The SSB 1000 is an intelligent device to switch computers and peripherals. Inbuilt logic electronically reads the data transfer configuration of the computer or peripheral RS232 port and matches its "connection" to the needs of the other RS232 port. By this means it is possible to hook up different computer hardware.

The smart switch box is transparent to code and baud rates and is housed in a durable, low profile case. No outside power supply or batteries are needed.

For further information, contact Prolog (Australia) Pty Ltd, 69 Canterbury Road, East Camberwell, 3126. Telephone: (03) 836 3533.



Fuseholders of all sizes and shapes

Tecnico Electronics have released two new Belling Lee PCB mounting enclosed fuseholders for 5 × 20mm fuses. They are rated at 6.3 amps and solder directly onto printed circuit boards.

The L2180 has two pins with standard spacing to fit PCB hole pitch centres while the L2179 is a three pin version with two of the pins being common and connected to the rear contact.

Also released is the L2190 panel mount fuseholder. This low profile fuseholder accepts 20 × 5mm fuses and is fully finger proof to prevent accidental contact when the fuse is being inserted. Current rating is 10 amps with soldered connections or 6.3 amps with snap-on connectors.

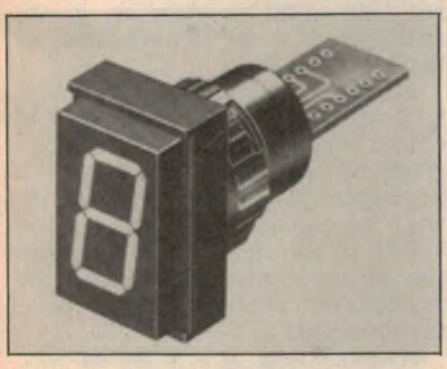
For further information contact Tecnico Electronics, 11 Waltham Street, Artarmon, 2064. Telephone: (02) 439 2200.

Rugged multimeters

Two new heavy duty multimeters are now being marketed by Neotronics. The model HC 5000 fetaures a rotary selection switch while the model HC 6000 has side pushbutton switches for single-handed operation. Both mdoels have 10MΩ input impedance and 2000-hour battery life (with 9V alkaline battery).

Both come complete with tilt bail, a set of test leads and two insulated screw-on crocodile clips.

For complete specifications, contact Neotronics Pty Ltd, PO Box 289, Newport, 2106. Telephone: (02) 918 8200.



Seven segment readout to match switches

The EAO Series 31D seven segment readout is identical in size to standard rectangular switches and annunciators allowing for a mix of units to be used on the one panel. The readout is available in common cathode or common anode configuration. Light output is between 0.04 and 0.11mcd with forward current of 5mA.

For further details, contact Associated Controls Pty Ltd, 55 Fairford Road, Padstow, NSW, 2211. Telephone: (02) 709 5700.

REVIEWS OF RECENT Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

RAVEL

Gaspard de la Nuit. Pavane pour une Infante Defunte. Valses Nobles et Sentimentales. Vladimir Ashkenazy (piano). Decca Digital Disc 410 255.

Ashkenazy is a very different style of pianist from Horowitz. Equipped with a more than adequate technique to deal with the most difficult music, he doesn't thrust his virtuosity at you. It is always part of a great mind's scholarly study of the score — the result, a convincing and moving interpretation.

Thus in the first of the Gaspard suite, Ondine (the spirit of the fountain), everything is fluid but never showy. He uses a great variety of sonorities and manages everything with an attractively delicate touch instead of emphasising, however subtly, the difficulty of the music.

The Gibbet offers the usual macabre picture — a corpse swinging slowly at the end of a rope, the persistent tolling of a single note bell that sounds in every bar, the whole chilly with menace. For some reason it always reminds me of a Drysdale landscape — without, of course, the Australian figures, but with the same treeless desolation.

A few issues ago I wrote enthusiastically about the dazzling technique of a young Yugoslav pianist, Ivo Pogorelich, whose recording of the third item of this suite, Scarbo, impressed me so much. It was a quite extraordinary performance, technically, of probably the most difficult piano solo in the repertoire.

Ashkenazy gives his version of the same piece without however thrusting his virtuosity at you. The solo graphically portrays a hobgoblin but under Ashkenazy's hands he becomes more mischievous than malicious. He uses a fine shaded touch more delicate than Pogorelich's. He also sounds much more relaxed, not unexpectedly because he is much the senior of the two artists. It is a guileful but entirely satisfactory performance.

Also on the disc is Ravel's Pavane Pour une Infant Defunte which Ashkenazy takes at a classical moderato in keeping with its function of a stately dance. The strange title? There is a simple explanation. Ravel was fascinated by the different nasal sounds in the last French words of the title.

Ashkenazy again uses a vast number of different sonoroties in Ravel's Valses Nobles et Sentimentales. It is a joined suite of valses of many different characters. Some don't sound like valses at all. It is a matter of conjecture whether you are listening to a noble one or a sentimental. Some are definitely not valses though they might be in 3/4 time.

But Ashkenazy bestows on each its own character and makes the whole exercise consistently interesting. (J.R.)

HOROWITZ

Piano music by Chopin, Schumann, Rachmanimov and Scriabin. CBS Masterworks Analog Discs (three in box) M3 37895.

This is an interesting issue, three discs of mostly unhackneyed music played with brilliant virtuosity by Horowitz. He is the virtuoso par excellence — his performance as immaculate as his tailoring. This is allied to a tall graceful figure and an impressively casual manner in all but the most difficult phrases.

Fast passages slip past with astounding fleetness. His impassive demeanour making them sound all the more remarkable. His interpretations are for the most part orthodox. It is only rarely that an illuminating thought is dealt out. The effect is mesmeric and leaves one with an uneasy feeling at the end — was it all real or just a sleight of hand trick. Everything is executed with such perfect timing. He starts his long recital with Chopin's Sonata in B Flat Minor, a passionate reading with the agitato beginning contrasting strongly with the broader middle section. The feeling is rhapsodic. There follows a bright scherzo with a poetic trio. Then comes the famous funeral march movement with tiny hesitations in the second subject that I at first found fascinating but when they persisted a trifle irritating. The windswept finale completes an impressive introduction to evening.

Next is the Nocturne in E Minor, Op. 72, No. 1 by Chopin. Horowitz takes it at an even pace with very small rubatos, the fancy bits later receiving their full share of attention. He starts the reverse side with the G Minor Ballade, its early treatment hypnotic in its persistent restraint. The fast bits disclose for the first time the formidability of his technique. The F Sharp Minor Polonaise has some slight reverberation in the recording and in this Horowitz starts to flaunt his virtuosity.

An early Scriabin Etude, a simple work displaying the composer's debt to Chopin follows. A second Etude makes a grand row. The second disc starts with Schumman's Kreisleriana which, by the way, has nothing to do with the late violinist of the same name. Here again you get some reverberation. Is it the recording or over-pedalling? I rather suspect the first.

A serious work, it is to me the least attractive of the Schumman piano suites — Papillons, Carnival and so on. Horowitz takes parts of it at tempestuous speeds. And this is where the sleight of hand mentioned earlier occured to me. The serene unblemished surface had been achieved so effortlessly. There is intense personal commitment but no profundities. A technical accomplishment of the highest order polished to high brilliance.

The second side starts with Liszt's Valle d'Oberman, a rather glum piece with a shattering climax of almost intolerable efficiency. Then comes a Schumman Arabesque, Op. 18 and a Toccata of terrifying difficulty played without a falter by Horowitz. Not a hair of his head is displaced, one imagines.

Next is the least satisfying item in the great recital — an unabashedly self-indulgent reading of Schumann's Traumerei. It is an exhibition of gross sentimentalisation.

He then plays his own piano transcription of an aria from Bizet's Carmen — another dazzling bit of pianism. It fits perfectly into the rest of the program which never seeks to achieve profoundity but is always electrifying playing. A pity that from time to time one's concentration is shattered by short bursts of shouted applause, betraying the fact that some of the pieces were recorded live.

The fifth side opens with Rachmaninov's Second Sonata in B Flat minor, of no great consequence, just virtuoso fodder. An Etude in C Major and another in E Flat Minor, improvisatory types of pieces, add little but show to the program. Then comes the most interestingly seldom-heard group, a bracket of pieces by Scriabin, a composer who is creeping back into the repertoire.

Scriabin was quite a lad in the immediate post World War One period when he and his like wrote music that was considered "decadent". In terms of his confreres, Scriabin was phosphorescent with decay. There were widespread rumors that he indulged in bestiality. In his large, inflated orchestral works — the Divine Poem, the poem of Ecstacy and Prometheus — he wrote feverish after feverish climax without ever achieving catharsis.

Scriabin's dissonances sound very ordinary nowdays and are always firmly anchored tonally. His Sonata No. 9 is subtitled "Black Mass" but I could find no evocation of such a ceremony. In a Poem there is a little drooping four-note theme reminiscent of Ravel's "Rhapsodie Espagnole." There are several short solo's by Scriabin that I couldn't separate because I was unfamiliar with them and the accompanying notes are not much help.

Altogether a most interesting issue of great historic value and here and there providing very real pleasure. But why did he have to make it all sound so damned easy? (J.R.)

LOVE DITTIES

Some Such Foolishness. Johnny Chester. Stereo LP, RCA/Victor VPL1-0496.

For some, Johnny Chester will have the undoubted advantage that he sings songs like they used to — with real lyrics instead of just the title, endlessly repeated! Even so, on this albums, he does have a one track

SCHUBERT

String Quintet in C major. Melos Quartet of Stuttgart with Mstislav Rostropovitch (cello) DGG Analog Disc 2530 980.

Why the extra cello? Most quintets add an extra viola to the other four strings to give more richness to the middle harmonies. Schubert's reason is uncertain. It was composed in the closing years of his life and wasn't performed until years after his death. It is regarded by many as one of the greatest examples of chamber music ever written.

Schubert's cello undeniably adds tonal depth and contrapuntal richness to the score. At the time of the quintet's composition Schubert was staying in his brother's house and the plenitude of string players might have encouraged him to add the extra cello for reasons of friendship with one of them. This however is pure guessing.

Schubert certainly had no love for the viola and went far to neglect it in this quintet. His addition of the cello however, gave him a tone richer than anything else he wrote as chamber music, even Death and the Maiden. Technically it gives him the opportunity of writing singing thirds and sixths on pairs of instruments while leaving the decorations to the remainder. That this adds strength to the bass is obvious.

Yet none of the technical speculations give any idea of the beauty of the music. In his final years he developed a depth of thought allied with technical ability unknown in his earlier works. And its performance here is altogether admirable.

The first movement is vigorous, its nuancing stylish. It is full of harmonic surprises. There is a free swing in many long rich reaches of the score. The players' complete unanimity can, of course, be taken for granted. And some of its most glorious melodies come from Rostropovitch's cello.

The second movement is a valuable example of immaculately engineered long sustained ultra pianissimo passages. It has a middle section of contrasting agitation, then reverts to half-awake musings. It generates an atmosphere somewhere between consciousness and sleep.

The third movement is joyous, reminiscent of a hunting scene. It also carries a full measure of rhythmic surprises. And the Finale has real swagger. Enthusiastically recommended. (J.R.)

Records & Tapes

mind, in that all 12 songs, seven of them his own compositions, are variations on a single theme: amour.

Tomorrow's Memories Tonight — Some Such Foolishness — My Kind of Woman — You've Still Got a Hold of My Dreams — Nobody Loves Me Like You — I Love You So, Rebecca — I Kissed You — Life After Louise — Love or the Next Best Thing — Hung Up on Love — Runaway — All I Have is Me.

Although the cover picture was taken in a Melbourne hotel, the recording itself was made in Tennessee, USA and, if not actually in Nashville, it has the same characteristic rhythmic sound — keyboards, synthesiser, guitars, drums, mandolin and chorus.

The sound is clean and pleasant and, I guess, a natural for easy listening and country radio. (WNW).

A FAMILY AFFAIR

The Judds — Wynonna & Naomi. Stereo mini-LP. RCA MAL-10006.

At first glance, the Judds could be taken for identical twins but the jacket notes introduce them as mother (Naomi) and daughter (Wynonna).

They started singing together in local churches (where have I heard that before?), featured in traditional singalongs in their native Kentucky, gravitated west to Hollywood and then back east to Nashville, Tennessee, where this album was made.

In the process, they've developed their own style — tuneful, contemporary, rhythmic — and with enough of the Nashville ingredient to have earned them a deal of airplay over rural radio stations around Australia.

The titles: Had a Dream — John Deere Tractor — Isn't He a Strange One — Blue Nun Cafe — Change of Heart — Mama He's Crazy.

Clean sound and well done, in the Nashville manner. (W.N.W.)

SPIRITUAL FITNESS

The Race Is On — Exercise your faith. Arranged by Steve Taylor. Stereo LP, Word SPCN7-01-893610-1. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.

Having in mind the current American preoccupation with fitness, aerobics and such like, it is perhaps not surprising that a Gospel music team has chosen to develop the Biblical writer's analogy in Hebrews 12,1: "... let us run with perseverance the race that is set before us."

Featuring five soloists and a chorus of young people, the recording opens with the ear-catching title track "The Race Is On", which serves to set the scene.

When the "runners" pause for breath, there is just time to encourage a couple of new recruits before launching into track 2: "Heavenly Bodies". And, when someone later complains that they are having difficulty in keeping up, they are duly encouraged to "Run Your Own Race". (What matters is not winning but having run with perseverance.)

So it continues, with snippets of teenage dialogue introducing, in turn, "Every Step of the Way", "Trust in the Lord", "Where Are You Now?" and "Racing to the Son". The album concludes with a reprise, "The Race Medley".

In the manner of modern Christian musicals, the vocals are predominantly rhythmic and up-tempo but melodic, nevertheless, and supported by imaginative scoring and highly professional musicians.

If you can forgive a trace of edginess in the sound, the recording makes interesting listening in its own right. But, no less important, it suggests a musical which could be produced by local youth groups, and which would provide plenty of scope for those interested in vocal and instrumental participation, sets, costuming, choreography and production.

With this in mind, a note on the jacket suggests that the Word organisation are in a position to supply a choral book and an accompaniment reel tape or cassette, as well as the regular LP and cassette albums.

Well worth checking out if you are interested in a local production that would appeal to all ages. (WNW).

TWO SYMPHONIES

Beethoven: Symphonies No. 1 & 2. Played by the Dresden Philharmonic Orchestra conducted by Herbert Kegel. Digitally mastered compact disc, Capriccio 10.001. [From P.C. Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612]

You may have a number of Beethoven recordings in your collection but the chances are that these two symphonies will not be among them. Glancing back through past issues, they have not featured in these columns for years, if at all, and receive only occasional mention in the specialist journals.

The present release on a Capriccio digitally sourced compact disc provides the opportunity to acquire both on a single 61-minute recording. Not only does it offer relatively recent performances (1982/3) but it avoids the one-time necessity on LP for an awkward turnover, with the Second Symphony occupying all of side 1 and part of side 2.

In his notes, Prof Dr Martin Staehelin (Beethoven-Archiv, Bonn) points out that, the sketches having been lost, the origin of Beethoven's Symphony No. 1 in C-major Op 21 is uncertain. What is known is that it received its first performance in April, 1800, its likely completion was during the previous year.

Beethoven had earlier received tuition in composition by Haydn and the characteristic slow introduction to the Symphony reflects his influence. Says Staehelin, "the models of Haydn and Mozart are...to be heard in the composition" but the work is nevertheless Beethoven's own.

His Symphony No. 2 in D-major, Op 36 was premiered two years later, in April of 1803, by which time the composer had registered anger and despair at his increasingly impaired hearing (see Julian Russel's note on p 124 of the September issue).

But there are no such emotions in this essentially relaxed Second Symphony in D-major, Op 36, presumably because it was conceived in 1801 and probably completed early in the following year. As such, there is much to attract in the 36 minutes which the four movements occupy.

Technically, my first reaction to the recording was lukewarm, partly by reason of the pedestrian introduction to Op 21 and partly because of a somewhat bass heavy orchestral balance — possibly warranting a couple of notches of bass cut.

Op 36, apparently recorded at a later time, is the more rewarding listening experience.

Incidentally, Capriccio has issued all nine Beethoven symphonies by the same conductor and orchestra, on seven compact discs, all available through PC Stereo, as noted above (WNW.)

GUITAR DEVOTIONAL

Lord of Paradise. Bud Tutmarc playing Hawaiian guitar, with orchestra and chorus conducted by Kurt Kaiser. Stereo LP, Word SPCN7-01-892710-2. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777]

Sight of this new album stirred a chord of memory and, sure enough, on checking back, I found that Bud Tutmarc's "Sacred Hawaiian Melodies" recorded with Mark Davidson on cinema pipe organ was one of the very early devotional records to be reviewed in these columns — a "Spectraphonic" mono recording on the "Sacred" label.

According to the notes on that early album, Bud was born in 1924 and, at age 9, was playing Spanish and Hawaiian steel guitar on radio and in his father's dance band. He became involved in church activities in 1935, attended university and Bible college in the '40s and has been occupied since then with the American Christian music scene. Now, at age 60, we have his latest album "Lord of Paradise" made in association with Word's Kurt Kaiser.

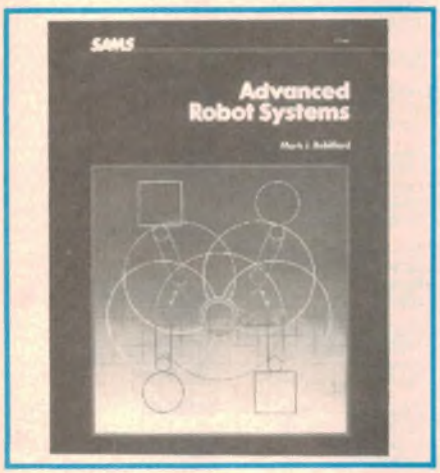
Forty years ago, the amplified Hawaiian steel guitar was a novel and beguiling sound in church musicals but now, in '85, one has consciously to reattune to the stylised vibrato and glissandos. (When did you last hear one in your church?) Possibly anticipating this reaction, arranger Kurt Kaiser has interposed instrumental and vocal stanzas, by way of support and variety.

The 10 tracks in the 33-minute program include: Open Our Eyes — The Lord of Paradise — Waikiki — Precious Lord, Take My Hand — Abide With Me — Only Jesus Can Satisfy — Frendship with Jesus — Reach Out to Jesus — He Careth for you — Come on Down/He's Coming Soon.

The sound is clean, smooth and well balanced and should have an immediate appeal to those who have memories long enough to associate the guitar with languid, tropical Pacific islands, rather than with the local disco! (W.N.W.)

Books & Literature

Robot techniques



Advanced Robot Systems: by Mark J. Robillard, published by Howard W. Sams & Co, Inc, 1984. Soft covers, 214 × 278mm, 215 pages, illustrated with diagrams and photographs. ISBN 0-672-22166-7. Recommended retail price $34.95.

Both theoretical and practical aspects of robotics are discussed in this book. Construction, control and feedback techniques are included. Industrial robots are barely mentioned — each topic is aimed squarely at the home or student experimenter.

Although the first chapter deals with some fairly elementary aspects of steering and mobility, the book is primarily concerned with microprocessor control of robots and the necessary software.

Detailed and readable methods of interface are discussed, with plenty of diagrams. Relevant semiconductor data and applications are also included, along with a number of trial control programs.

The six chapters are as follows: Moving Platform Mechanics, Software for Rover Steering, Manipulator Systems Hardware, Software for Manipulators, Personal Robot Hardware, Personal Robots: Software, Applications, Advanced Techniques. The Heathkit Hero 1 robot is the constructional example for the last two chapters.

For anyone interested in experimenting with robots, or just plain curious about how they work, this book is certainly worth a look. Our review copy came from Jaycar Electronics. (C.R.D.)

Integrated circuit manufacture

Workbench Guide to Microelectronics: by Andres G. Fortino. Published by Reston Publishing Company, Inc, 1985. Soft covers, 234 × 178mm, 134 pages, illustrated with diagrams and photographs. ISBN 0-8359-8820-1. Recommended retail price $33.95.

The title of this text is something of a misnomer. Rather than being a book about practical aspects of electronics, it is a general primer on the principles and manufacture of integrated circuits. Beginning with basic atomic theory, it takes the electronic novice through crystal structure, PN junctions and on to semiconductor types. Several chapters are devoted to manufacturing processes.

The text is divided into four main parts: part one deals with the chemistry of metals, insulators and semiconductors. Part two gives an overview of MOS devices, diodes, bipolar transistors and other semiconductor types. Part three deals with manufacturing, including the economics of yield. Part four has a brief description of computer aided design for semiconductors.

Although some of the areas discussed may have the depth required for a student majoring in electronics, this text would be of interest to anyone wishing to further their knowledge of the subject. Our copy came from the distributors, Prentice-Hall of Australia Pty Ltd. (C.R.D.)

Halley's Comet Cometh

HALLEY: The once-in-a-lifetime comet. By David & Carol Allen. Published by Unwin Paperbacks 1985. Soft covers, 225 × 176mm, 101 pages. Illustrated with photos and diagrams. ISBN 086861 567 6. Recommended retail price $9.95. OBSERVING HALLEY'S COMET; The complete guide to the comet from southern latitudes, 1985-1986. Published by Unwin Paperbacks 1985. Soft covers, 210 × 297mm, 66 pages. Illustrated with photos and diagrams. ISBN 0 86861 920 5. Recommended retail price $8.95.

Next month, Halley's comet will be visible in our skies. Once every 76 years or so, the comet's visitation has been a celebrated event, from time immemorial. This time around it will be the most photographed, recorded and reported. No less than six satellites, at last count, will be up there to meet it.

These two books give all the info on the comet, going right back to 467 BC. The first book is the more general of the two and is the more readable while the second is aimed squarely at Australian readers and gives specific information on how and when to observe, photograph and record the comet. Both books can be recommended as a guide to this truly once-in-a-lifetime event. (L.D.S.)

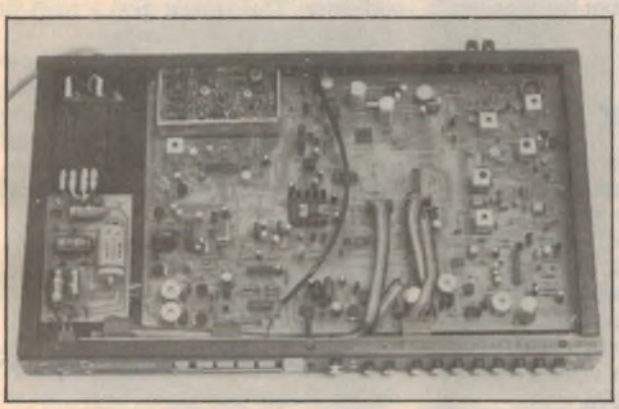
Apple Macintosh

Introducing the Apple Macintosh: by Connolly & Lieberman, published by Howard W. Sams & Co, Inc, 1984. Soft covers, 236 × 211mm, 188 pages, illustrated with photographs and diagrams. ISBN 0-672-22361-9. Recommended retail price $21.95.

In outlining the objectives of this book, a quote from the "Macforward" might be in order: "This book is a non-computer book written about the most exciting computer yet created: the Apple Macintosh. Although this book gives you a detailed description of the newest Apple creation, it was created, like the Macintosh, for those who are wary of pocket calculators, digital watches, and things that whir, buzz, and otherwise clutter your life with technology."

The Apple company would have to be well pleased with the book, irrespective of its reception amongst computer novices! In effect, it's a very good vehicle for marketing the Macintosh, as it enthusiastically deals with the various aspects of the machine. This is the only drawback, the book is one-eyed on the subject. With that proviso, it will be of interest to anyone who is about to buy a Macintosh. Our review copy came from Jaycar Electronics. (C.R.D.)

Next month in Electronics Australia



AM/FM Stereo Tuner

This synthesised AM/FM stereo tuner has got the works. In addition to FM, it features a wideband stereo AM tuner, digital readout, 12-station memory, a seek button and optional infrared remote control. Full details in the December issue of *Electronics Australia.*

Electric Fence

Keep the sheep in, the cats out, the cows corralled, the pigs penned, the goats grounded and the dogs otherwise preoccupied. Whatever your problem, our new Electric Fence is the answer to critter control.

Video Fader Control

Add a touch of professionalism to your home movies with our new video fader. It allows a scene to be faded to black (and back again) without loss of colour or picture lock (sync).

Special Supplement on Marine Electronics

Next month, we will include a special supplement on marine electronic equipment. It will cover everything from marine radio to satellite navigation, depth sounders, weather facsimile, radar, instrumentation and entertainment systems.

Note: Although these articles have been prepared for publication, circumstances may change the final content.

Information centre

Effects unit for musicians

I built the Effects Unit described in the June 1983 issue. It works well in all regards except that in the Reverb mode, the effects only works with the Flanger pot at maximum; ie, wound fully clockwise.

Also, when I constructed the kit, I had to connect the Echo Delay pot in reverse to the wiring diagram (ie, I was getting maximum echo when the pot was wound fully anti-clockwise). Perhaps there is some connection between the two symptoms. (M.M., Dongara, WA).

● Component tolerances have probably adversely affected the sensitivity of the reverb circuit. This can easily be adjusted by reducing the 8.2kΩ resistor in series with S1 and the associated 0.1μF capacitor.

Reduce the resistor value in small steps before testing the circuit on each occasion. If the resistor value is made too low, the amount of feedback provided by this path will cause the circuit to become unstable. This would be immediately evident as a loud howl from the speaker.

Modifying the Megohm Meter

My query concerns the 1000V Megohm Meter described in EA, July 1985. Could you please advise if it is possible to alter the scale from 2/2000MΩ to 20k/30MΩ; ie, divide the present range by 100. It would seem that variations to the 560Ω to 1MΩ divider could do this but I do not know what values these should be or whether other alterations are also required.

The reason for this request is that in electrical tests to SAA requirements, most limits are 1MΩ with some tests going as low as 10kΩ. (J.B., Kirra, Qld.)

● Although we haven't tried it, it should be possible to alter the scale as you require by scaling down the six resistors associated with the diode string by 100. That is, each resistor value must be divided by 100.

Trouble with brake flasher

I built the Brake Lamp Flasher described in EA, November 1984. Once I installed it in the car and pressed the brakes the accessory brake lamps flashed three times and then stayed on. However, when the pedal was released and pressed again after a short delay, the lights failed to flash and just stayed on. The system reset itself only after four hours rest and then the same thing happened after a further series of flashes.

Could you advise me as to what is wrong with the system and how I can fix it. (L.S. Doncaster, Vic.)

● Quite a few other constructors have also experienced this symptom. It appears that the problem is due to the light-gauge wiring used in some cars, particularly those of Japanese origin. The initial voltage drop across the wires is quite high — in the vicinity of three or four volts. The reduced voltage reaching the flasher circuit is not sufficient to activate the normal resetting mechanism.

In most cases, the problem can be cured by soldering a resistor across the 22μF capacitor on pin 16 of IC2. We suggest a value of 100kΩ to start with, although some experimentation may be necessary. This should give a reset time of about five to 10 seconds.

Should the above technique prove unsuccessful, try increasing the value of the the .01μF capacitor connected to pin 15 of IC2. Alternatively, try connecting the .01μF capacitor to the other side of D2 (ie, directly to the positive supply rail).

TV sound controller

I constructed the Remote Infrared TV Sound Controller (EA, Oct '79) some months ago. But it is not working satisfactorily when it is installed inside a Sanyo CTP 6603 set.

I made the PC board myself from your artwork. Both the transmitter and the receiver work perfectly when connected to a Sansui hifi amplifier as described in your article.

One important fact to mention is that the transmitter is not the one you described in the TV sound control article (EA Jan, Feb, '83). Instead it is the one described in October '79, stereo remote control with a .0068μF capacitor substituted for the .0082μF (no special reason).

Despite what you say about the need for complete 5ms or 1ms train of pulses for the receiver to work correctly in the TV sound control article, the '79 transmitter works perfectly in steps when the TV sound control is used on the Sansui hifi amplifier.

I have noted your observations in published answers regarding the TV sound control, but I have not made any changes to the receiver since it works perfectly on the hifi amplifier.

On the Sanyo CTP6603 as soon as the wiper of the volume control pot VR901 is disconnected, the volume goes high and remains high. Interposing the receiver between the wiper and R152 and pressing either button of the transmitter makes no change what-so-ever.

I tried connecting the receiver between R157 (pin 12) and the base of Q903 — but no sound output was obtained.

Pressing the transmitter buttons gives a just audible click. That's all. Note

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted: $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 227, Waterloo 2017.

the absence of a coupling capacitor on pin 12. I have tested the unit on the hifi amplifier repeatedly just to make sure I haven't damaged it. It works perfectly every time.

The circuit diagram for the Sanyo CTP6603 is enclosed. Could you please solve my problem? (S.K., Hobart, Tas.)

● We note that you have seen the second article on the Infrared TV sound control published in the February 1983 issue of EA. This is the solution to your problem. As with most TV receivers these days, your set uses a DC volume control. Hence, you must use the second version of the infrared control receiver published in February 1983.

Deluxe Car Burglar Alarm

I was wondering if you could help me fix my Deluxe Car Burglar Alarm costing $70, featured in the May 1984 edition of *Electronics Australia*.

The dash lamp sequence works well and all inputs work. The problem is in the amplifier stage because we can get sound from the horn, but you can only just hear it.

We double checked the circuit components. All ICs, capacitors and diodes are in the right way, and all links are in. We tested all the transistors, capacitors and diodes and all worked well.

I found that if I shorted all three pins of Q7 (TIP31) that the alarm would work at the proper sound level, but Q5 (TIP32) got extremely hot. (B.K., Shepparton, Vic.)

● From the symptoms you have listed, it seems likely that one of the ICs driving Q9 and Q11 is at fault, or possibly Q9 and Q11 are faulty. The reason that Q5 becomes hot when you short Q7 is that Q5 is then working into a short circuit.

Another strong possibility is that one or more of the transistors has been

Playmaster AM/FM Stereo Tuner

With reference to your Playmaster AM/FM Stereo Tuner as featured in EA November 1978 — January 1979, there is a problem with the FM frequency readout and all my efforts have failed to fix it. I have replaced the DS8629 ECL prescaler IC and all components on the interface PCB so far and this did not correct the problem of no frequency readout.

The next step of shorting out the 220Ω resistor going to pin 7 of the DS8629 produced a readout over about three quarters of the FM band. Replacing Q14 and a 2N5486 and fiddling with the length of the coil L1 produced the required frequency readout over the entire range with nothing to spare.

The shorted 220Ω resistor audibly degrades the performance of my favourite ABC FM station at 101.6MHz. I suspect that the tuner module is not providing enough output to the interface PCB. (M.L., Boondall, Qld.)

● In view of all the approaches you have tried, we agree that the problem is probably due to insufficient level from the tuner module. We suggest that you try reducing the 10pF capacitor in the emitter circuit of the local oscillator transistor (2SC461).

installed the wrong way round. At least one kit retailer (the retailer you bought the kit from) is substituting BC640 transistors for the BC327s (Q6 and Q9). While the BC640 wil do the job, its pin-out is quite different.

If you have BC640s, the leads may be determined as follows: face the pin towards you with the flat of the transistor body facing downwards. The leads are, from left to right, base, collector, emitter.

By the way, you can check each side of the output circuit by alternately disconnecting one side of the speaker and connecting it to ground instead.

More on the car alarm

I have recently purchased the *Electronics Australia* Deluxe Car Burglar Alarm to fit to my new Magna SE. I have been told by the car dealer that some alarms will damage the car's dash electronics. I believe your alarm system will be OK but I would appreciate it if you could answer the following:

(1) Will this alarm damage the car's electrical circuits?

(2) Can you suggest an "ignition killer" that is compatible with the Magna?

(3) To protect against entry from a broken window, have you any suggestions as to a device that will be compatible with this alarm system?

(4) Any suggestions to protect against tow away or jacking up?

The only other problem I perceive is obtaining a copy of the Magna SE wiring diagrams. Any assistance you can offer in particular when wiring the ignition killer would be appreciated.

Rather than use the barrel-type keyswitch I would like to fit a switch which can be behind the plastic of the dash or some other point and which is flexible enough to operate a push type switch. Have you any suggestions?

I am not an electronics fanatic but since I have recently begun purchasing your informative publication you are converting me. (B.R., Kurri Kurri, NSW).

● The Deluxe Car Burglar Alarm can be used in any car, including your new Magna. We recommend that a mercury switch be fitted to guard against tow-away while the Ultrasonic Movement Detector described in August 1984 (File 3/AU/41) can be used to protect against entry through a broken window.

The Ignition Killer described in our September 1985 issue is also suitable for use in the Magna. You don't need a wiring diagram. Just connect the output from the Ignition Killer to the negative terminal of the coil.

We doubt whether your idea of actuating a pushbutton switch hidden behind the dashboard would prove satisfactory. If you don't want to use a keyswitch, the best alternative is to install a hidden toggle switch.

Notes and Errata

CAR STEREO AMPLIFIER (August 1985, 1/SA/72): the parts list should show 2 × .047μF polyester capacitors, 11 × 10kΩ resistors (not 10), and 10 × 100Ω resistors (not 12 × 190Ω).

Selecting the best resistor/capacitor . . .

continued from page 89

available, their characteristics, recommended applications, and suggested derating factor. Use of a derating factor is an effective means to decrease the failure rate of most devices since device life is stress and temperature dependent. Derating is accomplished by either decreasing part stresses such as power/voltage or current, or by selecting a higher rated part. Optimum derating occurs at or below the point where an increase in stress or operating temperature results in a large increase in the device failure rate.

One note about Table 1: the values and rating shown are provided as guidelines. While they apply to the most commonly found units, it is not impossible to find units with slightly, or greatly, different specifications.

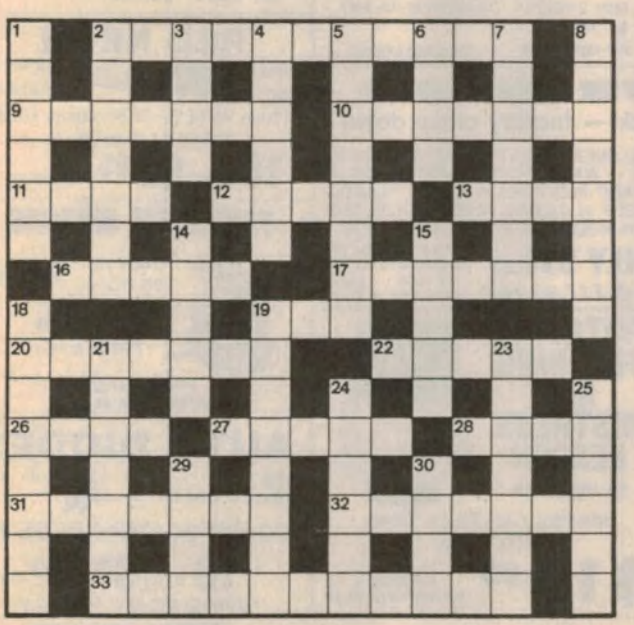
While that concludes our look at resistors, our look at component selection is far from over. In the next part of this article, we'll turn our attention to the factors that should be considered when selecting capacitors.

Reprinted from *Radio-Electronics*, February 1985.

NOVEMBER CROSSWORD

ACROSS

2. Remotely activated transmitter-receiver. (11)
9. British inventor of the diode valve. (7)
10. A millionth of an Ohm. (7)
11. Light-emitting device. (4)
12. Computerised TV activities. (5)
13. Bane of record makers. (4)
16. Degree of spread of a speaker horn. (5)
17. Early temperature scale. (7)
19. Once popular brand of TV. (3)
20. Unit of gain. (7)
22. Spherical version of 11 across. (5)
26. Flaws in pre-electronic ignition points. (4)
27. Play your guitar. (5)
28. Type of cell. (4)
31. Positively disconnect a device from circuit. (7)
32. Element used in semi-conductors. (7)
33. Devices first proposed by engineer Lilienfield in 1928. (11)



DOWN

1. Board for mounting speakers. (6)
2. Pertaining to heat. (7)
3. Reference line. (4)
4. Transmitted information. (6)
5. Unit of resistivity. (3,5)
6. Tape-recording unit. (4)
7. Expensive metal used for certain electroplating. (7)
8. Component of an electric motor. (8)
14. Testing tool. (5)
15. Body of data. (5)
18. Changing something to suit. (8)
19. Devices that prepare graphs. (8)
21. Term meaning "automatically switches off". (4,3)
23. Problems of mechanical switches in high-speed circuits. (7)
24. Transient disturbances. (6)
25. Kind of process used in semiconductor fabrication. (6)
29. Word of the phonetic alphabet. (4)
30. This name is associated with atmosphere electricity. (4)

SOLUTION FOR OCTOBER

S	U	P	E	R	C	O	N	D	U	C	T	O	R	S
T		I		E	R				A		R		P	
A	R	C	W	E	L	D	E	R		P	H	A	S	E
B		T		D		E		E		S		T		C
L	O	U	D		T	R	I	A	C		H	I	F	I
E		R		S		S		D	E		O		A	
	D	E	L	T	A		T	E	R	M	I	N	A	L
P				R		F		R		E				S
E	R	A	S	A	B	L	E		G	R	A	P	H	
R		R		P		U		M		Y		R		A
F	O	C	I		L	O	G	I	C		F	I	L	M
E		L		U		R		S		A		M		P
C	L	A	S	S		O	S	C	I	L	L	A	T	E
T		M		S				U		T		R		R
S	U	P	E	R	H	E	T	E	R	O	D	Y	N	E

A.C.E. RADIO ELECTRONICS CENTRE

136 VICTORIA RD, MARRICKVILLE, NSW 2204.
PHONE 51 3845.

PROUD TO BE AUSTRALIAN

50 WATT RMS SPEAKERS

★ NEW MODEL ★ ★ NEW MODEL ★

ETONE FACTORY SCOOP
EVEN LOWER THAN FACTORY PRICE

A PAIR FOR $46.50 OR $25.95 EACH

RUGGED TOP QUALITY HI-FI WOOFER. 30cm 8 ohms ● 90 DAYS FACTORY WARRANTY ● FOAM POLY SURROUND ● STURDY SUSPENSION FOR RICH REPRODUCTION ● 3.5cm VOICE COIL ● FERRITE MAGNET ● FREQ RESPONSE 35- 0Hz RESONANCE 35Hz

P-P NSW FOR ONE $4.50. INTERSTATE $6.90. P-P NSW FOR TWO $6.50 INTERSTATE $8.50.

BSR STEREOPHONIC RECORD CHANGER

(BE QUICK — THEY ARE ALMOST EXTINCT)

Latest Model ● 240VAC 50HZ ● Auto/Manual Operation ● 3-Speeds ● Big Platter ● Cue Lever ● Magnetic Cartridge ● 2 Spindles ● Instructions ● 4 Pole Motor ●

$85.95 P-P NSW $5.50
Q, V, SA, T $7.50; WA, NT $9.50

★ SPECIAL PRICES END 30th NOV ★

ETONE SPEAKER SPECIALS

GENUINE FACTORY PRICES

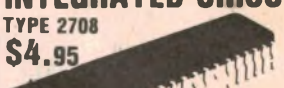
Rugged top quality Aust made brand new bargains — all with factory warranty

Model	Size	Cone Type	V/Coil	Reson Hz	Freq Hz	Watts Rms	Price Ea or 2 for
4310	38cm	Straight surround	8 or 15 Ohms	45	40-6000	60	**$79.95 or $155.00**
4510	38cm	Straight surround	8 or 15 Ohms	45	40-6000	100	**$99.95 or $195.00**
4350	38cm	Hi-Fi	8 or 15 Ohms	30	30-4000	120	**$79.95 or $155.00**

Pack and Post for 1 speaker NSW $7.50 Vic $8.50 SA Q T $10. NT WA $12.50
Pack & Post for 2 speakers NSW $9.50 Vic $11. SA Q T $20. NT WA $22.50

INTEGRATED CIRCUITS

TYPE 2708 **$4.95**



TYPE 6802P **$3.50**

TYPE 6821 **$1.95** P-P $1.50

LOW VOLTAGE TRANSFORMER

240V AC
50 HZ
Primary

Control Data Corp. Brand new spares

7V-0-7V 10amp.
0-30V 2A.
0-40V .2A

$25.

P-P NSW $5. V. Q. SA. T. $8.50 WA. NT. $10.

VARIABLE CAPACITOR

1" × ¼" DIA. SHAFT
100pF
P-P $1.35 **$6.50**

DIODES

650piv 3 AMP
50 FOR $9.50 P-P $1.35.

HI-POWER BRIDGE RECTIFIER

400 PIV 25 AMP
$3.75 P-P 75c

LOW PASS FILTER

50 OHMS 200 WATTS
AUST. MADE. IN DIECAST BOX, WITH SQ 239 COAX SOCKETS
$10.95 P-P $2.50

HEAD PHONES

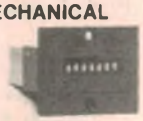
PADDED HI-QUALITY USA

$4.50 P-P $1.50 LO IMP

7 DIGIT COUNTER

ELECTRO — MECHANICAL

60 × 50 × 65mm
Mounting hole size.
50 × 25mm



$5.95

Mini 240/24V Transformer to suit $1.75.

P-P NSW $1.35 INTERSTATE $2.

240-110V Stepdown TRANSFORMER

Double wound 240V AC 50Hz input
110V AC output. 1.5 AMP

1.5A

$25.00

165VA

P-P NSW $5.50
INTERSTATE $7.50

CRYSTAL

3.579545 MHz. Mini Solder in.

95c P-P 75c

PYE SOLENOID

HEAVY DUTY ● 12MM DIA PLUNGER

24V DC 10 WATT CLOSED ● PULL 18MM 50 GRMS ● 12MM 100 GRMS ● 6MM 300 GRMS ● 2MM 1 KG ● AT 10MM SNAPS IN SHARPLY OFF 13.8 VDC ●

$7.95 P-P NSW $1.50 INTERSTATE $2.50

RF TRANSISTORS

2N 5589	$25.00	
2N 5590	$15.95	P-P $1.35
2N 5591	$33.80	

RED NEON

240V AC

INDICATOR LAMP

10mm SQ REFLECTOR. 40mm LONG
PUSH FITS 9mm HOLE

10 FOR $6.95 P-P $1.50

PERSPEX DUST COVER AND PLINTH

Brand new top quality stock — factory close down

FULLY MOULDED SMOKEY TINT COVER 415 × 330 × 75MM INSIDE — WALNUT VINYL BASE IS 450 × 357 × 75MM. AND INCLUDES A BLACK PLASTIC DRESS INSERT 337 × 288MM WHICH HOLDS THE RECORD PLAYER MOUNTING BOARD. WERE $59

TO CLEAR . . . ONLY $34.95

P-P NSW $4.50
INTERSTATE $7.50
PP NSW $3.50
interstate $5.50

Separate plinth or dust cover for sale @ $17.95 each.

PLESSEY CAPACITOR

IDEAL FOR CAPACITOR DISCHARGE IGNITION

55×30 mm

1.5μF 440Vac 50Hz. 1200Vdc

P-P $1.35 **$3.95** EACH

FANTASTIC MOTORS

240V AC 50 HZ — **$5.95**

IDEAL FOR FANS ETC

P-P NSW $1.50
INTERSTATE $2.50

TRIAC

TYPE 225D
SENSITIVE GATE
400V. 10AMP

10 FOR $17.50
OR $1.95 EA. P-P $1.50

MODEL MOTOR

1½ TO 3VDC
Mini Size
34 × 24mm
Shaft
1.5 × 8mm

High RPM. Good Torque. A1 Quality

$2.75 EACH P-P $1.35

ROTATING FLASHING RED DISTRESS BEACON

12 VOLT 2A

Ideal for Car, Truck, Boat. Also Disco.

$12.95 P-P NSW $ 0 INTERSTATE $3.50

AUTO DIODES

$2.25 EACH — BY X21L 100

100 PIV. 80AMP PRESS FIT

10 FOR $17.50 P-P $2

FORWARD AND REV. AVAILABLE

FOR REGISTERED POST, ADD AN EXTRA $3.65 TO PACK & POST CHARGE.

WE BUY

EA marketplace EA marketplace

FOR SALE

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 105X220 SASE to: R.J. & U.S. Imports, PO Box 157, Mortdale, NSW 2223. NSW: Geoff Wood Electronics, Rozelle. ACT: Electronic Components, Fyshwick Plaza. VIC: Truscott Electronics, Croydon. WA: Willis Trading Co, Perth.

ANTIQUE: Original "pyrox" audio wire recorder. About 50 years old, suit collector. Accept good offer. Phone (02) 709 2350 ask for Reg.

A NEW CONCEPT FOR LOW VOLTAGE PROJECTS
COPPER FOIL TAPE: thin pure copper tape backed by special hi-tack adhesive. Current carrying capacity, 5 amps. FULLY TESTED at 24V 5A. Not recommended for mains voltage.
4mm...RRP $8.03 6mm...RRP $9.84 33 metre rolls
GIFFORD PRODUCTIONS
PO BOX 62 St Kilda, Vic 3182 (03) 534 3482

DISTRIBUTOR FOR THE JAPANESE DATA BOOKS
Including The Transistor Manual, Substitution Manual, The Diode Manual, The FET Manual, The OP Amp Manual, The MPU LSI Manual, A-D/D-A Converter IC Manual, The TTL & The Interface IC Device ..... $22.00 each
HICOM UNITRONICS INTERNATIONAL P/L
7 President Lane, Caringbah 2229
Phone (02) 524 7878

PRINTED CIRCUIT BOARDS
Free postage on all EA & ETI Project PCBs.
Catalogue 1976-85 (inc components) $1.00.
PCBs made to order — 48 hr prototype service.
Bankcard/Mastercard
Acetronics PCBs
112 Robertson Rd, Bass Hill 2197
(02) 645 1241

SPDCAL: A fast M/L spread-sheet for Microbees. 16k, 1000 cells; 32k, 2000 cells. Tape and instructions $20. Electron Electronics, RMB 462, Talbot 3371.

BWD 804: 10MHZ single beam CRO, perfect condition, extra functions fitted, $350. Phone (02) 799 8242.

NEW RADIO VALVES: For entertainment or industrial use. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

R.C.S. RADIO PTY. LTD.
Established 1933
IS THE ONLY COMPANY
WHICH MANUFACTURES AND
SELLS EVERY PCB & FRONT PANEL
published in EA and ETI
651 Forest Road Bexley 2207
AUSTRALIA
RING (02) 587 3491 FOR INSTANT PRICES
24 HOUR TURNAROUND SERVICE

BENCH TECHNICIAN
Experience in communications essential, ie FM, HF, mobile communications.
PLEASE APPLY TO DASYL AVIONICS IN WRITING OR BY PHONE.
DASYL AVIONICS
PO BOX CP40, CONDOR PARK
Phone (02) 708 5911
ask for Mr Prior

BLACKTOWN NEXT TO TELECOM OFFICE
Electronic Components
PC Boards, Computer Repairs
OPEN MONDAY TO SATURDAY
(02) 621 5809
38 Campbell St BLACKTOWN NSW
CQ ELECTRONICS

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm. Ad sizes may be increased up to a maximum of 10 col cms.
CLASSIFIED RATES $3.60 for 40 letters or part thereof per insertion payable in advance. Minimum 80 letters.
CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Monday of each month.
PAYMENT & COPY to the Advertising Manager, Electronics Australia PO Box 227, Waterloo, NSW 2017.

EX-ABC AUDIO TAPES: ¼" wide on 10½" metal spool, $6.85; plastic spool, $5.85; 7" spool, $2.25; 5" spool, $1.25. Post extra. Also in stock: ½", 1" and 2" tapes. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

COMPONENT SELLOUT: Resistors, metal film, 5% ER Series. Kit 1 ¼W, 10 of each value (840 resistors). Kit 2 ½W as Kit 1. Linear pots Kit 3, 2 of each value, 500Ω, 1, 5, 10, 25, 50, 100, 250, 500K, 1, 2, 3M, 4, 7, 10, 22, 33, 4.7, 100, 220, 330, 470, 1000. 1000, 63V, 2500M 63V, $13 per kit plus, $2 p&p, per kit. D. Johnson. PO box 103, Sylvania Southgate 2224.

WANTED

PRE-1940: Pick-ups, early microphones, 16 inch recordings of Australian radio shows, Wireless Weekly and similar magazines. PO Box 36, Fairy Meadow 2519.

20'S AND 30'S: Radios, parts, magazines etc. Any condition wanted by genuine collector (03) 51 3640.

NEW RELEASE

Who needs a new car?

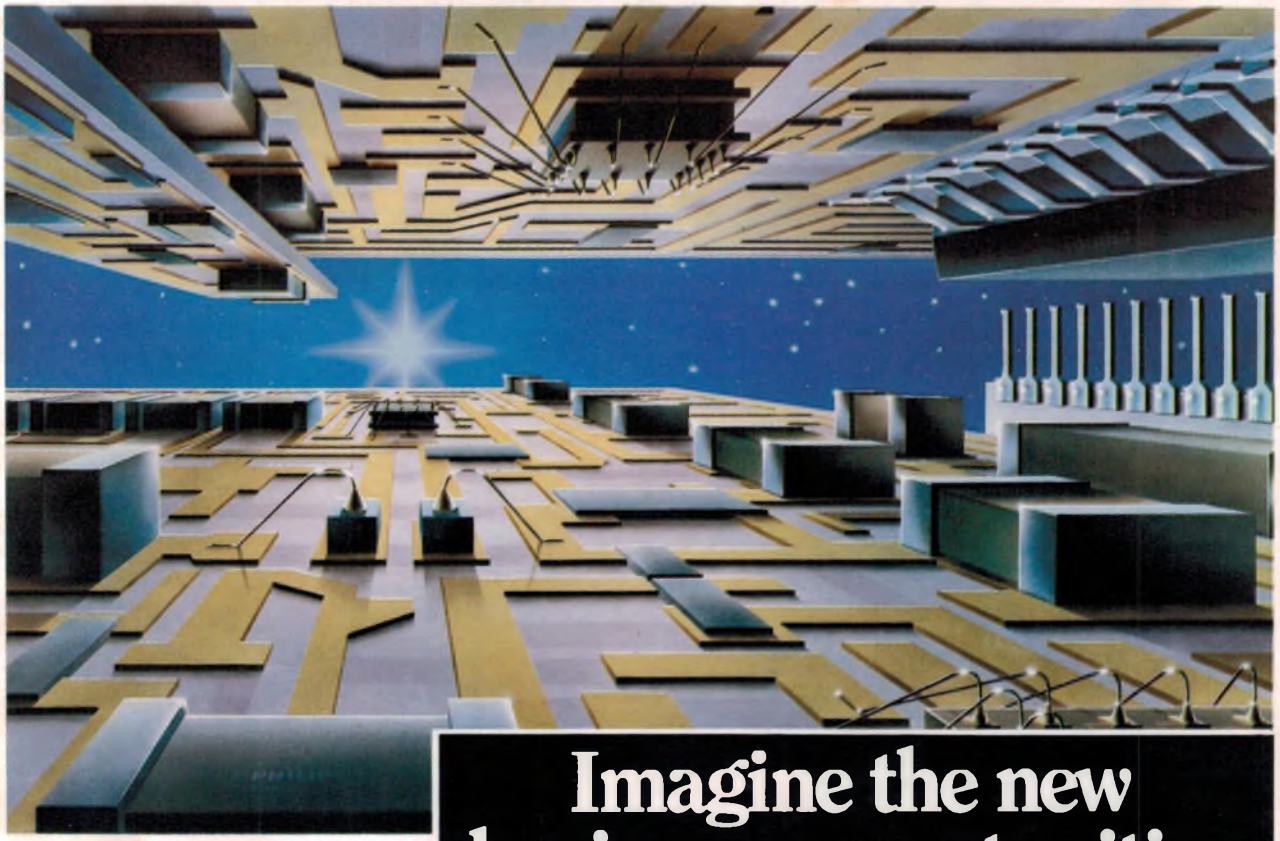
With these selected projects from *Electronics Australia* you can add all of the gadgets and gizmos you've dreamed of —

Cruise Control
Deluxe Burglar Alarm — Courtesy Light Delay
Audible Reversing Alarm — Headlight Reminder
Transistor-assisted Ignition with Optoelectronic Trigger
and many more easy-to-build projects to add value, interest and safety to your pride and joy!

***PLUS* Feedback from those who have built the projects themselves and Bright Ideas for you to develop yourself: Automatic Antenna Retraction, 6V Car Adaptor, Fuse-Failure Indicator and more . . .**

Available from your Newsagent Now! Or send $3.95 plus $1.00 post and packing for each title to *Electronics Australia*, PO Box 227, Waterloo 2017, NSW.

ADVERTISING INDEX



Imagine the new business opportunities with Philips custom microcircuits

You can come on an incredible journey, not to the future, but to a technology available today for innovative electronics users. Philips, custom design and manufacture right here in Australia, both hybrid circuits or custom I.C. chips, to suit your budget and product concept.

Access to reliable hi-technology at very competitive cost even in modest production quantities.

Tell the Philips Elcoma designers what you are trying to achieve and they will create for you a unique microcircuit solution. Perhaps you already have a design. That's where Philips 50 years of continuous production experience in Australia will ensure an efficient result. Naturally, your product design security is always assured and the resulting microcircuit is exclusively your own property.

Philips years of practical experience in computer aided design (CAD/CAM) will get you off to a good start. Your new electronics package will require little space, will improve reliability and the performance of your "new product." At the same time it will provide you with more features and added benefits for your customer, and protect your design against "copycats"!

The time it takes, from engineers briefing to delivery of your first electronic microcircuit or micro sub-assembly, will pleasantly surprise you. Design sampling and testing may be as little as 8 to 10 weeks for hybrid circuits. More advanced custom "monolithic chip" designs will take longer, depending on the size of the chip and complexity of the design.

Send off the coupon today or call Philips Electronic Components & Materials to get the ball rolling on the improvements you'd like to make to your product.

Sydney	**(02) 439 3322**
Melbourne	**(03) 542 3333**
Adelaide	**(08) 243 0155**
Perth	**(09) 277 4199**
Brisbane	**(07) 44 0191**

We make electronics in Australia

I'd like to explore the benefits of Philips microcircuits in my products. EA

My area of interest is _____

_____

Name: _____

Organisation: _____

Address: _____

Postcode: _____ **Phone:** _____

Send to: Philips Elcoma, 11 Waltham Street, ARTARMON, N.S.W. 2064.

The UNTOB

PHILIPS

Electronic Components & Materials

PHILIPS

NOW!
FOR THE FIRST TIME EVER . . . . .

TRUE MULTI-CHANNEL CINEMA SOUND RIGHT IN YOUR OWN HOME

Presenting *The ultimate dimension in sound for video*

The RAIDEK SURROUND STEREO SYSTEM is the next generation in home video entertainment. With an SD 100 Video Movie Soundtrack Decoder you can experience the stunning impact of three dimensional cinema sound, heard for the first time in the home just the way it was intended to be heard in the very best movie theatres.

The SD 100 is not a synthesiser, but a sophisticated decoder that has been designed to accurately extract the original left, right and surround channels which are encoded onto the soundtracks of most stereo movies released on video cassette, video-disc and broadcast in stereo on television.

SD 100 Features

★ Proprietry decoder circuit provides excellent separation between output channels ★ Built–in delay line for optimum front to back separation ★ Built–in power amplifiers deliver 2 x 25 watts RMS to drive surround speakers (no additional amplifiers needed) ★ Separation enhancement circuit for improved front to back separation with poor quality soundtracks ★ Treble and bass controls for surround channel ★ Connects directly between a stereo video recorder, stereo television or video–disc player and a normal hi-fi amplifier.

RAIDEK SURROUND STEREO

RAIDEK SOUND INDUSTRIES PTY LTD
30 Williams Road, North Rocks 2151
Australia Ph: (02) 871 7873